ENDANGERED SPECIES ACT SECTION 7 CONSULTATION
BIOLOGICAL OPINION

Action Agency: National Marine Fisheries Service, Northeast Fisheries Science Center

Activity: Endangered Species Act Section 7 Consultation on Two Research Projects to be Administered by the Northeast Fisheries Science Center in 2013: (1) the Northeast Area Monitoring and Assessment Program (NEAMAP) Near Shore Trawl Surveys, and (2) a Study Assessing Sea Turtle/Sturgeon Exclusion and Target Catch Retention in a Mid-Atlantic Gillnet Fishery
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Consulting Agency: National Marine Fisheries Service, Northeast Regional Office

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Approved by: [signature] for JOHN BULLARD

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1.0 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), requires each Federal agency to insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of the designated critical habitat of such species. When the action of a Federal agency may affect a species or critical habitat that is protected under the ESA, that agency is required to consult with either the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the species and/or critical habitat that may be affected. In instances where NMFS or USFWS authorizes, funds, or carries out an action that may affect ESA-listed species or critical habitat under their respective jurisdictions, the agency in question must conduct intra-service consultation. Since the actions described in this document are administered by the NMFS Northeast Fisheries Science Center (NEFSC), and in the case of the proposed Mid-Atlantic gillnet research study, are conducted on fishing trips that are regulated under a Federal fishery management plan (FMP) authorized by the NMFS Northeast Regional Office (NERO), NMFS is required to perform an intra-service section 7 consultation on these actions to assess their impacts on ESA-listed species under NMFS jurisdiction. For this consultation, the NEFSC is serving as the lead action agency as it is administering each of the studies discussed herein. As a result, the NEFSC assumes all responsibilities of that designation.

The NEFSC administers the granting of funds from the Mid-Atlantic Fishery Management Council via the Mid-Atlantic Research Set-Aside (RSA) Program. This program sets aside quota for catch and sale to fund scientific research in cooperation with commercial fishing activities. As part of the 2013 Mid-Atlantic RSA Program, funds will be granted to the Virginia Institute of Marine Science (VIMS) in the form of pounds of summer flounder, scup, black sea bass, bluefish, and *Loligo* squid. These funds will support the Northeast Area Monitoring and Assessment Program (NEAMAP) Near Shore Trawl Program, for which VIMS carries out field sampling, laboratory processing, and data analysis components. This program, which began in 2006 with a fall pilot survey, has conducted both spring and fall bottom trawl surveys for living marine resources in Mid-Atlantic and Southern New England waters since 2008.

We, the NERO, last completed formal ESA section 7 consultation on the NEFSC-funded NEAMAP surveys in early 2012 and issued a Biological Opinion (Opinion) on April 13, 2012. That Opinion concluded that the 2012 spring and fall NEAMAP surveys were likely to adversely affect but not likely to jeopardize the continued existence of the Northwest Atlantic (NWA) distinct population segment (DPS) of loggerhead sea turtles; leatherback, Kemp's ridley, or green sea turtles; or any of the five DPSs of Atlantic sturgeon that were listed under the ESA on February 6, 2012 (77 FR 5880 and 77 FR 5914). In that Opinion, we also concluded that the 2012 NEAMAP surveys were not likely to adversely affect shortnose sturgeon, the Gulf of Maine DPS of Atlantic salmon, hawksbill sea turtles, or any ESA-listed species of large whales. We have reinitiated consultation on the funding of the NEAMAP surveys to assess their effects on ESA-listed species and critical habitat in 2013 and beyond (if annual funding continues), or until such time that a programmatic Opinion covering all research activities conducted, funded, and administered by the NEFSC is completed. At present, the NEFSC is preparing an Environmental Assessment (EA) analyzing the impacts of the diverse array of research activities which it authorizes and undertakes. Once the EA is completed, formal consultation and the production of a programmatic Opinion can begin. By issuing this new Opinion, we withdraw the previous 2012 Opinion covering the NEAMAP surveys (Consultation No. F/NER/2012/01152).

In this Opinion we will also assess the effects of a gillnet gear research project to be developed and contracted out by the NEFSC Protected Species Branch (PSB) in 2013. We are including the gillnet gear research project in this Opinion as: (1) the NEFSC is also the lead action agency, (2) although the project is already covered under section 7 of the ESA for sea turtle interactions through an existing Opinion on the monkfish fishery, it is not currently covered for Atlantic sturgeon interactions, and (3) the project will be well underway prior to the completion of a new "batched" FMP Opinion which will cover Atlantic sturgeon interactions in the monkfish and six other Northeast U.S. fisheries in the near future (see Section 2.0 below).

This new Opinion is based on information on past interactions with ESA-listed species provided by the NEFSC and VIMS, as well as other scientific data and reports cited throughout this document. For the 2013 NEAMAP surveys, pertinent information was provided in VIMS's Supplemental EA for the NEAMAP Near Shore Trawl Program 2011-2012 (VIMS 2010) as well as a supplemental information report prepared for the NEFSC in accordance with the National Environmental Policy Act in 2012 (NEFSC 2012). We also utilized information from past Opinions that were completed for the NEAMAP surveys between 2008 and 2012. A complete administrative record of this combined consultation will be kept on file at the NERO.

2.0 CONSULTATION HISTORY

We have formally consulted on the effects of the NEAMAP surveys on multiple occasions. On September 19, 2008, we completed consultation on the adverse effects of the fall 2008 survey on loggerhead sea turtles. The fall 2008 survey was the first NEAMAP survey to be funded under the Mid-Atlantic RSA Program. On April 16, 2009, we completed consultation on the adverse effects of the spring and fall 2009 surveys on loggerhead sea turtles. On April 13, 2010, we completed consultation on the adverse effects of the spring and fall 2010-2012 surveys on loggerhead as well as leatherback, Kemp's ridley, and green sea turtles. Most recently, on April 13, 2012, we released an updated Opinion to account for adverse effects of the 2012 spring and fall surveys on the above four species of sea turtles as well as the five newly listed Atlantic sturgeon DPSs. This new Opinion will replace the 2012 Opinion on the NEAMAP surveys and provide ESA coverage for the near shore trawl program through 2013 and beyond, or until such time that a new Opinion is completed.

In addition to replacing the 2012 Opinion on the NEAMAP surveys, this Opinion will provide incidental take coverage for Atlantic sturgeon captured in the NEFSC's gillnet gear research project, as there currently is none. On February 6, 2012, NMFS issued two final rules (77 FR 5880 and 77 FR 5914) listing five DPSs of Atlantic sturgeon as threatened or endangered. Four DPSs (New York Bight, Chesapeake Bay, Carolina, and South Atlantic) are listed as endangered and one DPS (Gulf of Maine) is listed as threatened. According to the ESA reinitiation criteria, the listing of a new species that may be affected by an identified action results in the need for reinitiation of consultation. We have reinitiated consultation on the following seven "batched" FMPs: Atlantic Bluefish, Northeast Skate Complex, Northeast Multispecies, Spiny Dogfish, Monkfish, Atlantic Mackerel/Squid/Butterfish, and Summer Flounder/Scup/Black Sea Bass. Formal consultation on these seven FMPs was reinitiated on February 9, 2012. On August 28, 2012, we issued a memorandum indicating that the consultation period for the batched FMP consultation had been extended and that sections 7(a)(2) and 7(d) of the ESA were not violated by doing so. By issuing this Opinion, no previously active FMP Opinions are withdrawn as all relevant Opinions already provide incidental take statements (ITSs) for ESA-listed sea turtles.

3.0 DESCRIPTION OF THE PROPOSED ACTIONS

The activities considered in this Opinion are the NEAMAP near shore trawl surveys to be carried out by VIMS in the spring and fall of 2013, as well as a gillnet gear research project to be contracted out to commercial fishermen in the spring of 2013. In addition, the Mid-Atlantic RSA Program may opt to renew the funding of the NEAMAP surveys for additional years in 2014 and beyond. However, we expect that the programmatic NEFSC Opinion (described above) will be finalized by early 2014 and would cover activities of the 2014 surveys and beyond. If not, the proposed action for any future NEAMAP surveys after 2013 would be reviewed and the ITS in this Opinion would be applicable if it is deemed the action is similar in scope. A summary of the proposed actions assessed in this Opinion is presented below.

3.1 NEAMAP Surveys

The NEAMAP surveys are intended to be a complement to the NEFSC bottom trawl surveys that are conducted from the Gulf of Maine to Cape Hatteras in the spring and fall of each year. The NEFSC surveys are conducted in waters less than approximately 1,800 feet (300 fathoms; 549 meters), but few stations have been sampled in waters less than 90 feet (15 fathoms; 27.4 meters) due to the size and draft of the survey vessel. With the new larger, deeper-draft *F/SV Henry B. Bigelow* starting operations in 2009, survey coverage of near shore areas is now even less, and waters less than 60 feet (10 fathoms; 18.3 meters) are no longer surveyed by the NEFSC.

The objective of the NEAMAP Near Shore Trawl Program, in general, is to survey areas undersampled or not sampled by the NEFSC trawl surveys and to collect data on the diversity, biomass, relative abundance, and distribution of living marine resources that occur in waters of the Mid-Atlantic and Southern New England regions, from approximately Martha's Vineyard, Massachusetts to Cape Hatteras, North Carolina. The 2013 NEAMAP survey will use bottom trawl gear for approximately 30 days in April/May and again in September/October. Each 30-day cruise will involve 150 sampling sites. The spring surveys start at the southernmost sampling stations around Cape Hatteras and head north to Montauk, New York as Mid-Atlantic waters warm from April to May. The fall surveys start at the northernmost sampling stations around Montauk and head south to Cape Hatteras as Mid-Atlantic waters cool from September to October. Some sampling will also occur in Block Island Sound and Rhode Island Sound. The protocol for the Spring and Fall 2013 NEAMAP surveys, which is discussed in detail in VIMS (2010) and NEFSC (2012), is as follows:

- a single vessel, to be determined through an annual contract, will be used for the surveys;
- the vessel will tow a bottom otter trawl net with varying mesh-sizes in different panels;
- tows will only be conducted during daylight hours;

- each tow will be 20 minutes in duration;
- the target tow speed will be 3.1 knots;
- trawling will occur in waters of Rhode Island Sound and Block Island Sound at depths of 60-120 feet (10-20 fathoms; 18.3-37 meters);
- trawling will occur in waters from Montauk, New York to Cape Hatteras, North Carolina at depths of 20-60 feet (3.3-10 fathoms; 6-18 meters);
- the spring survey will be conducted for an approximately 30-day period starting in mid- to late April, and will start sampling at the southernmost stations and work northward;
- the fall survey will be conducted for an approximately 30-day period starting in mid- to late September, and will start sampling at the northernmost stations and work southward; and,
- a total of 150 randomly selected stations will be sampled during each cruise, with approximately 18 of these stations located in the Dr. Carl N. Shuster, Jr. Horseshoe Crab Reserve (a 1,500-square mile reserve in Federal waters adjacent to Delaware Bay).

3.2 Gillnet Gear Research Project

In the spring and early summer of 2013, the NEFSC PSB will be overseeing a study that will compare standard and experimental large mesh gillnets in the Mid-Atlantic monkfish fishery in terms of the retention of targeted catch as well as the exclusion of sea turtles and Atlantic sturgeon. To address issues of sea turtle and sturgeon bycatch, the NEFSC PSB has been working with the commercial fishing industry to develop modifications to gillnet gear that will reduce bycatch rates while retaining targeted finfish species.

The investigators plan to test the standard and experimental gillnets in continental shelf waters off Maryland and northern Virginia (north of Chincoteague) between May 1 and July 15, 2013. This study area was chosen because north of Chincoteague, Virginia, there are no restrictions on use of large mesh gillnets in Federal waters at any time of year. This project will occur during times, and in areas of the Mid-Atlantic, where commercial fishermen normally fish for monkfish using gillnets and when sea turtles and Atlantic sturgeon are likely to occur. The goal of this project is to determine if lower profile experimental gillnets can reduce the rate of sea turtle and Atlantic sturgeon bycatch while maintaining sufficient rates of targeted catch.

The study will use two commercial gillnet vessels and their crew and complete up to 120 sets. The vessels will fish under their permit and thus will be permitted to keep the catch. Soak duration will be 96 hours or less. This time was determined from the historic average soak duration utilized by commercial gillnet monkfish fishermen in the study area. Sets may begin during the day or night. Sets will only be prohibited during heavy weather conditions and when marine mammals such as dolphins and porpoises are seen in the vicinity.

Paired sets will consist of setting both control and experimental nets or strings (group of nets or net panels) in a similar location and keeping all aspects of the sets (*e.g.*, soak time, set direction, haulback speed) standardized. During the course of the study, the sequence of whether the control or experimental net is set first will be randomly chosen. Paired strings will be set 60 times (one control and one experimental per paired set) for 120 total hauled strings to provide a high level of certainty of detecting whether a statistically significant difference in catch of monkfish exists between the two net configurations. Depending on the number of sea turtles and Atlantic sturgeon encountered and the differences in catch between the nets, this level of effort may or may not provide robust estimates of bycatch reduction. However, this data may be combined with other data sets to obtain a better estimate.

Trained scientific data collectors/protected species observers will use NOAA approved sea sampling procedures (available from the NEFSC) aboard each cooperating vessel. Hard copy protected species resuscitation and handling best practices and guidelines will also be placed aboard each cooperating vessel. Data collectors will record total catch, including estimated total weight and length measurements, on the targeted species or a representative sub-sample if conditions do not permit recording all fish lengths, gear characteristics (*e.g.*, number and position of floats), and fishing operations data (*e.g.*, start and end of tow, location, etc.). In instances of abnormally large size catch and/or limited availability of time, only commercially significant finfish species may be sampled (length frequency data). Additionally, and if protected species (*e.g.*, sturgeon, sea turtles, or marine mammals) are present when the nets are hauled, they will be recorded (via high-resolution photo-documentation), sampled, resuscitated (if necessary), and released. Sampling of protected species will entail measuring, and if alive, tagging and biopsies will be performed on all sea turtles and marine mammals. Tagging will be performed on all sturgeon and biopsies will be performed on Atlantic sturgeon only. When found dead, sampling of marine mammals and sea turtles will be according to guidelines outlined under the Northeast Fisheries Observer Program's (NEFOP) Biological Sampling Manual. Necropsies will also be performed on Atlantic sturgeon when the animal is found dead. All data collected must be on NEFOP logs or data sheets.

Gillnet Gear Specifications
As mentioned previously, two variations in gillnet gear design will be utilized. Both will utilize 10 to 14 net panels per string. The control and experimental strings will contain the same number of net panels (~300 feet per panel) on any individual paired set. Two net configurations will be fished: a 12-mesh tall control net with 48-inch tie-downs placed every 24 feet (Figure 1) and an 8-mesh tall experimental net with 24-inch tie-downs placed at each float (Figure 2). Lead core line, poly float line, and weak links will be used in all net configurations. All other characteristics of the nets will be the same. The gear will be maintained and tears or damage that could affect the performance of the gear will be repaired prior to re-setting the gear. Anchors may be used to help maintain net position while soaking.

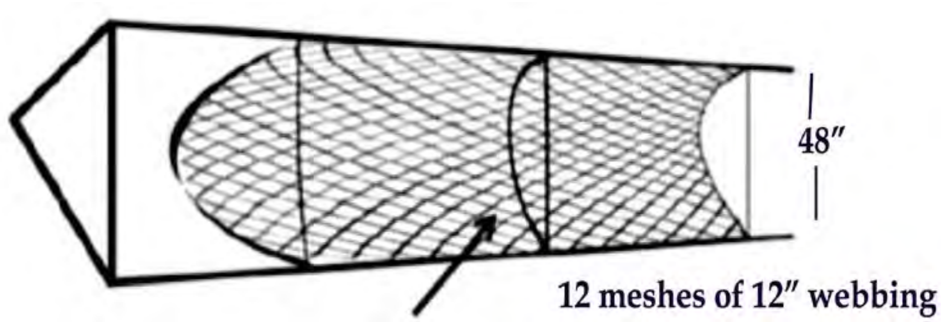

Figure 1. Example of a 12-mesh tall control net with 48 inch tie-downs placed every 24 feet.

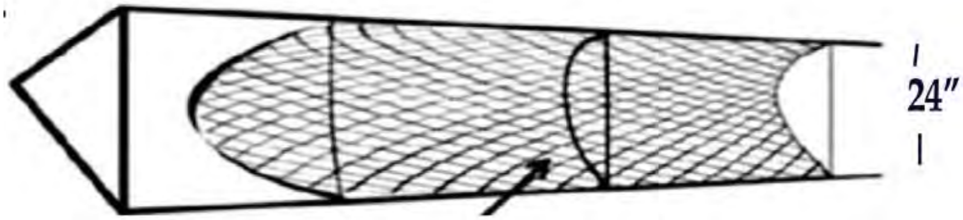

Figure 2. Example of an 8-mesh tall experimental net with 24 inch tie-downs placed at each float.

3.3 Action Area

The action area for section 7 consultations is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02). We anticipate that the effects on ESA-listed species and their habitats as a result of the proposed actions include the direct effects of interactions between listed species and the fishing gear that will be used for these studies (trawls and gillnets) as well as the effects on other marine organisms (*i.e*., prey) on or very near to the sea floor that may result from direct capture in the gear. In addition, indirect effects from the operation of the research and fishing vessels on ESA-listed species, their prey, and habitats are possible. Therefore, for the purpose of this consultation, the action area is defined by the area in which the contracted vessels will be conducting study activities and the areas through which they will be transiting. Broadly defined, this includes the entire study area for the NEAMAP surveys (*i.e.*, all U.S. Atlantic coastal ocean waters from Montauk, NY to Cape Hatteras, NC from 20-60 feet in depth and all waters in Rhode Island and Block Island Sounds from 60-120 feet in depth), in addition to continental shelf waters off Maryland and northern Virginia <20 feet and >60 feet in depth where the gillnet gear may be set.

4.0 STATUS OF LISTED SPECIES AND CRITICAL HABITAT

Several ESA-listed species under NMFS jurisdiction occur in the action area for this consultation. We have determined that the actions being considered in this Opinion may affect the following ESA-listed species in a manner that will likely result in adverse effects:

Common name	**Scientific name**	**ESA Status**
Loggerhead sea turtle - NWA DPS[1]	*Caretta caretta*	Threatened
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
Green sea turtle	*Chelonia mydas*	Endangered[2]
Leatherback sea turtle	*Dermochelys coriacea*	Endangered

[1] NWA DPS = Northwest Atlantic DPS, the only loggerhead DPS expected to occur in the action area

[2] Green sea 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 sea turtles are considered endangered wherever they occur in U.S. waters.

Common name	**Scientific name**	**ESA Status**
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	
Gulf of Maine (GOM) DPS		Threatened
New York Bight (NYB) DPS		Endangered
Chesapeake Bay (CB) DPS		Endangered
Carolina DPS		Endangered
South Atlantic (SA) DPS		Endangered

We have determined that the action being considered in this Opinion is not likely to adversely affect shortnose sturgeon (*Acipenser brevirostrum*), the Gulf of Maine DPS of Atlantic salmon (*Salmo salar*), hawksbill sea turtles (*Eretmochelys imbricata*), North Atlantic right whales (*Eubalaena glacialis*), humpback whales (*Megaptera novaengliae*), fin whales (*Balaenoptera physalus*), sei whales (*Balaenoptera borealis*), blue whales (*Balaenoptera musculus*), or sperm whales (*Physeter macrocephalus*), all of which are listed as endangered under the ESA. The following discussions are our rationale for these determinations.

4.1 Species Not Likely to be Adversely Affected by the Proposed Action

Shortnose sturgeon are benthic fish that occur in large coastal rivers of eastern North America. They range from as far south as the St. Johns River, Florida (possibly extirpated from this system) to as far north as the Saint John River in New Brunswick, Canada. Shortnose sturgeon occur in 19 rivers along the U.S. Atlantic coast. Limited information is available on intrabasin movements. Within the Gulf of Maine, some shortnose sturgeon have been documented to make coastal migrations from one river to another. At this time, it is unclear whether this is common in other areas outside of the Gulf of Maine. Given the range of the species and the proposed action occurring in more offshore ocean areas, we do not anticipate that shortnose sturgeon would be present in the area where the NEAMAP surveys and will take place and therefore, any effects to shortnose sturgeon are extremely unlikely to occur. The lack of any captures of shortnose sturgeon throughout the history of the NEAMAP surveys supports this determination.

The Gulf of Maine DPS of Atlantic salmon (*Salmo salar*), including 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; although there is evidence of forays into deeper water for shorter periods, in contrast adult Atlantic salmon demonstrate a wider depth profile (ICES 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 close to the bottom, as practiced in the NEAMAP surveys, reduces the potential for catching Atlantic salmon as either post-smolts or adults. In addition, commercial fisheries deploying small mesh active gear (pelagic trawls and purse seines within 10 meters of the surface) in nearshore waters of the Gulf of Maine may have the potential to incidentally take post-smolts, however, the NEAMAP surveys will not occur in or near the rivers where concentrations of Atlantic salmon are likely to be found and generally use gear with larger mesh sizes that are not likely to catch salmon post-smolts.

In its report on salmon bycatch, the ICES Working Group for North Atlantic Salmon (WGNAS) concluded that bycatch of Atlantic salmon in Northeast Atlantic commercial fisheries was not an obvious concern for Atlantic salmon. The 2006 WGNAS report also discussed potential salmon bycatch implication from these fisheries and believed there is insufficient information to quantify bycatch although, based on the information that was available, there was no evidence of major bycatch of salmon in these Northeast fisheries. Although an Atlantic salmon was captured during the 2012 NEFSC Spring Bottom Trawl Survey (Linda Despres, NEFSC, pers. comm.), it was due to improper gear setting at the water surface rather than at depth and has been deemed to be a unique and very rare event that is extremely unlikely to reoccur. Thus, we find it is highly unlikely that the action being considered in this Opinion will harm or harass the Gulf of Maine DPS of Atlantic salmon and, therefore, this species will not be considered further in this Opinion.

The hawksbill sea turtle is listed as endangered. This species is uncommon in the waters of the continental U.S. Hawksbills prefer coral reef habitats, such as those found in the Caribbean and Central America. Mona Island (Puerto Rico) and Buck Island (St. Croix, U.S. Virgin Islands) contain especially important foraging and nesting habitat for hawksbills. Within the continental U.S., nesting is restricted to the southeast coast of Florida and the Florida Keys, but nesting is rare in these areas. Hawksbills have been recorded from all the Gulf States and along the east coast of the U.S. as far north as Massachusetts, but sightings north of Florida are rare. Many of these strandings in the North Atlantic were observed after hurricanes or offshore storms. Aside from Florida, Texas is the only other U.S. state where hawksbills are sighted with any regularity. Since hawksbill sea turtles are not expected to be present in the areas where the surveys will occur, it is highly unlikely that the proposed action will affect this sea turtle species. The lack of any captures of hawksbill sea turtles in any NEAMAP survey to date supports this determination.

North Atlantic right whales, humpback whales, fin whales, and sei whales are known to occur in the areas where the proposed action will occur. However, none of these species are expected to be affected by the use of bottom trawl gear for the NEAMAP surveys given the following. While these species may occur in the action area, large whales have the speed and maneuverability to get out of the way of oncoming mobile gear. The slow speed of the trawl gear being towed and the short tow times to be implemented further reduce the potential for entanglement or any other interaction. Observations of many fishing trips using trawl gear have shown that entanglement or capture of large whales in this gear type is extremely rare and unlikely. Because of this, we have determined that it is extremely unlikely that any large whale would interact with the trawl gear during the proposed action.

We have determined that the action being considered in the Opinion is not likely to adversely modify or destroy designated critical habitat for North Atlantic right whales, as critical habitat for North Atlantic right whales is not located in the action area for this consultation. We have also determined that the proposed action will not have any adverse effects on the availability of prey for right, humpback, fin, and sei whales. Right and sei whales feed on copepods. As indicated above, the gears to be utilized will not affect the availability of copepods for foraging sei whales because copepods are very small organisms that will pass through the fishing gear rather than being captured in it. Humpback and fin whales feed on krill as well as small schooling fish (*e.g.*, sand lance, herring, mackerel) (Aguilar 2002; Clapham 2002). The trawl gear to be utilized operates on or very near the bottom. Fish species caught in these gears are species that live in benthic habitat (on or very near the bottom) such as monkfish and flounders versus schooling fish such as herring and mackerel that occur within the water column. Therefore, the proposed action will not affect the availability of prey for foraging humpback or fin whales. In addition, the proposed action will not occur 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). Therefore, the proposed action will not affect the oceanographic conditions that are conducive for calving and nursing.

Blue whales and sperm whales are listed as endangered. Although blue whales are occasionally seen in U.S. waters, they are more commonly found in Canadian waters (Waring *et al.* 2012). Photo identifications and an approximate 40% return rate estimated from annual blue whale identification mainly in the St. Lawrence estuary and northwestern Gulf of St. Lawrence suggest that these individuals range mostly outside the St. Lawrence, possibly in the waters at the edge of the continental shelf, from the Labrador Sea and Davis Strait in the north, east to the Flemish Cap and south to New England (Sears and Calambokidis 2002 in Waring *et al.* 2012). Unlike blue whales, sperm whales regularly occur in waters of the U.S. Exclusive Economic Zone (EEZ). However, the distribution of the sperm whale in the U.S. EEZ occurs on the continental shelf edge, over the continental slope, and into mid-ocean regions (Waring *et al.* 2012). During surveys for the Cetacean and Turtle Assessment Program (CeTAP), sperm whales were observed along the shelf edge, centered around the 1,000 meter depth contour but extending seaward out to the 2,000 meter depth contour (CeTAP 1982). In contrast, the surveys proposed in this Opinion operate in continental shelf waters. Given the predominantly offshore distribution of these two large whale species, and that calving for sperm whales occurs in low latitude waters outside of the area where the surveys proposed in this Opinion operate, both species are highly unlikely to occur in the action area and are not likely to be affected by the proposed action.

4.2 Species Likely to be Adversely Affected by the Proposed Action

This section will focus on the status of the various ESA-listed species likely to be adversely affected within the action area, summarizing information necessary to establish the environmental baseline and to assess the effects of the proposed action.

4.2.1 Overview of Status of Sea Turtles

With the exception of loggerheads, sea turtles are listed under the ESA at the species level rather than as subspecies or DPSs. Therefore, information on the range-wide status of Kemp’s ridley, green, and leatherback sea turtles is included to provide the status of each species overall. Information on the status of loggerheads will only be presented for the DPS affected by this action. Additional background information on the range-wide status of these species can be found in a number of published documents, including sea turtle status reviews and biological reports (NMFS and USFWS 1995, 2007a, 2007b, 2007c, 2007d; Hirth 1997; Marine Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; Conant *et al.* 2009), and recovery plans for the loggerhead sea turtle (NMFS and USFWS 2008), Kemp’s ridley sea turtle (NMFS *et al.* 2011), green sea turtle (NMFS and USFWS 1991, 1998a), and leatherback sea turtle (NMFS and USFWS 1992, 1998b).

2010 BP Deepwater Horizon Oil Spill
The April 20, 2010, explosion of the Deepwater Horizon oil rig affected sea turtles in the Gulf of Mexico. There is an on-going assessment of the long-term effects of the spill on Gulf of Mexico marine life, including sea turtle populations. Following the spill, juvenile Kemp's ridley, green, and loggerhead sea turtles were found in *Sargassum* algae mats in the convergence zones, where currents meet and oil collected. Sea turtles found in these areas were often coated in oil and/or had ingested oil. Approximately 536 live adult and juvenile sea turtles were recovered from the Gulf and brought into rehabilitation centers; of these, 456 were visibly oiled (these and the following numbers were obtained from http://www.nmfs.noaa.gov/pr/health/oilspill/). To date, 469 of the live recovered sea turtles have been successfully returned to the wild, 25 died during rehabilitation, and 42 are still in care but will hopefully be returned to the wild eventually. During the clean-up period, 613 dead sea turtles were recovered in coastal waters or on beaches in Mississippi, Alabama, Louisiana, and the Florida Panhandle. As of February 2011, 478 of these dead turtles had been examined. Many of the examined sea turtles showed indications that they had died as a result of interactions with trawl gear, most likely used in the shrimp fishery, and not as a result of exposure to or ingestion of oil.

During the spring and summer of 2010, nearly 300 sea turtle nests were relocated from the northern Gulf to the east coast of Florida with the goal of preventing hatchlings from entering the oiled waters of the northern Gulf. From these relocated nests, 14,676 sea turtles, including 14,235 loggerheads, 125 Kemp's ridleys, and 316 greens, were ultimately released from Florida beaches.

A thorough assessment of the long-term effects of the spill on sea turtles has not yet been completed. However, the spill resulted in the direct mortality of many sea turtles and may have had sublethal effects or caused environmental damage that will impact other sea turtles into the future. The population level effects of the spill and associated response activity are likely to remain unknown for some period into the future.

4.2.2 Status of Loggerhead Sea Turtles – Northwest Atlantic DPS

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 also 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 of the species and make recommendations regarding its ESA listing status. Based on a 2007 five-year status review of the species, which discussed a variety of threats to loggerheads including climate change, NMFS and USFWS determined that loggerhead sea turtles should not be delisted or reclassified as endangered. However, it was also determined that an analysis and review of the

species should be conducted in the future to determine whether DPSs should be identified for the loggerhead (NMFS and USFWS 2007a). 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 USFWS 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 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 indicating 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) to 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 on the listing action would be made to no later than September 16, 2011. 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. New information or analyses to help clarify these issues were requested by April 11, 2011.

On September 22, 2011, NMFS and USFWS issued a final rule (76 FR 58868), determining that the loggerhead sea turtle is composed of nine DPSs (as defined in Conant *et al*. 2009) that constitute species that may be listed as threatened or endangered under the ESA. 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, 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. 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 the U.S. (NWA DPS and North Pacific DPS) will 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 latitude, and west of 40° W longitude; Northeast Atlantic Ocean (NEA) DPS – north of the equator, south of 60° N latitude, east of 40° W longitude, and west of 5° 36’ W longitude; South Atlantic DPS – south of the equator, north of 60° S latitude, west of 20° E longitude, and east of 60° W longitude; Mediterranean DPS – the Mediterranean Sea east of 5° 36’ W longitude. 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 that it is unlikely that U.S. fishing fleets are interacting with either the NEA or

Mediterranean DPS (Peter Dutton, NMFS, Marine Turtle Genetics Program, Program Leader, personal communication, September 10, 2011). 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 NEA or Mediterranean 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). As such, 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 (2009) report, and the final revised recovery plan for loggerheads in the Northwest Atlantic Ocean (NMFS and USFWS 2008), which is a second revision to the original recovery plan that was approved in 1984 and subsequently revised in 1991.

In the western Atlantic, waters as far north as 41° N to 42° N latitude are used for foraging by juveniles, as well as adults (Shoop 1987; Shoop and Kenney 1992; Ehrhart *et al.* 2003; Mitchell *et al.* 2003). In U.S. Atlantic waters, loggerheads commonly occur throughout the inner continental shelf from Florida to Cape Cod, Massachusetts 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; Mitchell *et al.* 2003; Braun-McNeill *et al.* 2008). Loggerheads have been observed in waters with surface temperatures of 7°C to 30°C, but water temperatures ≥11°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. Aerial surveys of continental shelf waters north of Cape Hatteras, North Carolina 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). However, 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 U.S. (*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).

As presented on the following page, Table 3 from the 2008 loggerhead recovery plan (Table 1 in this Opinion) highlights the key life history parameters for loggerheads nesting in the U.S.

Population Dynamics and Status

By far, the majority of Atlantic nesting occurs on beaches of the southeastern U.S. (NMFS and USFWS 2007a). For the past decade or so, the scientific literature has recognized five distinct nesting groups, or subpopulations, of loggerhead sea turtles in the Northwest Atlantic, divided geographically as follows: (1) a northern group of nesting females that nest from North Carolina to northeast Florida at about 29° N latitude; (2) a south Florida group of nesting females that nest from 29° N latitude 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, Florida 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).

Table 1: Typical values of life history parameters for loggerheads nesting in the U.S.

Life History Parameter	**Data**
Clutch size	100-126 eggs[1]
Egg incubation duration (varies depending on time of year and latitude)	42-75 days[2,3]
Pivotal temperature (incubation temperature that produces an equal number of males and females)	29.0°C[5]
Nest productivity (emerged hatchlings/total eggs) x 100 (varies depending on site specific factors)	45-70%[2,6]
Clutch frequency (number of nests/female/season)	3-5.5 nests[7]
Internesting interval (number of days between successive nests within a season)	12-15 days[8]
Juvenile (<87 cm CCL) sex ratio	65-70% female[4]
Remigration interval (number of years between successive nesting migrations)	2.5-3.7 years[9]
Nesting season	late April-early September
Hatching season	late June-early November
Age at sexual maturity	32-35 years[10]
Life span	>57 years[11]

1 Dodd 1988.
2 Dodd and Mackinnon (1999, 2000, 2001, 2002, 2003, 2004).
3 Blair Witherington, FFWCC, personal communication, 2006 (information based on nests monitored throughout Florida beaches in 2005, n=865).
4 National Marine Fisheries Service (2001); Allen Foley, FFWCC, personal communication, 2005.
5 Mrosovsky (1988).
6 Blair Witherington, FFWCC, personal communication, 2006 (information based on nests monitored throughout Florida beaches in 2005, n=1,680).
7 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.
8 Caldwell (1962), Dodd (1988).
9 Richardson *et al*. (1978); Bjorndal *et al*. (1983); Ehrhart, unpublished data.
10 Melissa Snover, NMFS, personal communication, 2005; see Table A1-6.
11 Dahlen *et al*. (2000).

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 U.S. The fifth recovery unit is composed of all other nesting assemblages of loggerheads within the Greater Caribbean, outside the U.S., 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, Florida), (3) the Dry Tortugas Recovery Unit (DTRU: islands located west of Key West, Florida), (4) the Northern Gulf of Mexico Recovery Unit (NGMRU: Franklin County, Florida through Texas), and (5) the Greater Caribbean Recovery Unit (GCRU: Mexico through French Guiana, Bahamas, Lesser Antilles, and Greater Antilles).

The 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.

Note that 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 10-23 years. These analyses used different analytical approaches, but found the same finding that there had been a significant, overall nesting decline within the NWA DPS. However, with the addition of nesting data from 2008-2010, the trend line changes showing a very slight negative trend, but the rate of decline is not statistically different from zero (76 FR 58868, September 22, 2011). The nesting data presented in the Recovery Plan (through 2008) is 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 1989-2008, 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 U.S., has been declining at a rate of 1.3% annually since 1983 (NMFS and USFWS 2008). The NRU dataset included 11 beaches with an uninterrupted time series of coverage of at least 20 years; 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). 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 (from 1989-2008) with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year (from 1989-2007) with approximately 15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year (from 1995-2004, excluding 2002) with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year (from 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 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. Note that 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 U.S. East Coast 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 finally 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 variety in the proportions of sea turtles from loggerhead 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 have been conducted in some areas of the Northwest Atlantic and 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 U.S., one site showed no discernible trend, and the two sites located in the northeast U.S. showed a decreasing trend in abundance of loggerheads. 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 U.S. (Winyah Bay, South Carolina to St. Augustine, Florida) 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 1977-2004 show an increasing trend of loggerheads at the power plant 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 in comparison to the period 1987-1992, with only two loggerheads (of a total 54 turtles) observed captured in pound net gear during the period 2002-2004. This is in contrast to the previous decade's study where numbers of individual loggerheads ranged from 11 to 28 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 (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 U.S. Atlantic coast in the summer of 2010. AMAPPS is a multi-agency initiative to assess marine mammal, sea turtle, and seabird abundance and distribution in the Atlantic. Aerial surveys were conducted from Cape Canaveral, Florida to the Gulf of St. Lawrence, Canada. Satellite tags on juvenile loggerheads were deployed in two locations – off the coasts of northern Florida to South Carolina (n=30) and off the New Jersey and Delaware coasts (n=14). As presented in 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 (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, North Carolina, 30% in the southern Mid-Atlantic Bight, and 6% in the northern Mid-Atlantic Bight. Although they have been seen farther north in previous studies (*e.g.*, Shoop and Kenney 1992), no loggerheads were observed during the aerial surveys conducted in the summer of 2010 in the more northern zone encompassing Georges Bank, Cape Cod Bay, and the Gulf of Maine. 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 aerial surveys and research to improve the abundance estimates are anticipated through 2014, depending on available funds.

Threats

The diversity of a loggerhead 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). Amongst those of natural origin, 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, and 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 breeding adults 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.*, 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 U.S. 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 consultation. 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 2002; Lewison *et al.* 2003). A section 7 consultation on the U.S. South Atlantic and Gulf of Mexico shrimp fisheries completed in 2002 estimated the total annual level of loggerhead interactions to be 163,160 (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 being lethal (NMFS 2002).

In addition to improvements in TED designs and TED enforcement, interactions between loggerheads and the shrimp fishery have also been declining because of reductions in fishing effort unrelated to fisheries management actions. The 2002 Opinion 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 recent 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 have been 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). However, the most recent section 7 consultation on the shrimp fishery, completed in May 2012, was unable to estimate the total annual level of loggerhead interactions at present. 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 NRC (1990) report stated that other U.S. Atlantic fisheries collectively accounted for 500 to 5,000 loggerhead deaths each year, but recognized that there was considerable uncertainty in the estimate. 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 2005-2008 (Warden 2011a). NEFOP data from 1994-2008 were used to develop a model of interaction rates and those predicted rates 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 sea surface temperature

(SST) were associated with the interaction rate, with the rates being highest south of 37°N latitude 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 interacting annually with 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 re-evaluated loggerhead sea turtle interactions in scallop dredge gear from 2001-2008. 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 had been applied to trips with chain mats, the estimated number of observable and inferred interactions of hard-shelled sea turtles after chain mats were implemented would have been 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 SST, 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).

An estimate of the number of loggerheads interacting annually with U.S. Mid-Atlantic gillnet fisheries has also recently been published (Murray 2009a, 2009b). From 1995-2006, 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, SST, and mesh size. The highest predicted bycatch rates occurred in warm waters of the southern Mid-Atlantic in large-mesh gillnets (Murray 2009a).

The U.S. tuna and swordfish longline fisheries that are managed under the Highly Migratory Species (HMS) Fishery Management Plan (FMP) are estimated to capture 1,905 loggerheads (no more than 339 mortalities) for each three-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.

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. However, trying to assess the likely effects of climate change on loggerhead sea turtles is extremely difficult given the uncertainty in all climate change models and the difficulty in determining the likely rate of temperature increases and the scope and scale of any accompanying habitat effects. Additionally, no significant climate change-related impacts to loggerhead sea turtle populations have been observed to date. Over the long-term, climate change related impacts are expected to influence biological trajectories on a century scale (Parmesan and Yohe 2003). As noted in the 2009 Status Review (Conant *et al*. 2009), impacts from global climate change induced by human activities are likely to become more apparent in future years (IPCC 2007a). Climate change related increasing temperatures, sea level rise, changes in ocean productivity, and increased frequency of storm events may affect loggerhead sea turtles.

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 southern portions of the range.

Climate change also 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 as well as for 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 believed to be low relative to the entire life stage. However, only limited data are available on past trends related to climate effects on loggerhead sea turtles; current scientific methods are not able to reliably predict the future magnitude of climate change, associated impacts, whether and to what extent some impacts will offset others, or the adaptive capacity of this species.

While there is a reasonable degree of certainty that certain 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 to sea turtles resulting from climate change are not predictable or quantifiable at this time (Hawkes *et al*. 2009). Based on the BRT report, it is unlikely that impacts from climate change will have a significant effect on the status of loggerheads over the scope of the action assessed in this Opinion. This is because significant changes to biological trajectories resulting from climate change are expected to occur gradually over time (on a century scale), rather than immediately (Parmesan and Yohe 2003). However, significant impacts from climate change in the future beyond 2013 are to be expected, but the severity of and rate at which these impacts will occur is currently unknown. It is likely that once climate change impacts get to a certain level, there will be feedback loops that may cause indications of climate change (*e.g.*, increases in greenhouse gas concentrations, rising global temperatures, and sea level rise) to get much worse much more quickly (Torn and Harte 2006).

In terms of "climate forcing" (which is different from what we are defining as "climate change," in that it also factors in the effects of cyclical climate patterns such as the North Atlantic and Pacific Decadal Oscillations in addition to ongoing effects from anthropogenically-induced changes in climate under Intergovernmental Panel on Climate Change [IPCC] projections), Van Houtan and Halley (2011) recently developed climate-based models to investigate loggerhead nesting in the Northwest Atlantic and North Pacific. These models, which considered juvenile recruitment and breeding remigration, found that climate conditions/oceanographic influences explain loggerhead nesting variability, with climate models alone explaining an average of 60% (range 18%-88%) of the observed nesting changes over the past several decades. Hindcasts indicate that climatic conditions may have been a factor in past nesting declines in both the Atlantic and Pacific. However, in terms of future nesting projections, modeled climate data show a future positive trend for Atlantic nesting in Florida, with substantial increases through 2040 as a result of the Atlantic Multidecadal Oscillation signal (Van Houton and Halley 2011). Thus, independent of any dramatic losses of sea turtle nesting habitat in the Northwest Atlantic due to climate change, NWA DPS loggerheads are expected to increase their nesting output over the next few decades. Van Houton and Halley (2011) did not project nesting trends in the Northwest Atlantic beyond 2040 as forecasting beyond that point was not deemed possible given their methods. Much like our analyses of climate change, climate forcing analyses can only predict so far into the future.

Summary of Status for Loggerhead Sea Turtles

Loggerheads are a long-lived species and reach sexual maturity relatively late at around 32-35 years in the Northwest Atlantic (NMFS and USFWS 2008). The species continues to be affected by many factors occurring 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.

As mentioned previously, a final revised recovery plan for loggerhead sea turtles in the Northwest Atlantic was recently published by NMFS and USFWS in December 2008. The revised recovery plan is significant in that it identifies five unique recovery units, which comprise the population of loggerheads in the Northwest Atlantic, and describes specific recovery criteria for each recovery unit. The recovery plan noted a decline in annual nest counts for three of the five recovery units for loggerheads in the Northwest Atlantic, including the PFRU, which is the largest (in terms of number of nests laid) in the Atlantic Ocean. The nesting trends for the other two recovery units could not be determined due to an absence of long term data.

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 stocks 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 2010 are analyzed, the nesting trends from 1989-2010 are not significantly different than zero for all recovery units within the NWA DPS for which there are enough data to analyze (76 FR 58868, September 22, 2011). 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.

4.2.3 Status of Kemp's Ridley Sea Turtles

Distribution and Life History

The Kemp's ridley is one of the least abundant of the world's sea turtle species. In contrast to loggerhead, leatherback, and green sea turtles, which are found in multiple oceans of the world, Kemp's ridleys typically occur only in the Gulf of Mexico and the northwestern Atlantic Ocean (NMFS *et al.* 2011).

Kemp's ridleys mature at 10-17 years (Caillouet *et al.* 1995; Schmid and Witzell 1997; Snover *et al.* 2007; NMFS and USFWS 2007b). Nesting occurs from April through July each year with hatchlings emerging after 45-58 days (NMFS *et al.* 2011). Females lay an average of 2.5 clutches within a season (TEWG 1998, 2000) and the mean remigration interval for adult females is two years (Márquez *et al.* 1982; TEWG 1998, 2000).

Once they leave the nesting beach, hatchlings presumably enter the Gulf of Mexico where they feed on available S*argassum* and associated infauna or other epipelagic species (NMFS *et al.* 2011). The presence of juvenile turtles along both the U.S. Atlantic and Gulf of Mexico coasts, where they are recruited to the coastal benthic environment, indicates that post-hatchlings are distributed in both the Gulf of Mexico and Atlantic Ocean (TEWG 2000).

The location and size classes of dead turtles recovered by the Sea Turtle Stranding and Salvage Network (STSSN) suggests that benthic immature developmental areas occur along the U.S. coast and that these areas may change given resource quality and quantity (TEWG 2000). Developmental habitats are defined by several characteristics, including coastal areas sheltered from high winds and waves such as embayments and estuaries, and nearshore temperate waters shallower than 50 meters (NMFS and USFWS 2007b). The suitability of these habitats depends on resource availability, with optimal environments providing rich sources of crabs and other invertebrates. Kemp's ridleys consume a variety of crab species, including *Callinectes*, *Ovalipes*, *Libinia*, and *Cancer* species. Mollusks, shrimp, and fish are consumed less frequently (Bjorndal 1997). A wide variety of substrates have been documented to provide good foraging habitat, including seagrass beds, oyster reefs, sandy and mud bottoms, and rock outcroppings (NMFS and USFWS 2007b).

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 (Stetzar 2002), and Long Island Sound (Morreale and Standora 1993; Morreale *et al.* 2005). For instance, in the Chesapeake Bay, Kemp's ridleys frequently forage in submerged aquatic grass beds for crabs (Musick and Limpus 1997). Upon leaving Chesapeake Bay in autumn, juvenile Kemp's ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus 1997). These larger juveniles are joined by juveniles of the same size from North Carolina and smaller juveniles from New York and New England to form one of the densest concentrations of Kemp's ridleys outside of the Gulf of Mexico (Epperly *et al.* 1995a, 1995b; Musick and Limpus 1997).

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). Adults are primarily found in nearshore waters of 37 meters or less that are rich in crabs and have a sandy or muddy bottom (NMFS and USFWS 2007b).

Population Dynamics and Status

The majority of Kemp's ridleys nest along a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; NMFS and USFWS 2007b; NMFS *et al.* 2011). There is a limited amount of scattered nesting to the north and south of the primary nesting beach (NMFS and USFWS 2007b). Nesting often occurs in synchronized emergences termed *arribadas*. The number of recorded nests reached an estimated low of 702 nests in 1985, corresponding to fewer than 300 adult females nesting in that season (TEWG 2000; NMFS and USFWS 2007b; NMFS *et al.* 2011). Conservation efforts by Mexican and U.S. agencies have aided this species by eliminating egg harvest, protecting eggs and hatchlings, and reducing at-sea mortality through fishing regulations (TEWG 2000). Since the mid-1980s, the number of nests observed at Rancho Nuevo and nearby beaches has increased 14-16% per year (Heppell *et al.* 2005), allowing cautious optimism that the population is on its way to recovery. An estimated 5,500 females nested in the State of Tamaulipas over a three-day period in May 2007 and more than 4,000 of those nested at Rancho Nuevo (NMFS and USFWS 2007b). In 2008, 17,882 nests were documented on Mexican nesting beaches (NMFS *et al*. 2011). There is limited nesting in the U.S., most of which is located in South Texas. While six nests were documented in 1996, a record 195 nests were found in 2008 (NMFS *et al*. 2011).

Threats

Kemp's ridleys face many of the same natural threats as loggerheads, including destruction of nesting habitat from storm events, predators, and oceanographic-related events such as cold-stunning. Although cold-stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. From 2006-2010, the number of cold-stunned turtles on Cape Cod beaches averaged 115 Kemp's ridleys, seven loggerheads, and seven greens (NMFS unpublished data). The numbers ranged from a low in 2007 of 27 Kemp's ridleys, five loggerheads, and five greens to a high in 2010 of 213 Kemp's ridleys, four loggerheads, and 14 greens. Annual cold stun events vary in magnitude; the extent of episodic major cold stun events may be associated with numbers of turtles utilizing Northeast U.S. waters in a given year, oceanographic conditions, and/or the occurrence of storm events in the late fall. Although many cold-stunned turtles can survive if they are found early enough, these events represent a significant source of natural mortality for Kemp's ridleys.

Like other sea turtle species, the severe decline in the Kemp's ridley population appears to have been heavily influenced by a combination of exploitation of eggs and impacts from fishery interactions. From the 1940s through the early 1960s, nests from Ranch Nuevo were heavily exploited, but beach protection in 1967 helped to curtail this activity (NMFS *et al.* 2011). Following World War II, there was a substantial increase in the number of trawl vessels, particularly shrimp trawlers, in the Gulf of Mexico where adult Kemp's ridley sea turtles occur. Information from fisheries observers helped to demonstrate the high number of turtles captured in these shrimp trawls (USFWS and NMFS 1992). Subsequently, NMFS has worked with the industry to reduce sea turtle captures in shrimp trawls and other trawl fisheries, including the development and use of TEDs. As described above, there is lengthy regulatory history on the use of TEDs in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries (NMFS 2002; Epperly 2003; Lewison *et al.* 2003). The 2002 Opinion on shrimp trawling in the southeastern U.S. concluded that 155,503 Kemp's ridley sea turtles would be captured annually in the fishery with 4,208 of the captures resulting in mortality (NMFS 2002).

Although modifications to shrimp trawls have helped to reduce mortality of Kemp's ridleys, a recent assessment found that the Southeast/Gulf of Mexico shrimp trawl fishery remained responsible for the vast majority of U.S. fishery interactions (up to 98%) and mortalities (more than 80%). 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.*, 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). 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 Kemp's ridley interactions occurring in the fishery. Instead, it qualitatively estimated that the shrimp fishery, as currently operating, would result in at least tens of thousands and possibly hundreds of thousands of interactions annually, of which at least thousands and possibly tens of thousands are expected to be lethal (NMFS 2012a).

This species is also affected by other sources of anthropogenic impact (fishery and non-fishery related), similar to those discussed above. Three Kemp's ridley captures in Mid-Atlantic trawl fisheries were documented by NMFS observers between 1994 and 2008 (Warden and Bisack 2010), and eight Kemp's ridleys were documented by NMFS observers in Mid-Atlantic sink gillnet fisheries between 1995 and 2006 (Murray 2009a). Additionally, in the spring of 2000, five Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. The cause of death for most of the turtles recovered was unknown, but the mass mortality event was suspected by NMFS to have been from a large-mesh gillnet fishery for monkfish and dogfish operating offshore in the preceding weeks (67 FR 71895, December 3, 2002). The five Kemp's ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction, since it is unlikely that all of the carcasses washed ashore. The NEFSC also documented 14 Kemp's ridleys entangled in or impinged on Virginia pound net leaders from 2002-2005. Note that bycatch estimates for Kemp's ridleys in various fishing gear types (*e.g.*, trawl, gillnet, dredge) are not available at this time, largely due to the low number of observed interactions precluding a robust estimate. Kemp's ridley interactions in non-fisheries have also been observed; for example, the Oyster Creek Nuclear Generating Station in Barnegat Bay, New Jersey, recorded a total of 27 Kemp's ridleys (15 of which were found alive) impinged or captured on their intake screens from 1992-2006 (NMFS 2006).

The recovery plan for Kemp's ridley sea turtles (NMFS *et al*. 2011) identifies climate change as a threat; however, as with the other species discussed above, no significant climate change-related impacts to Kemp’s ridley sea turtles have been observed to date. Atmospheric warming could cause habitat alteration which may change 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. In addition, 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 Kemp's ridleys, as well as change rain regimes and levels of nearshore runoff.

Considering that the Kemp’s ridley has temperature-dependent sex determination (Wibbels 2003) and the vast majority of the nesting range is restricted to the State of Tamaulipas, Mexico, global warming could potentially shift population sex ratios towards females and thus change the reproductive ecology of this species. A female bias is presumed to increase egg production (assuming that the availability of males does not become a limiting factor) (Coyne and Landry 2007) and increase the rate of recovery; however, it is unknown at what point the percentage of males may become insufficient to facilitate maximum fertilization rates in a population. If males become a limiting factor in the reproductive ecology of the Kemp's ridley, then reproductive output in the population could decrease (Coyne 2000). Low numbers of males could also result in the loss of genetic diversity within a population; however, there is currently no evidence that this is a problem in the Kemp's ridley population (NMFS *et al*. 2011). Models (Davenport 1997, Hulin and Guillon 2007, Hawkes *et al*. 2007, all referenced in NMFS *et al*. 2011) predict very long-term reductions in fertility in sea turtles due to climate change, but due to the relatively long life cycle of sea turtles, reductions may not be seen until 30 to 50 years in the future.

Another potential impact from global climate change is sea level rise, which may result in increased beach erosion at nesting sites. Beach erosion may 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. In the case of the Kemp’s ridley where most of the critical nesting beaches are undeveloped, beaches may shift landward and still be available for nesting. The Padre Island National Seashore (PAIS) shoreline is accreting, unlike much of the Texas coast, and with nesting increasing and sand temperatures slightly cooler than at Rancho Nuevo, PAIS could become an increasingly important source of males for the population.

As with the other sea turtle species discussed in this section, while there is a reasonable degree of certainty that certain 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 on loggerheads, it is unlikely that impacts from climate change will have a significant effect on the status of Kemp’s ridleys over the scope of the proposed action. However, significant impacts from climate change in the future are to be expected, but the severity of and rate at which these impacts will occur is currently unknown.

Summary of Status for Kemp’s Ridley Sea Turtles

The majority of Kemp’s ridleys nest along a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; NMFS and USFWS 2007b; NMFS *et al.* 2011). The number of nesting females in the Kemp's ridley population declined dramatically from the late 1940s through the mid-1980s, with an estimated 40,000 nesting females in a single *arribada* in 1947 and fewer than 300 nesting females in the entire 1985 nesting season (TEWG 2000; NMFS *et al.* 2011). However, the total annual number of nests at Rancho Nuevo gradually began to increase in the 1990s (NMFS and USFWS 2007b). Based on the number of nests laid in 2006 and the remigration interval for Kemp's ridley sea turtles (1.8-2 years), there were an estimated 7,000-8,000 adult female Kemp's ridley sea turtles in 2006 (NMFS and USFWS 2007b). The number of adult males in the population is unknown, but sex ratios of hatchlings and immature Kemp's ridleys suggest that the population is female-biased, suggesting that the number of adult males is less than the number of adult females (NMFS and USFWS 2007b). While there is cautious optimism for recovery, events such as the Deepwater Horizon oil release, and stranding events associated increased skimmer trawl use and poor TED compliance in the northern Gulf of Mexico may dampen recent population growth.

As with the other sea turtle species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like dredging, pollution, and habitat destruction also contribute to annual human caused mortality, but the levels are unknown. Based on their five-year status review of the species, NMFS and USFWS (2007b) determined that Kemp's ridley sea turtles should not be reclassified as threatened under the ESA. A revised bi-national recovery plan was published for public comment in 2010, and in September 2011, the NMFS, USFWS, and the Secretary of Environment and Natural Resources, Mexico (SEMARNAT) released the second revision to the Kemp's ridley recovery plan.

4.2.4 Status of Green Sea Turtles

Green sea turtles are distributed circumglobally, and can be found in the Pacific, Indian, and Atlantic Oceans as well as the Mediterranean Sea (NMFS and USFWS 1991, 2007c; Seminoff 2004). In 1978, the Atlantic population of the green sea turtle was listed as threatened under the ESA, except for the breeding populations in Florida and on the Pacific coast of Mexico, which were listed as endangered. As it is difficult to differentiate between breeding populations away from the nesting beaches, all green sea turtles in the water are considered endangered.

Pacific Ocean

Green sea turtles occur in the western, central, and eastern Pacific. Foraging areas are located throughout the Pacific and along the southwestern U.S. coast (NMFS and USFWS 1998a). In the western Pacific, major nesting rookeries at four sites including Heron Island (Australia), Raine Island (Australia), Guam, and Japan have been evaluated. Three were determined to be increasing in abundance, while the population in Guam which appears stable (NMFS and USFWS 2007c). In the central Pacific, nesting occurs on French Frigate Shoals, Hawaii, which has also been reported as increasing, with a mean of 400 nesting females annually from 2002-2006 (NMFS and USFWS 2007c). The main nesting sites for the green sea turtle in the eastern Pacific are located in Michoacán, Mexico and in the Galapagos Islands, Ecuador (NMFS and USFWS 2007c). The number of nesting females per year exceeds 1,000 females at each site (NMFS and USFWS 2007c). However, historically, greater than 20,000 females per year were believed to have nested in Michoacán alone (Cliffton *et al.* 1982; NMFS and USFWS 2007c).

The Mexican Pacific green turtle nesting population (also called the black turtle) is considered endangered.

Historically, green sea turtles were caught for food in many areas of the Pacific. They were also commercially exploited, which, coupled with habitat degradation, led to their decline in the Pacific (NMFS and USFWS 1998a). Green sea turtles in the Pacific continue to be affected by poaching, habitat loss or degradation, fishing gear interactions, and fibropapillomatosis, which is a viral disease that causes tumors in affected turtles (NMFS and USFWS 1998a; NMFS 2004b).

Indian Ocean

There are numerous nesting sites for green sea turtles in the Indian Ocean. One of the largest nesting sites for green sea turtles worldwide occurs on the beaches of Oman where an estimated 20,000 green sea turtles nest annually (Hirth 1997; Ferreira *et al.* 2003). Based on a review of the 32 Index Sites used to monitor green sea turtle nesting worldwide, Seminoff (2004) concluded that declines in green sea turtle nesting were evident for many of the Indian Ocean Index Sites. While several of these had not demonstrated further declines in the recent past, only the Comoros Island Index Site in the western Indian Ocean showed evidence of increased nesting (Seminoff 2004).

Mediterranean Sea

There are four nesting concentrations of green sea turtles in the Mediterranean from which data are available – Turkey, Cyprus, Israel, and Syria. Currently, approximately 300-400 females nest each year, about two-thirds of which nest in Turkey and one-third in Cyprus. Although green sea turtles are depleted from historic levels in the Mediterranean Sea (Kasparek *et al.* 2001), nesting data gathered since the early 1990s in Turkey, Cyprus, and Israel show no apparent trend in any direction. However, a declining trend is apparent along the coast of Palestine/Israel, where 300-350 nests were deposited each year in the 1950s (Sella 1982) compared to a mean of six nests per year from 1993-2004 (Kuller 1999; Y. Levy, Israeli Sea Turtle Rescue Center, unpublished data). A recent discovery of green sea turtle nesting in Syria adds roughly 100 nests per year to green sea turtle nesting activity in the Mediterranean (Rees *et al.* 2005). That such a major nesting concentration could have gone unnoticed until recently (the Syrian coast was surveyed in 1991, but nesting activity was attributed to loggerheads) bodes well for the speculation that the unsurveyed coast of Libya may also host substantial nesting.

Atlantic Ocean

Distribution and Life History

Green sea turtles were once the target of directed fisheries in the U.S. and throughout the Caribbean. In 1890, over one million pounds of green sea turtles were captured in a directed fishery in the Gulf of Mexico (Doughty 1984). However, declines in the turtle fishery throughout the Gulf of Mexico were evident by 1902 (Doughty 1984).

In the western Atlantic, large juvenile and adult green sea turtles are largely herbivorous, occurring in habitats containing benthic algae and seagrasses 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.

Some of the principal feeding areas in the western Atlantic Ocean include the upper west coast of Florida, the Florida Keys, and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito and Indian River Lagoon systems and nearshore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean coast of Panama, and scattered areas along Colombia and Brazil (Hirth 1971). The waters surrounding the island of Culebra, Puerto Rico, and its outlying keys are designated critical habitat for the green sea turtle.

Age at maturity for green sea turtles is estimated to be 20-50 years (Balazs 1982; Frazer and Ehrhart 1985; Seminoff 2004). Adult females may nest multiple times in a season (average three nests/season with approximately 100 eggs/nest) and typically do not nest in successive years (NMFS and USFWS 1991; Hirth 1997).

Population Dynamics and Status

Nest count information for green sea turtles provides information on the relative abundance of nesting, 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 five-year status review for the species identified eight geographic areas considered to be primary nesting sites in the Atlantic/Caribbean, and reviewed the trend in nest count data for each (NMFS and USFWS 2007c). These include: (1) Yucatán Peninsula, Mexico, (2) Tortuguero, Costa Rica, (3) Aves Island, Venezuela, (4) Galibi Reserve, Suriname, (5) Isla Trindade, Brazil, (6) Ascension Island, United Kingdom, (7) Bioko Island, Equatorial Guinea, and (8) Bijagos Achipelago, Guinea-Bissau (NMFS and USFWS 2007c). Nesting at all of these sites is considered to be stable or increasing with the exception of Bioko Island, which may be declining. However, the lack of sufficient data precludes a meaningful trend assessment for this site (NMFS and USFWS 2007c).

Seminoff (2004) reviewed green sea turtle nesting data for eight sites in the western, eastern, and central Atlantic, including all of the above nesting sites except that nesting in Florida was reviewed in place of Isla Trindade, Brazil. He concluded that all sites in the central and western Atlantic showed increased nesting except Aves Island, Venezuela, while both sites in the eastern Atlantic demonstrated decreased nesting. These sites are not inclusive of all green sea turtle nesting in the Atlantic Ocean. However, other sites are not believed to support nesting levels high enough to change the overall status of the species in the Atlantic (NMFS and USFWS 2007c).

By far, the most important nesting concentration for green sea turtles in the western Atlantic is in Tortuguero, Costa Rica (NMFS and USFWS 2007c). Nesting in the area has increased considerably since the 1970s and nest count data from 1999-2003 suggest nesting by 17,402-37,290 females per year (NMFS and USFWS 2007c). The number of females nesting per year on beaches in the Yucatán, at Aves Island, Galibi Reserve, and Isla Trindade number in the hundreds to low thousands, depending on the site (NMFS and USFWS 2007c).

The status of the endangered Florida breeding population was also evaluated in the five-year status review (NMFS and USFWS 2007c). The pattern of green sea turtle nesting shows biennial peaks in abundance, with a generally positive trend since establishment of the Florida index beach surveys in 1989. This trend is perhaps due to increased protective legislation throughout the Caribbean (Meylan *et al.* 1995), as well as protections in Florida and throughout the U.S. (NMFS and USFWS 2007c).

The statewide Florida surveys (2000-2006) have shown that a mean of approximately 5,600 nests are laid annually in Florida, with a low of 581 in 2001 to a high of 9,644 in 2005 (NMFS and USFWS 2007c). Most nesting occurs along the east coast of Florida, but occasional nesting has been documented along the Gulf coast of Florida, at Southwest Florida beaches, as well as the beaches in the Florida Panhandle (Meylan *et al.* 1995). More recently, green sea turtle nesting occurred on Bald Head Island, North Carolina (just east of the mouth of the Cape Fear River), Onslow Island, and Cape Hatteras National Seashore. One green sea turtle nested on a beach in Delaware in 2011, although its occurrence was considered very rare.

Threats

Green sea turtles face many of the same natural threats as loggerhead and Kemp's ridley sea turtles. In addition, green sea turtles appear to be particularly susceptible to fibropapillomatosis, an epizootic disease producing lobe-shaped tumors on the soft portion of a turtle's body. Juveniles appear to have the highest incidence of disease and the most extensive lesions, whereas lesions in nesting adults are rare. Also, green sea turtles frequenting nearshore waters, areas adjacent to large human populations, and areas with low water turnover, such as lagoons, have a higher incidence of the disease than individuals in deeper, more remote waters. The occurrence of fibropapilloma tumors may result in impaired foraging, breathing, or swimming ability, leading potentially to death (George 1997).

Incidental fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches. Witherington *et al.* (2009) observed that because green sea turtles spend a shorter time in oceanic waters, and as older juveniles occur on shallow seagrass pastures (where benthic trawling is unlikely), they avoid high mortalities in pelagic longline and benthic trawl fisheries. Although the relatively low number of observed green sea turtle captures makes it difficult to estimate bycatch rates and annual levels of interactions, green sea turtles have been observed captured in the pelagic driftnet, pelagic longline, southeast shrimp trawl, and Mid-Atlantic trawl and gillnet fisheries. Murray (2009a) indicated that there were five observed captures of green sea turtles in Mid-Atlantic sink gillnet gear between 1995 and 2006.

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.*, 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. The most recent section 7 consultation on the shrimp fishery, completed in May 2012, was unable to estimate the total annual level of green sea turtle interactions occurring in the fishery. Instead, it qualitatively estimated that the shrimp fishery, as currently operating, would result in at least hundreds and possibly low thousands of interactions annually, of which hundreds are expected to be lethal (NMFS 2012a).

Other activities like channel dredging, marine debris, pollution, vessel strikes, power plant impingement, and habitat destruction account for an unquantifiable level of other mortality. Stranding reports indicate that between 200-400 green sea turtles strand annually along the eastern U.S. coast from a variety of causes most of which are unknown (STSSN database).

The most recent five-year status review for green sea turtles (NMFS and USFWS 2007c) notes that global climate change is affecting the species and will likely continue to be a threat. There is an increasing female bias in the sex ratio of green sea turtle hatchlings. While this is partly attributable to imperfect egg hatchery practices, global climate change is also implicated as a likely cause, as warmer sand temperatures at nesting beaches are likely to result in the production of more female embryos. At least one nesting site, Ascension Island, has had an increase in mean sand temperature in recent years (Hays *et al*. 2003 in NMFS and USFWS 2007c). Climate change may also impact nesting beaches through sea level rise which may reduce the availability of nesting habitat and increase the risk of nest inundation. Loss of appropriate nesting habitat may also be accelerated by 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. Oceanic changes related to rising water temperatures could result in changes in the abundance and distribution of the primary food sources of green sea turtles, which in turn could result in changes in behavior and distribution of this species. Seagrass habitats may suffer from decreased productivity and/or increased stress due to sea level rise, as well as salinity and temperature changes (Short and Neckles 1999; Duarte 2002).

As noted above, the increasing female bias in green sea turtle hatchlings is thought to be at least partially linked to increases in temperatures at nesting beaches. However, due to a lack of scientific data, the specific future effects of climate change on green sea turtles species are not predictable or quantifiable to any degree at this time (Hawkes *et al*. 2009). For example, information is not available to predict the extent and rate to which sand temperatures at the nesting beaches used by green sea turtles may increase in the short-term future and the extent to which green sea turtles may be able to cope with this change by selecting cooler areas of the beach or shifting their nesting distribution to other beaches at which increases in sand temperature may not be experienced. Based on the most recent five-year status review (NMFS and USFWS 2007c), and following from the climate change discussions on the other hard-shelled sea turtle species, it is unlikely that impacts from climate change will have a significant effect on the status of green sea turtles over the scope of the action assessed in this Opinion. However, significant impacts from climate change in the future are to be expected, but the severity of and rate at which these impacts will occur is currently unknown.

Summary of Status of Green Sea Turtles
A review of 32 Index Sites distributed globally, which include all of the major known nesting areas as well as many of the lesser known nesting areas for which quantitative data are available, revealed a 48%-67% decline in the number of mature females nesting annually over the last three generations[3] (Seminoff 2004). An evaluation of green sea turtle nesting sites was also conducted as part of the five-year status review of the species (NMFS and USFWS 2007c). Of the 23 threatened nesting groups assessed in that report for which nesting abundance trends could be determined, ten were considered to be increasing, nine were considered stable, and four were considered to be decreasing (NMFS and USFWS 2007c). Nesting groups were considered to be doing relatively well (the number of sites with increasing nesting were greater than the number of sites with decreasing nesting) in the Pacific, western Atlantic, and central Atlantic (NMFS and USFWS 2007c). However, nesting populations were determined to be doing relatively poorly in Southeast Asia, eastern Indian Ocean, and the Mediterranean. Overall, based on mean annual reproductive effort, the report estimated that 108,761 to 150,521 females nest each year among the 46 threatened and endangered nesting sites included in the evaluation (NMFS and USFWS 2007c). However, given the late age to maturity for green sea turtles, caution is urged regarding the status for any of the nesting groups since no area has a dataset spanning a full green sea turtle generation (NMFS and USFWS 2007c).

Seminoff (2004) and NMFS and USFWS (2007c) made comparable conclusions for four nesting sites in the western Atlantic that indicate sea turtle abundance is increasing in the Atlantic Ocean. Both also concluded that nesting at Tortuguero, Costa Rica represented the most important nesting area for green sea turtles in the western Atlantic and that nesting at Tortuguero had increased markedly since the 1970s (Seminoff 2004; NMFS and USFWS 2007c).

However, the five-year status review also noted that the Tortuguero nesting stock continued to be affected by ongoing directed captures at their primary foraging area in Nicaragua (NMFS and USFWS 2007c). The endangered breeding population in Florida appears to be increasing based upon index nesting data from 1989-2010 (NMFS 2011).

As with the other sea turtle species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like hopper dredging, pollution, and habitat destruction also contribute to human caused mortality, though the level is unknown. Based on its five-year status review of the species, NMFS and USFWS (2007c) determined that the listing classification for green sea turtles should not be changed. However, it was also determined that an analysis and review of the species should be conducted to determine whether DPSs should be identified (NMFS and USFWS 2007c).

4.2.5 Status of Leatherback Sea Turtles

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.

[3] Generation times ranged from 35.5 years to 49.5 years for the assessment depending on the Index Beach site

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, 2007d; 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 is currently 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 2011). 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, leatherbacks 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 reported throughout the western Pacific region where observers report that nesting groups are well below abundance levels that were 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), but a total of only 120 nests on the four primary index beaches (combined) were counted in the 2003-2004 season (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 2007d), 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 Semaeostomeae, 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, Columbia, 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, North Carolina 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 one 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 SST range similar to that observed for loggerheads; from 7° to 27.2°C (Shoop and Kenney 1992). However, leatherbacks appear to have a greater tolerance for colder waters in comparison to 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. 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 the petition on July 16, 2010, which found that the petition did not present substantial scientific information indicating that the petitioned revision was warranted. The original petitioners submitted a second petition on November 2, 2010 to revise the critical habitat designation to again include waters adjacent to a major nesting beach in Puerto Rico, including additional information on the usage of the waters. NMFS determined on May 5, 2011, that a revision to critical habitat off Puerto Rico may be warranted, and an analysis is underway. 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 (>30 years). 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 (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 U.S. 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 centimeters 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. As is the case with other sea turtle species, 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 2007d) 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 2007d). 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 1989-2006 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 all 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 Goverse 2004). Nest numbers in Suriname have shown an increase and the long-term trend for the Suriname and French Guiana nesting group seems to show an increase (Hilterman and

Goverse 2004). In 2001, the number of nests for Suriname and French Guiana combined was 60,000, one of the highest numbers observed for this region in 35 years (Hilterman and Goverse 2004). The TEWG (2007) report indicates that a positive population growth rate was found for French Guinea and Suriname using nest numbers from 1967-2005, 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 1978-1982 estimated the summer leatherback population for the northeastern U.S. 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 for the northeastern U.S. at the time of the survey. 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 at the surface, the author considered the estimates to be negatively biased and the true abundance of leatherbacks may be 4.27 times higher (Palka 2000).

Threats

The five-year status review (NMFS and USFWS 2007d) and TEWG (2007) report 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, trap/pot gear in particular. 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 and associated seawater ingestion, as well as a general stress response.

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.*, 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. The most recent section 7 consultation on the shrimp fishery, completed in May 2012, was unable to estimate the total annual level of leatherback interactions occurring in the fishery 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 bycatch events (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 1990-2000, 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). More recently, from 2002 to 2010, NMFS received 137 reports of sea turtles entangled in vertical lines from Maine to Virginia, with 128 events confirmed (verified by photo documentation or response by a trained responder; NMFS 2008a). Of the 128 confirmed events during this period, 117 events involved leatherbacks. NMFS identified the gear type and fishery for 72 of the 117 confirmed events, which included lobster (42[4]), whelk/conch (15), black sea bass (10), crab (2), and research pot gear (1). 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 2002). Leatherbacks are likely to encounter shrimp trawls working in the coastal waters off the U.S. Atlantic coast (from Cape Canaveral, Florida 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

[4] One case involved both lobster and whelk/conch gear.

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). Modifications to the design of TEDs are now required in order to exclude leatherbacks as well as large benthic immature and sexually mature loggerhead and green sea turtles. Given those modifications, Epperly *et al.* (2002) anticipated an average of 80 leatherback mortalities a year in shrimp gear interactions, dropping to an estimate of 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).

Other trawl fisheries are also known to interact with leatherback sea turtles on a much smaller scale. In October 2001, for example, a NMFS fisheries observer documented the capture of a leatherback in a bottom otter trawl fishing for *Loligo* squid off Delaware. 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. Data collected by the NEFOP from 1994-1998 (excluding 1997) indicate that a total of 37 leatherbacks were incidentally captured (16 lethally) in drift gillnets set in offshore waters from Maine to Florida during this period. Observer coverage for this period ranged from 54%-92%. In North Carolina, six additional leatherbacks were reported captured in gillnet sets in the spring (SEFSC 2001). In addition to these, in September 1995, two dead leatherbacks were removed from an 11-inch (28.2-centimeter) monofilament shark gillnet set in the nearshore waters off of Cape Hatteras (STSSN unpublished data reported in SEFSC 2001). Lastly, Murray (2009a) reports five observed leatherback captures in Mid-Atlantic sink gillnet fisheries between 1994 and 2008.

Fishing gear interactions can occur throughout the range of leatherbacks, 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 in the leatherback sea turtle population in French Guiana (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 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 get them out of their nets (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 1885 and 2007) reported plastic within the turtle's stomach contents, and in some cases (8.7% of those cases in which plastic was reported), blockage of the gut was found in a manner that 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 even movements as they drift about, 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 2007d); 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 2007d). 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 2007d). 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*. 2008). 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 2007d). 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 the other three sea turtle species, 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 2007d), and following from the climate change discussion in the previous sections on sea turtles, 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. However, significant impacts from climate change in the future 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, by egg poaching) (NMFS and USFWS 2007d). 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 2007d).

Nest counts in many areas of the Atlantic Ocean show increasing trends, including for beaches in Suriname and French Guiana, which support the majority of leatherback nesting in this region (NMFS and USFWS 2007d). 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 2007d).

Based on its five-year status review of the species, NMFS and USFWS (2007d) 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 2007d).

4.2.6 Status of Atlantic Sturgeon

The section below describes the Atlantic sturgeon listing, provides life history information that is relevant to all DPSs of Atlantic sturgeon, and then provides information specific to the status of each DPS of Atlantic sturgeon. Below, we also provide a description of the Atlantic sturgeon DPSs likely to occur in the action area and their use of the action area.

The Atlantic sturgeon is a subspecies of sturgeon distributed along the east coast of North America from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida (Scott and Scott 1988; ASSRT 2007). NMFS has divided U.S. populations of Atlantic sturgeon into five DPSs: Gulf of Maine (GOM), New York Bight (NYB), Chesapeake Bay (CB), Carolina, and South

Atlantic (SA) (77 FR 5880 and 77 FR 5914; Figure 3)[5]. The results of genetic studies suggest that natal origin influences the distribution of Atlantic sturgeon in the marine environment (Wirgin and King 2011). However, satellite tracking and tagging data demonstrate that Atlantic sturgeon from all five DPSs and Canada occur throughout the full range of the subspecies. Therefore, Atlantic sturgeon originating from any of the five DPSs can be affected by threats in the marine, estuarine, and riverine environment that occur far from natal spawning rivers.

On February 6, 2012, NMFS published notice in the *Federal Register* that listed the NYB, CB, Carolina, and SA DPSs as "endangered," and the GOM DPS as "threatened" (77 FR 5880 and 77 FR 5914). The effective date of the listings is April 6, 2012. The DPSs do not include Atlantic sturgeon that are spawned in Canadian rivers. Therefore, fish that originated in Canada are not included in the listings. As described below, individuals originating from all five of the listed DPSs may occur in the action area. Information general to all Atlantic sturgeon, as well as information specific to each of the DPSs, is provided below.

Life history
Atlantic sturgeon are long lived (approximately 60 years), late maturing, estuarine dependent, anadromous[6] fish (Bigelow and Schroeder 1953; Vladykov and Greeley 1963; Mangin 1964; Pikitch *et al.* 2005; Dadswell 2006; ASSRT 2007). They are relatively large fish, even amongst sturgeon species (Pikitch *et al.* 2005) and can grow to over 14 feet and weigh up to 800 pounds. Atlantic sturgeon are bottom feeders that suck food into a ventral protruding mouth (Bigelow and Schroeder 1953). Four barbels in front of the mouth assist the sturgeon in locating prey (Bigelow and Schroeder 1953). Diets of adult and migrant subadult Atlantic sturgeon include mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (Bigelow and Schroeder 1953; ASSRT 2007; Guilbard *et al.* 2007; Savoy 2007). Juvenile Atlantic sturgeon feed on aquatic insects, larvae, and other invertebrates (Bigelow and Schroeder 1953; ASSRT 2007; Guilbard *et al.* 2007). The life history of Atlantic sturgeon can be divided into five general categories as described in Table 2 below (adapted from ASSRT 2007).

Table 2. Descriptions of Atlantic sturgeon life history stages.

Age Class	**Size**	**Description**
Egg		Fertilized or unfertilized
Larvae		Negative photo-taxic, nourished by yolk sac
Young-of-the-Year (YOY)	**0.3 grams; <41 cm TL**	Fish that are > 3 months and < one year; capable of capturing and consuming live food
Sub-adults	**>41 cm and <150 cm TL**	Fish that are at least age 1 and are not sexually mature
Adults	**>150 cm TL**	Sexually mature fish

[5] To be considered for listing under the ESA, a group of organisms must constitute a "species." A "species" is defined in section 3 of the ESA to include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature."
[6] Anadromous refers to a fish that is born in freshwater, spends most of its life in the sea, and returns to freshwater to spawn (NEFSC FAQ's, available at http://www.nefsc.noaa.gov/faq/fishfaq1a.html, modified June 16, 2011)

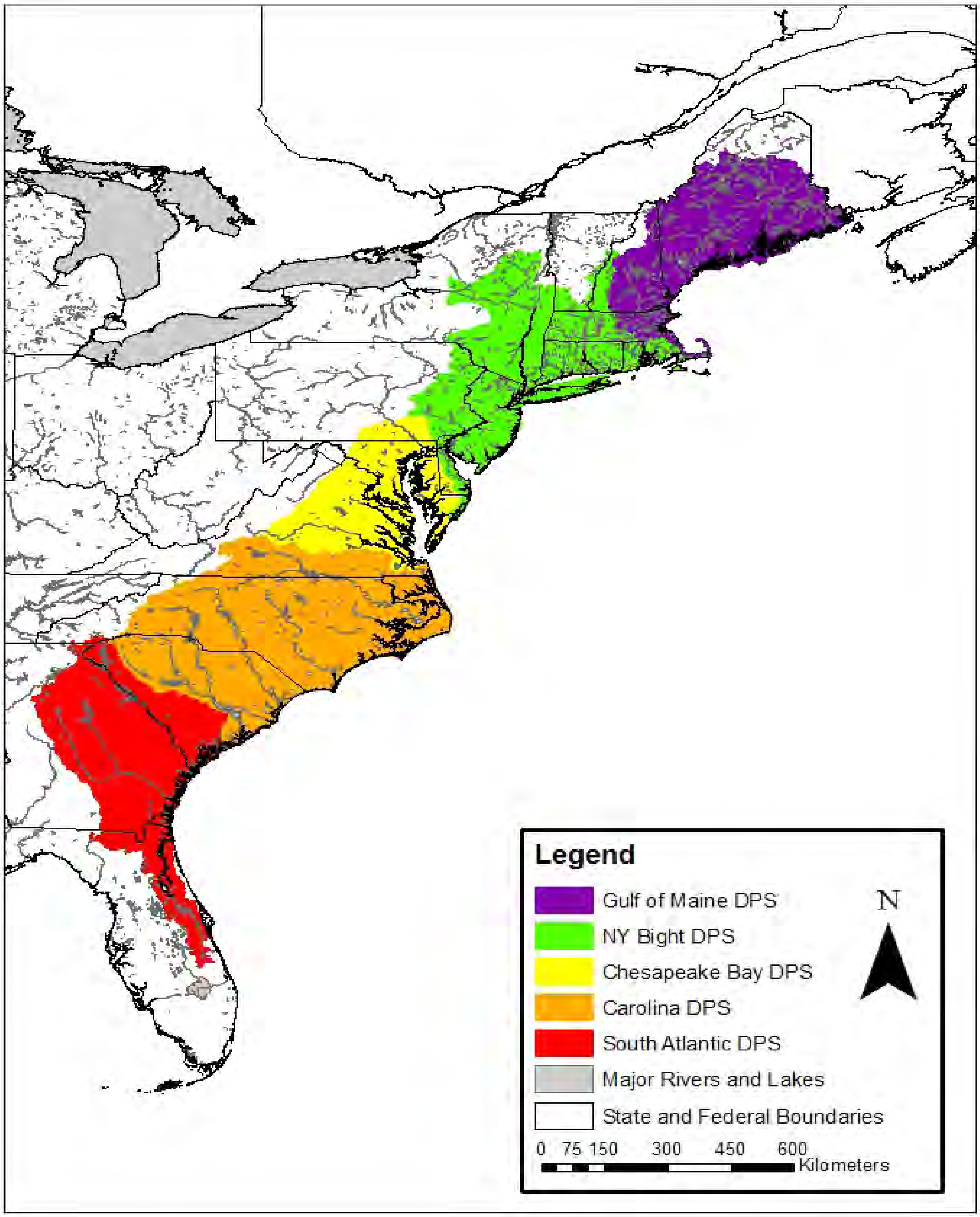

Figure 3. Map Depicting the Boundaries of the five Atlantic sturgeon DPSs

Rate of maturation is affected by water temperature and gender. In general: (1) Atlantic sturgeon that originate from southern systems grow faster and mature sooner than Atlantic sturgeon that originate from more northern systems; (2) males grow faster than females; (3) fully mature females attain a larger size (*i.e.*, length) than fully mature males. The largest recorded Atlantic sturgeon was a female captured in 1924 that measured approximately 4.26 meters (Vladykov and Greeley 1963). Dadswell (2006) reported seeing seven fish of comparable size in the St. John River estuary from 1973 to 1995. Observations of large-sized sturgeon are particularly important given that egg production is correlated with age and body size (Smith *et al.* 1982; Van Eenennaam *et al.* 1996; Van Eenennaam and Doroshov 1998; Dadswell 2006). The lengths of Atlantic sturgeon caught since the mid-late 20th century have typically been less than three meters (Smith *et al.* 1982, Smith and Dingley 1984; Smith 1985; Scott and Scott 1988; Young *et al.* 1998; Collins *et al.* 2000; Caron *et al.* 2002; Dadswell 2006; ASSRT 2007; Kahnle *et al.* 2007; DFO 2011). While females are prolific, with egg production ranging from 400,000 to four million eggs per spawning year, females spawn at intervals of two to five years (Vladykov and Greeley 1963; Smith *et al.* 1982; Van Eenennaam *et al.* 1996; Van Eenennaam and Doroshov 1998; Stevenson and Secor 1999; Dadswell 2006). Given spawning periodicity and a female's relatively late age to maturity, the age at which 50% of the maximum lifetime egg production is achieved is estimated to be 29 years (Boreman 1997). Males exhibit spawning periodicity of one to five years (Smith 1985; Collins *et al.* 2000; Caron *et al.* 2002). While long-lived, Atlantic sturgeon are exposed to a multitude of threats prior to achieving maturation and have a limited number of spawning opportunities once mature.

Water temperature plays a primary role in triggering the timing of spawning migrations (Greene *et al.* 2009). Spawning migrations generally occur during February-March in southern systems, April-May in Mid-Atlantic systems, and May-July in Canadian systems (Murawski and Pacheco 1977; Smith 1985; Bain 1997; Smith and Clugston 1997; Caron *et al.* 2002). Male sturgeon begin upstream spawning migrations when waters reach approximately 6°C (43°F) (Smith *et al.* 1982; Dovel and Berggren 1983; Smith 1985; Greene *et al.* 2009), and remain on the spawning grounds throughout the spawning season (Bain 1997). Females begin spawning migrations when temperatures are closer to 12° to 13°C (54° to 55°F) (Dovel and Berggren 1983; Smith 1985; Collins *et al.* 2000), make rapid spawning migrations upstream, and quickly depart following spawning (Bain 1997).

The spawning areas in most U.S. rivers have not been well defined. However, the habitat characteristics of spawning areas have been identified based on historical accounts of where fisheries occurred, tracking and tagging studies of spawning sturgeon, and physiological needs of early life stages. Spawning is believed to occur in flowing water between the salt front of estuaries and the fall line of large rivers, when and where optimal flows are 46-76 centimeters/ second and depths are 3-27 meters (Borodin 1925; Dees 1961; Leland 1968; Scott and Crossman 1973; Crance 1987; Shirey *et al.* 1999; Bain *et al.* 2000; Collins *et al.* 2000; Caron *et al.* 2002; Hatin *et al.* 2002; Greene *et al.* 2009). Sturgeon eggs are deposited on hard bottom substrate such as cobble, coarse sand, and bedrock (Dees 1961; Scott and Crossman 1973; Gilbert 1989; Smith and Clugston 1997; Bain *et al.* 2000; Collins *et al.* 2000; Caron *et al.* 2002; Hatin *et al.* 2002; Mohler 2003; Greene *et al.* 2009), and become adhesive shortly after fertilization (Murawski and Pacheco 1977; Van den Avyle 1984; Mohler 2003). Incubation time for the eggs increases as water temperature decreases (Mohler 2003). At temperatures of 20° and 18°C, hatching occurs approximately 94 and 140 hours, respectively, after deposition (ASSRT 2007).

Larval Atlantic sturgeon (*i.e.*, less than four weeks old, with total lengths (TL) less than 30 millimeters; Van Eenennaam *et al.* 1996) are assumed to mostly live on or near the bottom and inhabit the same riverine or estuarine areas where they were spawned (Smith *et al.* 1980; Bain *et al.* 2000; Kynard and Horgan 2002; Greene *et al.* 2009). Studies suggest that age-0 (*i.e.*, YOY), age-1, and age-2 juvenile Atlantic sturgeon occur in low salinity waters of the natal estuary (Haley 1999; Hatin *et al.* 2007; McCord *et al.* 2007; Munro *et al.* 2007) while older fish are more salt tolerant and occur in higher salinity waters as well as low salinity waters (Collins *et al.* 2000). Atlantic sturgeon remain in the natal estuary for months to years before emigrating to open ocean as subadults (Holland and Yelverton 1973; Dovel and Berggen 1983; Waldman *et al.* 1996; Dadswell 2006; ASSRT 2007).

After emigration from the natal estuary, subadults and adults travel within the marine environment, typically in waters less than 50 meters in depth, using coastal bays, sounds, and ocean waters (Vladykov and Greeley 1963; Murawski and Pacheco 1977; Dovel and Berggren 1983; Smith 1985; Collins and Smith 1997; Welsh *et al.* 2002; Savoy and Pacileo 2003; Stein *et al.* 2004a; Laney *et al.* 2007; Dunton *et al.* 2010; Erickson *et al.* 2011; Wirgin and King 2011). Tracking and tagging studies reveal seasonal movements of Atlantic sturgeon along the coast. Satellite-tagged adult sturgeon from the Hudson River concentrated in the southern part of the Mid-Atlantic Bight at depths greater than 20 meters during winter and spring, and in the northern portion of the Mid-Atlantic Bight at depths less than 20 meters in summer and fall (Erickson *et al.* 2011). A similar movement pattern for juvenile Atlantic sturgeon has been found based on recaptures of fish originally tagged in the Delaware River (C. Shirey, Delaware Department of Fish and Wildlife, unpublished data reviewed in Greene *et al.* 2009). After leaving the Delaware River estuary during the fall, juvenile Atlantic sturgeon were recaptured by commercial fishermen in nearshore waters along the Atlantic coast as far south as Cape Hatteras from November through early March. In the spring, a portion of the tagged fish re-entered the Delaware River estuary. However, many fish continued a northerly coastal migration through the Mid-Atlantic as well as into southern New England waters where they were recovered throughout the summer months. Movements as far north as Maine were documented. A southerly coastal migration was apparent from tag returns reported in the fall. The majority of these tag returns were reported from relatively shallow nearshore fisheries with few fish reported from waters in excess of 25 meters (C. Shirey, Delaware Department of Fish and Wildlife, unpublished data reviewed in Greene *et al.* 2009). Areas where migratory Atlantic sturgeon commonly aggregate include the Bay of Fundy (*e.g.*, Minas and Cumberland Basins), Massachusetts Bay, Connecticut River estuary, Long Island Sound, New York Bight, Delaware Bay, Chesapeake Bay, and waters off of North Carolina from the Virginia/North Carolina border to Cape Hatteras at depths up to 24 meters (Dovel and Berggren 1983; Dadswell *et al.* 1984; Johnson *et al.* 1997; Rochard *et al.* 1997; Kynard *et al.* 2000; Eyler *et al.* 2004; Stein *et al.* 2004a; Wehrell 2005; Dadswell 2006; ASSRT 2007; Laney *et al.* 2007). These sites may be used as foraging sites and/or thermal refugia.

Determination of DPS Composition in the Action Area

As explained above, the range of all five DPSs overlaps and extends from Canada through Cape Canaveral, Florida. We have considered the best available information to determine from which DPSs individuals in the action area are likely to have originated. We have determined that Atlantic sturgeon in the action area likely originate from the five DPSs at the following frequencies: NYB 49%; SA 20%; CB 14%; GOM 11%; and Carolina 4%. These percentages are based on genetic sampling of individuals (n=173) sampled in commercial fisheries by the NEFOP. This covers potential captures in what Damon-Randall *et al.* (2013) describe as Marine Mixing Zone 2, which includes ocean waters from roughly Chatham, Massachusetts to Cape Hatteras, North Carolina and is generally aligned with the action area for this consultation. Therefore, this represents the best available information on the likely genetic makeup of individuals occurring in the action area. The genetic assignments have a plus/minus 5% confidence interval; however, for purposes of section 7 consultation we have selected the reported values above, which approximate the mid-point of the range, as a reasonable indication of the likely genetic makeup of Atlantic sturgeon in the action area. These assignments and the data from which they are derived are described in detail in Damon-Randall *et al*. (2013).

Distribution and Abundance

Atlantic sturgeon underwent significant range-wide declines from historical abundance levels due to overfishing in the mid to late 19th century when a caviar market was established (Scott and Crossman 1973; Taub 1990; MNRPD 1993; Smith and Clugston 1997; Dadswell 2006; ASSRT 2007). Abundance of spawning-aged females prior to this period of exploitation was predicted to be greater than 100,000 for the Delaware River, and at least 10,000 females for other spawning stocks (Secor and Waldman 1999; Secor 2002). Historical records suggest that Atlantic sturgeon spawned in at least 35 rivers prior to this period. Currently, only 17 U.S. rivers are known to support spawning (*i.e.*, presence of YOY or gravid Atlantic sturgeon documented within the past 15 years) (ASSRT 2007). While there may be other rivers supporting spawning for which definitive evidence has not been obtained (*e.g.*, in the Penobscot and York Rivers), the number of rivers supporting spawning of Atlantic sturgeon are approximately half of what they were historically. In addition, only five rivers (Kennebec, Androscoggin, Hudson, Delaware, and James) are known to currently support spawning from Maine through Virginia, where historical records show that there used to be 15 spawning rivers (ASSRT 2007). Thus, there are substantial gaps between Atlantic sturgeon spawning rivers amongst northern and Mid-Atlantic states which could make recolonization of extirpated populations more difficult.

There are no current, published population abundance estimates for any of the currently known spawning stocks or for any of the five DPSs of Atlantic sturgeon. An estimate of 863 mature adults per year (596 males and 267 females) was calculated for the Hudson River based on fishery-dependent data collected from 1985-1995 (Kahnle *et al.* 2007). An estimate of 343 spawning adults per year is available for the Altamaha River, Georgia, based on fishery-independent data collected in 2004 and 2005 (Schueller and Peterson 2006). Using the data collected from the Hudson and Altamaha Rivers to estimate the total number of Atlantic sturgeon in either subpopulation is not possible, since mature Atlantic sturgeon may not spawn every year (Vladykov and Greeley 1963; Smith 1985; Van Eenennaam *et al.* 1996; Stevenson and Secor 1999; Collins *et al.* 2000; Caron *et al.* 2002), the age structure of these populations is not well understood, and stage to stage survival is unknown. In other words, the information that would allow us to take an estimate of annual spawning adults and expand that estimate to an estimate of the total number of individuals (*e.g.*, yearlings, subadults, and adults) in a population is lacking. The ASSRT presumed that the Hudson and Altamaha Rivers had the most robust of the remaining U.S. Atlantic sturgeon spawning populations and concluded that the other U.S. spawning populations were likely less than 300 spawning adults per year (ASSRT 2007).

Lacking complete estimates of population abundance across the distribution of Atlantic sturgeon, the NEFSC developed a virtual population analysis model with the goal of estimating bounds of Atlantic sturgeon ocean abundance. The NEFSC suggested that cumulative annual estimates of surviving fishery discards could provide a minimum estimate of abundance. The objectives of producing the Atlantic Sturgeon Production Index (ASPI) were to characterize uncertainty in abundance estimates arising from multiple sources of observation and process error and to complement future efforts to conduct a more comprehensive stock assessment (Table 3). The ASPI provides a general abundance metric to assess risk for actions that may affect Atlantic sturgeon in the ocean; however, it is not a comprehensive stock assessment. In general, the model uses empirical estimates of post-capture survivors and natural survival, as well as probability estimates of recapture using tagging data from the USFWS sturgeon tagging database, and federal fishery discard estimates from 2006 to 2010 to produce a virtual population. The USFWS sturgeon tagging database is a repository for sturgeon tagging information on the Atlantic coast. The database contains tag release and recapture information from state and federal researchers. The database records recaptures by the fishing fleet, researchers, and researchers on fishery vessels.

In additional to the ASPI, a population estimate was derived from the NEAMAP trawl surveys (Table 3). The NEAMAP trawl surveys are conducted from Cape Cod, Massachusetts to Cape Hatteras, North Carolina in nearshore waters at depths up to 18.3 meters (60 feet) during the fall since 2007 and spring since 2008. Each survey employs a spatially stratified random design with a total of 35 strata and 150 stations. The Atlantic States Marine Fisheries Commission (ASMFC) has initiated a new stock assessment with the goal of completing it by the end of 2014. NMFS will be partnering with them to conduct the stock assessment, and the ocean population abundance estimates produced by the NEFSC will be shared with the stock assessment committee for consideration in the stock assessment.

Table 3. Description of the ASPI model and NEAMAP survey based area estimate method.

Model Name	Model Description
A. ASPI	Uses tag-based estimates of recapture probabilities from 1999 to 2009. Natural mortality based on Kahnle *et al.* (2007) rather than estimates derived from tagging model. Tag recaptures from commercial fisheries are adjusted for non-reporting based on recaptures from observers and researchers. Tag loss assumed to be zero.
B. NEAMAP Swept Area	Uses NEAMAP survey-based swept area estimates of abundance and assumed estimates of gear efficiency. Estimates based on average of ten surveys from fall 2007 to spring 2012.

Atlantic sturgeon are frequently encountered during the NEAMAP surveys. The information from these surveys can be used to calculate minimum swept area population estimates within the strata swept by the surveys. The estimate from fall surveys ranges from 6,980 to 42,160 with coefficients of variation between 0.02 and 0.57, and the estimates from spring surveys ranges from 25,540 to 52,990 with coefficients of variation between 0.27 and 0.65 (Table 4). These are considered minimum estimates because the calculation makes the assumption that the gear will capture (*i.e.*, net efficiency) 100% of the sturgeon in the water column along the tow path and that all sturgeon are with the sampling domain of the survey. We define catchability as: 1) the product of the probability of capture given encounter (*i.e.*, net efficiency), and 2) the fraction of the population within the sampling domain. Catchabilities less than 100% will result in estimates greater than the minimum. The true catchability depends on many factors including the availability of the species to the survey and the behavior of the species with respect to the gear. True catchabilities much less than 100% are common for most species. The average ASPI estimate of 417,934 fish implies a catchability of between 6% and 13% for the spring NEAMAP surveys, and a catchability of between 2% and 10% for the fall NEAMAP surveys. If the availability of Atlantic sturgeon in the areas sampled by the spring NEAMAP surveys were say 50%, then the implied range of net efficiencies for this survey would double to 12% and 26%. The ratio of total sturgeon habitat to area sampled by the NEAMAP surveys is unknown, but is certainly greater than one.

The NEAMAP-based estimates do not include YOY fish and juveniles in the rivers; however, those segments of the Atlantic sturgeon populations are not at risk from the proposed actions since they do not occur within the action area. The NEAMAP surveys are conducted in waters that include the preferred depth ranges of subadult and adult Atlantic sturgeon and take place during seasons that coincide with known Atlantic sturgeon coastal migration patterns in the ocean. Therefore, the NEAMAP estimates are minimum estimates of the ocean population of Atlantic sturgeon but are based on sampling throughout the action area, in known sturgeon coastal migration areas during times that sturgeon are expected to be migrating north and south.

Available data do not support estimation of true catchabilty (*i.e.*, net efficiency x availability) of the NEAMAP trawl survey for Atlantic sturgeon. Thus, the NEAMAP swept area biomass estimates were produced and presented for catchabilities from 5% to 100%. Assuming the NEAMAP surveys have been 100% efficient would require the unlikely assumption that the survey gear captures all Atlantic sturgeon within the path of the trawl and all sturgeon are within the sampling area of the NEAMAP survey. The 50% efficiency assumption seems to reasonably account for the robust, yet not complete sampling of the Atlantic sturgeon oceanic temporal and spatial ranges and the documented high rates of encounter with NEAMAP survey gear and Atlantic sturgeon. For this Opinion, we have determined that the best available data at this time are the population estimates derived from NEAMAP swept area biomass resulting from the 50% catchability rate (Table 5). The estimates are derived directly from empirical data with fewer assumptions than have been required to model Atlantic sturgeon populations to date.

Table 4. Annual minimum swept area estimates for Atlantic sturgeon during the spring and fall NEAMAP surveys. Estimates provided by Dr. Chris Bonzek (VIMS) and assume 100% net efficiencies.

Year	Fall Number	CV	Spring Number	CV
2007	6,981	0.015		
2008	33,949	0.322	25,541	0.391
2009	32,227	0.316	41,196	0.353
2010	42,164	0.566	52,992	0.265
2011	22,932	0.399	52,840	0.480
2012			28,060	0.652

Table 5. Modeled results from the ASPI and NEAMAP Atlantic sturgeon estimation methods.

Model Run	**Model Years**	**95% low**	**Mean**	**95% high**
A. ASPI	1999-2009	165,381	417,934	744,597
B.1 NEAMAP Survey, swept area assuming 100% efficiency	2007-2012	8,921	33,888	58,856
B.2 NEAMAP Survey, swept area assuming 50% efficiency	2007-2012	13,962	67,776	105,984
B.3 NEAMAP Survey, swept area assuming 10% efficiency	2007-2012	89,206	338,882	588,558

The ocean population abundance of 67,776 fish estimated from the NEAMAP surveys assuming 50% efficiency (Table 5) was subsequently partitioned by DPS based on genetic frequencies of occurrence (Table 6). Given the proportion of adults to subadults in the observer database (approximate ratio of 1:3), we have also estimated a number of subadults originating from each DPS (Table 6). However, this cannot be considered an estimate of the total number of subadults because it only considers those subadults that are of a size vulnerable to capture in commercial gillnet and trawl gear in the marine environment and are present in the marine environment.

Table 6. Summary of calculated population estimates based upon the NEAMAP survey swept area model assuming 50% efficiency.

DPS	Estimated Ocean Population Abundance	Estimated Ocean Population of Adults	Estimated Ocean Population of Subadults (of size vulnerable to capture in fisheries)
GOM (11%)	7,455	1,864	5,591
NYB (49%)	33,210	8,303	24,907
CB (14%)	9,489	2,372	7,117
Carolina (4%)	2,711	678	2,033
SA (20%)	13,555	3,389	10,166
Canada (2%)	1,356	339	1,017

Threats

Atlantic sturgeon are susceptible to over exploitation given their life history characteristics (*e.g.*, late maturity, dependence on a wide-variety of habitats). Similar to other sturgeon species (Vladykov and Greeley 1963; Pikitch *et al.* 2005), Atlantic sturgeon experienced range-wide declines from historical abundance levels due to overfishing (for caviar and meat) and impacts to habitat in the 19th and 20th centuries (Taub 1990; Smith and Clugston 1997; Secor and Waldman 1999).

Because a DPS is a group of populations, the stability, viability, and persistence of individual populations affects the persistence and viability of the larger DPS. The loss of any population within a DPS could result in: (1) a long-term gap in the range of the DPS that is unlikely to be recolonized; (2) loss of reproducing individuals; (3) loss of genetic biodiversity; (4) loss of unique haplotypes; (5) loss of adaptive traits; and (6) reduction in total number. The loss of a population will negatively impact the persistence and viability of the DPS as a whole, as fewer than two individuals per generation spawn outside their natal rivers (Secor and Waldman 1999). The persistence of individual populations, and in turn the DPS, depends on successful spawning and rearing within the freshwater habitat, emigration to marine habitats to grow, and return of adults to natal rivers to spawn.

Based on the best available information, NMFS has concluded that unintended catch in fisheries, vessel strikes, poor water quality, freshwater availability, dams, lack of regulatory mechanisms for protecting the fish, and dredging are the most significant threats to Atlantic sturgeon (77 FR 5880 and 77 FR 5914; February 6, 2012). While all the threats are not necessarily present in the same area at the same time, given that Atlantic sturgeon subadults and adults use ocean waters from Labrador, Canada to Cape Canaveral, Florida, as well as estuaries of large rivers along the U.S. East Coast, activities affecting these water bodies are likely to impact more than one Atlantic sturgeon DPS. In addition, because Atlantic sturgeon depend on a variety of habitats, every life stage is likely affected by one or more of the identified threats.

Atlantic sturgeon are particularly sensitive to bycatch mortality because they are a long-lived species, have an older age at maturity, have lower maximum fecundity values, and a large percentage of egg production occurs later in life. Based on these life history traits, Boreman (1997) calculated that Atlantic sturgeon can only withstand the annual loss of up to 5% of their population to bycatch mortality without suffering population declines. Mortality rates of Atlantic sturgeon taken as bycatch in various types of fishing gear range between 0% and 51%, with the greatest mortality occurring in sturgeon caught by sink gillnets. Atlantic sturgeon are particularly vulnerable to being caught in sink gillnets; therefore, fisheries using this type of gear account for a high percentage of Atlantic sturgeon bycatch. Fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may access multiple river systems, they are subject to being caught in multiple fisheries throughout their range. In addition, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (*e.g.*, exposure to toxins and low dissolved oxygen). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality.

As a wide-ranging, anadromous species, Atlantic sturgeon are subject to numerous Federal (U.S. and Canadian), state and provincial, and inter-jurisdictional laws, regulations, and agency activities. While these mechanisms, including the prohibition on possession, have addressed impacts to Atlantic sturgeon through directed fisheries, there are currently insufficient mechanisms in place to address the significant risk posed to Atlantic sturgeon from commercial bycatch.

An ASMFC interstate fishery management plan for sturgeon (Sturgeon FMP) was developed and implemented in 1990 (Taub 1990). In 1998, the remaining Atlantic sturgeon fisheries in U.S. state waters were closed per Amendment 1 to the Sturgeon FMP. NMFS implemented complementary regulations in 1999 that prohibit fishing for, harvesting, possessing, or retaining Atlantic sturgeon or their parts in or from the EEZ in the course of a commercial fishing activity.

Commercial fisheries for Atlantic sturgeon still exist in Canadian waters (DFO 2011). Sturgeon belonging to one or more of the DPSs may be harvested in the Canadian fisheries. In particular, the Bay of Fundy fishery in the Saint John estuary may capture sturgeon of U.S. origin given that sturgeon from the GOM and the NYB DPSs have been incidentally captured in other Bay of Fundy fisheries (DFO 2011; Wirgin and King 2011). Because Atlantic sturgeon are listed under Appendix II of the Convention on International Trade in Endangered Species (CITES), the U.S. and Canada are currently working on a conservation strategy to address the potential for captures of U.S. fish in Canadian directed Atlantic sturgeon fisheries and of Canadian fish incidentally captured in U.S. commercial fisheries. At this time, there are no estimates of the number of individuals from any of the DPSs that are captured or killed in Canadian fisheries each year. Based on geographic distribution, most U.S. Atlantic sturgeon that are intercepted in Canadian fisheries are likely to originate from the GOM DPS, with a smaller percentage from the NYB DPS.

Fisheries bycatch in U.S. waters is the primary threat faced by all five DPSs. At this time, we have an estimate of the number of Atlantic sturgeon captured and killed in sink gillnet and otter trawl fisheries authorized by Federal FMPs (NEFSC 2011b) in the Northeast Region but do not have a similar estimate for Southeast fisheries. We also do not have an estimate of the number of Atlantic sturgeon captured or killed in state fisheries. At this time, we are not able to quantify the effects of other significant threats (*e.g.*, vessel strikes, poor water quality, water availability, dams, and dredging) in terms of habitat impacts or loss of individuals. While we have some information on the number of mortalities that have occurred in the past in association with certain activities (*e.g.*, mortalities in the Delaware and James Rivers that are thought to be due to vessel strikes), we are not able to use those numbers to extrapolate effects throughout one or more DPS. This is because of (1) the small number of data points and, (2) lack of information on the percent of incidences that the observed mortalities represent.

As noted above, the NEFSC prepared an estimate of the number of encounters of Atlantic sturgeon in fisheries authorized by Northeast FMPs (NEFSC 2011b). The analysis estimates that from 2006-2010 there were averages of 1,548 and 1,569 encounters per year in observed gillnet and trawl fisheries, respectively, with an average of 3,118 encounters combined annually. Mortality rates in gillnet gear were approximately 20%. Mortality rates in otter trawl gear were generally lower at approximately 5%.

Global climate change may affect all DPSs of Atlantic sturgeon in the future; however, effects of increased water temperature and decreased water availability are most likely to affect the SA and Carolina DPSs. Implications of climate change to the Atlantic sturgeon DPSs have been speculated, yet no scientific data are available on past trends related to climate effects on this species, and current scientific methods are not able to reliably predict the future magnitude of climate change and associated impacts or the adaptive capacity of these species. Impacts of climate change on Atlantic sturgeon are uncertain at this time, and cannot be quantified. Any prediction of effects is made more difficult by a lack of information on the rate of expected change in conditions and a lack of information on the adaptive capacity of the species (*i.e.*, its ability to evolve to cope with a changing environment). For analysis on the potential effects of climate change on Atlantic sturgeon, see Section 5.3.4 below.

4.2.7 Gulf of Maine DPS of Atlantic sturgeon

The GOM DPS includes the following: all anadromous Atlantic sturgeon that spawn or are spawned in the watersheds from the Maine/Canadian border and, extending southward, all watersheds draining into the Gulf of Maine as far south as Chatham, Massachusetts. The marine range of Atlantic sturgeon from the GOM DPS extends from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the GOM DPS and the adjacent portion of the marine range are shown in Figure 3. Within this range, Atlantic sturgeon historically spawned in the Androscoggin, Kennebec, Merrimack, Penobscot, and Sheepscot Rivers (ASSRT 2007). Spawning still occurs in the Kennebec and Androscoggin Rivers, and it is possible that it still occurs in the Penobscot River as well. Spawning in the Androscoggin River was just recently confirmed by the Maine Department of Marine Resources when they captured a larval Atlantic sturgeon during the 2011 spawning season below the Brunswick Dam. There is no evidence of recent spawning in the remaining rivers. In the 1800s, construction of the Essex Dam on the

Merrimack River at river kilometer (rkm) 49 blocked access to 58% of Atlantic sturgeon habitat in the river (Oakley 2003; ASSRT 2007). However, the accessible portions of the Merrimack seem to be suitable habitat for Atlantic sturgeon spawning and rearing (*i.e.*, nursery habitat) (Kieffer and Kynard 1993). Therefore, the availability of spawning habitat does not appear to be the reason for the lack of observed spawning in the Merrimack River. Studies are on-going to determine whether Atlantic sturgeon are spawning in the Penobscot and Saco Rivers. Atlantic sturgeon that are spawned elsewhere continue to use habitats within all of these rivers as part of their overall marine range (ASSRT 2007).

At its mouth, the Kennebec River drains an area of 24,667 square kilometers, and is part of a large estuarine system that includes the Androscoggin and Sheepscot Rivers (ASMFC 1998a; ASSRT 1998; Squiers 1998). The Kennebec and Androscoggin Rivers flow into Merrymeeting Bay, a tidal freshwater bay, and exit as a combined river system through a narrow channel, flowing approximately 32 kilometers (20 miles) to the Atlantic Ocean as the tidal segment of the Kennebec River (Squiers 1998). This lower tidal segment of the Kennebec River forms a complex with the Sheepscot River estuary (ASMFC 1998a; Squiers 1998).

Substrate type in the Kennebec estuary is largely sand and bedrock (Fenster and FitzGerald 1996; Moore and Reblin 2010). Main channel depths at low tide typically range from 17 meters (58 feet) near the mouth to less than 10 meters (33 feet) in the Kennebec River above Merrymeeting Bay (Moore and Reblin 2010). Salinities range from 31 parts per thousand at Parker Head (five kilometers from the mouth) to 18 parts per thousand at Doubling Point during summer low flows (ASMFC 1998a). The 14-kilometer river segment above Doubling Point to Chops Point (the outlet of Merrymeeting Bay) is an area of transition (mid estuary) (ASMFC 1998a). The salinities in this section vary both seasonally and over a tidal cycle. During spring freshets this section is entirely fresh water but during summer low flows, salinities can range from two to three parts per thousand at Chops Point to 18 parts per thousand at Doubling Point (ASMFC 1998a). The river is essentially tidal freshwater from the outlet of Merrymeeting Bay upriver to the site of the former Edwards Dam (ASMFC 1998a). Mean tidal amplitude ranges from 2.56 meters at the mouth of the Kennebec River estuary to 1.25 meters in Augusta near the head of tide on the Kennebec River (in the vicinity of the former Edwards Dam) and 1.16 meters at Brunswick on the Androscoggin River (ASMFC 1998a).

Bigelow and Schroeder (1953) surmised that Atlantic sturgeon likely spawned in Gulf of Maine Rivers in May-July. More recent captures of Atlantic sturgeon in spawning condition within the Kennebec River suggest that spawning more likely occurs in June-July (Squiers *et al.* 1981; ASMFC 1998a; ASSRT 1998). Evidence for the timing and location of Atlantic sturgeon spawning in the Kennebec River includes: (1) the capture of five adult male Atlantic sturgeon in spawning condition (*i.e.*, expressing milt) in July 1994 below the (former) Edwards Dam; (2) the capture of 31 adult Atlantic sturgeon from June 15 through July 26, 1980, in a small commercial fishery directed at Atlantic sturgeon from the South Gardiner area (above Merrymeeting Bay) that included at least four ripe males and one ripe female captured on July 26, 1980; and, (3) the capture of nine adults during a gillnet survey conducted from 1977-1981, the majority of which were captured in July in the area from Merrymeeting Bay and upriver as far as Gardiner, Maine (ASSRT 1998; ASMFC TC 2007). The low salinity values for waters above Merrymeeting Bay are consistent with values found in other rivers where successful Atlantic sturgeon spawning is known to occur.

Age to maturity for GOM DPS Atlantic sturgeon is unknown. However, Atlantic sturgeon riverine populations exhibit clinal variation with faster growth and earlier age to maturity for those that originate from southern waters, and slower growth and later age to maturity for those that originate from northern waters (75 FR 61872; October 6, 2010). Age at maturity is 11 to 21 years for Atlantic sturgeon originating from the Hudson River (Young *et al.* 1998), and 22 to 34 years for Atlantic sturgeon that originate from the Saint Lawrence River (Scott and Crossman 1973). Therefore, age at maturity for Atlantic sturgeon of the GOM DPS likely falls within these values. Of the 18 sturgeon examined from the commercial fishery that occurred in the Kennebec River in 1980, all of which were considered mature, age estimates for the 15 males ranged from 17-40 years, and from 25-40 years old for the three females (Squiers *et al.* 1981).

Several threats play a role in shaping the current status of GOM DPS Atlantic sturgeon. Historical records provide evidence of commercial fisheries for Atlantic sturgeon in the Kennebec and Androscoggin Rivers dating back to the 17th century (Squiers *et al.* 1979). In 1849, 160 tons of sturgeon was caught in the Kennebec River by local fishermen (Squiers *et al.* 1979). After the collapse of sturgeon stock in the 1880s, the sturgeon fishery was almost non-existent. All directed Atlantic sturgeon fishing as well as retention of Atlantic sturgeon bycatch has been prohibited since 1998. Nevertheless, mortalities associated with bycatch in fisheries in state and Federal waters still occurs. In the marine range, GOM DPS Atlantic sturgeon are incidentally captured in Federal and state-managed fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (Stein *et al.* 2004b; ASMFC TC 2007). As explained above, we have estimates of the number of subadults and adults that are killed as a result of bycatch in fisheries authorized under Northeast FMPs. At this time, we are not able to quantify the impacts from other threats or estimate the number of individuals killed as a result of other anthropogenic threats. Habitat disturbance and direct mortality from anthropogenic sources are the primary concerns.

Riverine habitat may be impacted by dredging and other in-water activities, disturbing spawning habitat and also altering the benthic forage base. Many rivers in the GOM DPS have navigation channels that are maintained by dredging. Dredging outside of Federal channels and in-water construction occurs throughout the GOM DPS. While some dredging projects operate with observers present to document fish mortalities, many do not. To date we have not received any reports of Atlantic sturgeon killed during dredging projects in the Gulf of Maine region. At this time, we do not have any information to quantify the number of Atlantic sturgeon killed or disturbed during dredging or in-water construction projects are also not able to quantify any effects to habitat.

Connectivity is disrupted by the presence of dams on several rivers in the Gulf of Maine region, including the Penobscot and Merrimack Rivers. While there are also dams on the Kennebec, Androscoggin, and Saco Rivers, these dams are near the site of istorical natural falls and likely represent the maximum upstream extent of sturgeon occurrence even if the dams were not present. Because no Atlantic sturgeon occur upstream of any hydroelectric projects in the Gulf of Maine region, passage over hydroelectric dams or through hydroelectric turbines is not a source of injury or mortality in this area. The extent that Atlantic sturgeon are affected by operations of dams in the Gulf of Maine region is currently unknown; however, the documentation of an Atlantic sturgeon larvae downstream of the Brunswick Dam in the Androscoggin River suggests that Atlantic sturgeon spawning may be occurring in the vicinity of at least that project and therefore, may be affected by project operations. The range of Atlantic sturgeon in the Penobscot River is limited by the presence of the Veazie Dam, which prevents Atlantic sturgeon from accessing approximately 29 kilometers of habitat, including the presumed historical spawning habitat located downstream of Milford Falls, the site of the Milford Dam. While removal of the Veazie Dam is anticipated to occur in the near future, the presence of this dam is currently preventing access to significant habitats within the Penobscot River. Atlantic sturgeon are known to occur in the Penobscot River, but it is unknown if spawning is currently occurring in this river. The Essex Dam on the Merrimack River blocks access to approximately 58% of historically accessible habitat in this river. Atlantic sturgeon occur in the Merrimack River but spawning has not been documented. As with the Penobscot, it is unknown how the Essex Dam affects the likelihood of spawning in this river.

GOM DPS Atlantic sturgeon may also be affected by degraded water quality. In general, water quality has improved in the Gulf of Maine over the past decades (Lichter *et al.* 2006; EPA 2008). Many rivers in Maine, including the Androscoggin River, were heavily polluted in the past from pulp and paper mill industrial discharges. While water quality has improved and most discharges are limited through regulations, many pollutants persist in the benthic environment. This can be particularly problematic if pollutants are present on spawning and nursery grounds, as developing eggs and larvae are particularly susceptible to exposure to contaminants.

There are no direct in-river abundance estimates for the GOM DPS. The Atlantic Sturgeon Status Review Team (ASSRT 2007) presumed that the GOM DPS was comprised of less than 300 spawning adults per year, based on extrapolated abundance estimates from the Hudson and Altamaha riverine populations of Atlantic sturgeon. Surveys of the Kennebec River over two time periods, 1977-1981 and 1998-2000, resulted in the capture of nine adult Atlantic sturgeon (Squiers 2004). However, since the surveys were primarily directed at capture of shortnose sturgeon, the capture gear used may not have been selective for the larger-sized, adult Atlantic sturgeon; several hundred subadult Atlantic sturgeon were caught in the Kennebec River during these studies. As described earlier in Section 4.2.6, we have estimated that there are a minimum of 7,455 GOM DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in the action area. We note further that this estimate is predicated on the assumption that fish in the GOM DPS would be available for capture in the NEAMAP surveys which extend from Block Island Sound, Rhode Island southward. Recoveries of tagged sturgeon do not support this migration pattern.

Summary of the Gulf of Maine DPS

Spawning for the GOM DPS is known to occur in two rivers (Kennebec and Androscoggin). Spawning may be occurring in other rivers, such as the Sheepscot, Merrimack, and Penobscot, but has not been confirmed. There are indications of potential increasing abundance of Atlantic sturgeon belonging to the GOM DPS. Atlantic sturgeon continue to be present in the Kennebec River; in addition, they are captured in directed research projects in the Penobscot River, and are observed in rivers where they were unknown to occur or had not been observed to occur for many years (*e.g.*, Saco, Presumpscot, and Charles Rivers). These observations suggest that abundance of the GOM DPS of Atlantic sturgeon is sufficient such that recolonization to rivers historically suitable for spawning may be occurring. However, despite some positive signs, there is not enough information to establish a trend for this DPS.

Some of the impacts from the threats that contributed to the decline of the GOM DPS have been removed (*e.g.*, directed fishing), or reduced as a result of improvements in water quality and removal of dams (*e.g.*, the Edwards Dam on the Kennebec River in 1999). In Maine state waters, there are strict regulations on the use of fishing gear that incidentally catches sturgeon. In addition, in the last several years there have been reductions in fishing effort in state and Federal waters, which most likely would result in a reduction in bycatch mortality of Atlantic sturgeon. A significant amount of fishing in the Gulf of Maine is conducted using trawl gear, which is known to have a much lower mortality rate for Atlantic sturgeon caught in the gear compared to sink gillnet gear (ASMFC TC 2007). Atlantic sturgeon from the GOM DPS are not commonly taken as bycatch in areas south of Chatham, Massachusetts, with only 8% (*e.g.*, 7 of 84 fish) of interactions observed south of Chatham being assigned to the GOM DPS (Wirgin and King 2011). Tagging results also indicate that GOM DPS fish tend to remain within the waters of the Gulf of Maine and only occasionally venture to points south.

Data on Atlantic sturgeon incidentally caught in trawls and intertidal fish weirs fished in the Minas Basin area of the Bay of Fundy (Canada) indicate that approximately 35% originated from the GOM DPS (Wirgin *et al.* 2012). Thus, a significant number of the GOM DPS fish appear to migrate north into Canadian waters where they may be subjected to a variety of threats including bycatch.

As noted previously, studies have shown that in order to rebuild, Atlantic sturgeon can only sustain low levels of bycatch and other anthropogenic mortality (Boreman 1997; ASMFC TC 2007; Kahnle *et al*. 2007; Brown and Murphy 2010). We have determined that the GOM DPS is at risk of becoming endangered in the foreseeable future throughout all of its range (*i.e.*, is a threatened species) based on the following: (1) significant declines in population sizes and the protracted period during which sturgeon populations have been depressed; (2) the limited amount of current spawning; and, (3) the impacts and threats that have and will continue to affect recovery.

4.2.8 New York Bight DPS of Atlantic sturgeon

The NYB DPS includes the following: all anadromous Atlantic sturgeon that spawn or are spawned in the watersheds that drain into coastal waters from Chatham, Massachusetts to the Delaware-Maryland border on Fenwick Island. The marine range of Atlantic sturgeon from the NYB DPS extends from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the NYB DPS and the adjacent portion of the marine range are shown in Figure 3. Within this range, Atlantic sturgeon historically spawned in the Connecticut, Delaware, Hudson, and Taunton Rivers (Murawski and Pacheco 1977; Secor 2002; ASSRT 2007). Spawning still occurs in the Delaware and Hudson Rivers, but there is no recent evidence (within the last 15 years) of spawning in the Connecticut and Taunton Rivers (ASSRT 2007). Atlantic sturgeon that are spawned elsewhere continue to use habitats within the Connecticut and Taunton Rivers as part of their overall marine range (ASSRT 2007; Savoy 2007; Wirgin and King 2011).

The abundance of the Hudson River Atlantic sturgeon riverine population before the over-exploitation of the 1800s is unknown, but has been conservatively estimated at 6,000 adult females (Secor 2002). Current abundance is likely at least one order of magnitude smaller than historical levels (Secor 2002; ASSRT 2007; Kahnle *et al.* 2007). As described above, an estimate of the mean annual number of mature adults (863 total; 596 males and 267 females) was calculated for the Hudson riverine population based on fishery-dependent data collected from 1985-1995 (Kahnle *et al.* 2007). Kahnle *et al.* (1998, 2007) also showed that the level of fishing mortality from the Hudson River Atlantic sturgeon fishery during the period of 1985-1995 exceeded the estimated sustainable level of fishing mortality for the riverine population and may have led to reduced recruitment. All available data on abundance of juvenile Atlantic sturgeon in the Hudson River Estuary indicate a substantial drop in production of young since the mid-1970s (Kahnle *et al.* 1998). A decline appeared to occur in the mid to late 1970s followed by a secondary drop in the late 1980s (Kahnle *et al.* 1998; Sweka *et al.* 2007; ASMFC 2010). Catch-per-unit-effort (CPUE) data suggests that recruitment has remained depressed relative to catches of juvenile Atlantic sturgeon in the estuary during the mid-late 1980s (Sweka *et al.* 2007; ASMFC 2010). The CPUE data from 1985-2011 show significant fluctuations. There appears to be a decline in the number of juveniles between the late 1980s and early 1990s and then a slight increase in the 2000s, but, given the significant annual fluctuation, it is difficult to discern any trend. Despite the CPUEs from 2000-2011 being slightly higher than those from 1990-1999, they are low compared to the late 1980s (Figure 4). There is currently not enough information regarding any life stage to establish a trend for the Hudson River population.

There is no overall, empirical abundance estimate for the Delaware River population of Atlantic sturgeon. Harvest records from the 1800s indicate that this was historically a large population with an estimated 180,000 adult females prior to 1890 (Secor and Waldman 1999; Secor 2002). Sampling in 2009 to target YOY Atlantic sturgeon in the Delaware River (*i.e.*, natal sturgeon) resulted in the capture of 34 YOY, ranging in size from 178 to 349 millimeters TL (Fisher 2009), and the collection of 32 YOY Atlantic sturgeon in a separate study (Brundage and O'Herron 2009 in Calvo *et al.* 2010). Genetics information collected from 33 of these YOY indicates that at least three females successfully contributed to the 2009 year class (Fisher 2011). Therefore, while the capture of YOY in 2009 provides evidence that successful spawning still occurs in the Delaware River, the relatively low numbers suggest the existing riverine population is small.

Several threats play a role in shaping the current status and trends observed in the Delaware River and Estuary. In-river threats include habitat disturbance from dredging, and impacts from historical pollution and impaired water quality. A dredged navigation channel extends from Trenton seaward through the tidal river (Brundage and O'Herron 2009), and the river receives significant shipping traffic. Vessel strikes have been identified as a threat in the Delaware River and may be detrimental to the long-term viability of the NYB DPS, as well as other DPSs (Brown and Murphy 2010).

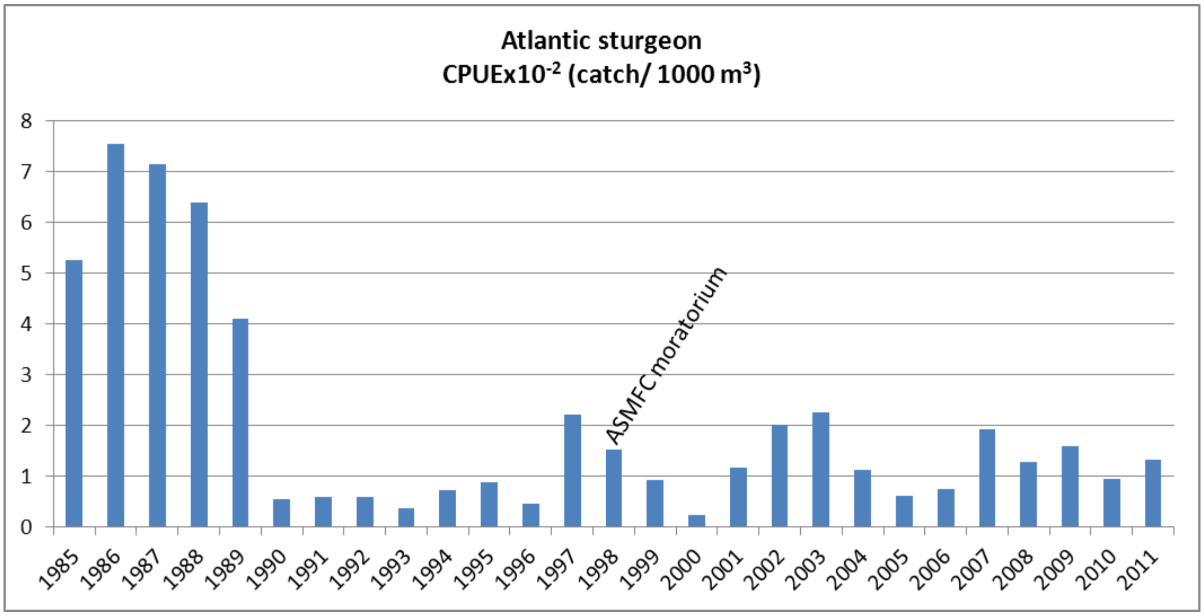

Figure 4. Hudson River Atlantic sturgeon CPUE juvenile index (1985-2011).

Summary of the New York Bight DPS

Atlantic sturgeon originating from the NYB DPS spawn in the Hudson and Delaware Rivers. While genetic testing can differentiate between individuals originating from the Hudson or Delaware River, the available information suggests that the straying rate is relatively high between these rivers. Some of the impact from the threats that contributed to the decline of the NYB DPS have been removed (*e.g.*, directed fishing) or reduced as a result of improvements in water quality since passage of the Clean Water Act (CWA). In addition, there have been reductions in fishing effort in state and Federal waters, which may result in a reduction in bycatch mortality of Atlantic sturgeon. Nevertheless, areas with persistent, degraded water quality, habitat impacts from dredging, continued bycatch in state and federally-managed fisheries, and vessel strikes remain significant threats to the NYB DPS.

In its marine range, NYB DPS Atlantic sturgeon are incidentally captured in Federal and state-managed fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (Stein *et al.* 2004a; ASMFC TC 2007). Based on mixed stock analysis results presented by Wirgin and King (2011), more than 40% of the Atlantic sturgeon bycatch interactions in the Mid-Atlantic Bight region were sturgeon from the NYB DPS. Individual-based assignment and mixed stock analysis of samples collected from sturgeon captured in Canadian fisheries in the Bay of Fundy indicated that approximately 1%-2% were from the NYB DPS (Wirgin *et al*. 2012). At this time, we are not able to quantify the impacts from threats other than fisheries or estimate the number of individuals killed as a result of other anthropogenic threats.

Riverine habitat may be impacted by dredging and other in-water activities, disturbing spawning habitat and also altering the benthic forage base. Both the Hudson and Delaware Rivers have navigation channels that are maintained by dredging. Dredging is also used to maintain channels in the nearshore marine environment. Dredging outside of Federal channels and in-water construction occurs throughout the New York Bight region. While some dredging projects operate with observers present to document fish mortalities, many do not. We have reports of one Atlantic sturgeon entrained during hopper dredging operations in Ambrose Channel, New Jersey. We recently consulted on two Army Corps of Engineers (ACOE) dredging projects: (1) the Delaware River Federal Navigation Channel deepening project and (2) the New York and New Jersey Harbor Deepening Project. In both cases, we determined that while the proposed actions may adversely affect Atlantic sturgeon, they were not likely to jeopardize the continued existence of any DPS of Atlantic sturgeon.

In the Hudson and Delaware Rivers, dams do not block access to historical habitat. The Holyoke Dam on the Connecticut River blocks passage past the dam at Holyoke; however, the extent that Atlantic sturgeon would historically have used habitat upstream of Holyoke is unknown. The first dam on the Taunton River may block access to historical spawning habitat. Connectivity also may be disrupted by the presence of dams on several smaller rivers in the New York Bight region. Because no Atlantic sturgeon occur upstream of any hydroelectric projects in the New York Bight region, passage over hydroelectric dams or through hydroelectric turbines is not a source of injury or mortality in this area. The extent to which Atlantic sturgeon are affected by operations of dams in the New York Bight region is currently unknown. Atlantic sturgeon may also be impinged or entrained at power plants in the Hudson and Delaware Rivers, and may be adversely affected by the operation of the power plants, but the power plants have not been found to jeopardize their continued existence.

NYB DPS Atlantic sturgeon may also be affected by degraded water quality. Rivers in the New York Bight region, including the Hudson and Delaware, have been heavily polluted by industrial and sewer discharges. In general, water quality has improved in the Hudson and Delaware over the past several decades (Lichter *et al.* 2006; EPA 2008). While water quality has improved and most discharges are limited through regulations, it is likely that pollutants persist in the benthic environment. This can be particularly problematic if pollutants are present on spawning and nursery grounds, where developing eggs and larvae are particularly susceptible to exposure to contaminants.

Vessel strikes are known to occur in the Delaware River. Twenty-nine mortalities believed to be the result of vessel strikes were documented in the Delaware River from 2004-2008, and at least 13 of these fish were large adults. Given the time of year in which the fish were observed (predominantly May through July, with two in August), it is likely that many of the adults were migrating through the river to the spawning grounds. Because we do not know the percent of total vessel strikes that the observed mortalities represent, we are not able to quantify the number of individuals likely killed as a result of vessel strikes in the NYB DPS.

Studies have shown that to rebuild, Atlantic sturgeon can only sustain low levels of anthropogenic mortality (Boreman 1997; ASMFC TC 2007; Kahnle *et al.* 2007; Brown and Murphy 2010). There are no empirical abundance estimates of the number of Atlantic sturgeon in the NYB DPS. As described in Section 4.2.6, we have estimated that there are a minimum of 33,210 NYB DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in the action area. We have determined that the NYB DPS is currently at risk of extinction due to: (1) precipitous declines in population sizes and the protracted period in which sturgeon populations have been depressed; (2) the limited amount of current spawning; and (3) the impacts and threats that have and will continue to affect population recovery.

4.2.9 Chesapeake Bay DPS of Atlantic sturgeon

The CB DPS includes the following: all anadromous Atlantic sturgeon that spawn or are spawned in the watersheds that drain into the Chesapeake Bay and into coastal waters from the Delaware-Maryland border on Fenwick Island to Cape Henry, Virginia. The marine range of Atlantic sturgeon from the CB DPS extends from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the CB DPS and the adjacent portion of the marine range are shown in Figure 3. Within this range, Atlantic sturgeon historically spawned in the Susquehanna, Potomac, James, York, Rappahannock, and Nottoway Rivers (ASSRT 2007). Based on the review by Oakley (2003), 100% of Atlantic sturgeon habitat is currently accessible in these rivers since most of the barriers to passage (*i.e.*, dams) are located upriver of where spawning is expected to have historically occurred (ASSRT 2007). Spawning still occurs in the James River, and the presence of juvenile and adult sturgeon in the York River suggests that spawning may occur there as well (Musick *et al.* 1994; ASSRT 2007; Greene *et al*. 2009). However, conclusive evidence of current spawning is only available for the James River, where a recent study found evidence of Atlantic sturgeon spawning in the fall (Balazik *et al*. 2012). Atlantic sturgeon that are spawned elsewhere are known to use the Chesapeake Bay for other life functions, such as foraging and as juvenile nursery habitat (Vladykov and Greeley 1963; Wirgin *et al.* 2000; ASSRT 2007; Grunwald *et al.* 2008).

Age to maturity for CB DPS Atlantic sturgeon is unknown. However, Atlantic sturgeon riverine populations exhibit clinal variation with faster growth and earlier age to maturity for those that originate from southern waters, and slower growth and later age to maturity for those that originate from northern waters (75 FR 61872; October 6, 2010). Age at maturity is five to 19 years for Atlantic sturgeon originating from South Carolina rivers (Smith *et al.* 1982) and 11 to 21 years for Atlantic sturgeon originating from the Hudson River (Young *et al.* 1998). Therefore, age at maturity for Atlantic sturgeon of the CB DPS likely falls within these values.

Several threats play a role in shaping the current status of CB DPS Atlantic sturgeon. Historical records provide evidence of the large-scale commercial exploitation of Atlantic sturgeon from the James River and Chesapeake Bay in the 19th century (Hildebrand and Schroeder 1928; Vladykov and Greeley 1963; ASMFC 1998b; Secor 2002; Bushnoe *et al.* 2005; ASSRT 2007) as well as subsistence fishing and attempts at commercial fisheries as early as the 17th century (Secor 2002; Bushnoe *et al.* 2005; ASSRT 2007; Balazik *et al.* 2010). Habitat disturbance caused by in-river work, such as dredging for navigational purposes, is thought to have reduced available spawning habitat in the James River (Holton and Walsh 1995; Bushnoe *et al.* 2005; ASSRT 2007). At this time, we do not have information to quantify this loss of spawning habitat.

Decreased water quality also threatens Atlantic sturgeon of the CB DPS, especially since the Chesapeake Bay system is vulnerable to the effects of nutrient enrichment due to a relatively low tidal exchange and flushing rate, large surface-to-volume ratio, and strong stratification during the spring and summer months (Pyzik *et al.* 2004; ASMFC 1998a; ASSRT 2007; EPA 2008).

These conditions contribute to reductions in dissolved oxygen levels throughout the Bay. The availability of nursery habitat, in particular, may be limited given the recurrent hypoxia (low dissolved oxygen) conditions within the Bay (Niklitschek and Secor 2005, 2010). Heavy industrial development during the 20th century in rivers inhabited by sturgeon impaired water quality and impeded these species' recovery.

Although there have been improvements in the some areas of the Bay's health, the ecosystem remains in poor condition. The EPA gave the overall health of the Bay a grade of 45% based on goals for water quality, habitats, lower food web productivity, and fish and shellfish abundance (EPA CBP 2010). This was a 6% increase from 2008. According to the EPA, the modest gain in the health score was due to a large increase in the adult blue crab population, expansion of underwater grass beds growing in the Bay's shallows, and improvements in water clarity and bottom habitat health as highlighted below:

- 12% of the Bay and its tidal tributaries met CWA standards for dissolved oxygen between 2007 and 2009, a decrease of 5% from 2006 to 2008,
- 26% of the tidal waters met or exceeded guidelines for water clarity, a 12% increase from 2008,
- Underwater bay grasses covered 9,039 more acres of the Bay's shallow waters for a total of 85,899 acres, 46% of the Bay-wide goal,
- The health of the Bay's bottom dwelling species reached a record high of 56% of the goal, improving by approximately 15% Bay-wide, and
- The adult blue crab population increased to 223 million, its highest level since 1993.

At this time we do not have sufficient information to quantify the extent that degraded water quality effects habitat or individuals in the James River or throughout the Chesapeake Bay.

Vessel strikes have been observed in the James River (ASSRT 2007). Eleven Atlantic sturgeon were reported to have been struck by vessels from 2005-2007. Several of these were mature individuals. Because we do not know the percent of total vessel strikes that the observed mortalities represent, we are not able to quantify the number of individuals likely killed as a result of vessel strikes in the CB DPS.

In the marine and coastal range of the CB DPS from Canada to Florida, fisheries bycatch in federally and state-managed fisheries poses a threat to the DPS, reducing survivorship of subadults and adults and potentially causing an overall reduction in the spawning population (Stein *et al.* 2004b; ASMFC TC 2007; ASSRT 2007).

Summary of the Chesapeake Bay DPS

Spawning for the CB DPS is known to occur in only the James River. Spawning may be occurring in other rivers, such as the York, but has not been confirmed. There are anecdotal reports of increased sightings and captures of Atlantic sturgeon in the James River. However, this information has not been comprehensive enough to develop a population estimate for the James River or to provide sufficient evidence to confirm increased abundance. Some of the impact from the threats that facilitated the decline of the CB DPS have been removed (*e.g.*, directed fishing) or reduced as a result of improvements in water quality since passage of the

CWA. As described in Section 4.2.6, we have estimated that there are a minimum of 9,489 CB DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in the action area.

Areas with persistent, degraded water quality, habitat impacts from dredging, continued bycatch in U.S. state and federally-managed fisheries, Canadian fisheries, and vessel strikes remain significant threats to the CB DPS of Atlantic sturgeon. Of the 35% of Atlantic sturgeon incidentally caught in the Bay of Fundy, about 1% were CB DPS fish (Wirgin *et al.* 2012). Studies have shown that Atlantic sturgeon can only sustain low levels of bycatch mortality (Boreman 1997; ASMFC TC 2007; Kahnle *et al.* 2007). The CB DPS is currently at risk of extinction given (1) precipitous declines in population sizes and the protracted period in which sturgeon populations have been depressed; (2) the limited amount of current spawning; and, (3) the impacts and threats that have and will continue to affect the potential for population recovery.

4.2.10 Carolina DPS of Atlantic sturgeon

The Carolina DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) from Albemarle Sound southward along the southern Virginia, North Carolina, and South Carolina coastal areas to Charleston Harbor. The marine range of Atlantic sturgeon from the Carolina DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the Carolina DPS and the adjacent portion of the marine range are shown in Figure 3. Sturgeon are commonly captured 40 miles offshore (Dewayne Fox, Delaware State University, pers. comm.). Records providing fishery bycatch data by depth show the vast majority of Atlantic sturgeon bycatch via gillnets is observed in waters less than 50 meters deep (Stein *et al*. 2004b, ASMFC TC 2007), but Atlantic sturgeon are recorded as bycatch out to 500 fathoms.

Rivers known to have current spawning populations within the range of the Carolina DPS include the Roanoke, Tar-Pamlico, Cape Fear, Waccamaw, and Pee Dee Rivers. We determined spawning was occurring if YOY were observed or mature adults were present in freshwater portions of a system (Table 7). However, in some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development. There may also be spawning populations in the Neuse, Santee, and Cooper Rivers, though it is uncertain. Historically, both the Sampit and Ashley Rivers were documented to have spawning populations at one time. However, the spawning population in the Sampit River is believed to be extirpated, and the current status of the spawning population in the Ashley River is unknown. Both rivers may be used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. Fish from the Carolina DPS likely use other river systems than those listed here for their specific life functions.

Historical landings data indicate that between 7,000 and 10,500 adult female Atlantic sturgeon were present in North Carolina prior to 1890 (Armstrong and Hightower 2002; Secor 2002). Secor (2002) estimates that 8,000 adult females were present in South Carolina during that same time frame. Prior reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the Carolina DPS. Currently, the Atlantic sturgeon spawning population in at least one river system within the Carolina DPS has been

Table 7. Major rivers, tributaries, and sounds within the range of the Carolina DPS and currently available data on the presence of an Atlantic sturgeon spawning population in each system.

River/Estuary	Spawning Population	Data
Roanoke River, VA/NC; Albemarle Sound, NC	Yes	collection of 15 YOY (1997-1998); single YOY (2005)
Tar-Pamlico River, NC; Pamlico Sound	Yes	one YOY (2005)
Neuse River, NC; Pamlico Sound	Unknown	
Cape Fear River, NC	Yes	upstream migration of adults in the fall, carcass of a ripe female upstream in mid-September (2006)
Waccamaw River, SC; Winyah Bay	Yes	age-1, potentially YOY (1980s)
Pee Dee River, SC; Winyah Bay	Yes	running ripe male in Great Pee Dee River (2003)
Sampit, SC; Winyah Bay	Extirpated	
Santee River, SC	Unknown	
Cooper River, SC	Unknown	
Ashley River, SC	Unknown	

extirpated, with potential extirpation in an additional system. The abundances of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, are estimated to be less than 3% of what they were historically (ASSRT 2007). As described in Section 4.2.6, we have estimated that there are a minimum of 2,711 Carolina DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in the action area.

Threats

The Carolina DPS was listed as endangered under the ESA as a result of a combination of habitat curtailment and modification, overutilization (*i.e.*, being taken as bycatch) in commercial fisheries, and the inadequacy of regulatory mechanisms in ameliorating these impacts and threats.

The modification and curtailment of Atlantic sturgeon habitat resulting from dams, dredging, and degraded water quality is contributing to the status of the Carolina DPS. Dams have curtailed Atlantic sturgeon spawning and juvenile developmental habitat by blocking more than 60% of the historical sturgeon habitat upstream of the dams in the Cape Fear and Santee-Cooper River systems. Water quality (velocity, temperature, and dissolved oxygen) downstream of these dams, as well as on the Roanoke River, has been reduced, which modifies and curtails the extent of spawning and nursery habitat for the Carolina DPS. Dredging in spawning and nursery grounds modifies the quality of the habitat and is further curtailing the extent of available habitat in the Cape Fear and Cooper Rivers, where Atlantic sturgeon habitat has already been modified and curtailed by the presence of dams. Reductions in water quality from terrestrial activities have modified habitat utilized by the Carolina DPS. In the Pamlico and Neuse systems, nutrient-loading and seasonal anoxia are occurring, associated in part with concentrated animal feeding operations (CAFOs). Heavy industrial development and CAFOs have also degraded water quality in the Cape Fear River. Water quality in the Waccamaw and Pee Dee Rivers has been affected by industrialization and riverine sediment samples contain high levels of various toxins, including dioxins. Additional stressors arising from water allocation and climate change threaten to exacerbate water quality problems that are already present throughout the range of the Carolina DPS. Twenty interbasin water transfers in existence prior to 1993, averaging 66.5 million gallons per day (mgd), were authorized at their maximum levels without being subjected to an evaluation for certification by the North Carolina Department of Environmental and Natural Resources and other resource agencies. Since the 1993 legislation requiring certificates for transfers took effect, almost 170 mgd of interbasin water withdrawals have been authorized, with an additional 60 mgd pending certification. The removal of large amounts of water from the system will alter flows, temperature, and dissolved oxygen. Existing water allocation issues will likely be compounded by population growth and potentially climate change. Climate change is also predicted to elevate water temperatures and exacerbate nutrient-loading, pollution inputs, and lower dissolved oxygen, all of which are current stressors to the Carolina DPS.

Overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations in the Southeast in the mid- to late 19th century, from which they have never rebounded. Continued bycatch of Atlantic sturgeon in commercial fisheries is an ongoing impact to the Carolina DPS. More robust fishery independent data on bycatch are available for the Northeast and Mid-Atlantic than in the Southeast where high levels of bycatch underreporting are suspected.

Though there are statutory and regulatory regulations that authorize reducing the impact of dams on riverine and anadromous species, these mechanisms have proven inadequate for preventing dams from blocking access to habitat upstream and degrading habitat downstream. Water quality continues to be a problem in the Carolina DPS, even with existing controls on some pollution sources. Current regulatory regimes are not effective in controlling water allocation issues (*e.g.*, no restrictions on interbasin water transfers in South Carolina, the lack of ability to regulate non-point source pollution, etc.).

The recovery of Atlantic sturgeon along the Atlantic Coast, especially in areas where habitat is limited and water quality is severely degraded, will require improvements in the following areas: (1) elimination of barriers to spawning habitat either through dam removal, breaching, or installation of successful fish passage facilities; (2) operation of water control structures to provide appropriate flows, especially during spawning season; (3) imposition of dredging restrictions including seasonal moratoriums and avoidance of spawning/nursery habitat; and (4) mitigation of water quality parameters that are restricting sturgeon use of a river (*i.e.*, dissolved oxygen). Additional data regarding sturgeon use of riverine and estuarine environments are needed.

The concept of a viable population able to adapt to changing environmental conditions is critical to Atlantic sturgeon, and the low population numbers of every river population in the Carolina DPS put them in danger of extinction throughout their range; none of the populations are large or stable enough to provide with any level of certainty for the continued existence of Atlantic sturgeon in this part of its range. Although the largest impact that caused the precipitous decline of the species has been curtailed (directed fishing), the population sizes within the Carolina DPS have remained relatively constant at greatly reduced levels (approximately 3% of historical population sizes) for 100 years. Small numbers of individuals resulting from drastic reductions in populations, such as that which occurred due to the commercial fishery, can remove the buffer against natural demographic and environmental variability provided by large populations (Berry 1971; Soulé 1980; Shaffer 1981). Recovery of depleted populations is an inherently slow process for late-maturing species such as Atlantic sturgeon, and they continue to face a variety of other threats that contribute to their risk of extinction. Their late age at maturity provides more opportunities for individual Atlantic sturgeon to be removed from the population before reproducing. While a long life-span also allows multiple opportunities to contribute to future generations, it also increases the timeframe over which exposure to the multitude of threats facing the Carolina DPS can occur. The viability of the Carolina DPS depends on having multiple self-sustaining riverine spawning populations and maintaining suitable habitat to support the various life functions (spawning, feeding, growth) of Atlantic sturgeon populations.

Summary of the Status of the Carolina DPS of Atlantic Sturgeon

Recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon. Their late age at maturity provides more opportunities for individuals to be removed from the population before reproducing. While a long life-span also allows multiple opportunities to contribute to future generations, this is hampered within the Carolina DPS by habitat alteration and bycatch. This DPS was severely depleted by past directed commercial fishing, and faces ongoing impacts and threats from habitat alteration or inaccessibility, bycatch, and the inadequacy of existing regulatory mechanisms to address and reduce habitat alterations and bycatch that have prevented river populations from rebounding and will prevent their recovery.

The presence of dams has resulted in the loss of more than 60% of the historical sturgeon habitat on the Cape Fear River and in the Santee-Cooper system. Dams are contributing to the status of the Carolina DPS by curtailing the extent of available spawning habitat and further modifying the remaining habitat downstream by affecting water quality parameters (such as depth, temperature, velocity, and dissolved oxygen) that are important to sturgeon. Dredging is also contributing to the status of the Carolina DPS by modifying Atlantic sturgeon spawning and nursery habitat. Habitat modifications through reductions in water quality are contributing to the status of the Carolina DPS due to nutrient-loading, seasonal anoxia, and contaminated sediments. Interbasin water transfers and climate change threaten to exacerbate existing water quality issues. Bycatch is also a current threat to the Carolina DPS that is contributing to its status. Fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may utilize multiple river systems for nursery and foraging habitat in addition to their natal spawning river, they are subject to being caught in multiple fisheries throughout their range. In addition to direct mortality, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (*e.g.*, exposure to toxins). This may result in either reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality. While many of the threats to the

Carolina DPS have been ameliorated or reduced due to existing regulatory mechanisms, such as the moratorium on directed fisheries for Atlantic sturgeon, bycatch and habitat alterations are currently not being addressed through existing mechanisms. Further, despite NMFS's authority under the Federal Power Act to prescribe fish passage and existing controls on some pollution sources, access to habitat and improved water quality continues to be a problem. The inadequacy of regulatory mechanisms to control bycatch and habitat alterations is contributing to the status of the Carolina DPS.

4.2.11 South Atlantic DPS of Atlantic sturgeon

The SA DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) of the Ashepoo, Combahee, and Edisto Rivers (ACE) Basin southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. The marine range of Atlantic sturgeon from the SA DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the SA DPS and the adjacent portion of the marine range are shown in Figure 3. Sturgeon are commonly captured 40 miles offshore (Dewayne Fox, Delaware State University, pers. comm.). Records providing fishery bycatch data by depth show the vast majority of Atlantic sturgeon bycatch via gillnets is observed in waters less than 50 meters deep (Stein *et al.* 2004b, ASMFC TC 2007), but Atlantic sturgeon are recorded as bycatch out to 500 fathoms (900 meters).

Rivers known to have current spawning populations within the range of the South Atlantic DPS include the Combahee, Edisto, Savannah, Ogeechee, Altamaha, and Satilla Rivers. We determined spawning was occurring if YOY were observed, or mature adults were present, in freshwater portions of a system (Table 8). However, in some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development. Historically, both the Broad-Coosawatchie and St. Marys Rivers were documented to have spawning populations at one time; there is also evidence that spawning may have occurred in the St. Johns River or one of its tributaries. However, the spawning population in the St. Marys River, as well as any historical spawning population present in the St. Johns, is believed to be extirpated, and the status of the spawning population in the Broad-Coosawatchie is unknown. Both the St. Marys and St. Johns Rivers are used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. The use of the Broad-Coosawatchie by sturgeon from other spawning populations is unknown at this time. The presence of historical and current spawning populations in the Ashepoo River has not been documented; however, this river may currently be used for nursery habitat by young Atlantic sturgeon originating from other spawning populations. Fish from the SA DPS likely use other river systems than those listed here for their specific life functions.

Secor (2002) estimates that 8,000 adult females were present in South Carolina before the collapse of the fishery in 1890. However, because fish from South Carolina are included in both the Carolina and SA DPSs, it is likely that some of the historical 8,000 fish would be attributed to both the Carolina DPS and SA DPS. The sturgeon fishery had been the third largest fishery in Georgia. Reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the South Atlantic DPS. Currently, the Atlantic

Table 8. Major rivers, tributaries, and sounds within the range of the SA DPS and currently available data on the presence of an Atlantic sturgeon spawning population in each system.

River/Estuary	Spawning Population	Data
ACE (Ashepoo, Combahee, and Edisto Rivers) Basin, SC; St. Helena Sound	Yes	1,331 YOY (1994-2001); gravid female and running ripe male in the Edisto (1997); 39 spawning adults (1998)
Broad-Coosawhatchie Rivers, SC; Port Royal Sound	Unknown	
Savannah River, SC/GA	Yes	22 YOY (1999-2006); running ripe male (1997)
Ogeechee River, GA	Yes	age-1 captures, but high inter-annual variability (1991-1998); 17 YOY (2003); 9 YOY (2004)
Altamaha River, GA	Yes	74 captured/308 estimated spawning adults (2004); 139 captured/378 estimated spawning adults (2005)
Satilla River, GA	Yes	4 YOY and spawning adults (1995-1996)
St. Marys River, GA/FL	Extirpated	
St. Johns River, FL	Extirpated	

sturgeon population in at least two river systems within the SA DPS has been extirpated. As described in Section 4.2.6, we have estimated that there are a minimum of 13,555 SA DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in the action area.

Threats

The SA DPS was listed as endangered under the ESA as a result of a combination of habitat curtailment and modification, overuse (*i.e.*, being taken as bycatch) in commercial fisheries, and the inadequacy of regulatory mechanisms in ameliorating these impacts and threats.

The modification and curtailment of Atlantic sturgeon habitat resulting from dredging and degraded water quality is contributing to the status of the SA DPS. Dredging is a present threat to the SA DPS and is contributing to its status by modifying the quality and availability of Atlantic sturgeon habitat. Maintenance dredging is currently modifying Atlantic sturgeon nursery habitat in the Savannah River and modeling indicates that the proposed deepening of the navigation channel will result in reduced dissolved oxygen and upriver movement of the salt wedge, curtailing spawning habitat. Dredging is also modifying nursery and foraging habitat in the St. Johns Rivers. Reductions in water quality from terrestrial activities have modified habitat utilized by the SA DPS. Low dissolved oxygen is modifying sturgeon habitat in the Savannah due to dredging, and non-point source inputs are causing low dissolved oxygen in the Ogeechee River and in the St. Marys River, which completely eliminates juvenile nursery habitat in summer. Low dissolved oxygen has also been observed in the St. Johns River in the summer.

Sturgeon are more sensitive to low dissolved oxygen and the negative (metabolic, growth, and feeding) effects caused by it increase when water temperatures are concurrently high, as they are within the range of the SA DPS. Additional stressors arising from water allocation and climate change threaten to exacerbate water quality problems that are already present throughout the range of the SA DPS. Large withdrawals of over 240 million gallons per day mgd of water occur in the Savannah River for power generation and municipal uses. However, permits for users withdrawing less than 100,000 gallons per day (gpd) are not required to get permits, so actual water withdrawals from the Savannah and other rivers within the range of the SA DPS are unknown, but likely much higher. The removal of large amounts of water from the system will alter flows, temperature, and dissolved oxygen. Water shortages and "water wars" are already occurring in the rivers occupied by the SA DPS and will likely be compounded in the future by population growth and, potentially, by climate change. Climate change is also predicted to elevate water temperatures and exacerbate nutrient-loading, pollution inputs, and lower dissolved oxygen, all of which are current stressors to the SA DPS.

The directed Atlantic sturgeon fishery caused initial severe declines in southeast Atlantic sturgeon populations. Although the directed fishery is closed, bycatch in other commercial fisheries continues to impact the SA DPS. Statutory and regulatory mechanisms exist that authorize reducing the impact of dams on riverine and anadromous species such as Atlantic sturgeon, but these mechanisms have proven inadequate for preventing dams from blocking access to habitat upstream and degrading habitat downstream. Further, water quality continues to be a problem in the SA DPS, even with existing controls on some pollution sources. Current regulatory regimes are not effective in controlling water allocation issues (*e.g.,* no permit requirements for water withdrawals under 100,000 gpd in Georgia, no restrictions on interbasin water transfers in South Carolina, the lack of ability to regulate non-point source pollution.)

The recovery of Atlantic sturgeon along the Atlantic coast, especially in areas where habitat is limited and water quality is severely degraded, will require improvements in the following areas: (1) elimination of barriers to spawning habitat either through dam removal, breaching, or installation of successful fish passage facilities; (2) operation of water control structures to provide appropriate flows, especially during spawning season; (3) imposition of dredging restrictions including seasonal moratoriums and avoidance of spawning/nursery habitat; and (4) mitigation of water quality parameters that are restricting sturgeon use of a river (*i.e.*, dissolved oxygen). Additional data regarding sturgeon use of riverine and estuarine environments is needed.

Summary of the Status of the South Atlantic DPS of Atlantic Sturgeon

The population of mature adult Atlantic sturgeon in the SA DPS is estimated to be at least 3,389. The DPS's freshwater range occurs in the watersheds (including all rivers and tributaries) of the ACE Basin southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. Recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon. Their late age at maturity provides more opportunities for individuals to be removed from the population before reproducing. While a long life-span also allows multiple opportunities to contribute to future generations, this is hampered within the SA DPS by habitat alteration, bycatch, and from the inadequacy of existing regulatory mechanisms to address and reduce habitat alterations and bycatch.

Dredging is contributing to the status of the SA DPS by modifying spawning, nursery, and foraging habitat. Habitat modifications through reductions in water quality and dissolved oxygen are also contributing to the status of the SA DPS, particularly during times of high water temperatures, which increase the detrimental effects on Atlantic sturgeon habitat. Interbasin water transfers and climate change threaten to exacerbate existing water quality issues. Bycatch also contributes to the SA DPS's status. Fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may utilize multiple river systems for nursery and foraging habitat in addition to their natal spawning river, they are subject to being caught in multiple fisheries throughout their range. In addition to direct mortality, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (*e.g.*, exposure to toxins). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality. While many of the threats to the SA DPS have been ameliorated or reduced due to the existing regulatory mechanisms, such as the moratorium on directed fisheries for Atlantic sturgeon, bycatch and habitat alteration are currently not being addressed through existing mechanisms. Further, access to habitat and good water quality continues to be a problem even with NMFS's authority under the Federal Power Act to prescribe fish passage and existing controls on some pollution sources. There is a lack of regulation for some large water withdrawals, which threatens sturgeon habitat. Current regulatory regimes do not require a permit for water withdrawals under 100,000 gpd in Georgia and there are no restrictions on interbasin water transfers in South Carolina. Data required to evaluate water allocation issues are either very weak, in terms of determining the precise amounts of water currently being used, or non-existent, in terms of our knowledge of water supplies available for use under historical hydrologic conditions in the region. Existing water allocation issues will likely be compounded by population growth, drought, and, potentially, climate change. The inadequacy of regulatory mechanisms to control bycatch and habitat alterations is contributing to the status of the SA DPS.

5.0 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 ESA-listed species in the action area.

5.1 Federal Actions that have Undergone Section 7 Consultation

NMFS has undertaken several ESA section 7 consultations to address the effects of various Federal actions on threatened and endangered species in the action area. Each of those consultations sought to develop ways of reducing the probability of adverse impacts of the action on listed species.

5.1.1 Authorization of Fisheries through Fishery Management Plans

NMFS authorizes the operation of several fisheries in the action area under the authority of the Magnuson-Stevens Fishery Conservation Act and through FMPs and their implementing regulations. Commercial and recreational fisheries in the action area employ gear that is known to harass, injure, and/or kill sea turtles and Atlantic sturgeon. In the Northeast Region (Maine through Virginia), formal ESA section 7 consultations have been conducted on the American lobster, Atlantic bluefish, Atlantic mackerel/squid/butterfish, Atlantic sea scallop, monkfish, northeast multispecies, Northeast skate complex, red crab, spiny dogfish, summer flounder/scup/black sea bass, and tilefish fisheries. Each of these consultations has considered adverse effects to loggerhead, green, Kemp's ridley and leatherback sea turtles. In each of the Opinions on these fisheries, we concluded that the ongoing action was likely to adversely affect but was not likely to jeopardize the continued existence of any sea turtle species. Each of these Opinions included an ITS exempting a certain amount of lethal and/or non-lethal take resulting from interactions with the fishery. These ITSs are summarized in the table below (Table 9). Further, in each Opinion, we concluded that the potential for interactions (*i.e.*, vessel strikes) between sea turtles and fishing vessels was extremely low and similarly that any effects to sea turtle prey and/or habitat would be insignificant and discountable. We have also determined that the Atlantic herring and surf clam/ocean quahog fisheries do not adversely affect any species of listed sea turtles.

NMFS's Southeast Regional Office (SERO) has carried out formal ESA section 7 consultations for several FMPs with action areas that at least partially overlap with the action area. These include: coastal migratory pelagics, swordfish/tuna/shark/billfish (highly migratory species), snapper/grouper, dolphin/wahoo, and the Southeast shrimp trawl fisheries. The ITSs provided with these Opinions are also included in Table 9.

Table 9. Dates of the most recent Opinions prepared by NMFS NERO and SERO for federally managed fisheries in the action area and their respective ITSs for sea turtles. Unless noted, levels of incidental take exempted are on an annual basis.

FMP	Date of Most Recent Opinion	Loggerhead	Kemp's ridley	Green	Leatherback
American lobster	August 3, 2012	1	0	0	5
Atlantic bluefish	October 29, 2010	82 (34 lethal)	4	5	4
Monkfish	October 29, 2010	173 (70 lethal)	4	5	4
Multispecies	October 29, 2010	46 in trawls (21 lethal)	4	5	4
Skate	October 29, 2010	39 (17 lethal)	4	5	4
Spiny dogfish	October 29, 2010	2	4	5	4
Mackerel/squid/butterfish	October 29, 2010	62 (25 lethal)	2	2	2
Summer flounder/scup/ black sea bass	October 29, 2010	205 (85 lethal)	4	5	6
Shark fisheries as managed under the Consolidated HMS FMP	May 20, 2008	679 (349 lethal) every 3 years	2 (1 lethal) every 3 years	2 (1 lethal) every 3 years	74 (47 lethal) every 3 years
Atlantic sea scallop	July 12, 2012	301 (102 lethal from FY 2013 on)	3	2	2
Coastal migratory pelagic	August 13, 2007	33 every 3 years	4 every 3 years	14 every 3 years	2 every 3 years
Red Crab	February 6, 2002	1	0	0	1
South Atlantic snapper-grouper	June 7, 2006	202 (67 lethal) every 3 years	19 (8 lethal) every 3 years	39 (14 lethal) every 3 years	25 (15 lethal) every 3 years
Pelagic longline under the HMS FMP (per the RPA)	June 1, 2004	1,905 (339 lethal) every 3 years	*105 (18 lethal) every 3 years	*105 (18 lethal) every 3 years	1764 (252 lethal) every 3 years
South-Atlantic dolphin-wahoo**	August 27, 2003	12 (2 lethal) every 3 years	2 (1 lethal) every 3 years	2 (1 lethal) every 3 years	12 (1 lethal) every 3 years
Southeastern shrimp trawling***	May 8, 2012	At least 1,000s and possibly 10,000s of interactions (100s to possibly 1,000s lethal)	At least 10,000s and possibly 100,000s of interactions (1,000s to possibly 10,000s lethal)	At least 100s and possibly low 1,000s of interactions (10s to possibly 100s lethal)	A few hundred interactions (10s lethal)
Tilefish	March 13, 2001	6 (3 lethal)			1

** combination of 105 (18 lethal) Kemp's ridley, green, hawksbill, or olive ridley*
*** combination of 16 turtles total every 3 years with 2 lethal (Kemp's ridley, green, hawksbill, leatherback)*
**** although the ITS does not provide estimates of incidental take for any sea turtle species, the effects section provides a qualitative assessment of the anticipated number of interactions and mortalities by order of magnitude*

In addition to these consultations, NMFS has conducted a formal consultation on the pelagic longline component of the Atlantic highly migratory species FMP. Portions of this fishery occur within the action area. In a June 1, 2004 Opinion, NMFS concluded that the ongoing action was likely to adversely affect but was not likely to jeopardize the continued existence of loggerhead, Kemp's ridley or green sea turtles but was likely to jeopardize the continued existence of leatherback sea turtles. This Opinion included a Reasonable and Prudent Alternative (RPA) that when implemented would modify operations of the fishery in a way that would remove jeopardy. This fishery is currently operated in a manner that is consistent with the RPA. The RPA included an ITS which is reflected in Table 9 above. Unless specifically noted, all numbers denote an annual number of captures that may be lethal or non-lethal.

We are in the process of reinitiating several FMP consultations that consider fisheries actions that may affect Atlantic sturgeon. Atlantic sturgeon originating from the five DPSs considered in this consultation are known to be captured and killed in fisheries operating in the action area. At the time of this writing, only the Atlantic sea scallop and American lobster fisheries currently have Opinions completed which cover Atlantic sturgeon interactions if likely to occur in the fishery. We have determined that the Atlantic sea scallop fishery is likely to capture one Atlantic sturgeon per year, a capture which may remove an individual from any of the five DPSs. As noted in the *Status of the Species* section above, the NEFSC prepared a bycatch estimate for Atlantic sturgeon captured in sink gillnet and otter trawl fisheries operated from Maine through Virginia. This estimate indicates that, based on data from 2006-2010, annually, an average of 3,118 Atlantic sturgeon are captured in these fisheries with 1,569 in sink gillnet and 1,548 in otter trawls. The mortality rate in sink gillnets is estimated at approximately 20% and the mortality rate in otter trawls is estimated at 5%. Based on this estimate, a total of 391 Atlantic sturgeon are estimated to be killed annually in these fisheries that are prosecuted in the action area. We are currently in the process of determining the effects of this annual loss to each of the DPSs. Any of these fisheries that operate with sink gillnets or otter trawls are likely to interact with Atlantic sturgeon and be an additional source of mortality in the action area. At this time, the only fishery regulated by the SERO for which a bycatch estimate is available for Atlantic sturgeon is the southeast shrimp trawl fishery. Please refer to page 199 in NMFS (2012a) for a summary of the expected number of interactions with Atlantic sturgeon in this fishery. The SERO has also reinitiated consultation on the smooth dogfish fishery, in coordination with NMFS HMS, to assess effects on Atlantic sturgeon.

5.1.2 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. Atlantic sturgeon may also be killed during hopper dredging operations, although this is rare. All hopper dredging projects are authorized or carried out by the U.S. Army Corps of Engineers. In the action area, these projects are under the jurisdiction of the districts within the North Atlantic Division or the Wilmington District. Hopper dredging projects in this area have resulted in the recorded mortality of approximately 87 loggerheads, four greens, nine Kemp's ridleys and four unidentified hard shell turtles since observer records began in 1993. To date, nearly all of these interactions have occurred in nearshore coastal waters with very few interactions in the open ocean. Few interactions between hopper dredges and Atlantic sturgeon have been reported, with just three records documenting interactions between hopper dredges and Atlantic sturgeon in the action area (two in Virginia near the Chesapeake Bay entrance, and one in the New York Bight). NMFS NERO and SERO have completed several ESA section 7 consultations with the Corps to consider effects of these hopper dredging projects on listed sea turtles. Many of these consultations have been reinitiated to consider effects to Atlantic sturgeon. Recently, the U.S. Navy's Dam Annex Shoreline Protection System Repairs operations and NASA's Wallops Island Shoreline Restoration/Infrastructure Protection Program were determined to cause the entrainment of up to one Atlantic sturgeon from any of the five DPSs for approximately every 9.4 million cy of material removed from the borrow areas. This equated to one and two captures, respectively, from any of the five DPSs over the course of the two projects. Four additional Opinions (one Navy project and three ACOE projects) were also completed in 2012 to assess Atlantic sturgeon interactions in Northeast dredging operations. The table below (Table 10) provides information on 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 10. 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

5.1.3 Vessel Activity and Military Operations

Potential sources of adverse effects to sea turtles from Federal vessel operations in the action area include operations of the U.S. Navy, U.S. Coast Guard (USCG), Environmental Protection Agency (EPA), ACOE, and NOAA to name a few. 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), 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, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. We are currently in the process of determining if any of these activities may affect Atlantic sturgeon and if any existing section 7 consultations on these actions need to be reinitiated. To date, ocean going vessels and military activities have not been identified as significant threats to Atlantic sturgeon. However, the possibility exists for interactions between vessels and Atlantic sturgeon in the marine environment. Because of a lack of information on the effects of these activities on Atlantic sturgeon, the discussion below focuses on sea turtles.

Although consultations on individual Navy and USCG activities have been completed, only one formal consultation on overall military activities in all of the Atlantic has been completed at this time. In June 2009, NMFS prepared an Opinion on Navy activities in each of their four training range complexes along the U.S. Atlantic coast—Northeast, Virginia Capes, Cherry Point, and Jacksonville (NMFS 2009a). In addition, the following Opinions for the Navy (NMFS 1996, 1997, 2008b, 2009b) and USCG (NMFS 1995, 1998) 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 estimated to take no more than one individual sea turtle, of any species, per year (NMFS 1995).

Military activities such as ordnance detonation also affect listed species of sea turtles. A section 7 consultation was conducted in 1997 for Navy 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 Opinion for this consultation determined that the activity was likely to adversely affect sea turtles but would not jeopardize their continued existence. In the ITS included within the 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 Navy explosive ordnance disposal, mine warfare, sonar testing (e.g., AFAST, SURTASS LFA), and other major training exercises (e.g., bombing, Naval gunfire, combat search and rescue, anti-submarine warfare, and torpedo and missile exercises) in the Atlantic Ocean. These consultations have determined that the proposed Navy activities may adversely affect but would not jeopardize the continued existence of ESA-listed sea turtles (NMFS 2008b, 2009a, 2009b). NMFS estimated that five loggerhead and six Kemp's ridley sea turtles are 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 ten leatherbacks, are likely to experience harassment (NMFS 2009a).

Similarly, operations of vessels by other Federal agencies within the action area (NOAA, EPA, and ACOE) may adversely affect sea turtles. However, vessel activities of those agencies are often limited in scope, as they operate a limited number of vessels or are engaged in research/ operational activities that are unlikely to contribute a large amount of risk. From 2013 on, NOAA research vessels conducting fisheries surveys for the NEFSC are estimated to take no more than 14 sea turtles per year. This includes: (a) up to nine loggerheads, one Kemp's ridley, one leatherback, and one green sea turtle per year during the NEFSC's spring and fall bottom trawl surveys, and (b) up to one loggerhead and one Kemp's ridley sea turtle per year (both potentially lethal) during the NEFSC's scallop dredge survey (NMFS 2012b).

5.2 Non-Federally Regulated Fisheries

Like federally authorized fisheries, Atlantic sturgeon and 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 Rhode Island through North Carolina. Captures of sea turtles in these fisheries have been reported (SEFSC 2001). Information on the number of Atlantic sturgeon captured or killed in state fisheries is extremely limited and as such, efforts are currently underway to obtain more information on the numbers of Atlantic sturgeon captured and killed in state water fisheries. Atlantic sturgeon are vulnerable to capture in state fisheries occurring in rivers, including shad fisheries; however, these riverine areas are outside the action area under consideration in this Opinion. Specific information on sea turtle and sturgeon interactions in state fisheries is provided below.

Virginia

Two, 10-14 inch (25.6-35.9 cm) 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 capture or entangle sea turtles given the gear type, but no interactions have been observed. Similarly, sea turtles are thought to be vulnerable to capture in small mesh gillnet fisheries occurring in Virginia state waters 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 captures were observed (NMFS 2004c). Based on gear type (i.e., gillnets), it is likely that Atlantic sturgeon would be vulnerable to capture in these fisheries. An Atlantic sturgeon "reward program" where fishermen were provided monetary rewards for reporting captures of Atlantic sturgeon operated in the late 1990s in Virginia. The majority of reports of Atlantic sturgeon captures were in drift gill nets and pound nets. No quantitative information on the number of Atlantic sturgeon captured or killed in Virginia fisheries is currently available.

North Carolina

In North Carolina, a large-mesh gillnet fishery for summer flounder in the southern portion of Pamlico Sound was found to take sea turtles in gillnet gear. A section 10 incidental take permit was issued to the state for this fishery in 2001. Exempted take levels were based on information from the 2000 fishing season for large mesh gillnet fisheries in both shallow and deep water. The annual estimated 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. The permit does not currently include Atlantic sturgeon.

During 2004, 42 Atlantic sturgeon were observed captured in gillnet fisheries operating in Abermarle and Pamilco Sounds. Of these observed sturgeon, five mortalities were reported. A quantitative assessment of the number of Atlantic sturgeon captured or killed in North Carolina state fisheries that occur in the action area is not currently available.

Atlantic croaker fishery
An Atlantic croaker fishery using trawl and gillnet gear also occurs within the action area and turtle takes 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 loggerhead sea turtles (Warden 2011a). 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 2002-2006, was estimated to be 11 per year with a 95% CI of 3-20 (Murray 2009b). A quantitative assessment of the number of Atlantic sturgeon captured in the croaker fishery is not available. Mortality rates of Atlantic sturgeon in commercial trawls has been estimated at 5%. A review of the NEFOP observer database indicates that from 2006-2010, 60 Atlantic sturgeon (out of a total of 726 observed interactions) were captured during observed trips where the trip target was identified as croaker. This represents a minimum number of Atlantic sturgeon captured in the croaker fishery during this time period as it only considers observed trips trips for boats with federal permits only.

Weakfish fishery
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 gill nets, 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 gill net 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 3.1.1, sea turtle bycatch in the weakfish fishery has occurred (Murray 2009a, 2009b; Warden 2011a). 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 2011a). 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 2002-2006, was estimated to be one (1) per year with a 95% CI of 0-1 (Murray 2009b). A quantitative assessment of the number of Atlantic sturgeon captured in the weakfish fishery is not available. Mortality rates of Atlantic sturgeon in

commercial trawls has been estimated at 5%. A review of the NEFOP observer database indicates that from 2006-2010, 36 Atlantic sturgeon (out of a total of 726 observed interactions) were captured during observed trips where the trip target was identified as weakfish. This represents a minimum number of Atlantic sturgeon captured in the weakfish fishery during this time period as it only considers observed trips.

Whelk fishery

A whelk fishery using pot/trap gear is known to occur in several parts of the action area, including waters off of Maine, Connecticut, Massachusetts, Delaware, Maryland, and Virginia. Landings data for Delaware suggests that the greatest effort in the whelk fishery for waters off of that state occurs in the months of July and October; times 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 to enter the trap to get the bait or whelks caught 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 (SEFSC 2001; Dwyer *et al.* 2002; NMFS 2007). Whelk pots are not known to interact with Atlantic sturgeon.

Crab fisheries

Various crab fisheries, such as horseshoe crab and blue crab, also occur in Federal and state waters. Atlantic sturgeon are not known to be captured in crab pot gear. 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 in the diet of loggerheads in the area 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; Eyler *et al.* 2007). Given the variety of loggerheads 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; Eyler *et al.* 2007), a direct correlation 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.

Virginia pound net fishery

Sea turtle takes 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) take turtles as a result of entanglement in the pound net leader. As described in section 4.4.3.4 below, NMFS has taken regulatory action to address turtle takes in the Virginia pound net fishery. Atlantic sturgeon are also captured in pound nets; however, mortality rates are thought to be very low. No estimate of the number of Atlantic sturgeon caught in pound nets in the action area is currently available.

American lobster trap fishery
An American lobster trap fishery also occurs in state waters of New England and the Mid-Atlantic and is managed under the ASMFC's ISFMP. Like the Federal waters component of the fishery, the state waters fishery has also been identified as a source of gear causing injuries to and mortality of loggerhead and leatherback sea turtles as a result of entanglement in vertical buoy lines of the pot/trap gear. Between 2002 and 2008, the lobster trap fishery in state waters was verified as the fishery involved in at least 27 leatherback entanglements in the Northeast Region. All entanglements involved the vertical line of the gear. These verified/confirmed entanglements occurred in Maine, Massachusetts, and Rhode Island state waters from June through October (Northeast Region Sea Turtle Disentanglement Network [STDN] database). Atlantic sturgeon are not known to interact with lobster trap gear.

Incidental captures of loggerheads in fish traps have also been reported from several Atlantic coast states (Shoop and Ruckdeschel 1989; Wendy Teas, SEFSC, pers. comm.). Long haul seines and channel nets are also known to incidentally capture loggerheads and other sea turtles in sounds and other inshore waters along the U.S. Atlantic coast, although no lethal takes have been reported (SEFSC 2001). No information on interactions between Atlantic sturgeon and fish traps, long haul seines or channel nets is currently available; however, depending on where this gear is set and the mesh size, the potential exists for Atlantic sturgeon to be entangled or captured in this gear.

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 (SEFSC 2001). A summary of known impacts of hook-and-line captures on loggerhead sea turtles can be found in the TEWG (1998, 2000, 2009) reports. Atlantic sturgeon have been observed captured in hook and line gear; the number of interactions that occur is unknown. While most Atlantic sturgeon are likely to be released alive, we currently have no information on post-release survival.

5.3 Other Activities

5.3.1 Maritime Industry

Private and commercial vessels, including fishing vessels, operating in the action area of this consultation also have the potential to interact with sea turtles and Atlantic sturgeon. The effects of fishing vessels, recreational vessels, or other types of commercial vessels on ESA-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 entanglement. Listed species may also be affected by fuel oil spills resulting from vessel accidents. Fuel oil spills could affect animals through the food chain. However, these spills typically involve small amounts of material that are unlikely to adversely affect listed species. Larger oil spills may result from severe accidents, although these events would be rare and involve small areas. No direct adverse effects on listed sea turtles or Atlantic sturgeon resulting from fishing vessel fuel spills have been documented.

5.3.2 Pollution

Anthropogenic sources of marine pollution, while difficult to attribute to a specific Federal, state, local, or private action, may affect sea turtles and Atlantic sturgeon in the action area. Sources of pollutants in 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; sewage treatment plant effluents; and oil spills. The pathological effects of oil spills on sea turtles have been documented in several laboratory studies (Vargo *et al.* 1986).

Nutrient loading from land-based sources, such as coastal communities and agricultural operations, is known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effect to larger embayments is unknown. Contaminants could degrade habitat if pollution and other factors reduce the food available to marine animals.

5.3.3 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 and more coastal counties are adopting stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting. Coastal development may also impact Atlantic sturgeon if it disturbs or degrades foraging habitats or otherwise affects the ability of sturgeon to use coastal habitats.

5.3.4 Global Climate Change and Ocean Acidification

The global mean temperature has risen 0.76ºC over the last 150 years, and the linear trend over the last 50 years is nearly twice that for the last 100 years (IPCC 2007b) and precipitation has increased nationally by 5%-10%, mostly due to an increase in heavy downpours (NAST 2000). 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 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.

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 per decade is projected for the next two decades over a range of emission scenarios (IPCC 2007b). 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 (IPCC 2007b; Greene *et al.* 2008). With respect specifically to the North Atlantic Oscillation (NAO), changes in salinity and temperature are thought to be the result of changes in the earth's atmosphere caused by anthropogenic forces (IPCC 2007b). The NAO impacts climate variability throughout the northern hemisphere (IPCC 2007b). Data from the 1960s through the present show that the NAO index has increased from minimum values in the 1960s to strongly positive index values in the 1990s and somewhat declined since (IPCC 2007b). This warming extends over 1000m deep and is deeper than anywhere in the world oceans and is particularly evident under the Gulf Stream/ North Atlantic Current system (IPCC 2007b). 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 (IPCC 2007b; Greene *et al.* 2008). There is evidence that the NADW has already freshened significantly (IPCC 2007b). This is 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 coastal and marine resources on smaller geographic scales, such as the action area, 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 United States. 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. during the next 25 to 50 years regardless of reduction in GHGs, due to emissions that have already occurred (NAST 2000). It is very likely that the magnitude and frequency of ecosystem changes will continue to increase in the next 25 to 50 years, and it is possible that they 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 2007b).

A warmer and drier climate is expected to result in reductions in stream flows and increases in water temperatures. Expected consequences could be a decrease in the amount of dissolved oxygen 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. Within 50 years, river basins that are impacted by dams or by extensive development will experience greater changes in discharge and water stress than unimpacted, free-flowing rivers (Palmer *et al.* 2008).

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^{o}C 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 cm, and between 1985 and 1995 more than 32,000 acres of coastal salt marsh was lost in the southeastern U.S. due to a combination of human development activities, sea level rise, natural subsidence and erosion.

Effects on sea turtles and Atlantic sturgeon globally
Sea turtle species and Atlantic sturgeon 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. As such, climate change at normal rates (thousands of years) is not thought to have historically a problem for sea turtle or sturgeon species. As explained in the *Status of the Species* sections 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 in available nesting beach habitat, increased risk of nest inundation, and changes in the abundance and distribution of forage species which could result in changes in the foraging behavior and distribution of sea turtle species. Atlantic sturgeon could be affected by changes in river ecology resulting from increases in precipitation and changes in water temperature which may affect recruitment and distribution in these rivers. Changes in oceanic conditions could also affect the marine distribution of Atlantic sturgeon or their marine and estuarine prey resources. However, as noted in the "Status of the Species" section above, with the exception of green sea turtles, information on current effects of global climate change on sea turtles and Atlantic sturgeon is not available and while it is speculated that future climate change may affect these species, it is not possible to quantify the extent to which effects may occur. However, given the short duration of the proposed actions (to be completed by the end of 2014) it is not likely that there will be any new effects of climate change in the action area that may affect any of these species in a manner that was not already considered in the *Status of the Species* sections above.

5.4 Reducing Threats to ESA-listed Sea Turtles

Numerous efforts are ongoing to reduce threats to listed sea turtles. Below, we detail efforts that are ongoing within the action area. The majority of these activities are related to regulations that have been implemented to reduce the potential for incidental mortality of sea turtles from commercial fisheries. These include sea turtle release gear requirements for Atlantic HMS; TED requirements for Southeast shrimp trawl fishery and the southern part of the summer flounder trawl fishery; mesh size restrictions in the North Carolina gillnet fishery and Virginia's gillnet and pound net fisheries; modified leader requirements in the Virginia Chesapeake Bay pound net fishery; area closures in the North Carolina gillnet fishery; and gear modifications in the Atlantic sea scallop dredge fishery. In addition to regulations, outreach programs have been established and data on sea turtle interactions and strandings are collected. The summaries below discuss all of these measures in more detail.

5.4.1 Final Rules for Large-Mesh Gillnets

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) and were implemented to reduce the impact of the monkfish and other large-mesh gillnet fisheries on ESA-listed 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. As a result, gillnets with larger than 8-inch (20.3 cm) stretched mesh are not allowed in Federal waters (3-200 nautical miles) in the areas described as follows: (1) North of the North Carolina/South Carolina border at the coast to Oregon Inlet 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. On April 26, 2006, NMFS published a final rule (71 FR 24776) that included modifications to the large-mesh gillnet restrictions. The new final rule revised the gillnet restrictions to apply to stretched mesh that is ≥7 inches (17.9 cm). Federal waters north of Chincoteague, VA, remain unaffected by the large-mesh gillnet restrictions. These measures are in addition to the HPTRP measures that prohibit the use of large-mesh gillnets in southern Mid-Atlantic waters (territorial and Federal waters from Delaware through North Carolina out to 72°30'W longitude) from February 15 through March 15, annually. The measures are also in addition to comparable North Carolina and Virginia regulations for large-mesh gillnet fisheries in their respective state waters that were enacted in 2005.

NMFS has also issued a rule addressing capture of sea turtles in gillnet gear fished in the southern flounder fishery in Pamlico Sound. NMFS issued a final rule (67 FR 56931), effective September 3, 2002, that closed the waters of Pamlico Sound, NC, to fishing with gillnets with larger than 4 ¼-inch (10.8 cm) stretched mesh from September 1 through December 15 each year to protect migrating sea turtles. The closed area includes all inshore waters of Pamlico Sound south of 35°46.3'N latitude, north of 35°00'N latitude, and east of 76°30'W longitude.

5.4.2 Revised Use of TEDs for U.S. Southeast Shrimp Trawl Fisheries

On February 21, 2003, NMFS issued a final rule (68 FR 8456) to amend regulations for reducing sea turtle mortality resulting from shrimp trawling in the Atlantic and Gulf areas of the southeastern U.S. TEDs have proven to be effective at excluding sea turtles from shrimp trawls. However, NMFS determined that modifications to the design of TEDs needed to be made to exclude leatherbacks, as well as large, benthic, immature and sexually mature loggerhead and green sea turtles. In addition, several previously approved TED designs did not function properly under normal fishing conditions. Therefore, NMFS disallowed these TEDs (*e.g.*, weedless TEDs, Jones TEDs, hooped hard TED, and the use of accelerator funnels) as described in the final rule. Finally, the rule also required modifications to the trynet and bait shrimp exemptions to the TED requirements to decrease mortality of sea turtles.

In 1993 (with a final rule implemented in 1995), NMFS established a Leatherback Conservation Zone to restrict shrimp trawl activities from the coast of Cape Canaveral, Florida, to the North Carolina/Virginia border. This provided for short-term closures when high concentrations of normally pelagically distributed leatherbacks are recorded in near coastal waters where the shrimp fleet operates. This measure was necessary because, due to their size, adult leatherbacks were larger than the escape openings of most NMFS-approved TEDs. With the implementation of the new TED rule requiring larger opening sizes on all TEDs, the reactive emergency closures within the Leatherback Conservation Zone became unnecessary, and the Leatherback Conservation Zone was removed from the regulations.

5.4.3 TED Requirements for the Summer Flounder Fishery

As mentioned above, significant measures have been developed to reduce the incidental take of sea turtles in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which would include fisheries for other species like scup and black sea bass) by requiring TEDs in trawl nets fished in trawls used in the area of greatest turtle bycatch off the North Carolina and part of the Virginia coast from North Carolina/South Carolina border to Cape Charles, Virginia. The TED requirements for the summer flounder trawl fishery do not, however, require the use of larger TEDs that are required to be used in the U.S. Southeast shrimp trawl fisheries.

5.4.4 Modification of Gear for Virginia Pound Nets

Existing information indicates that pound nets with traditional large mesh and stringer leaders, as used in the Chesapeake Bay, incidentally take sea turtles. NMFS published a temporary rule in June 2001 (66 FR 33489) that prohibited fishing with pound net leaders with a mesh size measuring 8-inches (20.3 cm) or greater, and pound net leaders with stringers in mainstream waters of the Chesapeake Bay and its tributaries for a 30-day period beginning June 19, 2001. NMFS subsequently published an interim final rule in 2002 (67 FR 41196, June 17, 2002) that further addressed the take of sea turtles in large-mesh pound net leaders and stringer leaders used in the Chesapeake Bay and its tributaries. Following new observations of sea turtle entanglements in pound net leaders in the spring of 2003, NMFS issued a temporary final rule (68 FR 41942, July 16, 2003) that restricted all pound net leaders throughout Virginia's waters of the Chesapeake Bay and a portion of its tributaries from July 16 - July 30, 2003.

A new final rule was published May 5, 2004 (69 FR 24997) to address sea turtle entanglements with pound net gear that might occur in the Chesapeake Bay during the period May 6 - July 15 each year. That rule prohibited the use of all pound net leaders, set with the inland end of the leader greater than 10 horizontal feet (3 meters) from the mean low water line, from May 6 - July 15 each year in the Virginia waters of the mainstream Chesapeake Bay, south of 37°19'N and west of 76°13'W, and all waters south of 37°13'N to the Chesapeake Bay Bridge Tunnel at the mouth of the Chesapeake Bay, and the James and York Rivers downstream of the first bridge in each tributary. Outside of this area, the prohibition of leaders with greater than or equal to 12 inches (30.5 cm) stretched mesh and leaders with stringers, as established by the June 17, 2002, interim final rule, applied from May 6 - July 15 each year.

In response to new information acquired through gear research, on April 17, 2006, NMFS published a proposed rule in the *Federal Register* that would allow the use of offshore pound net leaders meeting the definition of a *modified pound net leader* in a portion of the Chesapeake Bay during the period May 6 to July 15 each year. Modifications to the pound net leader address: (1) the maximum allowed mesh size; (2) placement of the leader in relation to the sea floor; (3) the height of the mesh from the sea floor in relation to the depth at mean lower low water; and (4) the use of vertical lines to hold the mesh in place. Following review of public comments received on the proposed rule, NMFS published a final rule implementing the action on June 23, 2006 (71 FR 36024).

5.4.5 HMS Sea Turtle Protection Measures

NMFS completed the most recent biological opinion on the FMP for the Atlantic HMS fisheries for tuna and swordfish on June 1, 2004, and concluded that the pelagic longline component of the fishery was 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 the operation of this component of the fishery. The RPA was also expected to benefit loggerhead sea turtles by reducing the likelihood of mortality resulting from interactions with the gear. Regulatory components of the RPA have been implemented through rulemaking. 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 *et al.* 2009).

5.4.6 Use of a Chain-Mat Modified Scallop Dredge in the Mid-Atlantic

In response to the observed capture of sea turtles in scallop dredge gear, including serious injuries and sea turtle mortality as a result of capture, NMFS proposed a modification to scallop dredge gear (70 FR 30660, May 27, 2005). The rule was finalized as proposed (71 FR 50361, August 25, 2006) and required federally permitted scallop vessels fishing with dredge gear to modify their gear by adding an arrangement of horizontal and vertical chains (hereafter referred to as a “chain mat”) between the sweep and the cutting bar when fishing in Mid-Atlantic waters south of 41°9’N from the shoreline to the outer boundary of the EEZ during the period of May 1-November 30 each year. The requirement was subsequently modified by emergency rule on November 15, 2006 (71 FR 66466), and by a final rule published on April 8, 2008 (73 FR 18984). On May 5, 2009, NMFS proposed additional minor modifications to the regulations on how chain mats are configured (74 FR 20667). In general, the chain mat gear modification is expected to reduce the severity of some sea turtle interactions with scallop dredge gear. However, this modification is not expected to reduce the overall number of sea turtle interactions with scallop dredge gear.

5.4.7 Sea Turtle Handling and Resuscitation Techniques

NMFS has developed and published as a final rule in the *Federal Register* (66 FR 67495, December 31, 2001) sea turtle handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities. Persons participating in fishing activities or scientific research are required to handle and resuscitate (as necessary) sea turtles as prescribed in the final rule. These measures help to prevent mortality of hard-shelled turtles caught in fishing or scientific research gear.

5.4.8 Sea Turtle Entanglements and Rehabilitation

A final rule (70 FR 42508) published on July 25, 2005, allows any agent or employee of NMFS, the USFWS, the U.S. Coast Guard, 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, to take endangered sea turtles encountered in the marine environment if such taking is necessary to aid a sick, injured, or entangled endangered sea turtle, or dispose of a dead endangered sea turtle, or salvage a dead endangered sea turtle that may be useful for scientific or educational purposes. NMFS already affords the same protection to sea turtles listed as threatened under the ESA (50 CFR 223.206(b)).

5.4.9 Education and Outreach Activities

Education and outreach activities do not directly reduce the threats to ESA-listed sea turtles. However, education and outreach are a means of better informing the public of steps that can be taken to reduce impacts to sea turtles (*i.e.*, reducing light pollution in the vicinity of nesting beaches) and increasing communication between affected user groups (*e.g.*, the fishing community). For the HMS fishery, NMFS has been active in public outreach to educate fishermen regarding sea turtle handling and resuscitation techniques. For example, NMFS has conducted workshops with longline fishermen to discuss bycatch issues including protected species, and to educate them regarding handling and release guidelines. NMFS intends to continue these outreach efforts in an attempt to increase the survival of protected species through education on proper release techniques.

5.4.10 Sea Turtle Stranding and Salvage Network (STSSN)

As is the case with education and outreach, the STSSN does not directly reduce the threats to sea turtles. However, the extensive network of STSSN participants along the Atlantic and Gulf of Mexico coasts not only collects data on dead sea turtles, but also rescues and rehabilitates live stranded turtles. Data collected by the STSSN are used to monitor stranding levels and identify areas where unusual or elevated mortality is occurring. 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 provide an understanding of sea turtle movements, longevity, and reproductive patterns, all of which contribute to our ability to reach recovery goals for the species.

5.5 Reducing Threats to Atlantic Sturgeon

Several conservation actions aimed at reducing threats to Atlantic sturgeon are currently ongoing. In the near future, NMFS will be convening a recovery team and will be drafting a recovery plan which will outline recovery goals and criteria and steps necessary to recover all Atlantic sturgeon DPSs. Numerous research activities are underway, involving NMFS and other Federal, State, and academic partners, to obtain more information on the distribution and abundance of Atlantic sturgeon throughout their range, including in the action area. Efforts are also underway to better understand threats faced by the DPSs and ways to minimize these threats, including bycatch and water quality. Fishing gear research is underway to design fishing gear that minimizes interactions with Atlantic sturgeon while maximizing retention of targeted fish species. Several states are in the process of preparing ESA Section 10 Habitat Conservation Plans aimed at minimizing the effects of state fisheries on Atlantic sturgeon.

6.0 EFFECTS OF THE ACTIONS

As discussed in the *Description of the Proposed Actions,* the proposed actions are: (1) the NEAMAP Spring and Fall bottom trawl surveys, and (2) a study looking at sea turtle/Atlantic sturgeon exclusion and target catch retention in a Mid-Atlantic gillnet fishery. Both of these studies will be administered by the NEFSC in 2013 (and possibly in subsequent years). Sea turtles and Atlantic sturgeon may be affected by the proposed actions in a number of ways, including through (1) direct capture in fishing gear, (2) interactions with the research/fishing vessels, (3) effects to prey, and (4) effects to habitat. The following effects analysis will be organized along these topics.

6.1 Distribution of Sea Turtles and Atlantic Sturgeon in the Action Area

As described in sections 4.2.2 - 4.2.5, the occurrence of loggerhead, Kemp's ridley, green, and leatherback sea turtles in New England, Mid-Atlantic, and south Atlantic waters is primarily temperature dependent (Thompson 1984; Keinath *et al.* 1987; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998, 2005; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a). In general, sea turtles move up the U.S. Atlantic 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, 2005; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a). The trend is reversed in the fall as water temperatures cool. By December, sea 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, 2005; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a). 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, Kemp's ridleys, and greens are found in inshore, nearshore, and offshore waters of North Carolina and Virginia from May through November and in inshore, nearshore, and offshore waters of New York from June through October (Keinath *et al.* 1987; Morreale and Standora 1993; Braun-McNeill and Epperly 2004). The hard-shelled sea turtles (loggerheads, Kemp's ridleys, and greens) appear to be temperature limited to water no further north than 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 to Nova Scotia, Canada in the 1980s (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 meters. However, they were generally found in waters where bottom depths ranged from 22-49 meters deep (the median value was 36.6 meters; Shoop and Kenney 1992). Leatherbacks were sighted at the surface in waters with bottom depths ranging from 1-4,151 meters deep (Shoop and Kenney 1992). However, 84.4% of leatherback sightings occurred in waters where the bottom depth was less than 180 meters (Shoop and Kenney 1992), whereas 84.5% of loggerhead sightings occurred in waters where the bottom depth was less than 80 meters (Shoop and Kenney 1992). Neither species was commonly found in waters over Georges Bank, regardless of season (Shoop and Kenney 1992). The CeTAP study did not include Kemp's ridley and green sea turtle sightings, given the difficulty of sighting these smaller sea turtle species (CeTAP 1982).

The Southeast Turtle Survey (SeTS), an aerial survey research program initiated by the SEFSC in 1982 through 1984, was conducted from Cape Hatteras to Key West over coastal waters from the coastline to the approximate mean western boundary of the Gulf Stream (Thompson 1984). Seasonal surveys that corresponded to spring (April-May) and summer (July-August) were completed in all three years. Fall (October-November) surveys were completed in 1982 and 1983 and a single winter survey was completed in January/February 1983 (Thompson and Huang 1993). The study area was designed as a southern extension of the CeTAP aerial surveys. These surveys showed that sea turtles in the south Atlantic region are distributed randomly from the coast out to the Gulf Stream except in the winter. During the winter, sea turtles appear to aggregate within the western Gulf Stream boundary waters which can be 5°-6°C warmer than coastal waters (Thompson 1988).

Given the seasonal occurrence patterns and water depth preferences of sea turtles off the Mid-Atlantic and southern New England coasts, the distribution of sea turtles is likely to overlap with the use of trawl gear in the NEAMAP surveys and the use of gillnet gear in the PSB cooperative gear research study throughout the areas of operation. This is confirmed by the past capture of sea turtles during the NEAMAP spring and fall surveys as well as in the monkfish gillnet commercial fishery as evidenced by NEFOP incidental take data.

Subadult and adult Atlantic sturgeon may be present in the action area year-round. In the marine environment, Atlantic sturgeon are most often captured in depths less than 50 meters. Some information suggests that captures in otter trawl gear are most likely to occur in waters with depths less than 30 meters and in depths less than 40 meters and mesh sizes greater than 10 inches for sink gillnet gear (ASMFC TC 2007). Given the past capture of Atlantic sturgeon in both the spring and fall NEAMAP surveys, it is reasonable to anticipate that Atlantic sturgeon will be present throughout the action area during the proposed actions. As described above, we expect that Atlantic sturgeon in the action area will originate from the NYB (49%), SA (20%), CB (14%), GOM (11%), and Carolina (4%) DPSs. It is possible that a small fraction (2%) of Atlantic sturgeon in the action area may be Canadian origin (from the St. John River).

6.2 Sea Turtle and Atlantic Sturgeon Interactions during the Proposed Actions

Sea turtles and Atlantic sturgeon are known to be susceptible to capture in both trawl and gillnet gear. In regards to the history of interactions during the NEAMAP surveys, sea turtles and Atlantic sturgeon have been captured during both the spring and fall surveys. Sea turtles and Atlantic sturgeon have also been captured in past gillnet studies overseen by the NEFSC (Fox and Breece 2010; Fox *et al*. 2011) as well as during the course of normal commercial fishing activities. As the Mid-Atlantic gillnet study will overlap temporally and spatially when sea turtle and Atlantic sturgeon presence is expected, that study is also expected to result in impacts.

6.3 NEAMAP Surveys

6.3.1 Capture in Trawl Gear – Sea Turtles

The potential for capture of sea turtles in bottom otter trawl gear is well established (see for example, Lutcavage *et al.* 1997, Henwood and Stuntz 1987; NRC 1990). Here, we establish the expected number of sea turtles that will be captured in the 2013 NEAMAP surveys and the effect of those captures on individual sea turtles.

Estimated number of captures in the 2013 spring and fall NEAMAP surveys

Table 11 below provides information on all sea turtles captured in NEAMAP surveys conducted since the program began in 2007 (n=21, 12 loggerheads, eight Kemp's ridleys, one green). As described in Section 3.0, the NEAMAP surveys follow the same protocol as the NEFSC spring and fall bottom trawl surveys with the exception that a different (smaller draft) vessel is used and the areas surveyed are waters at depths that have been undersampled by the NEFSC bottom trawl surveys, and the trawl times are 20 minutes instead of 30 minutes. Extensive survey effort of the continental shelf from Cape Hatteras to Nova Scotia, Canada in the 1980s revealed that loggerhead sea turtles were observed at the surface in waters from the beach to waters with bottom depths of up to 4,481 meters (CeTAP 1982). However, they were generally found in waters where bottom depths ranged from 22-49 meters deep (the median value was 36.6 meters; Shoop and Kenney 1992). The bottom depth range identified for loggerheads during the CeTAP surveys encompasses the water depths previously sampled by the NEFSC bottom trawl surveys, and the water depths proposed to be sampled by the 2013 NEAMAP surveys. Therefore, the

Table 11. Sea turtle captures that have been recorded during the NEAMAP surveys: 2007-2012.

Cruise	Date	Species	Length (cm)	Alive	Injured	Approx. Handling Time
Spring 2008	4/25/2008	*Caretta caretta*	NONE	YES	NO	< 5 MIN
Spring 2008	4/25/2008	*Caretta caretta*	NONE	YES	NO	< 5 MIN
Fall 2009	10/14/2009	*Lepidochelys kempii*	30	YES	NO	< 5 MIN
Fall 2009	10/22/2009	*Chelonia mydas*	30-40	YES	NO	< 5 MIN
Spring 2010	4/22/2010	*Caretta caretta*	113	YES	NO	10 MIN
Fall 2010	10/11/2010	*Lepidochelys kempii*	31	YES	NO	< 5 MIN
Fall 2010	10/19/2010	*Caretta caretta*	96	YES	NO	< 5 MIN
Fall 2010	10/24/2010	*Lepidochelys kempii*	25	YES	NO	5-7 MIN
Spring 2011	4/25/2011	*Caretta caretta*	88	YES	NO	
Fall 2011	10/24/11	*Caretta caretta*	59	YES	NO	5-7 MIN
Fall 2011	10/24/11	*Caretta caretta*	59	YES	NO	5-7 MIN
Fall 2011	10/24/11	*Lepidochelys kempii*	50	YES	NO	5-7 MIN
Fall 2011	10/24/11	*Lepidochelys kempii*	32	YES	NO	
Fall 2011	10/26/11	*Caretta caretta*	62	YES	NO	
Spring 2012	4/27/2012	*Caretta caretta*	82	YES	NO	
Spring 2012	4/29/2012	*Caretta caretta*	91.5	YES	NO	
Spring 2012	5/3/2012	*Caretta caretta*	67	YES	NO	
Fall 2012	10/2/2012	*Lepidochelys kempii*	36	YES	NO	< 10 MIN
Fall 2012	10/14/2012	*Lepidochelys kempii*	48	YES	NO	< 10 MIN
Fall 2012	10/20/2012	*Lepidochelys kempii*	40	YES	NO	< 10 MIN
Fall 2012	10/22/2012	*Caretta caretta*	80	YES	NO	< 10 MIN

likelihood of capturing a loggerhead sea turtle in gear used for the 2013 NEAMAP surveys is expected to be comparable to what has been reported for the NEFSC bottom trawl surveys.

We have previously determined the bycatch rates for loggerhead sea turtles captured in bottom otter trawl gear used in the NEFSC spring and fall bottom trawl surveys (NMFS 2012b). Using data from 1968-2012, the average bycatch rate for loggerheads during the NEFSC spring bottom trawl surveys was 0.002 turtles/trawl hour. The highest bycatch rate during the spring surveys was 0.015 turtles/trawl hour. The spring NEAMAP survey operates with approximately 50 hours of tow time. Using the highest bycatch rate, we calculate that no more than one loggerhead will be captured during the spring survey. However, because three loggerheads were captured in the spring 2012 NEAMAP survey, it is possible that the same number of loggerheads could be captured during the spring 2013 NEAMAP survey. For the NEFSC fall bottom trawl surveys, based upon data from 1963-2011, the average bycatch rate for loggerheads was 0.006 turtles/trawl hour and the highest bycatch rate was 0.035 turtles/trawl hour. The fall NEAMAP survey also operates for approximately 50 trawl hours. Using the highest bycatch rate, we calculate that no more than two loggerheads will be captured during the fall survey. However, three loggerheads were caught during the fall 2011 NEAMAP survey. Because of this, it is possible that three loggerheads could be captured during the fall 2013 NEAMAP survey.

Eight Kemp's ridleys have been captured in the history of the NEAMAP surveys. All Kemp's ridley captures have occurred during the fall surveys, although that does not rule out the possibility that a spring capture could occur. No more than three Kemp's ridleys have been captured in any one survey (fall 2012). As such, we estimate that no more than one Kemp's ridley will be captured during the 2013 spring survey and no more than three Kemp's ridleys will be captured during the 2013 fall survey. Only one green turtle has been captured during the NEAMAP surveys (in fall 2009). Therefore, we anticipate that no more than one green sea turtle will be captured during the 2013 surveys (spring or fall). To date, no leatherback sea turtles have been captured in the NEAMAP surveys. However, one leatherback sea turtle was captured during the fall 2009 NEFSC bottom trawl survey. This capture and the fact that the NEAMAP surveys use similar protocols to the NEFSC bottom trawl surveys indicates that it is reasonable to expect that a leatherback may be captured in the 2013 NEAMAP surveys. Because only one leatherback has been captured in the history of the NEFSC surveys, we anticipate that no more than one leatherback sea turtle may be captured annually in the 2013 NEAMAP surveys.

The number of sea turtles captured annually in the NEAMAP and NEFSC surveys is variable and is likely in part based on annual differences in weather patterns, currents, forage availability, and water temperature. Because of this variability and our inability to predict these factors for 2013, we have used the maximum number of sea turtles captured in past surveys to predict the number of sea turtles expected to be captured in the 2013 NEAMAP surveys. Based on past captures in the NEAMAP and NEFSC surveys, we anticipate the following captures of sea turtles in 2013 as presented in Table 12.

Potential for Mortality Resulting from Capture in Trawls – Sea Turtles

Sea turtles forcibly submerged in any type of restrictive gear can eventually suffer fatal consequences from prolonged anoxia and/or seawater infiltration of the lung (Lutcavage *et al.*

Table 12. Expected Sea Turtle Captures in the 2013 NEAMAP surveys

Sea Turtle Species	Spring 2013	Fall 2013	Total – 2013
Loggerhead	3	3	6
Kemp's ridley	1	3	4
Green	1*	1*	1
Leatherback	1*	1*	1

*for green and leatherback sea turtles, we anticipate the capture of 1 turtle of each species in either the spring or fall survey.

1997). A study examining the relationship between tow time and sea turtle mortality in the shrimp trawl fishery showed that mortality was strongly dependent on trawling duration, with the proportion of dead or comatose sea turtles rising from 0% for the first 50 minutes of capture to 70% after 90 minutes of capture (Henwood and Stuntz 1987). However, metabolic changes that can impair a sea turtle's ability to function can occur within minutes of a forced submergence. While most voluntary dives appear to be aerobic, showing little if any increases in blood lactate and only minor changes in acid-base status, the story is quite different in forcibly submerged sea turtles, where oxygen stores are rapidly consumed, anaerobic glycolysis is activated, and acid-base balance is disturbed, sometimes to lethal levels (Lutcavage and Lutz 1997). Forced submergence of Kemp's ridley sea turtles in shrimp trawls resulted in an acid-base imbalance after just a few minutes (times that were within the normal dive times for the species) (Stabenau *et al.* 1991). Conversely, recovery times for acid-base levels to return to normal may be prolonged. Henwood and Stuntz (1987) found that it took as long as 20 hours for the acid-base levels of loggerhead sea turtles to return to normal after capture in shrimp trawls for less than 30 minutes. This effect is expected to be worse for sea turtles that are recaptured before metabolic levels have returned to normal.

Following the recommendations of the NRC to reexamine the association between tow times and sea turtle deaths, the data set used by Henwood and Stuntz (1987) was updated and re-analyzed (Epperly *et al.* 2002; Sasso and Epperly 2006). Seasonal differences in the likelihood of mortality for sea turtles caught in trawl gear were apparent. For example, the observed mortality exceeded 1% after 10 minutes of towing in the winter (defined in Sasso and Epperly (2006) as the months of December-February), while the observed mortality did not exceed 1% until after 50 minutes in the summer (defined as March-November; Sasso and Epperly 2006). In general, tows of short duration (<10 minutes) in either season have little effect on the likelihood of mortality for sea turtles caught in the trawl gear and would likely achieve a negligible mortality rate (defined by the NRC as <1%). Intermediate tow times (10-200 minutes in summer and 10-150 minutes in winter) result in a rapid escalation of mortality, and eventually reach a plateau of high mortality, but will not equal 100%, as a sea turtle caught within the last hour of a long tow will likely survive (Epperly *et al.* 2002; Sasso and Epperly 2006). However, in both seasons, a rapid escalation in the mortality rate did not occur until after 50 minutes (Sasso and Epperly 2006) as had been found by Henwood and Stuntz (1987). Although the data used in the reanalysis were specific to bottom otter trawl gear in the U.S. south Atlantic and Gulf of Mexico shrimp fisheries, the authors considered the findings to be applicable to the impacts of forced submergence in general (Sasso and Epperly 2006).

Sea turtle behaviors may influence the likelihood of them being captured in bottom trawl gear. Video footage recorded by the SEFSC's Pascagoula Laboratory indicated that sea turtles will keep swimming in front of an advancing shrimp trawl, rather than deviating to the side, until they become fatigued and are caught by the trawl or the trawl is hauled up (NMFS 2002). Sea turtles have also been observed to dive to the bottom and hunker down when alarmed by loud noise or gear (Memo to the File, L. Lankshear, December 4, 2007), which could place them in the path of bottom gear such as a bottom otter trawl. With respect to oceanographic features, a review of the data associated with 11 sea turtles captured by the scallop dredge fishery in 2001 concluded that the sea turtles appeared to have been near the shelf/slope front (NMFS 2012c).

Tows for the Spring and Fall 2013 NEAMAP surveys will be 20 minutes in duration. Based on the analysis by Sasso and Epperly (2006) and Epperly *et al.* (2002) as well as information on captured sea turtles from the NEAMAP and NEFSC trawl surveys, as well as the NEFSC FSB observer program, a 20-minute tow time for the bottom otter trawl gear to be used in the survey will likely eliminate the risk of death from forced submergence for sea turtles caught in the bottom otter trawl survey gear.

During spring and fall bottom otter trawl surveys conducted by the NEFSC from 1963-2009, a total of 71 loggerhead sea turtles were observed captured. Only one of the 71 loggerheads suffered injuries (cracks to the carapace) causing death (Wendy Teas, SEFSC, pers. comm. to Linda Despres, NEFSC, 2007). All others were alive and returned to the water unharmed. The one leatherback sea turtle captured in the NEFSC trawl survey was released alive and uninjured. NEFSC trawl survey tows are approximately 30 minutes in duration. All sea turtles captured in the NEAMAP surveys have also been released alive and uninjured. Based on past results and the short duration of the tows, we do not anticipate that any of the 12 sea turtles (six loggerhead, four Kemp's ridley, one green, and one leatherback) captured during the 2013 NEAMAP surveys will be injured or killed.

6.3.2 Capture in Trawl Gear – Atlantic Sturgeon

The capture of Atlantic sturgeon in otter trawls used for commercial fisheries is well documented (see for example, Stein *et al.* 2004b and ASMFC TC 2007). Atlantic sturgeon are also captured incidentally in trawls used for scientific studies. No information on bycatch rates that could be applied to the NEAMAP study to predict future catch is available from the literature. However, VIMS has recorded all Atlantic sturgeon interactions since the NEAMAP bottom trawl survey program began. This information allows us to predict future interactions. To date, a total of 123 Atlantic sturgeon captures have been recorded, with a maximum of 16 Atlantic sturgeon captured in a particular survey (Table 13).

The number of Atlantic sturgeon captured each year is variable; because of this and because we are only considering one year of surveys, using the maximum number of Atlantic sturgeon captured in a given survey is a reasonable indicator of the likely number of captures during the 2013 surveys. Because the 2013 survey will follow identical protocols to the past and operate in the same areas, it is reasonable to anticipate similar catch levels in 2013. Based on this, we

Table 13. Captures of Atlantic Sturgeon in the NEAMAP surveys 2007-2012.

SEASON	2007	2008	2009	2010	2011	2012
SPRING		9	12	15	16	9
FALL	2	11	13	16	7	13

anticipate that 16 or fewer Atlantic sturgeon will be captured during the spring 2013 survey and an additional 16 or fewer Atlantic sturgeon will be captured during the fall 2013 survey (*i.e.*, 32 total in 2013). Based on the mixed stock analysis, in one year we expect that 49% of the captured Atlantic sturgeon will originate from the NYB DPS (16 individuals), 20% from the SA DPS (six individuals), 14% from the CB DPS (five individuals), 11% from the GOM DPS (four individuals), and 4% from the Carolina DPS (one individual).

Potential for Mortality Resulting from Capture in Trawls – Atlantic sturgeon
The short duration of the tow and careful handling of any Atlantic sturgeon once on deck is likely to result in a low potential for mortality. None of the 123 Atlantic sturgeon captured in the NEAMAP surveys have had any evidence of injury, and there have been no recorded mortalities. The NEFSC bottom trawl surveys have recorded the capture of 141 Atlantic sturgeon since 1972. To date, there have been no recorded injuries or mortalities. In the Hudson River, a trawl survey that incidentally captures shortnose and Atlantic sturgeon has been ongoing since the late 1970s. To date, no injuries or mortalities of any sturgeon have been recorded. Based on this information, we expect that all Atlantic sturgeon captured in the 2013 spring and fall NEAMAP surveys will be alive and will be released uninjured.

6.4 Gillnet Gear Research Project

As the gillnet gear research project proposed in this Opinion adheres to the same Federal regulations and may be described as identical to normal fish harvest activities that would occur in the monkfish fishery, captures of ESA-listed species of sea turtles and Atlantic sturgeon may occur in a similar fashion in the fishery as it would in the research project. As such, discussion of effects of the monkfish fishery in general to listed sea turtles and Atlantic sturgeon is relevant and applicable to the gillnet gear study proposed in this Opinion. However, since captures and mortalities of sea turtles in the monkfish fishery are already quantified and assessed in the existing Opinion on the Monkfish FMP (NMFS 2010), this section will only discuss the effects of the gillnet gear research project on Atlantic sturgeon.

6.4.1 Capture in Sink Gillnet Gear – Atlantic Sturgeon

PSB-funded gillnet gear modification studies in the monkfish fishery have been conducted over the last few years and have been influenced by research needs suggested in ASMFC TC (2007). The results of these prior studies have influenced the design of the gillnet gear modification study proposed in this Opinion. The gillnet gear modification study proposed in this Opinion will utilize similar methods to another cooperative research effort that has been conducted off northern New Jersey in November/December of 2010, 2011, and 2012. Those projects compared differences in catch per unit effort of monkfish (target) and Atlantic sturgeon (bycatch) between "tie down" and "non-tie down" gillnet configurations across 120 hauls (Fox *et al*. 2011, 2012).

In April/May of 2011, an additional 50 hauls were conducted off Delaware with gillnets of the same specifications as those used in the 120 haul studies, with the exception of alternating treatment/control panels. These gillnets were fished and then assessed as part of a directed sampling effort for Atlantic sturgeon in Delaware's coastal waters by researchers from Delaware State University (Fox *et al*. 2011).

Both the 120 haul sets conducted in the fall of 2010 and 2011 and the 50 haul set conducted in the spring of 2011 drew important conclusions relevant to the gillnet gear modification research proposed in this Opinion. Due to the effort magnitude similarities (*i.e.*, identical number of sets) between the gillnet gear research project proposed in this Opinion and the 120 haul set studies in the fall of 2010, 2011, and 2012, the results from those projects are the most relevant to the proposed action assessed here. A total of 23 Atlantic sturgeon were captured during the 120 haul sets in the fall of 2010—five in control nets and 18 in experimental nets (Fox *et al*. 2011). A total of 37 Atlantic sturgeon were captured during the 120 haul sets in the fall of 2011—28 in control nets and nine in treatment nets (Fox *et al*. 2012). A total of 35 Atlantic sturgeon were captured during the 120 haul sets in the fall of 2012—21 in control nets and 14 in treatment nets (Henry Milliken, NEFSC, pers. comm.). A significantly greater number of Atlantic sturgeon (67) were captured in the 50 haul set during the spring of 2011 (Fox *et al*. 2011). Those 67 Atlantic sturgeon were evenly split between the control (34 fish in nets with the dimensions of 12 meshes high, each of 30.5 cm stretch mesh with four mesh tie-downs) and experimental nets (33 fish in nets with the dimensions of 12 meshes high, each of 30.5 cm stretch mesh without tie-downs) (Fox *et al*. 2011). Although control and experimental nets proposed in the gillnet gear modification study in this Opinion are both tie-down configurations, we find the 120 haul set components of the PSB gillnet gear work conducted in November/December of 2012 to be very reliable and the best available information to use in our estimation of Atlantic sturgeon interactions for the gillnet study. As a result, we expect that the gillnet gear study proposed in this Opinion will capture up to 35 Atlantic sturgeon in the spring and early summer of 2013.

Based on the mixed stock analysis mentioned previously, we expect that 18 captured Atlantic sturgeon will originate from the NYB DPS, seven will originate from the SA DPS, five will originate from the CB DPS, four will originate from the GOM DPS, and one will originate from the Carolina DPS.

Potential for Mortality Resulting from Capture in Sink Gillnet Gear – Atlantic sturgeon
As indicated in ASMFC TC (2007) based upon NEFOP data from 2001-2006, increased regional movement and hence availability of migrating sturgeons increase the likelihood of interaction with sink gillnets of any type operating within migration corridors. Tie-down use appears to increase the overall size range of retained fish by increasing the susceptibility of smaller individuals. Water temperature and soak time duration affect survival of sturgeons through physiological constraints regardless of capture method. Across the range of temperatures, incidence of death increases with rising temperatures. A clear relationship was apparent between increasing mortality and soak times, with soak times greater than 24 hours resulting in a 40% incidence of death and those less than 24 hours resulting in a 14% incidence of death. Longer soak times may also increase bycatch and related deaths by increasing the likelihood of an interaction and perhaps through a baiting effect. Mortality rates appear to be unusually high in 12 inch mesh (*e.g.*, the monkfish fishery); however, mesh size cannot be analyzed in isolation

because these nets were also observed to contain tie-downs 98% of the time, and soak times over 24 hours occurred 83% of the time for these monkfish fishery deployments.

Careful handling of Atlantic sturgeon, once captured, should help enhance survival in gillnet gear modification research proposed in this Opinion relative to fish captured in the monkfish gillnet fishery. Of the 23 Atlantic sturgeon captured during the gillnet gear work in November and December 2010, 10 (43%) were released alive and 13 (57%) suffered mortality from entanglement in the net and/or were dead upon landing (Fox *et al*. 2011). Of the 37 Atlantic sturgeon captured during gillnet gear work in November and December 2011, 12 (32%) were released alive and 25 (68%) suffered mortality from entanglement in the net and/or were dead upon landing (Fox *et al*. 2012). Of the 35 Atlantic sturgeon captured during gillnet gear work in November and December 2012, 17 (49%) were released alive and 18 (51%) suffered mortality from entanglement in the net and/or were dead upon landing (Henry Milliken, NEFSC, pers. comm.). The number of dead Atlantic sturgeon across identical constraints as mentioned previously from VTR estimated Atlantic sturgeon interactions from NEFOP data between 2006 and 2010 was 24.8 (56%) (NEFSC 2011b). Using the highest observed mortality rate resulting from these studies (68%) to be conservative, we expect up to 24 dead Atlantic sturgeon as a result of the gillnet gear research project proposed in this Opinion.

Based on the mixed stock analysis mentioned previously, we expect that up to 12 dead Atlantic sturgeon will originate from the NYB DPS, five will originate from the SA DPS, three will originate from the CB DPS, three will originate from the GOM DPS, and one will originate from the Carolina DPS.

6.5 Interactions with the Research or Study Vessels

Sea turtles are known to be injured and/or killed as a result of being struck by vessels on the water and as a result of capture in or physical contact with fishing gear. With respect to the NEAMAP surveys and PSB gillnet gear study, the effects to sea turtles as a result of vessel activities are discountable. The small number of vessels that will operate on the water as a result of the proposed actions is unlikely to strike sea turtles in the action area given that: (a) the vessels will operate/travel at a slow speed such that a sea turtle would have the speed and maneuverability to avoid contact with the vessel and (b) sea turtles spend part of their time at depths out of range of a vessel collision.

As noted in the 2007 Status Review and the proposed rule, in certain geographic areas vessel strikes have been identified as a threat to Atlantic sturgeon. While the exact number of Atlantic sturgeon killed as a result of being struck by boat hulls or propellers is unknown, it is an area of concern in the Delaware and James Rivers. Brown and Murphy (2010) examined 28 dead Atlantic sturgeon observed in the Delaware River from 2005-2008. Fifty-percent of the mortalities resulted from apparent vessel strikes and 71% of these (ten of 14) had injuries consistent with being struck by a large vessel (Brown and Murphy 2010). Eight of the 14 vessel struck sturgeon were adult-sized fish (Brown and Murphy 2010). Given the time of year in which the fish were observed (predominantly May through July; Brown and Murphy 2010), it is likely that many of the adults were migrating through the river to the spawning grounds.

The factors relevant to determining the risk to Atlantic sturgeon from vessel strikes are currently unknown, but they may be related to size and speed of the vessels, navigational clearance (*i.e.*, depth of water and draft of the vessel) in the area where the vessel is operating, and the behavior of Atlantic sturgeon in the area (*e.g.*, foraging, migrating, etc.). It is important to note that vessel strikes have only been identified as a significant concern in the Delaware and James Rivers and current thinking suggests that there may be unique geographic features in these areas (*e.g.*, potentially narrow migration corridors combined with shallow/narrow river channels) that increase the risk of interactions between vessels and Atlantic sturgeon. The risk of vessel strikes between Atlantic sturgeon and research/fishing vessels operating in the open ocean is likely to be low given that the vessels are likely to be operating at slow speeds and there are no restrictions forcing Atlantic sturgeon into close proximity with the vessel as may be present in some rivers.

Given the large volume of vessel traffic in the action area and the wide variability in traffic on any given day, the increase in traffic (one or two vessels, traveling at relatively slow speeds) associated with the NEAMAP surveys or PSB gillnet study is extremely small. Given the small and localized increase in vessel traffic that would result from the NEAMAP surveys and gillnet study, it is unlikely that there would be any detectable increase in the risk of vessel strike. As such, effects to Atlantic sturgeon from the increase in vessel traffic are likely to be discountable.

6.6 Effects to Prey

Sea turtles could be negatively affected by the loss of prey as a result of mobile fishing gear that removes or incidentally kills such prey during NEAMAP surveys or gillnet study. However, the amount of potential prey that will be disturbed or removed is minimal. The trawl and the gillnet gear is expected to catch a variety of organisms including fish and crab species. The 12 inch mesh proposed to be utilized in gillnet gear work in this Opinion is expected to result in minimal bycatch (*e.g.*, fish and crab species) relative to NEAMAP trawl gear. However, none of the bycatch species expected from any activity (*i.e.*, utilizing otter trawl and gillnet gear) proposed in this Opinion are typical prey species of leatherback sea turtles or of neritic juvenile or adult green sea turtles (Rebel 1974; Mortimer 1982; Bjorndal 1985, 1997; USFWS and NMFS 1992). Those organisms that are caught in either trawl or gillnet will be sampled according to the survey protocol. Species that meet the sampling criteria will be sampled for scientific purposes and may not be returned to the water, while the other species will be returned to the water alive, dead, or injured to the extent that they will subsequently die. All of the species that will be retained for further study are fish. Crabs, on the other hand, which are the preferred prey of loggerhead and Kemp's ridley sea turtles, will not be retained for further study, and thus would still be available as prey for loggerheads and Kemp's ridleys when returned to the water, as both of these species of sea turtles are known to eat a variety of live prey as well as scavenge dead organisms (Lutcavage and Musick 1985; Keinath *et al.* 1987; Dodd 1988; Burke *et al.* 1993, 1994; Morreale and Standora 2005). Thus, the NEAMAP surveys and gillnet study considered here are expected to have an insignificant effect on the availability of prey for loggerhead and Kemp's ridley sea turtles in the action area given that: (a) the sea turtle food items that are returned to the water could still be preyed upon by loggerheads and Kemp's ridleys, (b) the number of trawl tows and gillnet hauls for the surveys and study are limited in scope and duration, (c) the priority species that will be retained for scientific analysis are all fish species, which are not the preferred prey for loggerhead and Kemp's ridley sea turtles (Keinath *et al.* 1987; Lutcavage and Musick

1985; Burke *et al.* 1993, 1994; Morreale and Standora 2005), and (d) and there is no evidence loggerhead or Kemp's ridley sea turtles are prey limited.

While in the ocean, Atlantic sturgeon feed primarily on small benthic invertebrates and occasionally on small fish such as sand lance. Because of the small size or benthic nature of these prey species, it is unlikely that the NEAMAP surveys or gillnet study will capture any Atlantic sturgeon prey items. Thus, the surveys and study will not affect the availability of prey for Atlantic sturgeon. Any effects to prey will be limited to minor disturbances to the bottom from the trawl and gillnet gear. Because of this, we have determined that any effects to Atlantic sturgeon prey or foraging Atlantic sturgeon will be insignificant and discountable.

6.7 Effects to Habitat

A panel of experts has previously concluded that the effects of even light weight otter trawl gear would include: (1) the 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) the removal or damage to benthic or demersal species, and (4) the 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 areas to be surveyed for the NEAMAP surveys include very few habitats that are purely gravel or hard clay—so few that the area encompassed by these habitats is insignificant compared to the area encompassed by sand and silt type habitats, which are more resilient to bottom trawling. For sea turtles and Atlantic sturgeon, the effects on habitat due to bottom otter trawl gear would be felt as an effect on their benthic prey species. As stated above, the effects on sea turtle and Atlantic sturgeon prey items from trawl gear are expected to be insignificant.

As gillnet gear is a form of fixed gear (*i.e.*, stationary, not moving), limited effects to bottom habitat are possible as a result of utilizing this form of fish harvest gear. The gear rests on the bottom and is capable of getting pushed by slow moving currents, or, when the gear is in process of being retrieved. Because the gillnet gear hauls proposed in this Opinion will not be conducted during adverse weather conditions (*i.e.*, when ocean currents may be stronger) and will have soak durations of 96 hours or less, adverse effects on habitat are not expected. As stated above, the effects on sea turtle and Atlantic sturgeon prey items from gillnet gear are expected to be insignificant.

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 within 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, are considered in the *Environmental Baseline* and *Status of the Species* sections above and are also factored into the *Integration and Synthesis of Effects* section below.

Sources of human-induced mortality, injury, and/or harassment of sea turtles and Atlantic sturgeon in the action area that are reasonably certain to occur in the future include interactions in state-regulated and recreational 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 sea turtles and Atlantic sturgeon, preventing or slowing a species' recovery, the magnitude of these effects is currently unknown.

State Water Fisheries - Future recreational and commercial fishing activities in state waters may capture, injure, or kill sea turtles and Atlantic sturgeon. However, it is not clear to what extent these future activities would affect listed species differently than the current state fishery activities described in the *Environmental Baseline* section. Atlantic sturgeon are captured and killed in fishing gear operating in the action area; however, at this time we are not able to quantify the number of interactions that occur. However, this Opinion assumes effects in the future would be similar to those in the past and are, therefore, reflected in the anticipated trends described in the *Status of the Species* and *Environmental Baseline* sections.

Fishing activities are considered one of the most significant causes of death and serious injury for sea turtles. 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. 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%). Fishing gear in state waters, including bottom trawls, gillnets, trap/pot gear, and pound nets, interacts with sea turtles each year. NMFS is working with state agencies to address the bycatch of sea turtles in state water fisheries within the action area of this consultation where information exists to show that these fisheries capture sea turtles. Action has been taken by some states to reduce or remove the likelihood of sea turtle bycatch and/or the likelihood of serious injury or mortality in one or more gear types. However, given that state managed commercial and recreational fisheries along the U.S. Atlantic coast are reasonably certain to occur within the action area in the foreseeable future, additional interactions of sea turtles with these fisheries are anticipated. There is insufficient information to quantify the number of sea turtle interactions with state water fisheries as well as the number of sea turtles injured or killed as a result of these interactions. While actions have been taken to reduce sea turtle bycatch 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. However, this Opinion assumes effects in the future would be similar to those in the past and are, therefore, reflected in the anticipated trends described in the *Status of the Species* and *Environmental Baseline* sections.

Vessel Interactions – NMFS's STSSN data indicate that vessel interactions are responsible for a number of sea turtle strandings within the action area each year. In the U.S. Atlantic from 1997-

2005, 14.9% of all stranded loggerheads were documented as having sustained some type of propeller or collision injuries (NMFS and USFWS 2007a). The incidence of propeller wounds rose from approximately 10% in the late 1980s to a record high of 20.5% in 2004 (STSSN database). Such collisions are reasonably certain to continue into the future. Collisions with boats can stun, injure, or kill sea turtles, and many live-captured and stranded sea 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 vessel interactions with sea turtles will continue in the future. An estimate of the number of sea turtles that will likely be killed by vessels is not available at this time. Similarly, we are unable at this time to assess the risk that vessel operations in the action area pose to Atlantic sturgeon. While vessel strikes have been documented in several rivers, the extent that interactions occur in the marine environment is currently unknown. However, this Opinion assumes effects in the future would be similar to those in the past and are, therefore, reflected in the anticipated trends described in the *Status of the Species* and *Environmental Baseline* sections.

Pollution and Contaminants - Human activities in the action area causing pollution are reasonably certain to continue in the future, as are impacts from them on sea turtles and Atlantic sturgeon. However, the level of impacts cannot be projected. Sources of contamination in the action area include atmospheric loading of pollutants, stormwater runoff from coastal development, groundwater discharges, and industrial development. Chemical contamination may have effects on listed species' reproduction and survival. Excessive turbidity due to coastal development and/or construction sites could influence sea turtle or sturgeon foraging ability. Marine debris (*e.g.*, discarded fishing line or lines from boats, plastics) also has the potential to entangle sea turtles in the water or to be fed upon by them. Sea turtles commonly ingest plastic or mistake debris for food and sometimes this may lead to asphyxiation. This Opinion assumes effects in the future would be similar to those in the past and are therefore reflected in the anticipated trends described in the *Status of the Species* and *Environmental Baseline* sections.

In the future, *global climate change* is expected to continue and may impact sea turtles and Atlantic sturgeon and their habitat 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 sea turtles or Atlantic sturgeon over the temporal scale of the proposed actions (*i.e.*, through 2013) 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.

8.0 INTEGRATION AND SYNTHESIS OF EFFECTS

In the effects analysis outlined above, we considered potential effects from the NEAMAP surveys in 2013 as well as the PSB gillnet gear research project proposed for the spring and summer of 2013. These effects include fishing with bottom otter trawls and sink gillnets. In addition to these gear-related effects, we considered the potential for collisions between ESA-listed species and project vessels as well as noise effects on ESA-listed species from vessels participating in the studies.

NMFS has estimated that the 2013 NEAMAP spring and fall bottom trawl surveys will result in the capture of up to six NWA DPS loggerheads, four Kemp's ridleys, one green, and one leatherback sea turtle, and up to 32 Atlantic sturgeon. No injuries or mortalities of sea turtles or Atlantic sturgeon are anticipated during the NEAMAP surveys and all captured animals are expected to recover from capture without any reduction in fitness or impact on survival. As explained in the *Effects of the Action* section, all other effects to sea turtles and Atlantic sturgeon from the NEAMAP surveys, including to their prey, will be insignificant or discountable.

NMFS has estimated that the gillnet gear research project to be carried out in the spring and summer of 2013 will result in the capture of up to 35 Atlantic sturgeon. We expect up to 24 Atlantic sturgeon will suffer serious injuries or die as a result of capture in the control or experimental gillnets proposed to be utilized in the gillnet gear study. As explained in the *Effects of the Action* section, all other effects to Atlantic sturgeon, including to their prey, as a result of the gillnet gear study will be insignificant or discountable.

In the discussion below, we consider whether the effects of the proposed actions reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the listed species in the wild by reducing the reproduction, numbers, or distribution of the listed species that will be adversely affected by the actions. The purpose of this analysis is to determine whether the proposed actions, in the context established by the status of the species, environmental baseline, and cumulative effects, would jeopardize the continued existence of any listed species.

In the USFWS/NMFS Section 7 Handbook (USFWS and NMFS 1998), for the purposes of determining jeopardy, survival is defined as, "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 in 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." We summarize below the status of the species and consider whether the proposed action will result in reductions in reproduction, numbers or distribution of these species and then considers whether any reductions in reproduction, numbers or distribution resulting from the proposed action would reduce appreciably the likelihood of both the survival and recovery of these species, as those terms are defined for purposes of the ESA.

8.1 Northwest Atlantic DPS of Loggerhead Sea Turtles

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.

In this Opinion, NMFS has considered the potential impacts of the proposed actions on the NWA DPS of loggerhead sea turtles. We have estimated that six loggerheads are likely to be captured in the 2013 NEAMAP surveys (three in the spring, three in the fall). All six turtles captured during the surveys are expected to be safely removed from the trawl gear and returned to the ocean without any injury or mortality. All other effects to loggerhead sea turtles, including effects to prey, are expected to be insignificant and discountable.

Capture during the surveys will temporarily prevent these sea turtles from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the turtles are returned to the water. The capture of live loggerhead sea turtles is not likely to reduce the numbers of loggerhead sea turtles in the action area, the numbers of loggerheads in any subpopulation or the species as a whole. Similarly, as the capture of live loggerhead sea turtles will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live loggerhead sea turtles is also not likely to affect the distribution of loggerhead sea turtles in the action area or affect the distribution of sea turtles throughout their range. As any effects to individual live loggerhead sea turtles temporarily removed from the water will be minor and temporary there are not anticipated to be any population level impacts.

Based on the information provided above, the capture of up to six NWA DPS loggerheads during the 2013 NEAMAP surveys 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: (1) there will be no mortality and therefore, no reduction in the numbers of NWA DPS loggerhead sea turtles; (2) there will be no effect to the fitness of any individuals and no effect on reproductive output of the species; and (3) the action will have only a minor and temporary effect on the distribution of NWA DPS loggerhead sea turtles in the action area (related to the temporary capture and handling of captured individuals) and no effect on the distribution of the species throughout its range.

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, we have determined that the proposed actions will not appreciably reduce the likelihood that loggerhead sea turtles will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed actions will affect the likelihood that the NWA DPS of loggerheads can rebuild to a point where listing is no longer appropriate. In 2008, NMFS and the USFWS issued a recovery plan for the Northwest Atlantic population of loggerheads (NMFS and USFWS 2008). The plan includes demographic recovery criteria as well as a list of tasks that must be accomplished. Demographic recovery criteria are included for each of the five recovery units. These criteria focus on sustained increases in the number of nests laid and the number of nesting females in each recovery unit, an increase in abundance on foraging grounds, and ensuring that trends in neritic strandings are not increasing at a rate greater than trends in in-water abundance. The recovery tasks focus on protecting habitats, minimizing and managing predation and disease, and minimizing anthropogenic mortalities.

Loggerheads have an increasing trend, and as explained above, since no mortalities are expected, the proposed actions will not affect the population trend. As such, the proposed actions will not affect the likelihood that the demographic criteria will be achieved or the timeline on which they will be achieved. The action area does not include nesting beaches; all effects to habitat will be insignificant and discountable; therefore, the proposed action will have no effect on the likelihood that habitat based recovery criteria will be achieved. The proposed actions will also not affect the ability of any of the recovery tasks to be accomplished. The effects of the proposed actions 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 actions will not change the rate at which recovery can occur.

In summary, the effects of the proposed actions will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the actions 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. Therefore, based on the analysis presented above, the proposed actions 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 actions 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 actions. We have considered the effects of the proposed actions in light of other threats, including climate change, and have 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 actions are not likely to appreciably reduce the survival and recovery of the NWA DPS of loggerhead sea turtles.

8.2 Kemp's Ridley Sea Turtles

Kemp's Ridley sea turtles are listed as a single species classified as "endangered" under the ESA. Kemp's ridleys occur in the Atlantic Ocean and Gulf of Mexico. The only major nesting site for Kemp's ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; USFWS and NMFS 1992; NMFS and USFWS 2007b).

Nest count data provides the best available information on the number of adult females nesting each year. As is the case with the other sea turtles species discussed above, nest count data must be interpreted with caution given that these estimates provide a minimum count of the number of nesting Kemp's ridley sea turtles. In addition, the estimates do not account for adult males or juveniles of either sex. Without information on the proportion of adult males to females, and the age structure of the Kemp's ridley population, nest counts cannot be used to estimate the total population size (Meylan 1982; Ross 1996; Zurita *et al.* 2003; Hawkes *et al.* 2005; letter to J. Lecky, NMFS Office of Protected Resources, from N. Thompson, NMFS Northeast Fisheries Science Center, December 4, 2007). Nevertheless, the nesting data does provide valuable information on the extent of Kemp's ridley nesting and the trend in the number of nests laid. Estimates of the adult female nesting population reached a low of approximately 250-300 in 1985 (USFWS and NMFS 1992; TEWG 2000). From 1985 to 1999, the number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3% per year (TEWG 2000). Current estimates suggest an adult female population of 7,000-8,000 Kemp's ridleys (NMFS and USFWS 2007b).

The most recent review of the Kemp's ridleys suggests that this species is in the early stages of recovery (NMFS and USFWS 2007b). Nest count data indicate increased nesting and increased numbers of nesting females in the population. NMFS also takes into account a number of recent conservation actions including the protection of females, nests, and hatchlings on nesting beaches since the 1960s and the enhancement of survival in marine habitats through the implementation of TEDs in the early 1990s and a decrease in the amount of shrimping off the coast of Tamaulipas and in the Gulf of Mexico in general (NMFS and USFWS 2007b).

In this Opinion, NMFS has considered the potential impacts of the proposed actions on Kemp's ridley sea turtles. We expect the capture of up to four Kemp's ridleys in the 2013 NEAMAP surveys. None of the Kemp's ridleys captured during the spring and fall surveys are expected to be seriously injured or killed.

Capture during the surveys will temporarily prevent these sea turtles from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the turtles are returned to the water. The capture of live Kemp's ridley sea turtles is not likely to reduce the numbers of Kemp's ridley sea turtles in the action area, the numbers of

Kemp's ridley sea turtles in any subpopulation or the species as a whole. Similarly, as the capture of live Kemp's ridley sea turtles will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live Kemp's ridley sea turtles is also not likely to affect the distribution of Kemp's ridley sea turtles in the action area or affect the distribution of sea turtles throughout their range. As any effects to individual live Kemp's ridley sea turtles temporarily removed from the water will be minor and temporary there are not anticipated to be any population level impacts.

The proposed actions are not likely to reduce distribution because the actions will not impede Kemp's ridleys from accessing foraging grounds or cause more than a temporary disruption to other migratory behaviors. Additionally, given that no mortalities of the species are expected, there will not be any loss of unique genetic haplotypes and no loss of genetic diversity.

Based on the information provided above, the capture of up to four Kemp's ridley sea turtles in the 2013 NEAMAP surveys 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 actions will not affect Kemp's ridleys 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 Kemp's ridleys from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the species' nesting trend is increasing; (2) no mortalities are expected as a result of the actions; (3) the actions will have only a minor and temporary effect on the distribution of Kemp's ridleys in the action area and no effect on the distribution of the species throughout its range; and, (4) the actions will have no effect on the ability of Kemp's ridleys to shelter and only an insignificant effect on individual foraging Kemp's ridleys.

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, we have determined that the proposed actions will not appreciably reduce the likelihood that Kemp's ridley sea turtles 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. Thus, we have considered whether the proposed actions will affect the likelihood that Kemp's ridleys can rebuild to a point where listing is no longer appropriate. In 2011, NMFS and the USFWS issued a recovery plan for Kemp's ridleys (NMFS *et al*. 2011). The plan includes a list of criteria necessary for recovery. These include:

1. An increase in the population size, specifically in relation to nesting females[7];
2. An increase in the recruitment of hatchlings[8];
3. An increase in the number of nests at the nesting beaches;
4. Preservation and maintenance of nesting beaches (*e.g.*, Rancho Nuevo, Tepehuajes, and Playa Dos); and,
5. Maintenance of sufficient foraging, migratory, and inter-nesting habitat.

Kemp's ridleys have an increasing trend, and as explained above, since no mortalities are expected, the proposed actions will not affect the population trend. As such, the proposed actions will not affect the likelihood that criteria one, two, or three will be achieved or the timeline on which they will be achieved. The action area does not include nesting beaches; therefore, the proposed actions will have no effect on the likelihood that recovery criteria four will be met. All effects to habitat will be insignificant and discountable; therefore, the proposed actions will have no effect on the likelihood that criteria five will be met.

The effects of the proposed actions will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the actions 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. Therefore, based on the analysis presented above, the proposed actions will not appreciably reduce the likelihood that Kemp's ridley 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 Kemp's ridley sea turtles inside and outside of the action area, the proposed actions 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 actions. We have considered the effects of the proposed actions in light of cumulative effects explained above, including climate change, and have 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 actions are not likely to appreciably reduce the survival and recovery of this species.

8.3 Green Sea Turtles

Green sea turtles are listed as both threatened and endangered under the ESA. Breeding colony populations in Florida and on the Pacific coast of Mexico are considered endangered while all others are considered threatened. Due to the inability to distinguish between these populations away from the nesting beach, for this Opinion green sea turtles are considered endangered wherever they occur in U.S. waters. Green sea turtles are distributed circumglobally and can be found in the Pacific, Indian, and Atlantic Oceans as well as the Mediterranean Sea (NMFS and USFWS 1991; Seminoff 2004; NMFS and USFWS 2007c). As is also the case with the other

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[7] A population of at least 10,000 nesting females in a season (as measured by clutch frequency per female per season) distributed at the primary nesting beaches in Mexico (Rancho Nuevo, Tepehuajes, and Playa Dos) is attained in order for downlisting to occur; an average of 40,000 nesting females per season over a 6-year period by 2024 for delisting to occur.

[8] Recruitment of at least 300,000 hatchlings to the marine environment per season at the three primary nesting beaches in Mexico (Rancho Nuevo, Tepehuajes, and Playa Dos).

sea turtle species, green sea turtles face numerous threats on land and in the water that affect the survival of all age classes.

A review of 32 Index Sites distributed globally revealed a 48% to 67% decline in the number of mature females nesting annually over the last three generations (Seminoff 2004). For example, in the eastern Pacific, the main nesting sites for the green sea turtle are located in Michoacán, Mexico, and in the Galapagos Islands, Ecuador, where the number of nesting females exceeds 1,000 females per year at each site (NMFS and USFWS 2007c). Historically, however, greater than 20,000 females per year are believed to have nested in Michoacán alone (Cliffton *et al.* 1982; NMFS and USFWS 2007c). However, the decline is not consistent across all green sea turtle nesting areas. Increases in the number of nests counted and, presumably, the numbers of mature females laying nests were recorded for several areas (Seminoff 2004; NMFS and USFWS 2007c). Of the 32 index sites reviewed by Seminoff (2004), the trend in nesting was described as: increasing for ten sites, decreasing for 19 sites, and stable (no change) for three sites. Of the 46 green sea turtle nesting sites reviewed for the five-year status review, the trend in nesting was described as increasing for 12 sites, decreasing for four sites, stable for ten sites, and unknown for 20 sites (NMFS and USFWS 2007c). The greatest abundance of green sea turtle nesting in the western Atlantic occurs on beaches in Tortuguero, Costa Rica (NMFS and USFWS 2007c). Nesting in the area has increased considerably since the 1970s and nest count data from 1999-2003 suggest nesting by 17,402-37,290 females per year (NMFS and USFWS 2007c). One of the largest nesting sites for green sea turtles worldwide is still believed to be on the beaches of Oman in the Indian Ocean (Hirth 1997; Ferreira *et al.* 2003; NMFS and USFWS 2007c). However, nesting data for this area has not been published since the 1980s and updated nest numbers are needed (NMFS and USFWS 2007c).

The results of genetic analyses show that green sea turtles in the Atlantic do not contribute to green sea turtle nesting elsewhere in the species' range (Bowen and Karl 2007). Therefore, increased nesting by green sea turtles in the Atlantic is not expected to affect green sea turtle abundance in other ocean basins in which the species occurs. However, the ESA-listing of green sea turtles as a species across ocean basins means that the effects of a proposed action must, ultimately, be considered at the species level for section 7 consultations. NMFS recognizes that the nest count data available for green sea turtles in the Atlantic clearly indicates increased nesting at many sites. However, NMFS also recognizes that the nest count data, including data for green sea turtles in the Atlantic, only provides information on the number of females currently nesting, and is not necessarily a reflection of the number of mature females available to nest or the number of immature females that will reach maturity and nest in the future. Given the late age to maturity for green sea turtles (20 to 50 years) (Balazs 1982; Frazer and Ehrhart 1985; Seminoff 2004), caution is urged regarding the trend for any of the nesting groups since no area has a dataset spanning a full green sea turtle generation (NMFS and USFWS 2007c).

In this Opinion, NMFS has considered the potential impacts of the proposed action on green sea turtles. We expect that up to one green sea turtle will be captured in 2013 NEAMAP surveys. The captured green sea turtle will be released alive and uninjured. As there will be no injury or mortality to any individual green sea turtle and no effects to the prey base that would cause sea turtles to leave the action area to forage elsewhere, the NEAMAP surveys are not likely to reduce the numbers of green sea turtles in the action area, the numbers of greens in any subpopulation, or the species as a whole. The 2013 NEAMAP surveys will have no effects to the prey base that would cause sea turtles to leave the action area to forage elsewhere and the green sea turtle's numbers in the action area and as part of any subpopulation as a whole will not be reduced. Similarly, as the proposed actions will not affect the fitness of any individuals, no effects to reproduction are anticipated. The actions are not expected to result in a reduction in the distribution of green sea turtles in the action area or throughout their range. Because effects are limited to capture, the population level impacts will be insignificant. Despite the threats faced by individual green sea turtles inside and outside of the action area, the proposed actions 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 actions. While NMFS is not able to predict with precision how climate change will continue to impact green 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 green sea turtles in the action area are anticipated over the life of the proposed actions (*i.e.*, through 2013). NMFS has considered the effects of the proposed actions 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.

As described in the *Status of the Species*, *Environmental Baseline*, and *Cumulative Effects* sections above, green sea turtles in the action area continue to be affected by multiple anthropogenic impacts including bycatch in commercial and recreational fisheries, habitat alteration and other factors that result in mortality of individuals at all life stages.

Based on the information provided above, the capture of up to one green sea turtle during the 2013 NEAMAP surveys 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 actions will not affect green sea turtles 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 green sea turtles from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the species' nesting trend is increasing; (2) no mortalities are expected as a result of capture; (3) the actions will have no effect on the distribution of greens in the action area or throughout its range; and (4) the actions will have no effect on the ability of green sea turtles to shelter and only an insignificant effect on individual foraging green sea turtles.

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, we have determined that the proposed actions will not appreciably reduce the likelihood that green sea turtles will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed actions will affect the likelihood that the species can rebuild to a point where listing is no longer appropriate. A recovery plan for green sea turtles was published by NMFS and USFWS in 1991. The plan outlines the steps necessary for recovery and the criteria which, once met, would ensure recovery. In order to be delisted, green sea turtles must experience sustained population growth, as measured in the number of nests laid per year, over time. Additionally, "priority one" recovery tasks must be achieved and nesting habitat must be protected (through public ownership of nesting beaches) and stage class mortality must be reduced. Here, we consider whether this proposed action will affect the population size and/or trend in a way that would affect the likelihood of recovery.

The proposed actions will not appreciably reduce the likelihood of survival of green sea turtles. Also, they are not expected to modify, curtail, or destroy the range of the species since they will not cause any reductions in the number of green sea turtles in any geographic area and since they will not affect the overall distribution of green sea turtles other than to cause minor temporary adjustments in movements in the action area. As explained above, the proposed actions are not likely to result in mortality, and thus are not expected to affect the persistence of green sea turtles or the species trend. The actions will not affect nesting habitat and will not hasten the extinction timeline or otherwise increase the danger of extinction. Further, the actions will not prevent the species from growing in a way that leads to recovery and the actions will not change the rate at which recovery can occur. Therefore, based on the analysis presented above, the proposed actions will not appreciably reduce the likelihood that green 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 green sea turtles inside and outside of the action area, the proposed actions 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 actions. We have considered the effects of the proposed actions in light of cumulative effects explained above, including climate change, and have 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 actions, resulting in the capture of up to one green sea turtle annually, is not likely to appreciably reduce the survival and recovery of this species.

8.4 Leatherback Sea Turtles

Leatherback sea turtles are listed as "endangered" under the ESA. Leatherbacks are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, and Indian Oceans, the Caribbean Sea, Mediterranean Sea, and the Gulf of Mexico (Ernst and Barbour 1972). Leatherback nesting occurs on beaches of the Atlantic, Pacific, and Indian Oceans as well as in the Caribbean (NMFS and USFWS 2007d). Leatherbacks face a multitude of threats that can cause death prior to and after reaching maturity. Some activities resulting in leatherback mortality have been addressed. There are some population estimates for leatherback sea turtles although there appears to be considerable uncertainty in the numbers. The most recent population size estimate for the North Atlantic alone is 34,000-94,000 adult leatherbacks (TEWG 2007; NMFS and USFWS 2007d).

Leatherback nesting in the eastern Atlantic (*i.e.,* off Africa) and in the Caribbean appears to be stable, but there is conflicting information for some sites and it is certain that some nesting groups (*e.g.*, St. John and St. Thomas, U.S. Virgin Islands) have been extirpated (NMFS and

USFWS 1995). Data collected for some nesting beaches in the western Atlantic, including leatherback nesting beaches in the U.S., clearly indicate increasing numbers of nests (SEFSC 2001; NMFS and USFWS 2007d). However, declines in nesting have been noted for beaches in the western Caribbean (NMFS and USFWS 2007d). The largest leatherback rookery in the western Atlantic remains along the northern coast of South America in French Guiana and Suriname. More than half the present world leatherback population is estimated to nest on the beaches in and close to the Marowijne River Estuary in Suriname and French Guiana (Hilterman and Goverse 2004). The long-term trend for the Suriname and French Guiana nesting group seems to show an increase (Hilterman and Goverse 2004). In 2001, the number of nests for Suriname and French Guiana combined was 60,000, one of the highest numbers observed for this region in 35 years (Hilterman and Goverse 2004). Studies by Girondot *et al.* (2007) also suggest that the trend for the Suriname - French Guiana nesting population over the last 36 years is stable or slightly increasing.

Increased nesting by leatherbacks in the Atlantic is not expected to affect leatherback abundance in the Pacific where the abundance of leatherback sea turtles on nesting beaches has declined dramatically over the past 10 to 20 years (NMFS and USFWS 2007d). Although genetic analyses suggest little difference between Atlantic and Pacific leatherbacks (Bowen and Karl 2007), it is generally recognized that there is little to no genetic exchange between these turtles.

In this Opinion, NMFS has considered the potential impacts of the proposed actions on leatherback sea turtles. We anticipate that up to one leatherback will be captured in the NEAMAP surveys annually. The survey captured turtle is expected to be safely removed from the trawl gear and returned to the ocean without any injury or mortality. All other effects to leatherback sea turtles, including effects to prey, are expected to be insignificant and discountable.

As there will be no injury or mortality to any individual leatherback sea turtle and no effects to the prey base that would cause sea turtles to leave the action area to forage elsewhere, the NEAMAP surveys are not likely to reduce the numbers of leatherback sea turtles in the action area, the numbers of leatherbacks in any subpopulation, or the species as a whole. In addition, the surveys will cause no effects to the prey base that would cause sea turtles to leave the action area to forage elsewhere and the leatherbacks sea turtle's numbers in the action area and as part of any subpopulation as a whole will not be reduced. Similarly, as the proposed actions will not affect the fitness of any individual, no effects to reproduction are anticipated. The actions are also not likely to affect the distribution of leatherback sea turtles in the action area or affect the distribution of leatherback sea turtles throughout their range. Despite the threats faced by individual leatherback sea turtles inside and outside of the action area, the proposed actions 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 actions. While NMFS is not able to predict with precision how climate change will continue to impact leatherback 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 leatherback sea turtles in the action area are anticipated over the life of the proposed actions (*i.e.*, through 2013). NMFS has considered the effects of the proposed actions 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 information provided above, the annual capture of up to one leatherback sea turtle during the proposed actions will not appreciably reduce the likelihood of survival of this species (*i.e.*, it will not increase the risk of extinction faced by this species) given that: (1) there will be no effect to the fitness of any individuals and no effect on reproductive output of the species and (2) the actions will have only a minor and temporary effect on the distribution of leatherback sea turtles in the action area (related to the temporary capture and handling of captured individuals) and no effect on the distribution of the species throughout its range.

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, NMFS has determined that the proposed actions will not appreciably reduce the likelihood that the leatherback sea turtle species 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 actions are not expected to modify, curtail, or destroy the range of the species since it will not result in a reduction in the number of leatherback sea turtles and since it will not affect the overall distribution of the species other than to cause minor temporary adjustments in movements in the action area. The proposed actions will not utilize leatherback sea turtles for recreational, scientific, or commercial purposes or affect the adequacy of existing regulatory mechanisms to protect this species. The proposed actions are not likely to result in any reductions in fitness or future reproductive output and therefore, are not expected to affect the persistence of the species. There will not be a change in the status or trend of the species. As there will be no reduction in future reproduction the actions would not cause any reduction in the likelihood of improvement in the status of leatherback sea turtles. The effects of the proposed actions will not delay the recovery timeline or otherwise decrease the likelihood of recovery since the actions will not cause any reduction of overall reproductive fitness for the species. The effects of the proposed actions will also 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 actions will not appreciably reduce the likelihood that leatherback sea turtles can be brought to the point at which they are no longer listed as endangered. Based on the analysis presented herein, the proposed actions are not likely to appreciably reduce the survival and recovery of this species.

8.5 Atlantic Sturgeon

As explained above, the proposed actions are likely to result in the mortality of no more than 24 Atlantic sturgeon. We expect that the Atlantic sturgeon killed will be of adult or subadult life stages. No mortality of juveniles is anticipated. All other effects to Atlantic sturgeon, including effects to habitat and prey due to survey/study activities, will be insignificant and discountable.

8.5.1 Determination of DPS Composition

Using mixed stock analysis explained above, we have determined that Atlantic sturgeon in the action area likely originate from the five DPSs at the following frequencies: NYB 49%; SA 20%; CB 14%; GOM 11%; and Carolina 4%. As a result of the PSB gillnet gear study, given the above percentages, it is most likely that of the 24 Atlantic sturgeon mortalities, 12 would be fish that originate from the NYB DPS, five would be fish originating from the SA DPS, three would be fish originating from the CB DPS, three would be fish originating from the GOM DPS, and one would be a fish originating from the Carolina DPS.

8.5.2 Gulf of Maine DPS

We expect that 11% of the Atlantic sturgeon in the action area will originate from the GOM DPS. The GOM DPS has been listed as threatened. While Atlantic sturgeon occur in several rivers in the GOM DPS, recent spawning has only been documented in the Kennebec and Androscoggin rivers. Gulf of Maine origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. While there are some indications that the status of the GOM DPS may be improving, there is currently not enough information to establish a trend for any life stage or for the DPS as a whole. We anticipate the annual mortality of no more than three adult/subadult Atlantic sturgeon from the GOM DPS during the activities described in this Opinion. This equates to 0.16% reduction in the estimated adult population (n=1,864) of Atlantic sturgeon comprising the GOM DPS (Table 6). Here, we consider the effect of the annual loss of three adults/subadults on the reproduction, numbers, and distribution of the GOM DPS.

The reproductive potential of the GOM DPS will not be affected in any way other than through a reduction in numbers of individuals. The loss of three adults/subadults would have the effect of reducing the amount of potential reproduction as any dead GOM DPS Atlantic sturgeon would have no potential for future reproduction. However, because these actions will result in the death of only three individuals, this small reduction in potential future spawners is expected to result in an extremely small reduction in the number of eggs laid or larvae produced in future years and similarly, an extremely small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individuals that would be killed as a result of the proposed actions, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. Reproductive potential of other captured or injured individuals is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior will be minor and temporary and that there will not be any delay or disruption of any normal behavior including spawning; there will also be no reduction in individual fitness or any future reduction in numbers of individuals. The proposed actions will also not affect the spawning grounds within the rivers where GOM DPS fish spawn. The actions will also not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds used by GOM DPS fish.

As the proposed actions will result in the loss of only three individuals annually, it is unlikely that these deaths will have a detectable effect on the numbers and population trend of the GOM DPS. The proposed actions are also not likely to reduce distribution because the action will not impede Atlantic sturgeon from accessing any seasonal concentration areas, including foraging areas within the action area that may be used by GOM DPS subadults or adults. Further, the actions are not expected to reduce the river by river distribution of Atlantic sturgeon.

Based on the information provided above, the death of no more than three GOM DPS Atlantic sturgeon will not appreciably reduce the likelihood of survival of the GOM DPS (*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 actions will not affect GOM DPS Atlantic sturgeon 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 Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of three adult/subadult GOM DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (2) the loss of three adult/subadult GOM DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (3) the loss of three adult/subadult GOM DPS Atlantic sturgeon is likely to have such a small effect on reproductive output that the loss of these individuals will not change the status or trends of the species; (4) the actions will have only a minor and temporary effect on the distribution of GOM DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and, (5) the actions will have no effect on the ability of GOM DPS Atlantic sturgeon to shelter and only an insignificant effect on any foraging GOM DPS Atlantic sturgeon.

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 actions will not appreciably reduce the likelihood that the GOM DPS 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. Thus, we have considered whether the proposed actions will affect the likelihood that the GOM DPS can rebuild to a point where listing is no longer appropriate. No recovery plan for the GOM DPS has been published. A recovery plan outlines the steps necessary for recovery and the demographic criteria which once attained would allow the species to be delisted. We know that in general, to recover, a species must have a sustained positive trend over time and an increase in population. To allow those things to happen, a species must have enough habitat in suitable condition that allows all normal life functions to occur (*i.e.*, spawning, foraging, resting) and have access to enough food. Here, we consider whether the proposed actions will affect the population size and/or trend in a way that would affect the likelihood of recovery.

The proposed actions are not expected to modify, curtail, or destroy the range of the species since they will result in an extremely small reduction in the number of GOM DPS Atlantic sturgeon and since they will not affect the overall distribution of GOM DPS Atlantic sturgeon. Any effects to habitat will be insignificant and discountable and will not affect the ability of Atlantic sturgeon to carry out any necessary behaviors or functions. Any impacts to available forage will also be insignificant. The proposed actions will result in an extremely small amount of mortality (three individuals annually) and a subsequent small reduction in future reproductive output. For these reasons, they are not expected to affect the persistence of the GOM DPS of Atlantic sturgeon. The actions will not change the status or trend of the GOM DPS of Atlantic sturgeon. The very small reduction in numbers and future reproduction resulting from the proposed actions will not reduce the likelihood of improvement in the status of the GOM DPS of Atlantic sturgeon. The effects of the proposed actions will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed actions will also 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 actions will not appreciably reduce the likelihood that the GOM DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as threatened. Based on the analysis presented herein, the proposed actions are not likely to appreciably reduce the survival and recovery of this species.

Despite the threats faced by individual GOM DPS Atlantic sturgeon inside and outside of the action area, the proposed actions will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed actions in light of cumulative effects explained above, including climate change, and have 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 actions, resulting in the annual mortality of three adult/subadult GOM DPS Atlantic sturgeon, are not likely to appreciably reduce the survival and recovery of this species.

8.5.3 New York Bight DPS

We expect that 49% of the Atlantic sturgeon in the action area will originate from the NYB DPS. The NYB DPS has been listed as endangered. While Atlantic sturgeon occur in several rivers in the NYB DPS, recent spawning has only been documented in the Delaware and Hudson Rivers. Kahnle *et al.* (2007) estimated that there is a mean annual total mature adult population of 863 Hudson River Atlantic sturgeon. Based on the NEAMAP model, there are an estimated 33,210 NYB DPS Atlantic sturgeon adults and subadults vulnerable to capture in the action area, with 8,303 of those being adults (Table 6). NYB DPS origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently not enough information to establish a trend for any life stage, for the Hudson or Delaware River spawning populations, or for the DPS as a whole. Some Delaware River fish have a unique genetic haplotype (the A5 haplotype); however, whether there is any evolutionary significance or fitness benefit provided by this genetic makeup is unknown. Genetic evidence indicates that while spawning continued to occur in the Delaware River and in some cases Delaware River origin fish can be distinguished genetically from Hudson River origin fish, there is free interchange between the two rivers. This relationship is recognized by the listing of the NYB DPS as a whole and not separate listings of a theoretical Hudson River DPS and Delaware River DPS. Thus, while we can consider the loss of Delaware River fish on the Delaware River population and the loss of Hudson River fish on the Hudson River population, it is more appropriate, because of the interchange of individuals between these two populations, to consider the effects of these mortalities on the NYB DPS as a whole.

We have estimated that the proposed actions will result in the annual mortality of up to 12 adult and/or subadult Atlantic sturgeon originating from the NYB DPS. Any New York Bight DPS adults or subadults could originate from the Delaware or Hudson River. The available information suggests that the vast majority of NYB DPS adults and subadults originate from the Hudson River; therefore, given that only 12 NYB DPS fish are likely to be killed, it is reasonable to assume that they will be Hudson River origin.

The annual mortality of 12 adult/subadult Atlantic sturgeon from the NYB DPS represents a very small percentage of subadult/adult population (*i.e.*, approximately 0.04% of the population, just considering the estimated number of subadults and adults; the percentage would be much less if the number of YOY and juveniles was considered). While the death of 12 adult/subadult Atlantic sturgeon will reduce the number of NYB DPS Atlantic sturgeon compared to the number that would have been present absent the proposed actions, it is not likely that this reduction in numbers will change the status of this species as this loss represents a very small percentage of the adult and subadult population and an even smaller percentage of the overall population of the DPS (juveniles, subadults, and adults combined). Even when converting these fish to adult equivalents[9] (using a conversion rate of 0.48 considering the adult equivalent and assuming the killed NYB DPS Atlantic sturgeon are killed in a 3:1 ratio of subadults to adults), and assuming no growth in the adult population, the mortality of three adults and nine subadults (which equate to an additional 4.5 adult equivalents) represents an extremely small percentage of the adult population (approximately 0.09%).

Because there will be the loss of both adults and subadults, the reproductive potential of the NYB DPS will be affected through a reduction in numbers of individual future spawners. The loss of 12 adults/subadults would have the effect of reducing the amount of potential reproduction as any dead NYB DPS Atlantic sturgeon would have no potential for future reproduction. This small reduction in potential future spawners is expected to result in an extremely small reduction in the number of eggs laid or larvae produced in future years and similarly, an extremely small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individuals that would be killed as a result of the proposed actions, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. The proposed actions will also not affect the spawning grounds within the Hudson River or Delaware River where NYB DPS fish spawn. There will be no effects to spawning adults and therefore no reduction in individual fitness or any future reduction in spawning by these individuals.

[9] The "adult equivalent" rate converts a number of subadults to adult equivalents (the number of subadults that would, through natural mortality, live to be adults; for Atlantic sturgeon, this is calculated as 0.48).

The proposed actions are not likely to reduce distribution because the actions will not impede NYB DPS Atlantic sturgeon from accessing any seasonal concentration areas, including foraging, spawning, or overwintering grounds in the Delaware or Hudson River or elsewhere.

Based on the information provided above, the death of 12 NYB DPS Atlantic sturgeon will not appreciably reduce the likelihood of survival of the NYB DPS (*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 actions will not affect NYB DPS Atlantic sturgeon 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 Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the annual death of 12 adult/subadult NYB DPS Atlantic sturgeon represents an extremely small percentage of the species; (2) the annual death of 12 adult/subadult NYB DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (3) the annual loss of 12 adult/subadult NYB DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the annual loss of 12 adult/subadult NYB DPS Atlantic sturgeon is likely to have such a small effect on reproductive output that the loss of these individuals will not change the status or trends of the species; (5) the actions will have only a minor and temporary effect on the distribution of NYB DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and (6) the actions will have no effect on the ability of NYB DPS Atlantic sturgeon to shelter and only an insignificant effect on individual foraging NYB DPS Atlantic sturgeon.

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 actions will not appreciably reduce the likelihood that the NYB DPS will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed actions will affect the likelihood that the NYB DPS can rebuild to a point where listing is no longer appropriate. Like the GOM DPS, no recovery plan for the NYB DPS has been published. We know that in general, to recover, a species must have a sustained positive trend over time and an increase in population. To allow those things to happen, a species must have enough habitat in suitable condition that allows all normal life functions to occur (*i.e.*, spawning, foraging, resting) and have access to enough food. Here, we consider whether the proposed actions will affect the population size and/or trend in a way that would affect the likelihood of recovery.

The proposed actions are not expected to modify, curtail, or destroy the range of the species since they will result in an extremely small reduction in the number of NYB DPS Atlantic sturgeon and since they will not affect the overall distribution of NYB DPS Atlantic sturgeon. Any effects to habitat will be insignificant and discountable and will not affect the ability of Atlantic sturgeon to carry out any necessary behaviors or functions. Any impacts to available forage will also be insignificant. The proposed actions will result in an extremely small amount of annual mortality (12 individuals) and a subsequent small reduction in future reproductive output. For these reasons, they are not expected to affect the persistence of the NYB DPS of Atlantic sturgeon. These actions will not change the status or trend of the NYB DPS of Atlantic sturgeon. The very small reduction in numbers and future reproduction resulting from the proposed actions will not reduce the likelihood of improvement in the status of the NYB DPS of Atlantic sturgeon. The effects of the proposed actions will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed actions will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Despite the threats faced by individual NYB DPS Atlantic sturgeon inside and outside of the action area, the proposed actions will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. Therefore, the proposed actions will not appreciably reduce the likelihood that the NYB DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as threatened. Based on the analysis presented herein, the proposed actions, resulting in the mortality of up to 12 adult/subadult NYB DPS Atlantic sturgeon, are not likely to appreciably reduce the survival and recovery of this species.

8.5.4 Chesapeake Bay DPS

We expect that 14% of the Atlantic sturgeon in the action area will originate from the CB DPS. The CB DPS has been listed as endangered. While Atlantic sturgeon occur in several rivers in the CB DPS, recent spawning has only been documented in the James River. Chesapeake Bay origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently not enough information to establish a trend for any life stage, for the James River spawning population or for the DPS as a whole. We anticipate the annual mortality of no more than three adult/subadult Atlantic sturgeon from the CB DPS during the activities described in this Opinion. This equates to 0.13% reduction in the estimated adult population (n=2,372) of Atlantic sturgeon comprising the CB DPS (Table 6). Here, we consider the effect of the loss of three adults and/or subadults on the reproduction, numbers and distribution of the CB DPS.

The reproductive potential of the CB DPS will not be affected in any way other than through a reduction in numbers of individuals. The loss of these three adults/subadults would have the effect of reducing the amount of potential reproduction as any dead CB DPS Atlantic sturgeon would have no potential for future reproduction. This small reduction in potential future spawners is expected to result in an extremely small reduction in the number of eggs laid or larvae produced in future years and similarly, an extremely small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individuals that would be killed as a result of the proposed actions, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. Reproductive potential of other captured or injured individuals is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior will be minor and temporary and that there will not be any delay or disruption of any normal behavior including spawning; there will also be no reduction in individual fitness or any future reduction in numbers of individuals. The proposed actions will also not affect the spawning grounds within the rivers where CB DPS fish spawn. The actions will also not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds used by CB DPS fish.

As the proposed actions will result in the loss of only three individuals, it is unlikely that these deaths will have a detectable effect on the numbers and population trend of the CB DPS. The proposed actions are also not likely to reduce distribution because the actions will not impede Atlantic sturgeon from accessing any seasonal concentration areas, including foraging areas within the action area that may be used by CB DPS subadults or adults. Further, the actions are not expected to reduce the river by river distribution of Atlantic sturgeon. Any effects to distribution will be minor and temporary and limited to the temporary avoidance of the immediate area where the surveys/studies are occurring.

Based on the information provided above, the death of no more than three CB DPS Atlantic sturgeon will not appreciably reduce the likelihood of survival of the CB DPS (*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 actions will not affect CB DPS Atlantic sturgeon 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 Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the annual death of three subadult/adult CB DPS Atlantic sturgeon represents an extremely small percentage of the species as a whole; (2) the annual death of three subadult/adult CB DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (3) the annual loss of three subadult/adult CB DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the annual loss of three subadult/adult CB DPS Atlantic sturgeon is likely to have such a small effect on reproductive output that the loss of these individuals will not change the status or trends of the species; (5) the actions will have only a minor and temporary effect on the distribution of CB DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and, (6) the actions will have no effect on the ability of CB DPS Atlantic sturgeon to shelter and only an insignificant effect on individual foraging CB DPS Atlantic sturgeon.

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 actions will not appreciably reduce the likelihood that the CB DPS will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed actions will affect the likelihood that the CB DPS can rebuild to a point where listing is no longer appropriate. Again, no recovery plan for the CB DPS has been published. We know that in general, to recover, a species must have a sustained positive trend over time and an increase in population. To allow those things to happen, a species must have enough habitat in suitable condition that allows all normal life functions to occur (*i.e.*, spawning, foraging, resting) and have access to enough food. Here, we consider whether this proposed action will affect the population size and/or trend in a way that would affect the likelihood of recovery.

The proposed actions are not expected to modify, curtail, or destroy the range of the species since they will result in an extremely small reduction in the number of CB DPS Atlantic sturgeon and since they will not affect the overall distribution of CB DPS Atlantic sturgeon. Any effects to habitat will be insignificant and discountable and will not affect the ability of Atlantic sturgeon to carry out any necessary behaviors or functions. Any impacts to available forage will also be insignificant. The proposed actions will result in an extremely small amount of mortality (three individuals) and a subsequent small reduction in future reproductive output. For these reasons, they are not expected to affect the persistence of the CB DPS of Atlantic sturgeon. These actions will not change the status or trend of the CB DPS of Atlantic sturgeon. The very small reduction in numbers and future reproduction resulting from the proposed actions will not reduce the likelihood of improvement in the status of the CB DPS of Atlantic sturgeon. The effects of the proposed actions will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed actions will also 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 actions will not appreciably reduce the likelihood that the CB DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as threatened. Based on the analysis presented herein, the proposed actions are not likely to appreciably reduce the survival and recovery of this species.

Despite the threats faced by individual CB DPS Atlantic sturgeon inside and outside of the action area, the proposed actions will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed actions in light of cumulative effects explained above, including climate change, and have 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 actions, resulting in the mortality of three subadult/adult CB DPS Atlantic sturgeon, are not likely to appreciably reduce the survival and recovery of this species.

8.5.5 Carolina DPS

We expect that 4% of the Atlantic sturgeon in the action area will originate from the Carolina DPS. The Carolina DPS is listed as endangered. The Carolina DPS consists of Atlantic sturgeon originating from at least five rivers where spawning is still thought to occur. Carolina DPS origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently not enough information to establish a trend for any life stage, for any of the spawning populations or for the DPS as a whole. We anticipate the annual mortality of no more than one adult/subadult Atlantic sturgeon from the Carolina DPS during the activities described in this Opinion. This equates to 0.15% reduction in the estimated adult population (n=678) of Atlantic sturgeon comprising the Carolina DPS (Table 6). Here, we consider the effect of the annual loss of one subadult/adult on the reproduction, numbers, and distribution of the Carolina DPS.

The reproductive potential of the Carolina DPS will not be affected in any way other than through a reduction in numbers of individuals. The annual loss of one subadult/adult would have the effect of reducing the amount of potential reproduction as any dead Carolina DPS Atlantic sturgeon would have no potential for future reproduction. This small reduction in potential future spawners is expected to result in an extremely small reduction in the number of eggs laid or larvae produced in future years and similarly, an extremely small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individual that would be killed as a result of the proposed actions, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. Additionally, we have determined that any impacts to behavior will be minor and temporary and that there will not be any delay or disruption of any normal behavior; there will also be no reduction in individual fitness or any future reduction in numbers of individuals. The proposed actions will also not affect the spawning grounds within the rivers where Carolina DPS fish spawn. The actions will also not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds used by Carolina DPS fish.

As the proposed actions will result in the annual loss of only one individual, it is unlikely that this death will have a detectable effect on the numbers and population trend of the Carolina DPS. The proposed actions are also not likely to reduce distribution because the actions will not impede Atlantic sturgeon from accessing any seasonal concentration areas, including foraging areas within the action area that may be used by Carolina DPS subadults or adults. Further, the actions are not expected to reduce the river by river distribution of Atlantic sturgeon.

Based on the analysis provided above, the annual death of no more than one Carolina DPS Atlantic sturgeon will not appreciably reduce the likelihood of survival of the Carolina DPS (*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 actions will not affect Carolina DPS Atlantic sturgeon 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 Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the annual death of one subadult/adult Carolina DPS Atlantic sturgeon represents an extremely small percentage of the species as a whole; (2) the annual death of one subadult/adult Carolina DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (3) the annual loss of one subadult/adult Carolina DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the annual loss of one subadult/adult Carolina DPS Atlantic sturgeon is likely to have such a small effect on reproductive output that the loss of this individual will not change the status or trends of the species; (5) the actions will have only a minor and temporary effect on the distribution of Carolina DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and, (6) the actions will have no effect on the ability of Carolina DPS Atlantic sturgeon to shelter and only an insignificant effect on individual foraging Carolina DPS Atlantic sturgeon.

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 actions will not appreciably reduce the likelihood that the Carolina DPS will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed actions will affect the likelihood that the Carolina DPS can rebuild to a point where listing is no longer appropriate. No recovery plan for the Carolina DPS has been published. We know that in general, to recover, a species must have a sustained positive trend over time and an increase in population. To allow those things to happen, a species must have enough habitat in suitable condition that allows all normal life functions to occur (*i.e.*, spawning, foraging, resting) and have access to enough food. Here, we consider whether the proposed actions will affect the population size and/or trend in a way that would affect the likelihood of recovery.

The proposed actions are not expected to modify, curtail, or destroy the range of the species since they will result in an extremely small reduction in the number of Carolina DPS Atlantic sturgeon and since they will not affect the overall distribution of Carolina DPS Atlantic sturgeon. Any effects to habitat will be insignificant and discountable and will not affect the ability of Atlantic sturgeon to carry out any necessary behaviors or functions. Any impacts to available forage will also be insignificant. The proposed actions will result in an extremely small amount of mortality (one individual) and a subsequent small reduction in future reproductive output. For these reasons, it is not expected to affect the persistence of the Carolina DPS of Atlantic sturgeon. These actions will not change the status or trend of the Carolina DPS of Atlantic sturgeon. The very small reduction in numbers and future reproduction resulting from the proposed actions will not reduce the likelihood of improvement in the status of the Carolina DPS of Atlantic sturgeon. The effects of the proposed actions will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed actions will also 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 actions will not appreciably reduce the likelihood that the Carolina DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as threatened. Based on the analysis presented herein, the proposed actions are not likely to appreciably reduce the survival and recovery of this species.

Despite the threats faced by individual Carolina DPS Atlantic sturgeon inside and outside of the action area, the proposed actions will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed actions in light of cumulative effects explained above, including climate change, and have 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 actions, resulting in the mortality of one subadult/adult Carolina DPS Atlantic sturgeon, are not likely to appreciably reduce the survival and recovery of this species.

8.5.6 South Atlantic DPS

We expect that 20% of the Atlantic sturgeon in the action area will originate from the SA DPS. The SA DPS is listed as endangered. The SA DPS consists of Atlantic sturgeon originating from at least six rivers where spawning is still thought to occur. SA DPS origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently not enough information to establish a trend for any life stage, for any of the spawning populations or for the DPS as a whole. We anticipate the annual mortality of no more than five adult/subadult Atlantic sturgeon from the SA DPS during the activities described in this Opinion. This equates to 0.15% reduction in the estimated adult population (n=3,389) of Atlantic sturgeon comprising the SA DPS (Table 6). Here, we consider the effect of the annual loss of five subadults/adults on the reproduction, numbers, and distribution of the SA DPS.

The reproductive potential of the SA DPS will not be affected in any way other than through a reduction in numbers of individuals. The annual loss of five subadults/adults would have the effect of reducing the amount of potential reproduction as any dead SA DPS Atlantic sturgeon would have no potential for future reproduction. This small reduction in potential future spawners is expected to result in an extremely small reduction in the number of eggs laid or larvae produced in future years and similarly, an extremely small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individuals that would be killed as a result of the proposed actions, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. Additionally, we have determined that any impacts to behavior will be minor and temporary and that there will not be any delay or disruption of any normal behavior; there will also be no reduction in individual fitness or any future reduction in numbers of individuals. The proposed actions will also not affect the spawning grounds within the rivers where SA DPS fish spawn. The actions will also not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds used by SA DPS fish.

The annual mortality of five subadult/adult Atlantic sturgeon from the SA DPS represents a very small percentage of total subadult and adult population vulnerable to capture in the action area (*i.e.*, approximately 0.04% of the population, just considering the estimated number of subadults and adults; the percentage would be much less if the number of YOY and juveniles was considered). While the death of five subadult/adult Atlantic sturgeon will reduce the number of SA DPS Atlantic sturgeon compared to the number that would have been present absent the proposed actions, it is not likely that this reduction in numbers will change the status of this species as this loss represents a very small percentage of the subadult and adult population and an even smaller percentage of the overall population of the DPS (juveniles, subadults, and adults combined). Even when converting this fish to adult equivalents[10] (using a conversion rate of 0.48 considering the adult equivalent and assuming the killed SA DPS Atlantic sturgeon are killed in a 3:1 ratio of subadults to adults), and assuming no growth in the adult population, the mortality of two adults and three subadults (which equates to an additional 1.5 adult equivalents) represents an extremely small percentage of the adult population (approximately 0.10%).

The proposed actions are not likely to reduce distribution because the actions will not impede Atlantic sturgeon from accessing any seasonal concentration areas, including foraging areas within the action area that may be used by SA DPS subadults or adults. Further, the actions are

[10] The "adult equivalent" rate converts a number of subadults to adult equivalents (the number of subadults that would, through natural mortality, live to be adults; for Atlantic sturgeon, this is calculated as 0.48).

not expected to reduce the river by river distribution of Atlantic sturgeon. Any effects to distribution will be minor and temporary and limited to the temporary avoidance of the immediate area where the surveys/studies are occurring.

Based on the information provided above, the annual death of no more than five SA DPS Atlantic sturgeon will not appreciably reduce the likelihood of survival of the SA DPS (*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 actions will not affect SA DPS Atlantic sturgeon 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 Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the annual death of five subadult/adult SA DPS Atlantic sturgeon represents an extremely small percentage of the species as a whole; (2) the annual death of five subadult/adult SA DPS Atlantic sturgeon will not change the status or trends of any spawning river or the species as a whole; (3) the annual loss of five subadult/adult SA DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the annual loss of five subadult/adult SA DPS Atlantic sturgeon is likely to have such a small effect on reproductive output that the loss of these individuals will not change the status or trends of the species; (5) the actions will have only a minor and temporary effect on the distribution of SA DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and, (6) the actions will have no effect on the ability of SA DPS Atlantic sturgeon to shelter and only an insignificant effect on individual foraging SA DPS Atlantic sturgeon.

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 actions will not appreciably reduce the likelihood that the SA DPS will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed actions will affect the likelihood that the SA DPS can rebuild to a point where listing is no longer appropriate. As is the case for the other four DPSs, no recovery plan for the SA DPS has been published. We know that in general, to recover, a species must have a sustained positive trend over time and an increase in population. To allow those things to happen, a species must have enough habitat in suitable condition that allows all normal life functions to occur (*i.e.*, spawning, foraging, resting) and have access to enough food. Here, we consider whether this proposed actions will affect the population size and/or trend in a way that would affect the likelihood of recovery.

The proposed actions are not expected to modify, curtail, or destroy the range of the species since they will result in an extremely small reduction in the number of SA DPS Atlantic sturgeon and since they will not affect the overall distribution of SA DPS Atlantic sturgeon. Any effects to habitat will be insignificant and discountable and will not affect the ability of Atlantic sturgeon to carry out any necessary behaviors or functions. Any impacts to available forage items will also be insignificant. The proposed actions will result in an extremely small amount of annual mortality (five individuals) and a subsequent small reduction in future reproductive output. For these reasons, they are not expected to affect the persistence of the SA DPS of Atlantic sturgeon. These actions will not change the status or trend of the SA DPS of Atlantic sturgeon. The very small reduction in numbers and future reproduction resulting from the proposed actions will not reduce the likelihood of improvement in the status of the SA DPS of Atlantic sturgeon. The effects of the proposed actions will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed actions will also 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 actions will not appreciably reduce the likelihood that the SA DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as threatened. Based on the analysis presented herein, the proposed actions are not likely to appreciably reduce the survival and recovery of this species.

Despite the threats faced by individual SA DPS Atlantic sturgeon inside and outside of the action area, the proposed actions will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed actions in light of cumulative effects explained above, including climate change, and have 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 actions, resulting in the mortality of five subadult/adult SA DPS Atlantic sturgeon, are not likely to appreciably reduce the survival and recovery of this species.

9.0 CONCLUSION

After reviewing the best available information on the status of endangered and threatened species under NMFS jurisdiction, the environmental baseline for the action area, the effects of the proposed actions, and the cumulative effects, it is our biological opinion that the proposed actions may adversely affect but are not likely to jeopardize the continued existence of the NWA DPS of loggerhead sea turtles; Kemp's ridley, green, or leatherback sea turtles; or the GOM, NYB, CB, Carolina, or SA DPSs of Atlantic sturgeon.

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 U.S., 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 ITS. In issuing ITSs, NMFS takes no position on whether an action is an "otherwise lawful activity."

The measures described below are non-discretionary, and must be undertaken by NMFS so that they become binding conditions for the exemption in section 7(o)(2) to apply. NMFS has a continuing duty to regulate the activity covered by this ITS. If NMFS (1) fails to assume and implement the terms and conditions or (2) fails to require survey vessels to adhere to the terms and conditions of the ITS through enforceable terms that are added to permits and/or contracts as appropriate, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, NMFS must report the progress of the action and its impact on the species to the NMFS as specified in the ITS [50 CFR §402.14(i)(3)] (See USFWS and NMFS's Joint Endangered Species Act Section 7 Consultation Handbook (1998) at 4-49).

10.1 Anticipated Amount or Extent of Incidental Take

Based on the information presented in the Opinion, we anticipate that the NEAMAP spring and fall surveys will result in the annual capture of:

- up to six NWA DPS loggerhead sea turtles;
- up to four Kemp's ridley sea turtles;
- up to one green sea turtle;
- up to one leatherback sea turtle; and,
- a total of no more than 32 Atlantic sturgeon. Based on mixed stock analyses, we anticipate that 16 of the Atlantic sturgeon captured will be NYB DPS origin, six will be SA DPS origin, five will be CB DPS origin, four will be GOM DPS origin, and one will be Carolina DPS origin.

As explained in the *Effects of the Action* section of the Opinion, none of these sea turtles or Atlantic sturgeon are expected to die, immediately or later, as a result of capture in the trawl gear used for the NEAMAP surveys. Therefore, no lethal take is anticipated. This level of incidental take is anticipated for the entire year (consisting of a spring and fall survey) considered in this Opinion. In the accompanying Opinion, we determined that this level of anticipated take is not likely to result in jeopardy to any species of sea turtle or to any DPS of Atlantic sturgeon.

In regards to the gillnet gear research project, we anticipate that it will result in the annual capture of no more than 35 Atlantic sturgeon. Based on mixed stock analyses, we anticipate the following breakdown by Atlantic sturgeon DPS in terms of captures:

- 18 will be NYB DPS origin (12 lethal);
- seven will be SA DPS origin (five lethal);
- five will be CB DPS origin (three lethal);
- four will be GOM DPS origin (three lethal); and
- one will be Carolina DPS origin (one lethal).

Again, we have determined that this level of anticipated take is not likely to result in jeopardy to any DPS of Atlantic sturgeon. For sea turtles, all captures recorded during the gillnet gear research project will be covered under the existing Opinion on the Monkfish FMP (NMFS 2010).

10.2 Reasonable and Prudent Measures

In order to effectively monitor the effects of the proposed actions, it is necessary to monitor the impacts of these actions to document the amount of incidental take (*i.e.*, the number of sea turtles and Atlantic sturgeon captured, injured, or killed) and to examine any sea turtles or Atlantic sturgeon that are captured during this monitoring. Monitoring provides information on the characteristics of sea turtles and Atlantic sturgeon encountered and may provide data which will help develop more effective measures to avoid future interactions with listed species. We do not anticipate any additional injury or mortality to be caused by handling and examining sea turtles and Atlantic sturgeon as required in the reasonable and prudent measures (RPMs) listed below. All live animals are to be released back into the water following the required documentation.

NMFS believes the following RPMs are necessary or appropriate to minimize and monitor the impacts of incidental take of listed sea turtles and Atlantic sturgeon:

1. Any sea turtles or Atlantic sturgeon caught during the NEAMAP surveys and gillnet gear research project must be handled and resuscitated according to established procedures.

2. Any sea turtles or Atlantic sturgeon caught and retrieved in trawl or gillnet gear must be identified to species.

3. Any sea turtles or Atlantic sturgeon caught and retrieved in trawl or gillnet gear must be properly documented.

4. NMFS NERO must be notified regarding all interactions with or observations of sea turtles and Atlantic sturgeon.

5. Any dead Atlantic sturgeon must be transferred to NMFS or an appropriately permitted research facility NMFS will identify so that a necropsy can be undertaken to attempt to determine the cause of death and/or other appropriate examinations can take place. Atlantic sturgeon carcasses should be held in cold storage until shipping.

10.3 Terms and Conditions

In order to be exempt from prohibitions of section 9 of the ESA, NMFS must comply with the following terms and conditions of the Incidental Take Statement, which implement the RPMs described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary. Any taking that is in compliance with the terms and conditions specified in this ITS shall not be considered a prohibited taking of the species concerned (ESA section 7(o)(2)).

1. To implement RPM #1 above, the NEFSC must ensure that all vessel operators have copies of the sea turtle handling and resuscitation requirements found at 50 CFR 223.206(d)(1) and as reproduced in Appendix A prior to the commencement of any on-water activity. The NEFSC or its research partners must carry out these handling and resuscitation procedures as appropriate.

2. To implement RPM#1 above, the NEFSC must ensure that the NEAMAP survey staff and gillnet gear research project investigators/observers give priority to handling and processing any sea turtles or Atlantic sturgeon that are captured in the gear being used. Handling times must be minimized for these species.

3. To implement RPM#1 above, the NEFSC must ensure that the NEAMAP survey staff and gillnet gear research project investigators/observers resuscitate any Atlantic sturgeon that may appear to be dead by providing a running source of water over the gills.

4. To implement RPM#1 above, the NEFSC must ensure that the NEAMAP survey vessel as well as the vessels participating in the gillnet gear research project have a PIT tag reader on board and that this reader is used to scan any captured Atlantic sturgeon for tags. Any recorded tags must be reported to the USFWS tagging database. Any untagged sturgeon must be tagged with PIT tags and the tag numbers recorded and reported to the USFWS tagging database.

5. To comply with RPM #2 above, the NEFSC must ensure that the NEAMAP survey vessel and the vessels participating in the gillnet gear research project have at least one scientist onboard at all times that on-water work is being conducted who is experienced in the identification of sea turtles and Atlantic sturgeon. Experience would include personnel that have received training as a NMFS fisheries observer or who have career experience in the identification of sea turtles and Atlantic sturgeon. Information provided as Appendix B can aid in species identification.

6. To comply with RPM #2 above, the NEFSC must ensure that the NEAMAP survey staff and gillnet gear research project investigators/observers obtain genetic samples from all captured Atlantic sturgeon. This must be done in accordance with the procedures provided by the NMFS NERO Protected Resources Division (PRD) and as included in Appendix C. If the NEFSC or its research partners anticipate any difficulty in complying with the recommended procedures (due to materials availability, length of time away from port, etc.), they must contact NMFS NERO PRD to discuss alternative sampling or holding procedures prior to the start of any survey or gear research project that is expected to capture Atlantic sturgeon.

7. To comply with RPM #3, all sea turtles and Atlantic sturgeon must be weighed, measured, and photographed. The condition of each animal must be recorded and any injuries documented.

8. To comply with RPM #4, the NEFSC or its research partners (*e.g.*, VIMS) must ensure that NMFS NERO PRD is notified within 24 hours of any interaction with a sea turtle or Atlantic sturgeon. These reports can be sent via e-mail to Incidental.take@noaa.gov (preferred), sent by fax to (978) 281-9394, or called in to William Barnhill, Section 7 Biologist at (978) 282-8460. If reporting within 24 hours is not possible (*e.g.*, due to distance from shore or lack of ability to communicate via phone, fax, or email), the interaction must be reported as soon as the vessel is in a position to do so and absolutely no later than 24 hours after the vessel returns to port. For purposes of monitoring the incidental take of sea turtles and Atlantic sturgeon during the 2013 NEAMAP surveys, reports must be made for any species: (a) found alive, dead, or injured within the survey gear; (b) found alive, dead, or injured and retained on any portion of the survey gear outside of the net; or (c) interacting with the vessel and gear in any other way must be reported to NMFS NERO PRD. A reporting form has been included as Appendix D to this document; this form may be used or you may use another form that allows for reporting of the required information.

9. To comply with RPM #4, the NEFSC or its research partners (*e.g.*, VIMS) must provide a written report to NMFS NERO PRD within 30 days of any interaction between a sea turtle or Atlantic sturgeon and the gear and/or vessel used during the survey/study. The report must include: a clear photograph of the animal (multiple views if possible, including at least one photograph of the head scutes); identification of the animal to the species level; GPS or Loran coordinates describing the location of the interaction; time of interaction; date of interaction; condition of the animal upon retrieval (alive uninjured, alive injured, fresh dead, decomposed, comatose or unresponsive); the condition of the animal upon return to the water; GPS or Loran coordinates of the location at which it was released; and a description of the care or handling provided. This report must be sent to NMFS NERO PRD, Attn: Section 7 Coordinator, 55 Great Republic Dr., Gloucester, MA 01930.

10. To comply with RPM #4, the NEFSC or its research partners (*e.g.*, VIMS) must provide a written report to NMFS NERO PRD within 60 days of completion of on-water work, indicating either that no interactions with sea turtles or Atlantic sturgeon occurred, or providing the total number of interactions that occurred by species. Any reports required by Term and Condition #9 that have not been provided to NMFS NERO PRD must be included in this report. This report must be sent to NMFS NERO PRD, Attn: Section 7 Coordinator, 55 Great Republic Dr., Gloucester, MA 01930.

11. To implement RPM #5, in the event of any lethal takes of Atlantic sturgeon, any dead specimens or body parts must be photographed, measured, and preserved (refrigerated or frozen) until disposal procedures are discussed with NMFS. In the event an Atlantic sturgeon carcass is severely damaged or decayed to the point at which a necropsy would not be feasible, the fish should be disposed of at sea after a genetic sample is taken. It is up to the fisheries observer or experienced personnel onboard to assess the state of damage/decay

and to ultimately make the call as to whether a necropsy is possible. The form included as Appendix E (sturgeon salvage form) must also be completed and submitted to NMFS.

The RPMs, with their implementing terms and conditions, are designed to minimize and monitor the impact of incidental take that might otherwise result from the proposed actions. Specifically, these RPMs and Terms and Conditions will ensure that NMFS monitors the impacts of the subject research projects in a way that allows for the detection, identification, and reporting of all interactions with listed species. The discussion below explains why each of these RPMs and Terms and Conditions are necessary or appropriate to minimize or monitor the level of incidental take associated with the proposed actions. The RPMs and terms and conditions involve only a minor change to the proposed actions.

RPM #1 and the accompanying Term and Condition establish the requirements for handling sea turtles and Atlantic sturgeon captured in gear used in the NEAMAP surveys and gillnet study in order to avoid the likelihood of injury to these species from the hauling, handling, and emptying of fishing gear.

RPMs #2-5 and the accompanying Terms and Conditions specify the collection of information for any sea turtles or Atlantic sturgeon observed captured in the gear. This is essential for monitoring the level of incidental take associated with the proposed actions. The taking of fin clips allows NMFS to run genetic analysis to determine the DPS of origin for Atlantic sturgeon. This allows us to determine if the actual level of take has been exceeded. Sampling of fin tissue is used for genetic sampling. This procedure does not harm Atlantic sturgeon and is a common practice in fisheries science. Tissue sampling does not appear to impair an Atlantic sturgeon's ability to swim and is not thought to have any long-term adverse impact. NMFS has received no reports of injury or mortality to any Atlantic sturgeon sampled in this way.

11.0 CONSERVATION RECOMMENDATIONS

In addition to section 7(a)(2), which requires agencies to ensure that proposed actions are not likely to 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 conservation of both sea turtles and Atlantic sturgeon:

1. NMFS should advise the Principal Investigator for the NEAMAP surveys and gillnet gear research study to provide guidance, before each survey cruise or trip, to the vessel crew members (including scientific crew and vessel operators) to the effect that: (a) all personnel are alert to the possible presence of sea turtles and Atlantic sturgeon in the study area, (b) care must be taken when emptying the gear to avoid damage to sea turtles and Atlantic sturgeon that may be caught in the gear but are not visible upon retrieval of the gear, and (c) the gear is emptied as quickly as possible after retrieval in order to determine whether sea turtles or Atlantic sturgeon are present in the gear.

12.0 REINITIATION OF CONSULTATION

This concludes formal consultation on the 2013 NEAMAP spring and fall surveys and gillnet gear research project as administered by the NEFSC. 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 actions that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the agency actions are 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 actions. In the event that the amount or extent of incidental take is exceeded, section 7 consultation must be reinitiated immediately.

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APPENDIX A

Sea turtle and resuscitation measures as found at 50 CFR 223.206(d)(1).

(d) (1) (i) Any specimen taken incidentally during the course of fishing or scientific research activities must be handled with due care to prevent injury to live specimens, observed for activity, and returned to the water according to the following procedures.

(A) Sea turtles that are actively moving or determined to be dead as described in (d)(1)(i)(C) of this section must be released over the stern of the boat. In addition, they must be released only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels.

(B) Resuscitation must be attempted on sea turtles that are comatose, or inactive, as determined in paragraph (d)(1) of this section by:

(1) placing the turtle on its bottom shell (plastron) so that the turtle is right side up, and elevating its hindquarters at least 6 inches (15.2 cm) for a period of 4 up to 24 hours. The amount of the elevation depends on the size of the turtle; greater elevations are needed for larger turtles. Periodically, rock the turtle gently left to right and right to left by holding the outer edge of the shell (carapace) and lifting one side about 3 inches (7.6 cm) then alternate to the other side. Gently touch the eye and pinch the tail (reflex test) periodically to see if there is a response.

(2) sea turtles being resuscitated must be shaded and kept damp or moist but under no circumstance be placed into a container holding water. A water-soaked towel placed over the head, neck, and flippers is the most effective method in keeping a turtle moist.

(3) sea turtles that revive and become active must be released over the stern of the boat only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels. Sea turtles that fail to respond to the reflex test or fail to move within 4 hours (up to 24, if possible) must be returned to the water in the same manner as that for actively moving turtles.

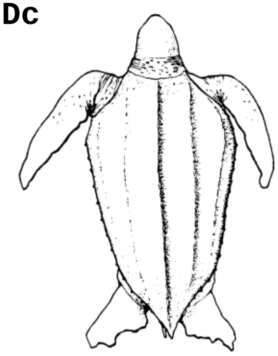
(C) A turtle is determined to be dead if the muscles are stiff (rigor mortis) and/or the flesh has begun to rot; otherwise the turtle is determined to be comatose or inactive and resuscitation attempts are necessary.

APPENDIX B

Identification Key for Sea Turtles and Sturgeon Found in Northeast U.S. Waters

SEA TURTLES

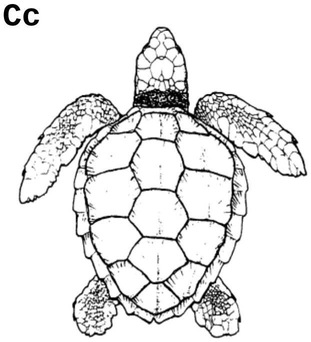
Dc



Leatherback (*Dermocheyls coriacea*)

Found in open water throughout the Northeast from spring through fall. Leathery shell with 5-7 ridges along the back. Largest sea turtle (4-6 feet). Dark green to black; may have white spots on flippers and underside.

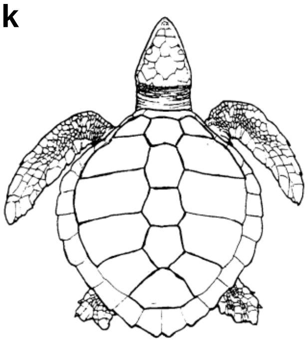
Cc



Loggerhead (*Caretta caretta*)

Bony shell, reddish-brown in color. Mid-sized sea turtle (2-4 feet). Commonly seen from Cape Cod to Hatteras from spring through fall, especially in southern portion of range. Head large in relation to body.

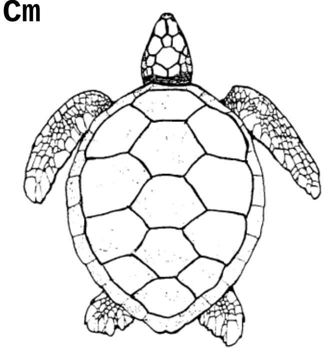
Lk



Kemp's ridley (*Lepidochelys kempi*)

Most often found in Bays and coastal waters from Cape Cod to Hatteras from summer through fall. Offshore occurrence undetermined. Bony shell, olive green to grey in color. Smallest sea turtle in Northeast (9-24 inches). Width equal to or greater than length.

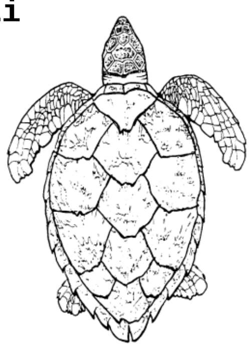
Cm



Green turtle (*Chelonia mydas*)

Uncommon in the Northeast. Occur in Bays and coastal waters from Cape Cod to Hatteras in summer. Bony shell, variably colored; usually dark brown with lighter stripes and spots. Small to mid-sized sea turtle (1-3 feet). Head small in comparison to body size.

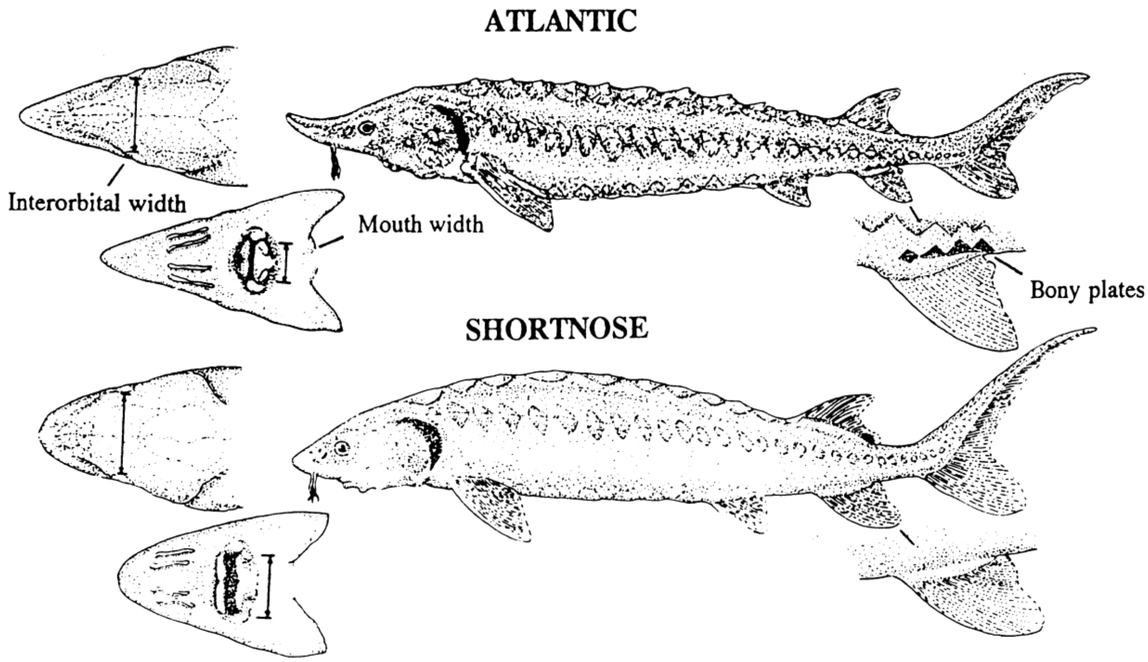
Ei



Hawksbill (*Eretmochelys imbricata*)

Rarely seen in Northeast. Elongate bony shell with overlapping scales. Color variable, usually dark brown with yellow streaks and spots (tortoise-shell). Small to mid-sized sea turtle (1-3 feet). Head relatively small, neck long.

APPENDIX B continued
Sturgeon Identification



Distinguishing Characteristics of Atlantic and Shortnose Sturgeon

Characteristic	Atlantic Sturgeon, *Acipenser oxyrinchus*	Shortnose Sturgeon, *Acipenser brevirostrum*
Maximum length	> 9 feet/ 274 cm	4 feet/ 122 cm
Mouth	Football shaped and small. Width inside lips < 55% of bony interorbital width	Wide and oval in shape. Width inside lips > 62% of bony interorbital width
*Pre-anal plates	Paired plates posterior to the rectum & anterior to the anal fin.	1-3 pre-anal plates almost always occurring as median structures (occurring singly)
Plates along the anal fin	Rhombic, bony plates found along the lateral base of the anal fin (see diagram below)	No plates along the base of anal fin
Habitat/Range	Anadromous; spawn in freshwater but primarily lead a marine existence	Freshwater amphidromous; found primarily in fresh water but does make some coastal migrations

* From Vecsei and Peterson, 2004

APPENDIX C

Procedure for obtaining fin clips from sturgeon for genetic analysis

Obtaining Sample

1. Wash hands and use disposable gloves. Ensure that any knife, scalpel or scissors used for sampling has been thoroughly cleaned and wiped with alcohol to minimize the risk of contamination.

2. For any sturgeon, after the specimen has been measured and photographed, take a one-cm square clip from the pelvic fin.

3. Each fin clip should be placed into a vial of 95% non-denatured ethanol and the vial should be labeled with the species name, date, name of project and the fork length and total length of the fish along with a note identifying the fish to the appropriate observer report. All vials should be sealed with a lid and further secured with tape Please use permanent marker and cover any markings with tape to minimize the chance of smearing or erasure.

Storage of Sample

1. If possible, place the vial on ice for the first 24 hours. If ice is not available, please refrigerate the vial. Send as soon as possible as instructed below.

Sending of Sample

1. Vials should be placed into Ziploc or similar resealable plastic bags. Vials should be then wrapped in bubble wrap or newspaper (to prevent breakage) and sent to:

   Julie Carter
   NOAA/NOS – Marine Forensics
   219 Fort Johnson Road
   Charleston, SC 29412-9110
   Phone: 843-762-8547

   a. Prior to sending the sample, contact Lynn Lankshear at NMFS Northeast Regional Office (978-282-8473) to report that a sample is being sent and to discuss proper shipping procedures.

APPENDIX D

Incident Report: ESA Listed Species Take

Photographs should be taken and the following information should be collected from all listed fish and sea turtles (alive and dead) collected.

Observer's full name:____
Reporter's full name:____

Species Identification:____

Type of Gear and Length of deployment:
____
____

Date animal observed:________________ Time animal observed: ________________________
Date animal collected:________________ Time animal collected:_________________________

Environmental conditions at time of observation (i.e., tidal stage, weather):
____
____

Water temperature (°C) at site and time of observation:_________________________
Describe location of animal and how it was documented (i.e., observer on boat):
____

Sturgeon Information:
Species ____________________________________

Fork length (or total length) _______________________ Weight ________________________

Condition of specimen/description of animal
____
____
____
____

Fish Decomposed: NO SLIGHTLY MODERATELY SEVERELY
Fish tagged: YES / NO *Please record all tag numbers.* Tag # _________________

Photograph taken: YES / NO
(please label *species, date, geographic site* and *vessel name* when transmitting photo)

Genetics Sample taken: YES / NO
Genetics sample transmitted to: _____________________ on ____/_____/2012

APPENDIX D continued

Sea Turtle Species Information: *(please designate cm/m or inches.)*
Species ______________________________ Weight (kg or lbs)____________________________

Sex (circle): Male Female Unknown How was sex determined? ___________________

Straight carapace length ________________ Straight carapace width _____________________

Curved carapace length ________________ Curved carapace width ______________________

Plastron length _______________________ Plastron width _____________________________

Tail length ____________________________ Head width _______________________________

Condition of specimen/description of animal____
____

Existing Flipper Tag Information
Left ______________________________ Right __________________________________
PIT Tag # _________________________________

Miscellaneous:
Genetic biopsy taken: YES NO
Photos Taken: YES NO Is this a Recapture: YES NO

Turtle Release Information:
Date ___________________________ Time ________________________________
Lat ____________________________ Long ________________________________
State __________________________ County ______________________________

Remarks: (note if turtle was involved with tar or oil, gear or debris entanglement, wounds or mutilations, propeller damage, papillomas, old tag locations, etc.)
____
____

APPENDIX E

STURGEON SALVAGE FORM

For use in documenting dead sturgeon in the wild under ESA permit no. 1614 (version 05-16-2012)

INVESTIGATORS'S CONTACT INFORMATION

Name: First ________________ Last ______________________

Agency Affiliation ________________ Email______________________

Address ____

____

Area code/Phone number ______________________________________

UNIQUE IDENTIFIER (Assigned by NMFS)

DATE REPORTED:
Month ☐☐ Day☐☐ Year 20☐☐

DATE EXAMINED:
Month ☐☐ Day☐☐ Year 20☐☐

SPECIES: (check one)
- ☐ shortnose sturgeon
- ☐ Atlantic sturgeon
- ☐ Unidentified *Acipenser* species

Check "Unidentified" if uncertain . See reverse side of this form for aid in identification.

LOCATION FOUND: ☐Offshore (Atlantic or Gulf beach) ☐Inshore (bay, river, sound, inlet, etc)

River/Body of Water________________ City______________________ State ____

Descriptive location (be specific)____

____

____

Latitude ______________N (Dec. Degrees) Longitude ______________ W (Dec. Degrees)

CARCASS CONDITION at time examined: (check one)
- ☐ 1 = Fresh dead
- ☐ 2 = Moderately decomposed
- ☐ 3 = Severely decomposed
- ☐ 4 = Dried carcass
- ☐ 5 = Skeletal, scutes & cartilage

SEX:
- ☐ Undetermined
- ☐ Female ☐ Male

How was sex determined?
- ☐ Necropsy
- ☐ Eggs/milt present when pressed
- ☐ Borescope

MEASUREMENTS: Circle unit

Fork length ________ cm / in

Total length ________ cm / in

Length ☐ actual ☐ estimate

Mouth width (inside lips, see reverse side) ________ cm / in

Interorbital width (see reverse side) ________ cm / in

Weight ☐ actual ☐ estimate ________ kg / lb

TAGS PRESENT? Examined for external tags including fin clips? ☐ Yes ☐ No Scanned for PIT tags? ☐ Yes ☐ No

Tag #	Tag Type	Location of tag on carcass

CARCASS DISPOSITION: (check one or more)
- ☐1 = Left where found
- ☐2 = Buried
- ☐3 = Collected for necropsy/salvage
- ☐4 = Frozen for later examination
- ☐5 = Other (describe) ________________________

Carcass Necropsied?
☐Yes ☐No

Date Necropsied:____________

Necropsy Lead:

____

PHOTODOCUMENTATION:
Photos/vide taken? ☐ Yes ☐ No

Disposition of Photos/Video:__________

____

____

SAMPLES COLLECTED? ☐ Yes ☐ No

Sample	How preserved	Disposition (person, affiliation, use)

Comments:

____

____

____

Distinguishing Characteristics of Atlantic and Shortnose Sturgeon (version 07-20-2009)

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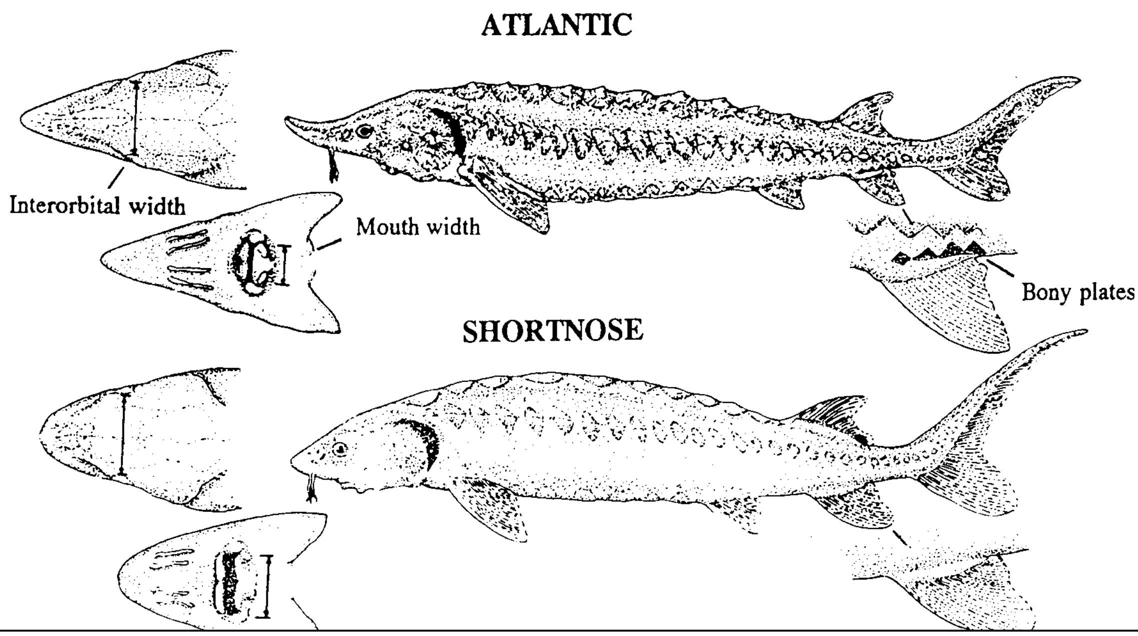

Describe any wounds / abnormalities (note tar or oil, gear or debris entanglement, propeller damage, etc.). **Please note if no wounds / abnormalities are found.**

____

____

____

____

____

Data Access Policy: Upon written request, information submitted to National Marine Fisheries Service (NOAA Fisheries) on this form will be released to the requestor provided that the requestor credit the collector of the information and NOAA Fisheries. NOAA Fisheries will notify the collector that these data have been requested and the intent of their use.

Submit completed forms (within 30 days of date of investigation) to: **Northeast Region Contacts** – Shortnose Sturgeon Recovery Coordinator (Jessica Pruden, Jessica.Pruden@noaa.gov, 978-282-8482) or Atlantic Sturgeon Recovery Coordinator (Lynn Lankshear, Lynn.Lankshear@noaa.gov, 978-282-8473); **Southeast Region Contacts**- Shortnose Sturgeon Recovery Coordinator (Stephania Bolden, Stephania.Bolden@noaa.gov, 727-824-5312) or Atlantic Sturgeon Recovery Coordinator (Kelly Shotts, Kelly.Shotts@noaa.gov, 727-551-5603).