ENDANGERED SPECIES ACT SECTION 7 CONSULTATION
BIOLOGICAL OPINION

Action Agency:	National Marine Fisheries Service, Northeast Fisheries Science Center (NEFSC)
Activity:	Endangered Species Act Section 7 Consultation on the NEFSC Research Vessel Surveys as well as Two Cooperative Gear Research Studies to be overseen by the NEFSC Protected Species Branch (PSB) **PCTS ID: NER-2012-9241** ECO ID: GARFO-2012-00015
Date Issued:	11/30/12
Approved by:	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 (FWS), depending upon the species and/or critical habitat that may be affected. In instances where NMFS or FWS are themselves authorizing, funding, or carrying out an action that may affect listed species or critical habitat, the respective agency must conduct intra-service consultation. Since the actions described in this document are being carried out and overseen by the NMFS Northeast Fisheries Science Center (NEFSC), and in the case of two cooperative gear research projects, are conducted on fishing trips that are regulated under Federal fishery management plans (FMPs) authorized by the NMFS Northeast Regional Office (NERO), we are required to perform an intra-service section 7 consultation on these actions. For this consultation, although both the NEFSC and NERO are Federal action agencies, the NEFSC is serving as the lead action agency and shall assume all responsibilities of that designation.

In the spring of 2012, we completed a formal section 7 consultation on the effects of 14 research vessel surveys carried out by the NEFSC in 2012. We prepared a biological opinion (Opinion) for these actions, dated June 13, 2012, which concluded that the NEFSC surveys were likely to adversely affect but not likely to jeopardize the continued existence of loggerhead (specifically the Northwest Atlantic [NWA] distinct population segment [DPS]), leatherback, Kemp's ridley, or green sea turtles, or any of the five DPSs of Atlantic sturgeon which were listed under the ESA on February 6, 2012 (77 FR 5880 and 77 FR 5914). In the Opinion, we also concluded that the proposed actions were not likely to adversely affect shortnose sturgeon, the Gulf of Maine DPS of Atlantic salmon, hawksbill sea turtles, or any listed species of large whales. We have reinitiated consultation on the NEFSC research vessel surveys to assess their effects on ESA-listed species and critical habitat in 2013 and 2014, or until such time that a programmatic Opinion covering all research activities conducted and funded by the NEFSC is completed. At present, the NEFSC is in the process of preparing an Environmental Assessment (EA) analyzing the impacts of this array of activities. Once the EA is completed, formal consultation and the production of an Opinion can begin. By issuing this Opinion, we withdraw the previous Opinion covering the 2012 NEFSC research vessel surveys (Consultation No. F/NER/2012/01792).

In this Opinion we will also assess the effects of two cooperative gear research projects being overseen by the NEFSC Protected Species Branch (PSB) in 2012 and 2013—a topless trawl study in the summer flounder fishery and a gillnet gear modification study in the monkfish fishery. We are including these two studies in this Opinion as: (1) the NEFSC is also the action agency, (2) although the studies are already covered under section 7 of the ESA for sea turtle interactions through pre-existing FMP Opinions on the summer flounder and monkfish fisheries, they are not currently covered for Atlantic sturgeon interactions, and (3) the studies will be well underway prior to the completion of a new "batched" FMP Opinion which will cover Atlantic sturgeon interactions in those as well as other fisheries in the near future (see Section 2.0 below).

This Opinion is based on information on past interactions with ESA-listed species provided by the NEFSC as well as other scientific data and reports cited throughout this document. A complete administrative record of this consultation will be kept on file at the NERO.

2.0 CONSULTATION HISTORY

We have formally consulted on the effects of the NEFSC research vessel surveys on two previous occasions. On August 20, 2007, we completed section 7 consultation on the adverse effects of the surveys on ESA-listed sea turtles. Most recently, on June 13, 2012, we prepared an updated Opinion to account for adverse effects on sea turtles as well as Atlantic sturgeon DPSs.

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. The effective date of the listing was April 6, 2012. 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 provide incidental take statements (ITSs) for ESA-listed sea turtles. This Opinion will replace the 2012 Opinion on the NEFSC research vessel surveys and will also provide an ITS for the two cooperative gear research studies in fisheries for which there is currently no incidental take coverage for Atlantic sturgeon.

3.0 DESCRIPTION OF THE PROPOSED ACTIONS

The activities considered in this Opinion are research vessel surveys to be carried out by the NEFSC in 2013 and 2014, as well as two cooperative gear research studies to be carried out by the NEFSC and its research partners in Fall 2012/Winter 2013 (gillnet study) and Winter/Spring 2013 (topless trawl study). In addition, the NEFSC may renew the gillnet study for an additional year in Fall 2013/Winter 2014. However, we expect that the batched FMP Opinion (described above) will be finalized by Fall 2013 and would cover activities of the 2013/2014 gillnet study. Alternatively, the proposed action for the Fall 2012/Winter 2013 gillnet study 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 NEFSC Research Vessel Surveys

The NEFSC conducts annual surveys aboard a suite of Fishery Survey Vessels (FSV), Fishery Research Vessels (FRV), NOAA ships, and occasional charter vessels. In 2013, the NEFSC will be utilizing the FSVs *Henry B. Bigelow* and *Pisces*, the FRVs *Hugh R. Sharp* and *Gloria*

Michelle, the NOAA Ships *Gordon Gunter* (on loan from the NMFS Southeast Fisheries Science Center [SEFSC] due to the recent retirement of the FRV *Delaware II*) and *Okeanus Explorer*, and a clam charter fishing vessel yet to be determined. Surveys aboard these vessels will take place in Atlantic Ocean waters as far north as Maine to as far south as North Carolina. The research vessel surveys to be considered in this Opinion for 2013 and 2014 are as follows[1]:

The NEFSC Spring Bottom Trawl Survey (BTS) has been conducted annually since 1968 and samples waters off Cape Hatteras, North Carolina to the Gulf of Maine (GOM). Approximately 410 stations are sampled each year during the months of February through May (~60 DAS). The Spring BTS is currently conducted aboard the FSV *Henry B. Bigelow* and uses a four-seam, three-bridle bottom trawl with a roller sweep which is towed at 3.0 knots for 20-minute tow intervals. In 2013, the Spring BTS is scheduled to occur from March 4 through May 11.

The NEFSC Ecosystem Monitoring Cruise (EcoMon) has been conducted in one form or another since 1977 and samples waters off Cape Hatteras to the GOM using the FSV H*enry B. Bigelow* and FRV *Delaware II*. However, in 2013, the EcoMon surveys will also be conducted aboard the FSV *Pisces* and NOAA Ship *Gordon Gunter* (which is replacing the FRV *Delaware II*). Approximately 120 stations are sampled on up to four dedicated surveys (EcoMon) and two additional surveys piggybacked onto the Spring and Fall BTS (~64 dedicated DAS). Sampling is conducted with oceanographic instruments lowered in profiling mode (Conductivity, Temperature, Depth [CTD] Instruments) and with plankton nets towed obliquely (61 cm bongo trawl with 0.3 mm mesh and 20 cm bongo trawl with 0.1 mm mesh). Occasionally larger nets are used (61 cm bongo trawl with 0.5 mm mesh, 6 foot Isaacs Kidd mid-water trawl with 2 mm mesh). Tow speeds are generally less than 3.0 knots and tow durations are generally less than 30 minutes. Typically, 100-200 m^3 of water is sampled per station. In 2013, dedicated EcoMon surveys are scheduled to occur from February 7-26 aboard the FSV *Pisces* and from May 29 through June 17 aboard the NOAA Ship *Gordon Gunter*, with an additional survey aboard the FSV *Pisces* sometime in late October through mid-November.

The NEFSC Deepwater Corals and Benthic Habitat Cruise is presently conducted aboard the FSV *Henry B. Bigelow* during the months of June and July (16 DAS). The FSV will be towing the Woods Hole Oceanographic Institution (WHOI) *TowCam*, an internally recording, 6,000-meter rated, digital deep-sea camera system that also acquires CTD water properties data. The *TowCam* frame is made of stainless steel with a bridle and lift point suitable for connection to standard University-National Oceanographic Laboratory System (UNOLS) CTD terminations. Approximately 14 days of up to 24-hour operations at identified sites of interest with 5-10 hour deployments of the *TowCam* are planned. A four-seam, three-bridle bottom trawl with a roller sweep and deepwater floats may also be used if additional collections are needed or *TowCam* operations fail. The bottom trawl would be towed approximately 10 times for 30 minute intervals, if necessary. The area of operation is on the continental slope targeting heads of canyons, particularly those north of Hudson Canyon to approximately Veatch Canyon. In 2013, the Deepwater Coral Habitat survey is scheduled to occur from June 10-24 and an additional benthic habitat survey will occur on the NOAA Ship *Gordon Gunter* from April 15-26.

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[1] This list includes a few surveys that are not planned for 2013, but which have occurred in previous years and may be undertaken in 2014 if funding and resources are available. A complete schedule for 2014 is not yet available.

The NEFSC Fall BTS has been conducted annually since 1963 and samples waters off Cape Hatteras to the GOM. Approximately 385 stations are sampled each year during the months of September through November (~60 DAS). Like the Spring BTS, this survey is currently conducted aboard the FSV *Henry B. Bigelow* and uses a four-seam, three-bridle bottom trawl with a roller sweep which is towed at 3.0 knots for 20-minute tow intervals. In 2013, the Fall BTS is scheduled to occur from September 3 through sometime in mid-November.

The Living Marine Resources Cooperative Science Center (LMRCSC) Training Cruise and Deepwater Survey, a collaborative research project between the NEFSC and the University of Maryland-Eastern Shore, has been conducted annually since 2005 for 10 DAS in January or February, and with differing trawl gears (#36 Yankee or four-seam otter trawls). Starting in 2009, a four-seam, three-bridle bottom otter trawl with a roller sweep and deepwater floats was used. In 2012, this gear was towed 14 times for 30-minute intervals at 2.0 knots. The operating area for this sampling was along the upper continental slope (250-900 meters) from Block Canyon in southern New England to Cape Hatteras. In addition, 25 two-meter beam trawl tows were made on the shelf and upper slope (30-300 meters) for 20-minute intervals at 2.0 knots at stations between New Jersey and Virginia. In 2013, this survey is proposed to occur aboard the NOAA Ship *Gordon Gunter* and will take place later in the year from June 22 through July 3.

The Atlantic Marine Assessment Program for Protected Species (AMAPPS) Survey is a line-transect aerial and shipboard abundance survey for marine mammals, sea turtles, and seabirds along the U.S. Atlantic coast that began in the summer of 2010. Both the NEFSC and SEFSC are principal investigators in this survey. The first shipboard surveys for AMAPPS were conducted in the summer of 2011 aboard the FSV *Henry B. Bigelow* (Massachusetts to Virginia) and the NOAA Ship *Gordon Gunter* (North Carolina to Florida). Loggerhead sea turtles and harbor seals were also captured and tagged by contract fishing vessels and small NEFSC boats. In 2013, the NEFSC will oversee the northern portion of the AMAPPS survey (Massachusetts to Virginia) conducted aboard the FSV *Henry B. Bigelow* from July 1 to August 19.

The NEFSC Surf Clam and Ocean Quahog Survey had been conducted triennially since 1976 and sampled waters off Cape Hatteras to the Scotian Shelf, Canada using the FRV *Delaware II*. In 2011, the final standardized survey was conducted aboard the *Delaware II*. Following the retirement of the *Delaware II*, the survey was transferred to a commercial platform for an annual summer survey starting in 2012. The contract vessel for 2013 has not yet been determined, but it will deploy a standard commercially sized clam dredge (13 foot blade width). The dredge will be towed at 1.5 knots for 5 minutes with a 2:1 tow wire to depth ratio (scope). The contract vessel will perform the survey over 15 DAS in August 2013.

The NEFSC Scallop Dredge and Integrated Benthic Habitat Survey has been conducted annually since 1982 and samples waters off Cape Hatteras to the Scotian Shelf. Since 2008, the FRV *Hugh R. Sharp* has been the research vessel contracted to conduct the standardized survey. Approximately 450 stations are sampled each year during the months of May through July (36 DAS). For standard dredge hauls, the survey uses a NEFSC 8-foot scallop dredge equipped with a 2-inch ring chain bag and lined with 1.5 inch mesh webbing liner to retain small scallops. The dredge is towed at 3.8 knots for 15-minute tow intervals with a 3.5:1 tow wire to depth ratio (scope). In addition, the NEFSC has collaborated with a group from WHOI to develop and test a stereo-optic towed camera array to count and measure sea scallops and associated fauna utilizing automated digital imagery. The camera system will be towed during the 2013 standard survey for half of the sea days. The non-invasive vehicle is towed by a 2-inch fiber optic cable that keeps the vehicle about 1.5 meters off the sea floor. In 2013, the NEFSC will conduct three surveys (June 13-24, June 26 through July 7, and July 9-20) aboard the FRV *Hugh R. Sharp*.

The NEFSC will be conducting a Sea Bass Habitat Survey aboard the FRV *Hugh R. Sharp* from July 22-26, 2013. This survey will use the aforementioned WHOI digital camera array to collect information on the distribution and status of black sea bass habitat in the Northeast.

The NEFSC will also be conducting a Habitat Mapping Survey aboard the NOAA Ship *Okeanus Explorer* from August 19-30, 2013. This survey will continue research efforts conducted 2012 in which scientists gathered baseline information and mapped priority frontier areas (*e.g.*, deepwater canyons) along the U.S. continental shelf and slope from Virginia to Rhode Island. High-resolution mapping will be done using a multi-beam sonar system towed behind the ship.

The MADMF Spring Bottom Trawl Survey has been conducted annually since 1978. Survey operations are conducted during daylight hours in Massachusetts territorial waters from the Rhode Island to New Hampshire border. A total of 103 randomly selected stations are assigned within 23 strata delineated by depth and geographic area. The survey trawl is towed for a maximum of 20 minutes at a speed of 2.5 knots by the FRV *Gloria Michelle*. The survey otter trawl (39-foot headrope/51-foot footrope) is rigged with a 3.5-inch rubber disc sweep and has a ½-inch stretched nylon liner in the codend to retain small fish. The net is spread by 72-inch x 40-inch, 325-pound wooden trawl doors connected to the net via 63-foot 3/8-inch chain bottom legs and 60-foot 3/8-inch wire top legs. The survey is normally accomplished in 15-18 DAS.

The Atlantic States Marine Fisheries Commission (ASMFC) Northern Shrimp Survey has been conducted annually since 1984 and samples waters in the western GOM using the FRV *Gloria Michelle*. Approximately 80 stations are sampled each year during the months of July and August (~22 DAS). The survey uses a NEFSC shrimp survey bottom trawl towed at 2 knots for 15-minute tow intervals.

The MADMF Fall Bottom Trawl Survey has been conducted annually since 1978. Survey operations are conducted during daylight hours in Massachusetts territorial waters from the Rhode Island to New Hampshire border. A total of 103 randomly selected stations are assigned within 23 strata delineated by depth and geographic area. The survey trawl is towed for a maximum of 20 minutes at a speed of 2.5 knots by the FRV *Gloria Michelle*. The survey otter trawl (39-foot headrope/51-foot footrope) is rigged with a 3.5-inch rubber disc sweep and has a ½-inch stretched nylon liner in the codend to retain small fish. The net is spread by 72-inch x 40-inch, 325-pound wooden trawl doors connected to the net via 63-foot 3/8-inch chain bottom legs and 60-foot 3/8-inch wire top legs. The survey is normally accomplished in 15-18 DAS.

In addition to the above surveys, the following four surveys have been conducted by the NEFSC in previous years but are not currently scheduled for 2013. However, since this Opinion intends to cover NEFSC research vessel activities in 2013 and 2014, they are mentioned here as well.

The NEFSC Atlantic Herring Acoustics Survey has been conducted annually since 1997 and samples waters on Georges Bank and in the GOM. Approximately 70 stations are sampled each year during the months of September to mid-October (~35 DAS). The survey uses a Polytron mid-water rope trawl and an Irish herring mid-water trawl with 53-meter head and foot ropes, which are towed at 4.0 knots for 5- to 30-minute tow intervals. In 2012, this survey was conducted aboard the FSV *Pisces* from September 12 through October 21. However, in 2013, the *Pisces* will not be available as a platform for this survey.

The Joint NEFSC-Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS) Mooring cruise performs routine maintenance on NERACOOS moorings deployed in the GOM. The cruise involves pulling a mooring, which is basically a string with equipment. The mooring is marked at the surface with a buoy and held to the bottom by a weight. Instruments are deployed at the bottom, along the string in the water column, and attached to the surface buoy. Once a mooring is pulled, either equipment is replaced and the same mooring is deployed or a new mooring is deployed. These are point-specific operations and between two to six moorings are generally serviced during the cruise. In 2012, this cruise was conducted aboard the FRV *Delaware II* from June 22-29. At present, this cruise will not be performed in 2013 (although it could occur again in 2014 if a suitable vessel is available).

The NEFSC Deepwater Biodiversity Survey is conducted aboard the FSV *Henry B. Bigelow*, which tows a four-seam trawl (non-standard) rigged with deep-water floats and rock-hopper sweep used with Perfect Doors. The bottom trawl is towed approximately nine times for one hour on the bottom at depths of 1,000 meters or greater. In addition, mid-water trawling includes approximately 16 mid-water tows targeting depths of 600-1,200 meters using a Superior Trawl rigged with deep-water floats and White Nets doors (standard tom weights and spectra bridles) for a total of 11 DAS. The area of operation is the Northwest Atlantic Ocean in the vicinity of Bear and Physalia Seamounts, within the area bounded by 39°45' to 40°00' N and 66°55' to 67°40' W. This survey was last completed in 2012 from June 5-15, but will not occur in 2013.

The NEFSC Large Coastal Shark Survey has been conducted bi- or tri-annually since 1996 and samples waters from Florida to Delaware using various vessels including FRV *Delaware II*, UNOLS vessels *Pelican* and *Longhorn*, and in 2012 a charter vessel. Approximately 60-90 stations are sampled in April and May (~50 DAS). The survey uses 300 hooks of commercial bottom longline gear. The hooks are baited with spiny dogfish and the gear is soaked for three hours. Pelagic sets are made if possible using commercial pelagic longline gear. This survey was last completed by the NEFSC in April and May 2012, but will not be occurring in 2013.

3.2 NEFSC PSB Studies

Previously, the NEFSC PSB has developed, carried out, and subsequently analyzed data as well as formulated research abstracts on commercial fishery related research very similar to what is proposed in this Opinion. Factors driving PSB research design are multifaceted. PSB research scientists are searching to not only optimize target catch retention of commercially marketable and managed species, but also to optimize bycatch reduction of NMFS-protected species (*e.g.*, ESA and Marine Mammal Protection Act [MMPA] as well as prohibited species). Another goal of this type of research is to accomplish catch optimization in the most efficient means possible resulting in as little cost and as few significant changes to the fishing industry as possible.

Several studies recently completed and currently underway are directly related to the cooperative gear research studies proposed in this Opinion. Related to the topless trawl study mentioned previously, DeAlteris, and Parkins (2012) evaluated the effectiveness of a topless trawl design in mitigating sea turtle bycatch. It was from this research that the optimal configuration of headrope dimensions was devised that will be utilized for study as described in this Opinion. Another impetus to continue with topless trawl types of turtle excluder device (TED) research is that the summer flounder fishery requires trawl vessels fishing within the Sea Turtle Protection Area (U.S. Exclusive Economic Zone [EEZ] waters from Cape Charles, Virginia to the North Carolina/South Carolina border) to use a TED as detailed at 50 CFR 223. Determining a type of TED that at least maintains target catch retention relative to a net without a TED is of direct interest to the commercial fishing industry.

The experimental design for the gillnet gear modification study is based largely on the results of a study incorporating two discrete sets of gillnet haul work. In 2010 and 2011, as described in Fox *et al*. (2011), it was determined that between an experimental “stand up” and control “tie down” net, the “tie down” net not only reduced the number of marine mammal interactions (namely harbor porpoise), but there was no significant increase in Atlantic sturgeon bycatch and catch retention of target monkfish increased with the “tie down” relative to the “stand up” net both in quantity and overall size (both of which are factors of commercial value to the commercial fishing industry). After this study was completed, the cooperating fishermen suggested that the addition of two more meshes, while maintaining the same tie-down length (24 inches), might improve the catch rates of the targeted monkfish (Henry Milliken, NEFSC, pers. comm.). This type of gear configuration needs to be tested to ensure that the additional meshes do not increase Atlantic sturgeon bycatch and to evaluate if the additional meshes will, as the fishermen speculate, reduce the loss of the targeted monkfish.

These two projects will evaluate the effectiveness of modified gear types in commercial trawl and gillnet fisheries, and in both cases, due to likely incidental interactions with ESA-listed species, are included in this Opinion in accordance with the requirements of section 7(a)(2) of the ESA. The topless trawl study, currently scheduled to begin in late winter or early spring 2013 and expected to be complete by mid-June 2013, will assess catch efficiency in the summer flounder fishery. The gillnet gear modification study is currently scheduled to begin when monkfish move into shallow waters in the Fall 2012. It is expected that monkfish will move close enough to shore to be effectively targeted for this study sometime in late November (Henry Milliken, NEFSC, pers. comm.). The in-water work for the gillnet study is expected to be completed by January 2013. The gillnet gear modification study will assess catch efficiency in the large mesh fishery. Both studies will be conducted within Federal waters of the Mid-Atlantic Bight and seek to determine the effect of the gear modifications on the catch efficiency for target species and other landed catch as well as reduction in catch of NMFS-protected species. Furthermore, both studies will be compliant with existing Federal regulations for fish harvest activities utilizing the gear types and targeting the fish species described in this Opinion.

Topless Trawl Study

The primary goal of the topless trawl study is to evaluate if a statistically significant difference in summer flounder and other landed catch exists between two different net configurations. Depending on the catch differential encountered, the level of effort may or may not provide a robust statistical catch differential of summer flounder and other landed catch (*e.g.*, legal commercial species such as little skate) between the nets. In addition, this data may be combined with other data sets to obtain a better estimate. A secondary goal is to analyze differences in capture between the two net designs with regard to any NMFS-protected species (*i.e.*, ESA and MMPA listed species).

Study Design Specifications:

All trips will be conducted by commercial otter trawl fishermen. The research will be conducted in continental shelf waters south of Cape Cod, Massachusetts and north of Cape Charles, Virginia in depths of 50-200 feet. Experimentation is scheduled to begin in the late winter or early spring of 2013 to correspond with the migration of summer flounder into that depth and geography. Sixty DAS are projected to be needed to complete the study, and these days will likely be carried out by two vessels with lengths between 75 and 95 feet. The vessel operators and contractor will ensure that the experimental and control nets are fished similarly. The control net will be representative of gear commonly used in the commercial fishery. Comparisons may also be made on fishing vessels of different size classes. If vessel size is evaluated, smaller vessels (45-70 feet in length) will be analyzed against the larger (75-95 feet in length) vessels. No other experimental parameters will be altered if this comparison is included in the study except for the number of tows. The addition of a size class variable may double the number of tows needed to complete the study. The addition of tows to the study will depend on the effects of vessel size observed during initial experimentation and availability of funds.

Flume tank work will be conducted in the winter of 2013 to verify the gear specifications and to evaluate changes that may improve the catch retention of the gear. Based on the results of the flume tank testing, modification to the experimental net design (*e.g.*, length ratio of headrope to sweep, number of floats and positioning on the headrope, etc.) may be made. If we determine that changes, including additional variables such as vessel size, are made beyond the scope of the effects analysis addressed in this Opinion, reinitiation of formal consultation may be required as stipulated in 50 CFR 402.16.

All vessels in the study, regardless of size class, will utilize tow speeds of approximately 2.6-3.2 knots. Tow duration will be standardized and will be reflective of that used in the commercial fishery. Tows may be conducted in both daytime and nighttime conditions. Tows will be prohibited during heavy weather conditions and when marine mammals such as dolphins and porpoises are seen in the vicinity. It is expected that testing of different nets utilized in the study will require a minimum of 80 tows (40 pairs or 80 alternates) to discern statistically significant differences in the targeted catch rate. All nets utilized in this study will have the same sweep length. The specific gear variables tested in this study design will be variations in head rope length as well as number of floats. As mentioned previously, vessel size may be evaluated within the experimental design resulting in an expected doubling of the number of required tows.

The study design will be an approved paired study methodology (*e.g.*, alternate haul, paired vessel or twin trawl) that will investigate the catch retention over a maximum of approximately 160 tows (80 pairs)[2] (up to a maximum of approximately 80 tows if vessel size is not added as an experimental variable). Experimentation will be conducted on an alternate tow basis, control followed by the experimental, or a paired haul basis, as described in ICES (1996). This methodology shall ensure that bias in experimental and control tows/nets is reduced and that standard scientific procedures are employed to ensure that the comparison is scientifically valid.

Trained scientific data collectors will use NOAA approved sea sampling procedures (hard copies, available from the NEFSC, will be placed 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 collect data on the total catch, including estimated total weight and length measurements, of all summer flounder and targeted species or a representative sub-sample if conditions do not permit recording all fish lengths, gear characteristics (*e.g.*, number of floats), and fishing operations data (*e.g.*, start and end of tow, location, etc.). Door spread will be monitored constantly during the tow using an acoustic trawl monitoring system. Underwater camera systems may be used to video the performance of the nets, the gear, and to document any potential problems in the rigging of the net if this is determined to be a component of the study. The methodology, results, and any unusual occurrences or catches (*e.g.*, protected species) will be photo documented in high resolution. In addition, catch of species other than targeted and protected species caught with the control and experimental nets will be sorted and counted to provide comparative data on the overall finfish catch efficiency of trawls. In instances of abnormally large size catch and/or limited availability of time, only commercially significant finfish species may be sampled (length frequency data). All data collected must be on NMFS Northeast Fisheries Observer Program (NEFOP) logs or data sheets.

Additionally, if protected species (*e.g.*, sturgeons, 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 dead marine mammals and sea turtles should be according to guidelines outlined under the NEFOP's Biological Sampling Manual (http://www.nefsc.noaa.gov/fsb/ manuals/2010/NEFBSM_01-01-10_BOOKMARKS_ Compressed.pdf). Necropsies will also be performed on Atlantic sturgeon when the animal is found dead. Again, all data collected must be on NMFS NEFOP logs or data sheets.

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[2] In essence, the greater the statistical variance between experimental and control nets in the study, the fewer the tows that will be required to detect that difference. Thus, the NEFSC and its partners may not need 80 tows (without the experimental variable of vessel size) to achieve the study goals mentioned previously. Also, the NEFSC may fund more or less hauls depending on the selected contractor's costs for completing the project. A statistical "power" analysis will be utilized during the study to detect if a significant statistical difference is being observed based upon the effort being exerted within the experiment between the experimental and control net designs.

Trawl Gear Specifications:

Both the experimental and control nets will utilize an 80-foot footrope (sweep). The headrope will be 65 feet for the control and 160 feet for the experimental (Figures 1 and 2). Dimensions other than the headrope that may not be consistent between different vessels utilized in this study include the combined or individual bridle, ground cable, door backstrap length, bridle angle of attack, and trawl wing spread. However, these will be the same for the experimental and control in each paired tow. The gear will be maintained, and tears or damage that could affect the performance of the gear will be repaired prior to re-setting of the gear.

All trawls will have 6-inch diamond mesh in the body and codend. All nets will be rigged with sweeps on travelers, which are made of small rubber discs (cookies) interspersed with lead discs (cookies). Eight-inch diameter floats will be used, but the number will vary between the control and experimental net designs in this study. The control net will be outfitted with a total of 16 floats on the headrope. The experimental net will be outfitted with a maximum of 42 floats on the headrope. All twine used in net construction will be made of twisted and braided nylon or polyethylene netting. The codend will be closed.

Gillnet Gear Modification Study

The goal of this study will be to compare the differences in both target catch retention rates (predominantly of monkfish) and incidental bycatch rates (for Atlantic sturgeon and harbor porpoise) in gillnet gears of different net heights and tie-down lengths in the directed gillnet fishery for monkfish. The three-tiered approach of this study is as follows:

1) Compare the catch rates of the target species (monkfish) for each net configuration;
2) Compare the bycatch rates of Atlantic sturgeon for each of two net configurations (control and experimental); and,
3) Record the bycatch rates of other NMFS regulated or protected species (*e.g.*, marine mammals and regulated finfish) for each net configuration.

The results of the field research will be analyzed to determine the statistical significance of target catch and incidental bycatch as described above between the two nets. An analysis of variance (ANOVA) with soak time and other environmental conditions as covariates may be conducted to ascertain whether there are confounding variables as data from the study is collected. As mentioned previously, all gear research described in this Opinion will be compliant with existing Federal regulations (*e.g.*, regulations included in the Harbor Porpoise Take Reduction Plan (HPTRP) for large mesh gillnet gear). See Appendix A for relevant HPTRP regulations.

Study Design Specifications:

All fishing trips will be conducted by fishermen permitted within the commercial monkfish fishery within NMFS statistical areas 612, 614, or 615 of the U.S continental shelf. The study

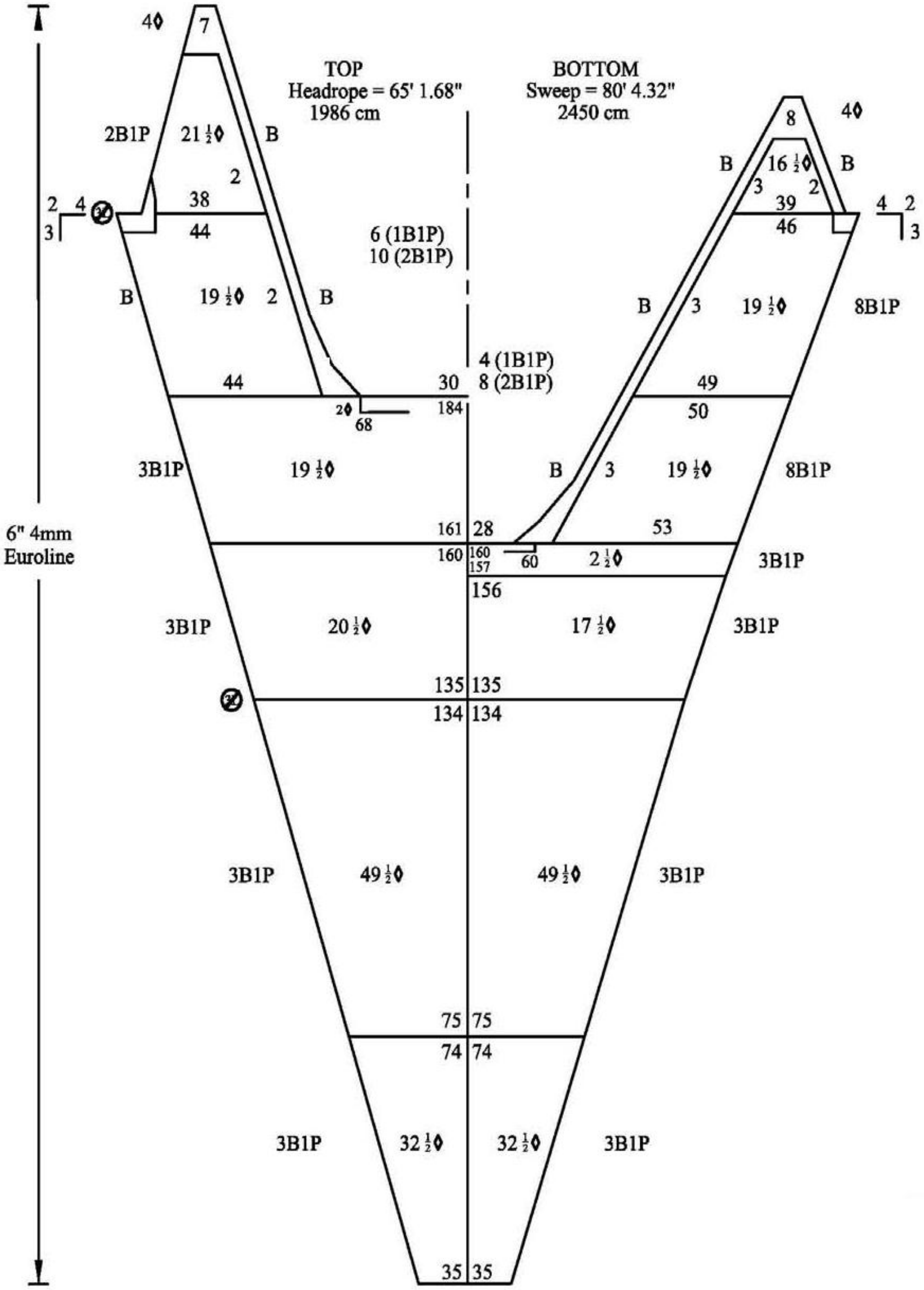

Figure 1. Example schematic of a topless trawl design, such as the control net described in this Opinion, with a 65 foot headrope. Source: DeAlteris and Parkins (2012).

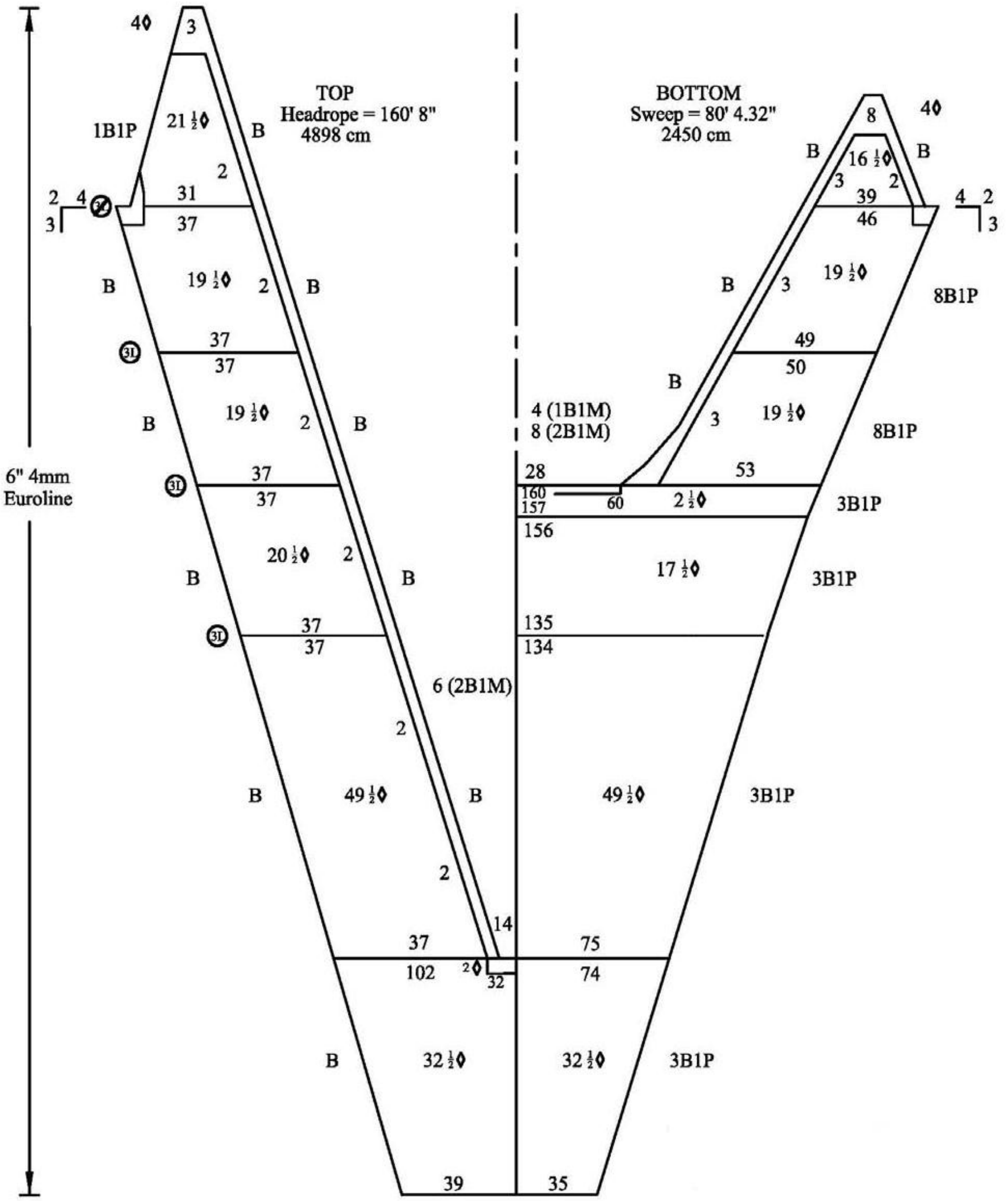

Figure 2. Example schematic of a topless trawl design, such as the experimental net described in this Opinion, with a 160 foot headrope. Source: DeAlteris and Parkins (2012).

will use a minimum of two commercial gillnet vessels and their crew to complete a maximum of 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 and as reported on vessel trip reports (VTRs). 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. Sets will occur from late November 2012 through January 2013 in depths of 50-160 feet. 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 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.

As in the topless trawl study, trained scientific data collectors 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 NEFOP's 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 3) and an 8-mesh tall experimental net with 24-inch tie-downs placed at each float (Figure 4).

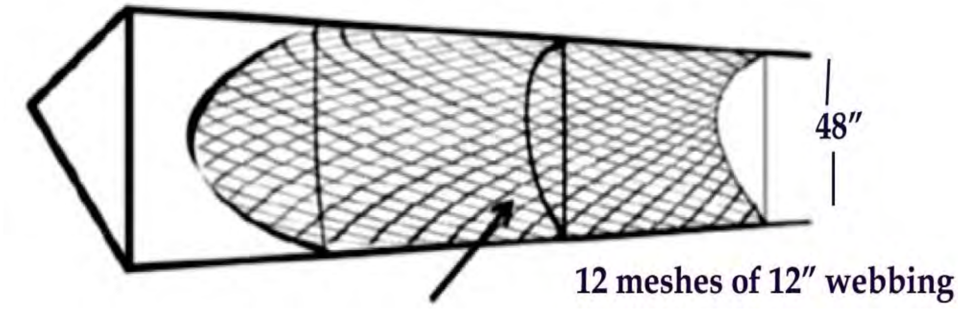

Figure 3. Example of a 12-mesh tall control net with 48 inch tie-downs placed every 24 feet.

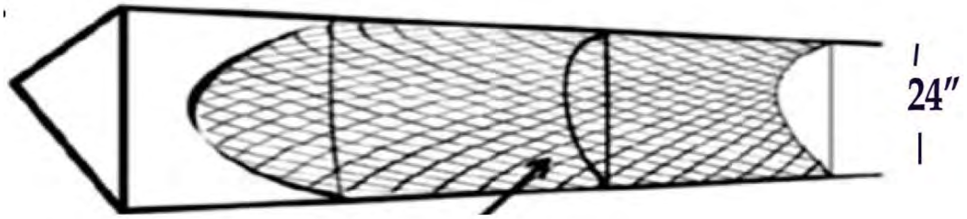

Figure 4. Example of an 8-mesh tall experimental net with 24 inch tie-downs placed at each float.

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.

3.3 Action Area

The action area 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). NMFS anticipates that the effects on ESA-listed species and their habitats as a result of NEFSC research vessel and commercial fishing vessel activities associated with this Opinion include the direct effects of interactions between listed species and the gear that will be used for these studies (*i.e.*, trawls, gillnets, and dredges) 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 research and fishing vessels on ESA-listed species, their prey, and habitats are possible as well. Therefore, for the purpose of this consultation, the action area is defined by the area in which various research and fishing vessels will be conducting study activities and the areas they will be transiting through. Broadly defined, this includes all U.S. EEZ waters in the Northwest Atlantic Ocean from the U.S./Canada border to Cape Hatteras.

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[3]	*Caretta caretta*	Threatened
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
Green sea turtle	*Chelonia mydas*	Endangered[4]
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
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 actions being considered in this Opinion are 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 Actions

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 actions occurring in more offshore ocean areas, we do not anticipate that shortnose sturgeon would be present in the area where the NEFSC surveys and gear research projects will take place and therefore, any effects to shortnose sturgeon are extremely unlikely to occur. The lack of any captures of shortnose sturgeon in any of the actions considered here 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.

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

[4] 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.

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 monkfish and summer flounder fisheries, as well as in the NEFSC bottom trawl and dredge 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, neither the monkfish nor the summer flounder fishery occurs 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 BTS (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, NMFS finds it is highly unlikely that the actions 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 trawl, gillnet, and dredge effort for the proposed surveys and gear research projects will occur, it is highly unlikely that the proposed actions will affect this sea turtle species. The lack of any captures of hawksbill sea turtles in any NEFSC 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 actions will occur. However, none of these species are expected to be affected by the use of bottom trawl or dredge gear for the NEFSC surveys and topless trawl project 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, including trawl and dredge gear. The slow speed of the mobile gears 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 mobile gear (*e.g.*, dredge and trawl gear) have shown that entanglement or capture of large whales in these gear types 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 or dredge gear during the proposed actions. In regards to the gillnet gear modification project, the potential for large whale interactions with monkfish gillnet gear in the action area has already been assessed in the 2010 Opinion on the Monkfish FMP.

NMFS has determined that the actions being considered in the Opinion are not likely to adversely modify or destroy designated critical habitat for North Atlantic right whales. This determination is based on the actions' effects on the conservation value of the habitat that has been designated. Specifically, we considered whether the actions were likely to affect the physical or biological features that afford the designated area value for the conservation of North Atlantic right whales. Critical habitat for right whales has been designated in the Atlantic Ocean in Cape Cod Bay, Great South Channel, and in nearshore waters off Georgia and Florida (50 CFR 226.203). Cape Cod Bay and Great South Channel, which are located within the action area, were designated as critical habitat for right whales due to their importance as spring/ summer foraging grounds for the species. What makes these two areas so critical is the presence of dense concentrations of copepods. Neither the gillnet, bottom trawl, nor dredge gear utilized in the proposed actions will affect the availability of copepods for foraging right whales because copepods are very small organisms that will pass through the fishing gear rather than being captured in it. Since the actions being considered in this Opinion are not likely to affect the availability of copepods and these were the biological feature that characterized feeding habitat, these actions is not likely to adversely modify or destroy designated critical habitat for right whales and, therefore, right whale critical habitat will not be considered further in this Opinion.

NMFS also determines that the proposed actions in question will not have any adverse effects on the availability of prey for humpback, fin, and sei whales. Like right whales, sei whales feed on copepods (Perry *et al.* 1999). As indicated above, the 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. Dense aggregations of late stage and diapausing *Calanus finmarchicus* in the Gulf of Maine and Georges Bank region will not be affected by the proposed actions. In addition, the physical and biological conditions and structures of the Gulf of Maine and Georges Bank region and the oceanographic conditions in Jordan, Wilkinson, and Georges Basin that aggregate and distribute *Calanus finmarchicus* are not affected by the gears to be used. Humpback and fin whales feed on krill as well as small schooling fish (*e.g.*, sand lance, herring, mackerel) (Aguilar 2002; Clapham 2002). Each of the fishing gears 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 actions will not affect the availability of prey for foraging humpback or fin whales. In addition, the proposed actions 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; Sears 2002). Therefore, the proposed actions 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. 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 and studies 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 and studies 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 actions.

4.2 Species Likely to be Adversely Affected by the Proposed Actions

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 actions.

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; Hirth 1997; Marine Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; NMFS and USFWS 2007a, 2007b, 2007c, 2007d; 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), leatherback sea turtle (NMFS and USFWS 1992, 1998a), and green sea turtle (NMFS and USFWS 1991, 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 5-year status review of the species, which discussed a variety of threats to loggerheads including climate change, NMFS and FWS 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 FWS established a Loggerhead Biological Review Team (BRT) to assess the global loggerhead population structure to determine whether DPSs exist and, if so, the status of each DPS. The BRT evaluated genetic 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 the 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 9 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 US 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 Northeast Atlantic loggerhead DPS or the Mediterranean loggerhead 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 US fleets, it is reasonable to assume that based on this new analysis, no individuals from the Mediterranean DPS or Northeast Atlantic DPS would be present in the action area. Sea turtles of the South Atlantic DPS do not inhabit the action area of this consultation (Conant *et al.* 2009). 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 5-year status review for loggerheads (NMFS and USFWS 2007a), the TEWG report (2009), and the final revised recovery plan for loggerheads in the Northwest Atlantic Ocean (NMFS and USFWS 2008), 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; Braun-McNeill *et al.* 2008; Mitchell *et al.* 2003). 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 m to 49 m 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).

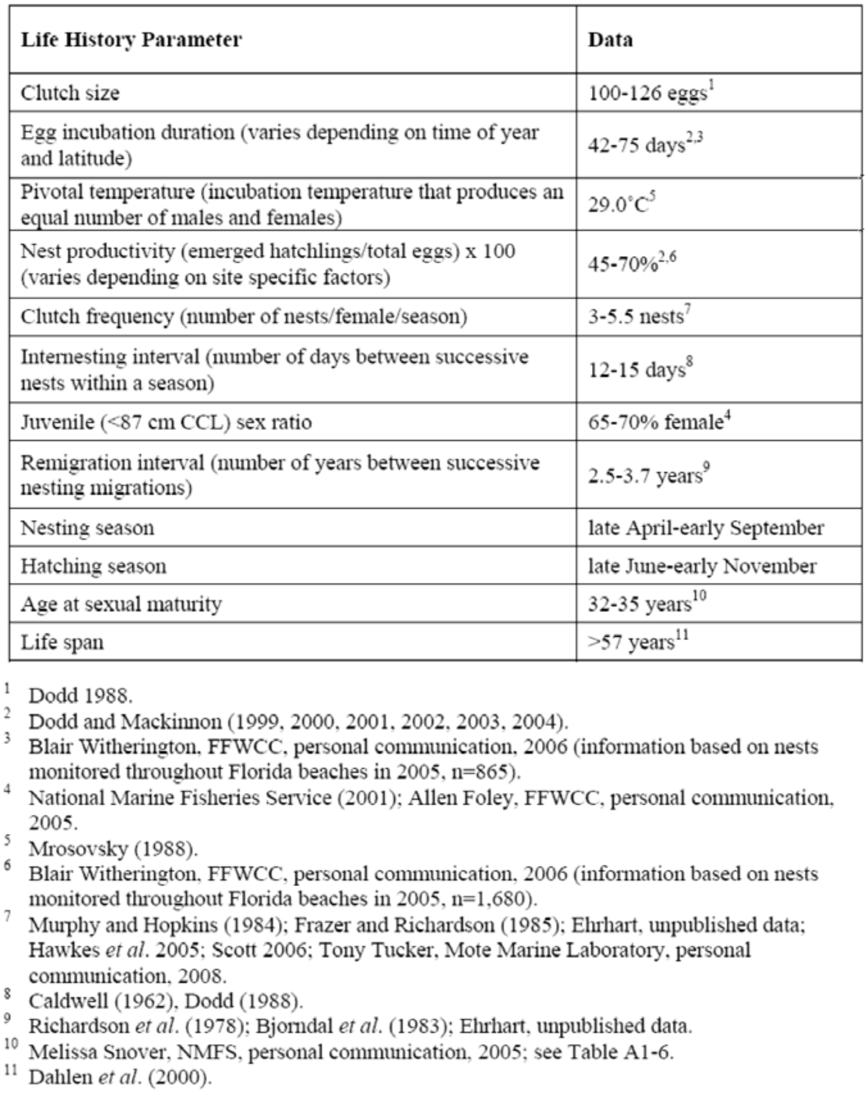
Loggerhead sea turtles occur year round in ocean waters off North Carolina, South Carolina, Georgia, and Florida. In these areas of the South Atlantic Bight, water temperature is influenced by the proximity of the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to migrate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

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

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

As presented below, Table 3 from the 2008 loggerhead recovery plan (Table 1 in this Opinion) highlights the key life history parameters for loggerheads nesting in the United States.

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).

Population Dynamics and Status

By far, the majority of Atlantic nesting occurs on beaches of the southeastern United States (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).

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

In the 2008 recovery plan, the Loggerhead Recovery Team designated five recovery units for the Northwest Atlantic population of loggerhead sea turtles based on the aforementioned nesting groups and inclusive of a few other nesting areas not mentioned above. The first four of these recovery units represent nesting assemblages located in the Southeast United States. The fifth recovery unit is composed of all other nesting assemblages of loggerheads within the Greater Caribbean, outside the United States, but which occur within U.S. waters during some portion of their lives. The five recovery units representing nesting assemblages are: (1) the Northern Recovery Unit (NRU: Florida/Georgia border through southern Virginia), (2) the Peninsular Florida Recovery Unit (PFRU: Florida/Georgia border through Pinellas County, 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 United States, 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 East Coast U.S. waters originate from these Northwest Atlantic nesting groups; primarily from the nearby nesting beaches of southern Florida, as well as the northern Florida to North Carolina beaches, and 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 turtle nesting assemblages documented in different east coast foraging habitats to a complex interplay of currents and the relative size and proximity of nesting beaches.

Unlike nesting surveys, in-water studies of sea turtles typically sample both sexes and multiple age classes. In-water studies 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 United States, one site showed no discernible trend, and the two sites located in the northeast United States 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 United States (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 4 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 (NMFS SEFSC 2009). The model results for population trajectory suggest that the population is most likely declining, but this result was very sensitive to the choice of the position of the parameters within their range and hypothesized distributions. The pelagic stage survival parameter had the largest effect on the model results. As a result of the large uncertainty in our knowledge of loggerhead life history, at this point predicting the future populations or population trajectories of loggerhead sea turtles with precision is very uncertain. It should also be noted that additional analyses are underway which will incorporate any newly available information.

As part of the AMAPPS line transect aerial abundance surveys and turtle telemetry studies were conducted along the 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 in 2011-2014, depending on available funds.

Threats

The diversity of a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the neritic environment, and in the oceanic environment. The 5-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., Biological Opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). The Southeast/Gulf of Mexico shrimp trawl fishery was responsible for the vast majority of U.S. interactions (up to 98%) and mortalities (more than 80%). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations.

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

In addition to improvements in TED 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 5-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). Northeast Fisheries Observer Program 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 SST were associated with the interaction rate, with the rates being highest south of 37°N latitude in waters < 50 m 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 9-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 sea surface temperature, depth, and use of a chain mat. Results from this recent analysis suggest that chain mats and fishing effort reductions have contributed to the decline in estimated loggerhead sea turtle interactions with scallop dredge gear after 2006 (Murray 2011).

An estimate of the number of loggerheads taken annually in U.S. Mid-Atlantic gillnet fisheries has also recently been published (Murray 2009a, b). From 1995-2006, the annual bycatch of loggerheads in U.S. Mid-Atlantic gillnet gear was estimated to average 350 turtles (CV=0.20, 95% CI over the 12-year period: 234 to 504). Bycatch rates were correlated with latitude, sea surface temperature, and mesh size. The highest predicted bycatch rates occurred in warm waters of the southern Mid-Atlantic in large-mesh gillnets (Murray 2009a).

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

Documented takes also occur in other fishery gear types and by non-fishery mortality sources (*e.g.*, hopper dredges, power plants, vessel collisions), but quantitative estimates are unavailable. Past and future impacts of global climate change are also considered in Section 5.0 below.

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 FWS 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 subpopulations is limited due to a lack of fundamental life history information and specific census and mortality data.

While several documents reported the decline in nesting numbers in the NWA DPS (NMFS and USFWS 2008, TEWG 2009), when nest counts through 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 2007c). 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 2 years (Marquez *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 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 m (NMFS and USFWS 2007c). 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 2007c).

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 sounds 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 United States, but are typically rare in the northeastern U.S. waters of the Atlantic (TEWG 2000). Adults are primarily found in nearshore waters of 37 m or less that are rich in crabs and have a sandy or muddy bottom (NMFS and USFWS 2007c).

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 2007c; 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 2007c). 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 2007c; 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 3-day period in May 2007 and over 4,000 of those nested at Rancho Nuevo (NMFS and USFWS 2007c). In 2008, 17,882 nests were documented on Mexican nesting beaches (NMFS 2011). There is limited nesting in the United States, most of which is located in South Texas. While six nests were documented in 1996, a record 195 nests were found in 2008 (NMFS 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. In the last five years (2006-2010), the number of cold-stunned turtles on Cape Cod beaches averaged 115 Kemp's ridleys, 7 loggerheads, and 7 greens (NMFS unpublished data). The numbers ranged from a low in 2007 of 27 Kemp's ridleys, 5 loggerheads, and 5 greens to a high in 2010 of 213 Kemp's ridleys, 4 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 taken in these shrimp trawls (USFWS and NMFS 1992). Subsequently, NMFS has worked with the industry to reduce sea turtle takes in shrimp trawls and other trawl fisheries, including the development and use of turtle excluder devices (TEDs). As described above, there is lengthy regulatory history with regard to the use of TEDs in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries (NMFS 2002a; Epperly 2003; Lewison *et al.* 2003). The 2002 Biological Opinion on shrimp trawling in the southeastern United States concluded that 155,503 Kemp's ridley sea turtles would be taken annually in the fishery with 4,208 of the takes resulting in mortality (NMFS 2002a).

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., Biological Opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). 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.

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, a total of 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).

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 2007c; 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 2007c). 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 2007c). 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 2007c). 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 account for an unknown level of other mortality. Based on their 5-year status review of the species, NMFS and USFWS (2007c) 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, NMFS, USFWS, and the Services 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, 2007d; 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 also found throughout the Pacific and along the southwestern U.S. coast (NMFS and USFWS 1998b). In the western Pacific, major nesting rookeries at four sites including Heron Island (Australia), Raine Island (Australia), Guam, and Japan were evaluated and determined to be increasing in abundance, with the exception of Guam which appears stable (NMFS and USFWS 2007d). 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 2007d). The main nesting sites for the green sea turtle in the eastern Pacific are located in Michoacan, Mexico and in the Galapagos Islands, Ecuador (NMFS and USFWS 2007d). The number of nesting females per year exceeds 1,000 females at each site (NMFS and USFWS 2007d). However, historically, greater than 20,000 females per year are believed to have nested in Michoacan alone (Cliffton *et al.* 1982; NMFS and USFWS 2007d). The Pacific Mexico green turtle nesting population (also called the black turtle) is considered endangered.

Historically, green sea turtles were used in many areas of the Pacific for food. They were also commercially exploited, which, coupled with habitat degradation, led to their decline in the Pacific (NMFS and USFWS 1998b). 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 1998b; 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 more 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 6 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 Syria coast was surveyed in 1991, but nesting activity was attributed to loggerheads) bodes well for the ongoing speculation that the unsurveyed coast of Libya may also host substantial nesting.

Atlantic Ocean

Distribution and Life History

As has occurred in other oceans of its range, green sea turtles were once the target of directed fisheries in the United States and throughout the Caribbean. In 1890, over one million pounds of green sea turtles were taken 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). As is the case with the other sea turtle species described above, adult females may nest multiple times in a season (average 3 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

Like other sea turtle species, 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 5-year status review for the species identified eight geographic areas considered to be primary sites for threatened green sea turtle nesting in the Atlantic/Caribbean, and reviewed the trend in nest count data for each (NMFS and USFWS 2007d). 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 2007d). 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 2007d).

Seminoff (2004) reviewed green sea turtle nesting data for eight sites in the western, eastern, and central Atlantic, including all of the above threatened nesting sites with the exception 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 with the exception of nesting at 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 that would change the overall status of the species in the Atlantic (NMFS and USFWS 2007d).

By far, the most important nesting concentration for green sea turtles in the western Atlantic is in Tortuguero, Costa Rica (NMFS and USFWS 2007d). 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 2007d). 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 2007d).

The status of the endangered Florida breeding population was also evaluated in the 5-year review (NMFS and USFWS 2007d). 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 United States (NMFS and USFWS 2007d).

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 2007d). 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 be most affected in that they 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).

As with the other sea turtle species, incidental fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches. Witherington *et al.* (2009) observes 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 take levels, 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) also lists five observed captures of green turtle 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., Biological Opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). The Southeast/Gulf of Mexico shrimp trawl fishery was responsible for the vast majority of U.S. interactions (up to 98%) and mortalities (more than 80%). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations.

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).

Summary of Status of Green Sea Turtles
A review of 32 Index Sites[5] distributed globally revealed a 48-67% decline in the number of mature females nesting annually over the last three generations[6] (Seminoff 2004). An evaluation of green sea turtle nesting sites was also conducted as part of the 5-year status review of the species (NMFS and USFWS 2007d). 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 2007d). 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 2007d). However, nesting populations were determined to be doing relatively poorly in Southeast Asia, eastern Indian Ocean, and perhaps 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 2007d). 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 2007d).

Seminoff (2004) and NMFS and USFWS (2007d) made comparable conclusions with regard to nesting for four nesting sites in the western Atlantic that indicate sea turtle abundance is increasing in the Atlantic Ocean. Each 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 had increased markedly since the 1970s (Seminoff 2004; NMFS and USFWS 2007d).

However, the 5-year review also noted that the Tortuguero nesting stock continued to be affected by ongoing directed take at their primary foraging area in Nicaragua (NMFS and USFWS 2007d). 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 account for an unknown level of other mortality. Based on its 5-year status review of the species, NMFS and USFWS (2007d) determined that the listing

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[5] The 32 Index Sites include all of the major known nesting areas as well as many of the lesser nesting areas for which quantitative data are available.

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

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 in the future to determine whether DPSs should be identified (NMFS and USFWS 2007d).

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. 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 1998a, 2007b; Sarti *et al.* 2000). In the western Pacific, major nesting beaches occur 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, leatherback sea turtles have only been known to nest in low densities and scattered sites.

The largest, extant leatherback nesting group in the Indo-Pacific lies on the North Vogelkop coast of West Papua, Indonesia, with 3,000-5,000 nests reported annually in the 1990s (Suárez *et al.* 2000). However, in 1999, local villagers started reporting dramatic declines in sea turtles near their villages (Suárez 1999). Declines in nesting groups have been 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. Based on their models, Spotila *et al.* (2000) estimated that the group could fall to less than 50 females by 2003-2004. Another, more recent, analysis of the Costa Rican nesting beaches indicates a decline in nesting during 15 years of monitoring (1989-2004) with approximately 1,504 females nesting in 1988-1989 to an average of 188 females nesting in 2000-2001 and 2003-2004 (NMFS and USFWS 2007b), indicating that the reductions in nesting females were not as extreme as the reductions predicted by Spotila *et al.* (2000).

On September 26, 2007, NMFS received a petition to revise the critical habitat designation for leatherback sea turtles to include waters along the U.S. West Coast. On December 28, 2007, NMFS published a positive 90-day finding on the petition and convened a critical habitat review team. On January 26, 2012, NMFS published a final rule to revise the critical habitat designation to include three particular areas of marine habitat. The designation includes approximately 16,910 square miles along the California coast from Point Arena to Point Arguello east of the 3,000 meter depth contour, and 25,004 square miles from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 meter depth contour. The areas comprise approximately 41,914 square miles of marine habitat and include waters from the ocean surface down to a maximum depth of 262 feet. The designated critical habitat areas contain the physical or biological feature essential to the conservation of the species that may require special management conservation or protection. In particular, the team identified one Primary Constituent Element: the occurrence of prey species, primarily scyphomedusae of the order 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 Ocean. 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 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 1 to 4,151 m, but 84.4% of sightings were in waters less than 180 m (Shoop and Kenney 1992). Leatherbacks were sighted in waters within a sea surface temperature range similar to that observed for loggerheads; from 7°-27.2°C (Shoop and Kenney 1992). However, leatherbacks appear to have a greater tolerance for colder waters 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, FWS 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 9 years reported as a likely minimum (Zug and Parham 1996) and 19 years as a likely maximum (NMFS SEFSC 2001). However, new sophisticated analyses suggest that leatherbacks in the Northwest Atlantic may reach maturity at 24.5-29 years of age (Avens *et al.* 2009). In the United States and Caribbean, female leatherbacks nest from March through July. In the Atlantic, most nesting females average between 150-160 cm curved carapace length (CCL), although smaller (<145 cm CCL) and larger nesters are observed (Stewart *et al.* 2007, TEWG 2007). They nest frequently (up to seven nests per year) during a nesting season and nest about every 2-3 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. Therefore, the actual proportion of eggs that can result in hatchlings is less than the total number of eggs produced per season. 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 cm CCL, Eckert (1999) found that leatherback juveniles remain in waters warmer than 26°C until they exceed 100 cm CCL.

Population Dynamics and Status

As described earlier, sea turtle nesting survey data is important in that 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 5-year review for leatherback sea turtles (NMFS and USFWS 2007b) compiled the most recent information on mean number of leatherback nests per year for each of the seven leatherback populations or groups of populations that were identified by the Leatherback TEWG as occurring within the Atlantic. These are: Florida, North Caribbean, Western Caribbean, Southern Caribbean, West Africa, South Africa, and Brazil (TEWG 2007).

In the United States, the Florida Statewide Nesting Beach Survey program has documented an increase in leatherback nesting numbers from 98 nests in 1988 to between 800 and 900 nests in the early 2000s (NMFS and USFWS 2007b). 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 exception of the Western Caribbean and West Africa. 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 using nest numbers from 1967-2005, a positive population growth rate was found over the 39-year period for French Guinea and Suriname, with 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 United States at approximately 300-600 animals (from near Nova Scotia, Canada to Cape Hatteras, North Carolina) (Shoop and Kenney 1992). However, the estimate was based on turtles visible at the surface and does not include those that were below the surface out of view. Therefore, it likely underestimated the leatherback population for the northeastern United States 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 of leatherbacks 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 5-year status review (NMFS and USFWS 2007b) 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., Biological Opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). The Southeast/Gulf of Mexico shrimp trawl fishery was responsible for the vast majority of U.S. interactions (up to 98%) and mortalities (more than 80%). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations.

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 2004c). 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[7]), whelk/conch (15), black sea bass (10), crab (2), and research pot gear (1). A review of leatherback mortality documented by the STSSN in

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

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 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 although on a much smaller scale. In October 2001, for example, a NMFS fisheries observer documented the take of a leatherback in a bottom otter trawl fishing for *Loligo* squid off of 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 NEFSC Fisheries Observer Program 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 (NMFS SEFSC 2001). In addition to these, in September 1995, two dead leatherbacks were removed from an 11-inch (28.2-cm) monofilament shark gillnet set in the nearshore waters off of Cape Hatteras (STSSN unpublished data reported in NMFS 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. Entanglements occur in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in fishing gear including salmon net, herring net, gillnet, trawl line, and crab pot line. 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 *et al.*1998). Observers on shrimp trawlers operating in the northeastern region of Venezuela documented the capture of six leatherbacks from 13,600 trawls (Marcano and Alio-M. 2000). An estimated

1,000 mature female leatherback sea turtles are caught annually in fishing nets off of Trinidad and Tobago with mortality estimated to be between 50%-95% (Eckert and Lien 1999). Many of the sea turtles do not die as a result of drowning, but rather because the fishermen cut them out of their nets (NMFS SEFSC 2001).

Leatherbacks may be more susceptible to marine debris ingestion than other sea turtle species due to the tendency of floating debris to concentrate in convergence zones that juveniles and adults use for feeding (Shoop and Kenney 1992; Lutcavage *et al.* 1997). Investigations of the necropsy results of leatherback sea turtles revealed that a substantial percentage (34% of the 408 leatherback necropsies' recorded between 1885 and 2007) reported plastic within the turtles' 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.

Summary of Status for Leatherback Sea Turtles

In the Pacific Ocean, the abundance of leatherback sea turtles on nesting beaches has declined dramatically over 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 by the combined effects of human activities that have reduced the number of nesting females and reduced the reproductive success of females that manage to nest (for example, egg poaching) (NMFS and USFWS 2007b). No reliable long term trend data for the Indian Ocean populations are currently available. While leatherbacks are known to occur in the Mediterranean Sea, nesting in this region is not known to occur (NMFS and USFWS 2007b).

Nest counts in many areas of the Atlantic Ocean show increasing trends, including for beaches in Suriname and French Guiana which support the majority of leatherback nesting (NMFS and USFWS 2007b). The species as a whole continues to face numerous threats in nesting and marine habitats. As with the other sea turtle species, fishery mortality 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 mortality. The long term recovery potential of this species may be further threatened by observed low genetic diversity, even in the largest nesting groups like French Guiana and Suriname (NMFS and USFWS 2007b).

Based on its 5-year status review of the species, NMFS and USFWS (2007b) determined that endangered leatherback sea turtles should not be delisted or reclassified. 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 (NMFS and USFWS 2007b).

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 which Atlantic sturgeon DPSs likely occur in the action area and provide information on the use of the action area by Atlantic sturgeon.

The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) is a subspecies of sturgeon distributed along the eastern coast of North America from Hamilton Inlet, Labrador, Canada to Cape Canaveral, Florida, USA (Scott and Scott 1988; ASSRT 2007; Thomas Savoy, CTDEP, pers. comm.). NMFS has delineated U.S. populations of Atlantic sturgeon into five DPSs[8] (77 FR 5880 and 77 FR 5914). These are: the Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs (see Figure 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, genetic data as well as tracking and tagging data demonstrate sturgeon from each DPS and Canada occur throughout the full range of the subspecies. Therefore, sturgeon originating from any of the 5 DPSs can be affected by threats in the marine, estuarine and riverine environment that occur far from natal spawning rivers.

On February 6, 2012, we published notice in the *Federal Register* that we were listing the New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs as "endangered," and the Gulf of Maine DPS as "threatened" (77 FR 5880 and 77 FR 5914). The effective date of the listings was April 6, 2012. The DPSs do not include Atlantic sturgeon that are spawned in Canadian rivers. Therefore, Canadian spawned fish are not included in the listings.

As described below, individuals originating from the five listed DPSs may occur in the action area. Information general to all Atlantic sturgeon as well as information specific to each of the relevant DPSs, is provided below.

4.2.6.1 Atlantic sturgeon life history

Atlantic sturgeon are long lived (approximately 60 years), late maturing, estuarine dependent, anadromous[9] fish (Bigelow and Schroeder, 1953; Vladykov and Greeley 1963; Mangin, 1964; Pikitch *et al.*, 2005; Dadswell, 2006; ASSRT, 2007).

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[8] 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."

[9] 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)

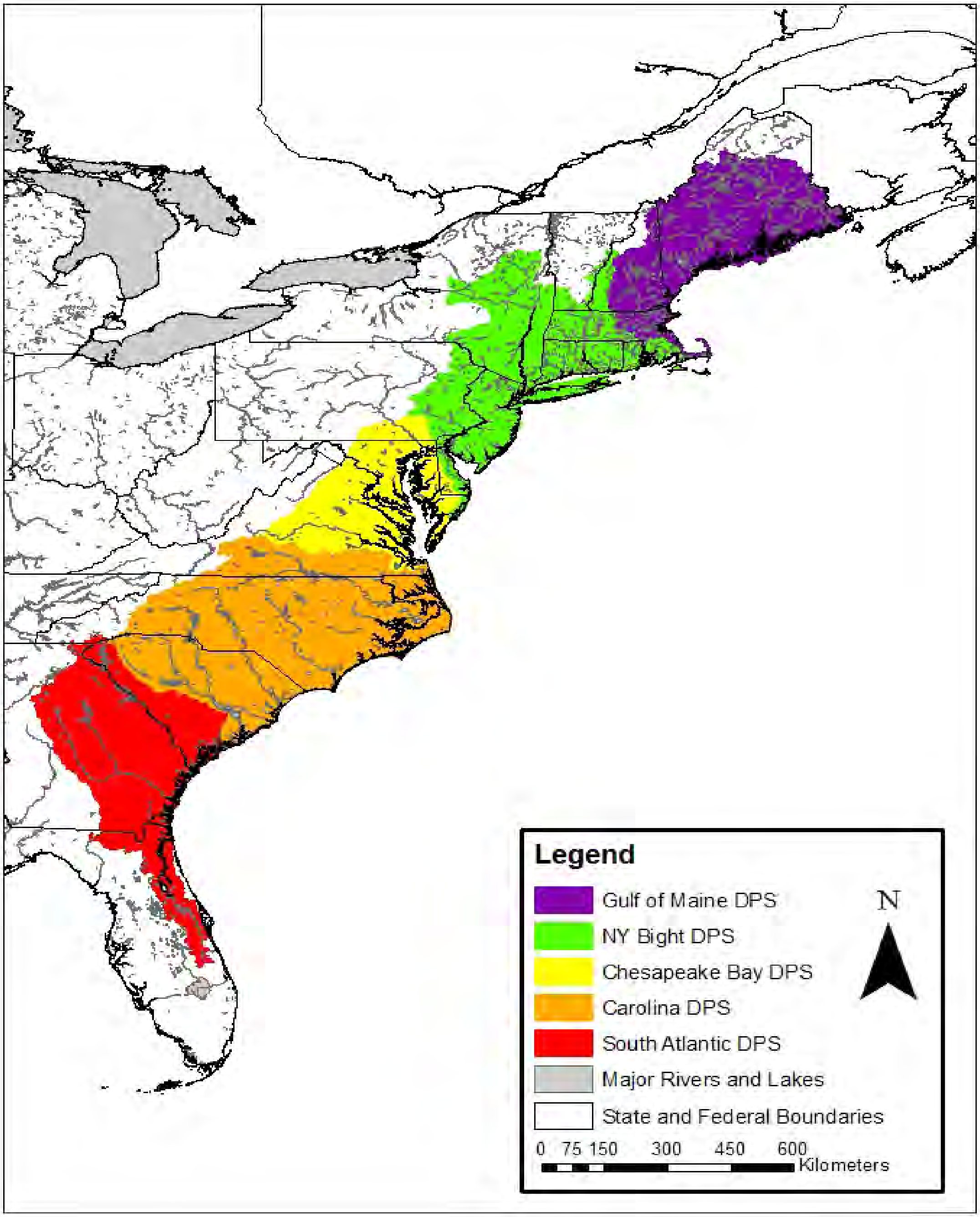

Figure 5. Map Depicting the Boundaries of the five Atlantic sturgeon DPSs

The life history of Atlantic sturgeon can be divided up into five general categories as described in the table below (adapted from ASSRT 2012).

Age Class	**Size**	**Description**
Egg		Fertilized or unfertilized
Larvae		Negative photo-taxic, nourished by yolk sac
Young of 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

Table 2. Descriptions of Atlantic sturgeon life history stages.

They are a relatively large fish, even amongst sturgeon species (Pikitch *et al.* 2005). Atlantic sturgeons are bottom feeders that suck food into a ventrally-located 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, insect larvae, and other invertebrates (Bigelow and Schroeder 1953; ASSRT 2007; Guilbard *et al.* 2007).

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; and (4) the length of Atlantic sturgeon caught since the mid-late 20th century have typically been less than 3 meters (Smith *et al.* 1982, 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). 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). However, while females are prolific with egg production ranging from 400,000 to 4 million eggs per spawning year, females spawn at intervals of 2-5 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 1-5 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 (ASMFC 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; ASMFC 2009), and remain on the spawning grounds throughout the spawning season (Bain 1997). Females begin spawning migrations when temperatures are closer to 12° C 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 cm/s 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; ASMFC 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; ASMFC 2009), and become adhesive shortly after fertilization (Murawski and Pacheco 1977; Van den Avyle 1983; 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 egg deposition (ASSRT 2007).

Larval Atlantic sturgeon (*i.e.*, less than 4 weeks old, with total lengths (TL) less than 30 mm; Van Eenennaam *et al.* 1996) are assumed to undertake a demersal existence and inhabit the same riverine or estuarine areas where they were spawned (Smith *et al.* 1980; Bain *et al.* 2000; Kynard and Horgan 2002; ASMFC 2009). Studies suggest that age-0 (i.e., young-of-year), 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.* 2004; USFWS 2004; 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). Shirey (Delaware Department of Fish and Wildlife, unpublished data reviewed in ASMFC 2009) found a similar movement pattern for juvenile Atlantic sturgeon based on recaptures of fish originally tagged in the Delaware River. 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, North Carolina 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 near shore fisheries with few fish reported from waters in excess of 25 meters (C. Shirey, Delaware Department of Fish and Wildlife, unpublished data reviewed in ASMFC 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.* 2004; Wehrell 2005; Dadswell 2006; ASSRT 2007; Laney *et al.* 2007). These sites may be used as foraging sites and/or thermal refuge.

4.2.6.2 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 46%; SA 29%; CB 16%; GOM 8%; and Carolina 0.5%. These percentages are largely based on genetic sampling of individuals (n=89) sampled in commercial fisheries by NEFOP. This covers captures from the Gulf of Maine to Cape Hatteras 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. Carolina DPS origin fish have rarely been detected in samples taken in the Northeast; however, mixed stock analysis from some sampling efforts (*e.g.*, Long Island Sound, n=275), indicates that approximately 0.5% of the fish sampled were Carolina DPS origin. Because any Carolina origin Atlantic sturgeon that were sampled in Long Island Sound would have swam through the action area, it is reasonable to expect that 0.5% of the Atlantic sturgeon captured in the action area could originate from the Carolina DPS. 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. (2012a).

4.2.6.3 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; Kennebec River Resource Management Plan 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, 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 16 U.S. rivers are known to support spawning based on available evidence (*i.e.*, presence of young-of-year 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 four rivers (Kennebec, Hudson, Delaware, James) are known to currently support spawning from Maine through Virginia where historical records support there used to be fifteen spawning rivers (ASSRT 2007). Thus, there are substantial gaps in the range 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. Therefore, there are no published abundance estimates for any of the five DPSs of Atlantic sturgeon. An annual mean estimate of 863 mature adults (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 River and Altamaha River 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).

Kahnle *et al.* (2007) estimated the number of total mature adults per year in the Hudson River using data from surveys in the 1980s to mid-1990s and based on mean harvest by sex divided by sex specific exploitation rate. While this data is over 20 years old, it is currently the best available data on the abundance of Hudson River origin Atlantic sturgeon. The sex ratio of spawners is estimated to be approximately 70% males and 30% females. As noted above, Kahnle *et al.* (2007) estimated a mean annual number of mature adults at 596 males and 267 females. It is important to note that the authors of this paper have stated that this is an estimate of the annual mean number of Hudson River mature adults during the 1985-1995 period, not an estimate of the number of spawners per year.

4.2.6.4 Threats faced by Atlantic sturgeon throughout their range

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).

Based on the best available information, NMFS has concluded that unintended catch of Atlantic sturgeon in fisheries, vessel strikes, poor water quality, water 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 of 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 the 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, given that Atlantic sturgeon depend on a variety of habitats, every life stage is likely affected by one or more of the identified threats.

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. Complementary regulations were implemented by NMFS in 1999 that prohibit fishing for, harvesting, possessing or retaining Atlantic sturgeon or its 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 Gulf of Maine and the New York Bight DPSs have been incidentally captured in other Bay of Fundy fisheries (DFO 2010; 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 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 Gulf of Maine DPS, with a smaller percentage from the New York Bight DPS.

Fisheries bycatch in U.S. waters is the primary threat faced by all 5 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 prepared by the NEFSC estimates that from 2006 through 2010 there were 2,250 to 3,862 encounters per year in observed gillnet and trawl fisheries, with an average of 3,118 encounters. Mortality rates in gillnet gear are approximately 20%, with the exception of monkfish gear which has a higher mortality rate of approximately 27%. Mortality rates in otter trawl gear are believed to be lower at approximately 5%.

4.2.7 Gulf of Maine DPS of Atlantic sturgeon

The Gulf of Maine DPS includes the following: all anadromous Atlantic sturgeons that 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. 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 these rivers. Atlantic sturgeons that are spawned elsewhere continue to use habitats within all of these rivers as part of their overall marine range (ASSRT 2007). The movement of subadult and adult sturgeon between rivers, including to and from the Kennebec River and the Penobscot River, demonstrates that coastal and marine migrations are key elements of Atlantic sturgeon life history for the Gulf of Maine DPS as well as likely throughout the entire range (ASSRT 2007; Fernandes, *et al.* 2010).

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 1998; NMFS and USFWS 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) capture of 31 adult Atlantic sturgeon from June 15,1980, 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 4 ripe males and 1 ripe female captured on July 26,1980; and, (3) 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, ME (NMFS and USFWS 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.

Several threats play a role in shaping the current status of Gulf of Maine 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). Following the 1880s, the sturgeon fishery was almost non-existent due to a collapse of the sturgeon stocks. All directed Atlantic sturgeon fishing as well as retention of Atlantic sturgeon by catch has been prohibited since 1998. Nevertheless, mortalities associated with bycatch in fisheries occurring in state and federal waters still occurs. In the marine range, Gulf of Maine DPS Atlantic sturgeon are incidentally captured in federal and state managed fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (Stein *et al.* 2004; 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 Gulf of Maine DPS have navigation channels that are maintained by dredging. Dredging outside of Federal channels and in-water construction occurs throughout the Gulf of Maine 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; however, as noted above, not all projects are monitored for interactions with fish. 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 natural falls and likely represent the maximum upstream extent of sturgeon occurrence even if the dams were not present. Because no Atlantic sturgeon are known to 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. While not expected to be killed or injured during passage at a dam, the extent that Atlantic sturgeon are affected by the existence of dams and their operations in the Gulf of Maine region is currently unknown. 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 and Great Works Dams. Together these dams prevent Atlantic sturgeon from accessing approximately 29 km of habitat, including the presumed historical spawning habitat located downstream of Milford Falls, the site of the Milford Dam. While removal of the Veazie and Great Works Dams is anticipated to occur in the near future, the presence of these dams is currently preventing access to significant habitats within the Penobscot River. While Atlantic sturgeon are known to occur in the Penobscot River, it is unknown if spawning is currently occurring or whether the presence of the Veazie and Great Works Dams affects the likelihood of spawning 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. Like the Penobscot, it is unknown how the Essex Dam affects the likelihood of spawning occurring in this river.

Gulf of Maine 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 industrial discharges from pulp and paper mills. 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 empirical abundance estimates for the Gulf of Maine DPS. The Atlantic sturgeon SRT (2007) presumed that the Gulf of Maine DPS was comprised of less than 300 spawning adults per year, based on abundance estimates for the Hudson and Altamaha River 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 explained above, we have estimated that there is an annual mean of 166 mature adult Atlantic sturgeon in the GOM DPS.

Summary of the Gulf of Maine DPS
Spawning for the Gulf of Maine DPS is known to occur in two rivers (Kennebec and Androscoggin) and possibly in a third. Spawning may be occurring in other rivers, such as the Sheepscot or Penobscot, but has not been confirmed. There are indications of increasing abundance of Atlantic sturgeon belonging to the Gulf of Maine 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.*, the Saco, Presumpscot, and Charles rivers). These observations suggest that abundance of the Gulf of Maine 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 Gulf of Maine 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). There are strict regulations on the use of fishing gear in Maine state waters that incidentally catch sturgeon. In addition, 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 the 84 fish) of interactions observed in the Mid Atlantic/Carolina region being assigned to the Gulf of Maine DPS (Wirgin and King 2011). Tagging results also indicate that Gulf of Maine DPS fish tend to remain within the waters of the Gulf of Maine and only occasionally venture to points south. However, 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 Gulf of Maine DPS (Wirgin *et al.* in draft).

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). NMFS has determined that the Gulf of Maine 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 New York Bight DPS includes the following: all anadromous Atlantic sturgeon spawned in the watersheds that drain into coastal waters from Chatham, Massachusetts to the Delaware-

Maryland border on Fenwick Island. 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 prior to the onset of expanded exploitation in the 1800s is unknown but, has been conservatively estimated at 10,000 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 River 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 1980's (Kahnle *et al.* 1998; Sweka *et al.* 2007; ASMFC 2010). Catch-per-unit-effort 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). In examining the CPUE data from 1985-2007, there are significant fluctuations during this time. There appears to be a decline in the number of juveniles between the late 1980s and early 1990s and while the CPUE is generally higher in the 2000s as compared to the 1990s, given the significant annual fluctuation it is difficult to discern any trend. Despite the CPUEs from 2000-2007 being generally higher than those from 1990-1999, they are low compared to the late 1980s. There is currently not enough information regarding any life stage to establish a trend for the Hudson River population.

There is no abundance estimate for the Delaware River population of Atlantic sturgeon. Harvest records from the 1800's 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 mm TL (Fisher 2009) and the collection of 32 YOY Atlantic sturgeon in a separate study (Brundage and O'Herron in Calvo *et al.* 2010). Genetics information collected from 33 of the 2009 year class YOY indicates that at least 3 females successfully contributed to the 2009 year class (Fisher 2011). Therefore, while the capture of YOY in 2009 provides evidence that successful spawning is still occurring in the Delaware River, the relatively low numbers suggest the existing riverine population is limited in size.

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; however, at this time we do not have information to quantify this threat or its impact to the population or the New York Bight DPS. Similar to the Hudson River, there is currently not enough information to determine a trend for the Delaware River population.

Summary of the New York Bight DPS

Atlantic sturgeon originating from the New York Bight 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 high between these rivers. There are no indications of increasing abundance for the New York Bight DPS (ASSRT 2009, 2010). Some of the impact from the threats that contributed to the decline of the New York Bight 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 New York Bight DPS.

In the marine range, New York Bight DPS Atlantic sturgeon are incidentally captured in federal and state managed fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (Stein *et al.* 2004; ASMFC TC 2007). As explained above, currently available estimates indicate that at least 4% of adults may be killed as a result of bycatch in fisheries authorized under Northeast FMPs. Based on mixed stock analysis results presented by Wirgin and King (2011), over 40% of the Atlantic sturgeon bycatch interactions in the Mid Atlantic Bight region were sturgeon from the New York Bight 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 New York Bight DPS. 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.

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. 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.

In the Hudson and Delaware Rivers, dams do not block access to historical habitat. The Holyoke Dam on the Connecticut River blocks further upstream passage; however, the extent that Atlantic sturgeon would historically have used habitat upstream of Holyoke is unknown. Connectivity 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 that Atlantic sturgeon are affected by operations of dams in the New York Bight region is currently unknown.

New York Bight DPS Atlantic sturgeon may also be affected by degraded water quality. In general, water quality has improved in the Hudson and Delaware over the past decades (Lichter *et al.* 2006; EPA 2008). Both the Hudson and Delaware rivers, as well as other rivers in the New York Bight region, were heavily polluted in the past from industrial and sanitary sewer 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.

Vessel strikes occur in the Delaware River. Twenty-nine mortalities believed to be the result of vessel strikes were documented in the Delaware River from 2004 to 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 New York Bight 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 New York Bight DPS. As explained above, we have estimated that there are an annual mean total of 950 mature adult Atlantic sturgeon in the New York Bight DPS. NMFS has determined that the New York Bight 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 Chesapeake Bay DPS includes the following: all anadromous Atlantic sturgeons that 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. 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 percent 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 2009). However, conclusive evidence of current spawning is only available for the James River. 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 prior to entering the marine system as subadults (Vladykov and Greeley 1963; ASSRT 2007; Wirgin *et al.* 2007; Grunwald *et al.* 2008).

Age to maturity for Chesapeake Bay 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 5 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 Chesapeake Bay DPS likely falls within these values.

Several threats play a role in shaping the current status of Chesapeake Bay 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 1998; 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 Chesapeake Bay 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 1998; 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). 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 through 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 New York Bight DPS.

In the marine and coastal range of the Chesapeake Bay 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.* 2004; ASMFC TC 2007; ASSRT 2007).

Summary of the Chesapeake Bay DPS

Spawning for the Chesapeake Bay 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 Chesapeake Bay DPS have been removed (*e.g.*, directed fishing) or reduced as a result of improvements in water quality since passage of the CWA. As explained above, we have estimated that there is an annual mean of 329 mature adult Atlantic sturgeon in the Chesapeake Bay DPS. We do not currently have enough information about any life stage to establish a trend for this DPS.

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 Chesapeake Bay DPS of Atlantic sturgeon. Studies have shown that Atlantic sturgeon can only sustain low levels of bycatch mortality (Boreman 1997; ASMFC TC 2007; Kahnle *et al.* 2007). The Chesapeake Bay 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. Sturgeon are commonly captured 40 miles offshore (Dewayne Fox, DSU, 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*. 2004, 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 3). 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. This represents our current knowledge of the river systems utilized by the Carolina DPS for specific life functions, such as spawning, nursery habitat, and foraging. However, fish from the Carolina DPS likely use other river systems than those listed here for their specific life functions.

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	

Table 3. 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.

The riverine spawning habitat of the Carolina DPS occurs within the Mid-Atlantic Coastal Plain ecoregion (TNC 2002a), which includes bottomland hardwood forests, swamps, and some of the world's most active coastal dunes, sounds, and estuaries. Natural fires, floods, and storms are so dominant in this region that the landscape changes very quickly. Rivers routinely change their courses and emerge from their banks. The primary threats to biological diversity in the Mid-Atlantic Coastal Plain, as listed by TNC are: global climate change and rising sea level; altered surface hydrology and landform alteration (e.g., flood-control and hydroelectric dams, inter-basin transfers of water, drainage ditches, breached levees, artificial levees, dredged inlets and river channels, beach renourishment, and spoil deposition banks and piles); a regionally receding water table, probably resulting from both over-use and inadequate recharge; fire suppression; land fragmentation, mainly by highway development; land-use conversion (e.g., from forests to timber plantations, farms, golf courses, housing developments, and resorts); the invasion of exotic plants and animals; air and water pollution, mainly from agricultural activities including concentrated animal feed operations; and over-harvesting and poaching of species. Many of the Carolina DPS' spawning rivers, located in the Mid-Coastal Plain, originate in areas of marl. Waters draining calcareous, impervious surface materials such as marl are: (1) likely to be alkaline; (2) dominated by surface run-off; (3) have little groundwater connection; and, (4) are seasonally ephemeral.

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 extirpated, with a 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, is estimated to be less than 3 percent of what they were historically (ASSRT 2007).

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 over 60 percent 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 (DO)) 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 degraded water quality in the Cape Fear River. Water quality in the Waccamaw and Pee Dee rivers have 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 North Carolina Department of Environmental and Natural Resources or other resource agencies. Since the 1993 legislation requiring certificates for transfers, 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 DO. 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 DO, 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, from which they have never rebounded. Further, continued overutilization of Atlantic sturgeon as bycatch in commercial fisheries is an ongoing impact to the Carolina DPS. Atlantic sturgeon are more 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 percent 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 percent, 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. Little data exists on bycatch in the Southeast and high levels of bycatch underreporting are suspected. Further, a total population abundance for the DPS is not available, and it is therefore not possible to calculate the percentage of the DPS subject to bycatch mortality based on the available bycatch mortality rates for individual fisheries. However, 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 DO). 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 have addressed impacts to Atlantic sturgeon through directed fisheries, there are currently no mechanisms in place to address the significant risk posed to Atlantic sturgeon from commercial bycatch. Though statutory and regulatory mechanisms exist that authorize reducing the impact of dams on riverine and anadromous species, such as Atlantic sturgeon, and their habitat, 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 Carolina DPS, even with existing controls on some pollution sources. Current regulatory regimes are not necessarily 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.*, DO). Additional data regarding sturgeon use of riverine and estuarine environments is 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 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 occurred with Atlantic sturgeon 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 a 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 results 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 sturgeon populations. 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 will 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) potential loss of unique haplotypes; (5) potential 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, the immigration into marine habitats to grow, and then the return of adults to natal rivers to spawn.

Summary of the Status of the Carolina DPS of Atlantic Sturgeon

In summary, the Carolina DPS is estimated to number less than 3% of its historic population size. There are estimated to be less than 300 spawning adults per year (total of both sexes) in each of the major river systems occupied by the DPS in which spawning still occurs, whose freshwater range occurs 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. 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 over 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 DO) 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 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 the existing regulatory mechanisms, such as the moratorium on directed fisheries for Atlantic sturgeon, bycatch is currently not being addressed through existing mechanisms. Further, access to habitat and water quality continues to be a problem even with NMFS's authority under the Federal Power Act to recommend fish passsage and existing controls on some pollution sources. 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 South Atlantic 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 South Atlantic DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida.

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 4). 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. This represents our current knowledge of the river systems utilized by the South Atlantic DPS for specific life functions, such as spawning, nursery habitat, and foraging. However, fish from the South Atlantic DPS likely use other river systems than those listed here for their specific life functions.

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	

Table 4. Major rivers, tributaries, and sounds within the range of the South Atlantic DPS and currently available data on the presence of an Atlantic sturgeon spawning population in each system.

The riverine spawning habitat of the South Atlantic DPS occurs within the South Atlantic Coastal Plain ecoregion (TNC 2002b), which includes fall-line sandhills, rolling longleaf pine uplands, wet pine flatwoods, isolated depression wetlands, small streams, large river systems, and estuaries. Other ecological systems in the ecoregion include maritime forests on barrier islands, pitcher plant seepage bogs and Altamaha grit (sandstone) outcrops. Other ecological systems in the ecoregion include maritime forests on barrier islands, pitcher plant seepage bogs and Altamaha grit (sandstone) outcrops. The primary threats to biological diversity in the South Atlantic Coastal Plain listed by TNC are intensive silvicultural practices, including conversion of natural forests to highly managed pine monocultures and the clear-cutting of bottomland hardwood forests. Changes in water quality and quantity, caused by hydrologic alterations (impoundments, groundwater withdrawal, and ditching), and point and nonpoint pollution, are threatening the aquatic systems. Development is a growing threat, especially in coastal areas. Agricultural conversion, fire regime alteration, and the introduction of nonnative species are additional threats to the ecoregion's diversity. The South Atlantic DPS's spawning rivers, located in the South Atlantic Coastal Plain, are primarily of two types: brownwater (with headwaters north of the Fall Line, silt-laden) and blackwater (with headwaters in the coastal plain, stained by tannic acids).

Secor (2002) estimates that 8,000 adult females were present in South Carolina prior to 1890. Prior to the collapse of the fishery in the late 1800s, the sturgeon fishery was the third largest fishery in Georgia. Secor (2002) estimated from U.S. Fish Commission landing reports that approximately 11,000 spawning females were likely present in the state prior to 1890. Reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the South Atlantic DPS. Currently, the Atlantic sturgeon spawning population in at least two river systems within the South Atlantic DPS has been extirpated. The Altamaha River population of Atlantic sturgeon, with an estimated 343 adults spawning annually, is believed to be the largest population in the Southeast, yet is estimated to be only 6 percent of its historical population size. The abundances of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, is estimated to be less than 1% of what they were historically (ASSRT 2007).

Threats

The South Atlantic 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 dredging and degraded water quality is contributing to the status of the South Atlantic DPS. Dredging is a present threat to the South Atlantic DPS and is contributing to their 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 DO 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 South Atlantic DPS. Low DO is modifying sturgeon habitat in the Savannah due to dredging, and non-point source inputs are causing low DO in the Ogeechee River and in the St. Marys River, which completely eliminates juvenile nursery habitat in summer. Low DO has also been observed in the St. Johns River in the summer. Sturgeon are more sensitive to low DO and the negative (metabolic, growth, and feeding) effects caused by low DO increase when water temperatures are concurrently high, as they are within the range of the South Atlantic 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 South Atlantic 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, 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 South Atlantic DPS are likely much higher. The removal of large amounts of water from the system will alter flows, temperature, and DO. Water shortages and "water wars" are already occurring in the rivers occupied by the South Atlantic 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 DO, all of which are current stressors to the South Atlantic DPS.

Overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations in the Southeast, from which they have never rebounded. Further, continued overutilization of Atlantic sturgeon as bycatch in commercial fisheries is an ongoing impact to the South Atlantic DPS. The loss of large subadults and adults as a result of bycatch impacts Atlantic sturgeon populations 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. Little data exists on bycatch in the Southeast and high levels of bycatch underreporting are suspected. Further, a total population abundance for the DPS is not available, and it is therefore not possible to calculate the percentage of the DPS subject to bycatch mortality based on the available bycatch mortality rates for individual fisheries. However, 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 DO). 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 have addressed impacts to Atlantic sturgeon through directed fisheries, there are currently no mechanisms in place to address the significant risk posed to Atlantic sturgeon from commercial bycatch. Though statutory and regulatory mechanisms exist that authorize reducing the impact of dams on riverine and anadromous species, such as Atlantic sturgeon, and their habitat, 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 South Atlantic DPS, even with existing controls on some pollution sources. Current regulatory regimes are not necessarily 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.*, DO). Additional data regarding sturgeon use of riverine and estuarine environments is needed.

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 South Atlantic 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 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 South Atlantic DPS have remained relatively constant at greatly reduced levels (approximately 6 percent of historical population sizes in the Altamaha River, and 1 percent of historical population sizes in the remainder of the DPS) for 100 years. Small numbers of individuals resulting from drastic reductions in populations, such as occurred with Atlantic sturgeon 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 a 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 results increases the timeframe over which exposure to the multitude of threats facing the South Atlantic DPS can occur.

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

The South Atlantic DPS is estimated to number fewer than 6% of its historical population size, with all river populations except the Altamaha estimated to be less than 1% of historical abundance. There are an estimated 343 spawning adults per year in the Altamaha and less than 300 spawning adults per year (total of both sexes) in each of the other major river systems occupied by the DPS in which spawning still occurs, whose 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 South Atlantic 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 South Atlantic DPS by modifying spawning, nursery, and foraging habitat. Habitat modifications through reductions in water quality are also contributing to the status of the South Atlantic DPS through reductions in DO, 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 is also a current impact to the South Atlantic 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 reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality. While many of the threats to the South Atlantic DPS have been ameliorated or reduced due to the existing regulatory mechanisms, such as the moratorium on directed fisheries for Atlantic sturgeon, bycatch is currently not being addressed through existing mechanisms. Further, access to habitat and water quality continues to be a problem even with NMFS's authority under the Federal Power Act to recommend fish passsage 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 South Atlantic 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 5). 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 included in the table below.

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 the table below. 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

Table 5. 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	Not able to be estimated	Not able to be estimated	Not able to be estimated	Not able to be estimated
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 in this Opinion does not provide actual estimates of incidental take for any sea turtle species, the effects section provides a qualitative assessment of likely impacts based on orders of magnitude (e.g., for Kemp's ridleys, at least tens of thousands and possibly hundreds of thousands of interactions are expected annually; of those interactions, thousands and possibly tens of thousands are expected to be lethal)*

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, 4 greens, 9 Kemp's ridleys and 4 unidentified hard shell turtles since observer records began in 1993. Nearly all of these interactions resulted in the death of the turtle. To date, nearly all of these interactions have occurred in nearshore coastal waters with very few interactions in the open ocean. Similarly, few interactions between hopper dredges and Atlantic sturgeon have been observed, with just 3 records documenting interactions between hopper dredges and Atlantic sturgeon in the action area (2 in Virginia near the Chesapeake Bay entrance, and one in 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 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. The table below (Table 6) 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 6. 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
USCOE - Continued Hopper Dredging of Channels and Borrow Areas in the SE U.S.	9/25/1997	24	7	7	0	Annual Estimate
Dredging of Sandbridge Shoals, VA	4/2/1993	5	1 Kemp's ridley or green		0	
Long Island NY to Manasquan NJ Beach Nourishment	12/15/1995	5 turtles total: combination of any species				
Sandy Hook Channel Dredging	6/10/1996	2	1	2	1	2 loggerheads/green inclusive; and 1 Kemp's/leatherback
ACOE Philadelphia District Dredging	11/26/1996	4	1	1	0	Annual Estimate
MD Coastal Beach Protection Project (includes 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
Thimble Shoals and Atlantic Ocean Channels Dredging	4/25/2002	4 (≤1 million cy) 10 (>1 to ≤3 million cy) 18 (>3 to ≤5 million cy)	1 (≤1 million cy) 2 (>1 to ≤3 million cy 4 (>3 to ≤5 million cy)	0	0	
Ambrose Channel, NJ Sand Mining	10/11/2002	2	1	1	1	1 leatherback OR Kemp's

Cape Henry, York Spit, York River Entrance, and Rappahannock Shoal Channels - Maintenance Dredging	7/24/2003	4 (≤1 million cy); 10 (>1 to ≤3 million cy); 18 (>3 to ≤5 million cy)	1 (≤1 million cy); 2 (>1 to ≤3 million cy); 4 (>3 to ≤5 million cy)	0	0	
		Relocation Trawling: 120 non-lethal takes for any combination of the four species.				
Dam Neck Naval Facility Beach Dredging and Beach Nourishment	7/20/2012	1 loggerhead or Kemp's ridley		0	0	
VA Beach Hurricane Protection Project	12/2/2005	4	0	0	1	
		Relocation Trawling: Up to 45 takes in any combination of loggerheads, greens, leatherbacks, and Kemps ridleys. 1 lethal take of a loggerhead, green, leatherback OR Kemps ridley.				
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 total of 24 turtles killed (2 Kemp's, 22 loggerheads)
NASA's Wallops Island Shoreline Restoration and Infrastructure Protection Program	7/22/2010	9			1	total 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 (USN), U.S. Coast Guard (USCG), Environmental Protection Agency (EPA), Army Corps of Engineers (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 USN 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 USN activities in each of their four training range complexes along the U.S. Atlantic coast—Northeast, Virginia Capes, Cherry Point, and Jacksonville (NMFS 2009d). In addition, the following Opinions for the USN (NMFS 1996, 1997a, 2008c, 2009e) and USCG (NMFS 1995, 1998c) contain details on the scope of vessel operations for these agencies and the conservation measures that are being implemented as standard operating procedures. In the U.S. Atlantic, the operation of USCG boats and cutters is 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 USN aerial bombing training in the ocean off the southeast U.S. coast, involving drops of live ordnance (500 and 1,000-lb bombs). The resulting 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 1997a).

NMFS has also conducted more recent section 7 consultations on USN explosive ordnance disposal, mine warfare, sonar testing (e.g., AFAST, SURTASS LFA), and other major training exercises (e.g., bombing, 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 USN activities may adversely affect but would not jeopardize the continued existence of ESA-listed sea turtles (NMFS 2008c, 2009c, 2009d). 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 10 leatherbacks, are likely to experience harassment (NMFS 2009d).

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 2009 on, NOAA research vessels conducting fisheries surveys for the NEFSC are estimated to take no more than nine sea turtles per year (eight alive, one dead). This includes up to seven loggerheads as well as an additional loggerhead, leatherback, Kemp's ridley, or green sea turtle per year during bottom trawl surveys and one loggerhead, leatherback, Kemp's ridley, or green sea turtle per year during scallop dredge surveys (NMFS 2007c).

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 (NMFS 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 2004b). 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 2011). Additional information on sea turtle interactions with gillnet gear, including gillnet gear used in the Atlantic croaker fishery, has also been recently published by Murray (2009a, 2009b). The average annual bycatch of loggerhead sea turtles in gillnet gear used in the Atlantic croaker fishery, based on VTR data from 2002-2006, 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 (Warden 2011; Murray 2009a, 2009b). The average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the weakfish fishery was estimated to be 1 loggerhead sea turtle (Warden 2011). Additional information on sea turtle interactions with gillnet gear, including gillnet gear used in the weakfish fishery, has also been recently published by Murray (2009a, 2009b). The average annual bycatch of loggerhead sea turtles in gillnet gear used in the weakfish fishery, based on VTR data from 2002-2006, 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 (NMFS SEFSC 2001; Dwyer *et al.* 2002: NMFS 2007a). 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 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 (NMFS 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 (NMFS 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 2007a) 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^{o}-5^{o}C (5^{o}-9^{o}F) on average in the next 100 years which is more than the projected global increase (NAST 2000). A warming of about 0.2^{o}C per decade is projected for the next two decades over a range of emission scenarios (IPCC 2007). This temperature increase will very likely be associated with more extreme precipitation and faster evaporation of water, leading to greater frequency of both very wet and very dry conditions. Climate warming has resulted in increased precipitation, river discharge, and glacial and sea-ice melting (Greene *et al.* 2008).

The past three decades have witnessed major changes in ocean circulation patterns in the Arctic, and these were accompanied by climate associated changes as well (Greene *et al.* 2008). Shifts in atmospheric conditions have altered Arctic Ocean circulation patterns and the export of freshwater to the North Atlantic (Greene *et al.* 2008, IPCC 2006). With respect specifically to the North Atlantic Oscillation (NAO), changes in salinity and temperature are thought to be the result of changes in the earth's atmosphere caused by anthropogenic forces (IPCC 2006). The NAO impacts climate variability throughout the northern hemisphere (IPCC 2006). Data from the 1960s through 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 2006). 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 2006). On a global scale, large discharges of freshwater into the North Atlantic subarctic seas can lead to intense stratification of the upper water column and a disruption of North Atlantic Deepwater (NADW) formation (Greene *et al.* 2008, IPCC 2006). There is evidence that the NADW has already freshened significantly (IPCC 2006). This 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 2007).

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 (see Appendix A) 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 the NEFSC carrying out research vessel surveys and overseeing the two cooperative gear research studies in the action area. This consultation is considering research vessel surveys to be carried out in 2013 and 2014 and the two cooperative gear research projects to be conducted in Fall 2012/Winter 2013 (gillnet gear modification) and Winter/Spring 2013 (topless trawl). Sea turtles and Atlantic sturgeon could be affected by the proposed actions in a number of ways. This includes via: (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; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a; Morreale and Standora 2005). 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; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a; Morreale and Standora 2005). 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; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a; Morreale and Standora 2005). Recreational anglers have reported sightings of sea turtles in waters defined as inshore waters (bays, inlets, rivers, or sounds; Braun-McNeill and Epperly 2004) as far north as New York as early as March-April, but in relatively low numbers (Braun-McNeill and Epperly 2004). Greater numbers of loggerheads, 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 and dredge gear in the NEFSC research vessel surveys and the use of trawl and gillnet gear in the PSB cooperative gear research studies throughout the areas of operation. This is confirmed by the past capture of sea turtles during the NEFSC's spring and fall BTSs as well as in both the summer flounder trawl and monkfish gillnet commercial fisheries 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 many of the spring and fall NEFSC trawl surveys, it is reasonable to anticipate that Atlantic sturgeon will be present in the action area during all of the proposed actions. As described above, we expect that Atlantic sturgeon in the action area will originate from the NYB (46%), SA (29%), CB (16%), GOM (8%), and Carolina (0.5%) DPSs. It is possible that a small fraction (1%) 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 trawls and gillnet gear while sea turtles are also known to be susceptible to dredge gear. However, not all surveys and studies that use these gear types have the potential or are likely to capture these species. This is likely due to the location or season where these surveys/studies operate and the level of sampling effort involved, which affects the potential for interactions.

6.2.1 Likelihood of Interactions in the NEFSC Research Vessel Surveys

In regards to the history of interactions during NEFSC research vessel activities, sea turtles have only been captured during the NEFSC spring and fall BTSs, while Atlantic sturgeon have been captured during the NEFSC spring and fall BTSs as well as during the MADMF spring bottom trawl surveys. We do not expect any captures of ESA-listed species in the EcoMon cruise, deepwater corals and benthic habitat cruise, LMRCSC training cruise and deepwater survey, AMAPPS survey, NEFSC surf clam and ocean quahog survey, sea bass habitat survey, habitat mapping survey, and ASMFC northern shrimp survey in 2013, nor in the Atlantic herring acoustics survey, NEFSC-NERACROOS mooring cruise, deepwater biodiversity survey or large coastal shark survey potentially to occur in 2014. Because the NEFSC and MADMF BTSs have a long history, it is reasonable to utilize information on past interactions to estimate the level of future interactions for 2013 and 2014.

The NEFSC also uses scallop dredge gear in the scallop dredge survey. While no sea turtles have been captured during past scallop dredge surveys conducted by the NEFSC, sea turtles are known to be vulnerable to capture in this type of commercial gear. For this reason, we will also consider the potential for interactions in this gear type below. No captures of Atlantic sturgeon during past scallop dredge surveys have been recorded. We have reviewed the NEFOP data and there are no observed captures of Atlantic sturgeon in scallop dredge gear. This gear has not been identified as one that is likely to result in the capture of Atlantic sturgeon. As such, we do not anticipate any future interactions between Atlantic sturgeon and the scallop dredge survey.

6.2.2 Likelihood of Interactions in the Topless Trawl and Gillnet Studies

Atlantic sturgeon and sea turtles have been captured in PSB related research in the past during both otter trawl and gillnet studies (Fox *et al*. 2011; DeAlteris and Parkins 2012). For example, in the recent study by DeAlteris and Parkins (2012), the traditional trawl (identical to the control net with a 65 foot headrope consulted on in this Opinion) captured 16 sea turtles as compared to one sea turtle in the 160 foot headrope topless trawl. Because of the number of tows conducted during experimentation with these studies (*e.g.*, 59 hauls in multiple months with similar gear configurations as described in DeAlteris and Parkins (2012)), these studies may provide the best gauge statistically as to what captures may be expected in the studies proposed in this Opinion. However, because of various similarities between the NEFSC spring BTS and the topless trawl research (*e.g.*, gear, location and time of year), analysis of previous spring BTSs conducted by the NEFSC may be relevant to analyzing the effects of the topless trawl study on sea turtles and Atlantic sturgeon. Because the gillnet gear modification study is expected to occur outside of the time when sea turtles are expected to be in the action area, sea turtles are not likely to be impacted by that study. As the topless trawl study may overlap temporally and spatially when sea turtle presence is expected, that study may result in sea turtle impacts. Although limited Atlantic sturgeon interactions have been recorded in otter trawl gear from PSB related research (Salerno and Eayrs (2010) reported catch of five Atlantic sturgeon in a study conducted in May, July, and September 2009), Atlantic sturgeon interactions are known to occur with trawl gear in the action area based on incidental take data from NEFOP reporting and the NEFSC spring and fall BTSs.

6.3 Capture in Trawl Gear

Because of the similar parameters between trawls conducted with otter trawl gear in the NEFSC spring and fall BTSs and trawls conducted with topless trawl study design discussed in this Opinion, the analysis of effects of the topless trawl design will be considered similarly to effects to sea turtles and Atlantic sturgeon from the NEFSC spring and fall BTSs.

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 NEFSC research vessel surveys for 2013 and 2014 and in the PSB topless trawl survey that use this gear type and the effect of that capture on individual sea turtles. The only trawl surveys considered in this Opinion that have encountered sea turtles in the past are the NEFSC spring and fall BTSs. We do not anticipate the capture of sea turtles in any other trawl surveys. A previously conducted PSB trawl work study comparing topless trawl gear configurations resulted in 40 sea turtles captured in traditional (*i.e.*, 65 foot headrope) net design tows such as is described in the proposed action in this Opinion (DeAlteris and Parkins 2012). Fifty-nine (59) comparative tows conducted with a 160 foot headrope experimental configuration, such as is proposed in the topless trawl study component of this Opinion, resulted in zero sea turtles captured with the 160 foot headrope and nine sea turtles captured in the traditional control configuration (DeAlteris and Parkins 2012). Furthermore, the topless trawl study component of this Opinion is not expected to result in as many sea turtle captures as the study discussed by DeAlteris and Parkins (2012), as that study took place off the coast of Georgia, outside of the action area discussed in this Opinion, where at certain times of the year there is a high likelihood of sea turtle encounters with trawl nets.

The NEFSC spring and fall BTSs have been ongoing since 1963. A total of 52 sea turtles have been captured during the fall survey; all except one leatherback (captured in 2009) were loggerheads. Sea turtles were captured in 25 of the 49 years that sampling has occurred with the annual number of captures ranging from zero to six (1994). Only one mortality has been recorded; one loggerhead was killed during the 1995 fall BTS. Based on the turtle's injuries, the NEFSC determined the cause of death was collision with the trawl doors. A total of 13 sea turtles have been captured during the spring BTS; all were loggerheads. Sea turtles were captured in 10 of the 49 years that sampling has occurred with the annual number of captures ranging from zero to three (1985). This data includes two loggerheads captured in winter surveys that are now incorporated into the spring survey work. In many years, trawl duration was 30 minutes. However, most recently, trawl duration has been (and will be in 2013 and 2014) 20 minutes. The trawl duration of individual tows of the topless trawl study are yet to be determined, but as mentioned previously, will be standardized and will be reflective of that used in the commercial fishery. Tows will not exceed 60 minutes in length (Henry Milliken, NEFSC, pers. comm.).

NEFOP data on sea turtle interactions with non-TED bottom trawls for fish and scallops from June 1994 through December 2008 in the Mid-Atlantic indicate that 112 loggerhead, 3 Kemp's ridley, 2 leatherback, and 6 unknown sea turtle observed interactions occurred over that time period (Warden 2011). No sea turtle interactions were recorded between April 15 and May 15 of any year and interaction rate and magnitude were highest in shallow, warm waters (depth less than 50 meters and SST greater than 15°C) with the highest rate below 37° N latitude (Warden 2011). As such, the interaction rate of sea turtles with the NEFSC spring and fall BTSs and the PSB topless trawl study is expected to be smaller than the general rate indicated in NEFOP data from June 1994 through December 2008 in the Mid-Atlantic.

The average number of sea turtle captures in the annual NEFSC spring and fall BTSs is 0.2 and 1.0, respectively (this includes the two turtles caught in the winter surveys). However, as noted above, as many as three loggerheads have been captured in one year for the spring survey and six in one year for the fall survey; therefore, it is reasonable to expect that up to three loggerheads could be captured during the spring BTS and up to six loggerheads could be captured during the fall BTS. No Kemp's ridley or green sea turtles have been captured in the past during any surveys. However, because these species occur in the action area and are known to be vulnerable to capture in bottom otter trawl gear, we anticipate that one Kemp's ridley and one green sea turtle could be captured during either the spring or fall BTS. Based on the capture of one leatherback sea turtle in the 2009 fall survey, we also anticipate that one leatherback sea turtle could be captured in either the spring or fall BTS.

Because the PSB topless trawl study involves a smaller number of tows than the spring BTS (*i.e.*, approximately 385 stations versus up to 80 paired tows proposed for the topless trawl study), we do not expect the topless trawl study to result in any more sea turtle captures than the spring BTS. However, topless trawl tows may be up to three times the duration of survey tows (*i.e.*, 60 minute tows for the study versus 20 minute tows for the survey in similarly sized nets) which could increase the likelihood of sea turtle captures in the topless trawl study. Because previous PSB study work with trawls is less similar to the topless trawl study than the NEFSC spring bottom trawl survey, we expect sea turtle interactions as a result of the spring BTS to be the best available estimate for sea turtle interactions as a result of the topless trawl study.

The number of sea turtles captured annually in the NEFSC spring and fall BTSs 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 and 2014, 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 upcoming surveys. Based on the information presented above, we anticipate the following captures of sea turtles in the trawl surveys annually in 2013 and 2014:

Table 7. Expected number of annual sea turtle captures in the NEFSC Spring and Fall BTS for 2013 and 2014.

Sea Turtle Species	Spring	Fall
Loggerhead	3	6
Kemp's ridley	1 in either season	
Green	1 in either season	
Leatherback	1 in either season	

The topless trawl study discussed in this Opinion is expected to begin in late March to early April 2013 and be complete by sometime in the middle of June 2013. As such, sea turtles may be encountered in that study after the middle of May as indicated by NEFOP data in Warden (2011). In late May, it is expected that sea turtles may begin to move into the action area where they may be vulnerable to capture by trawl gear utilized in the topless trawl study. Although information to estimate the number of sea turtle interactions expected with the topless trawl study is available for past NEFSC spring BTS data, a study conducted in 2009 was similar in nature to the topless trawl study proposed in this Opinion and it resulted in the catch of no sea turtles (Salerno and Eayrs 2010). Furthermore, one half of all topless trawl study tows will utilize a 160 foot head rope where, based upon observations discussed previously in this Opinion, we don't expect those tows to result in sea turtle catch. Because sea turtles may be in the area at the time the topless trawl study is proposed to take place, we do expect the topless trawl study to result in the capture of sea turtles, but at no more than the rate anticipated for the NEFSC spring BTS. Based on the information presented above, we anticipate six captures of sea turtles in the topless trawl study in Winter/Spring 2013; three loggerheads, one Kemp's ridley, one green, and one leatherback sea turtle.

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.* 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 2002a). 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 2012).

Tows for the spring and fall bottom trawl surveys will be 20 minutes in duration. Tows for the topless trawl survey will be less than 60 minutes in length. 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 tow time between 20 and 50 minutes for the bottom otter trawl gear to be used in the survey or the study will likely eliminate the risk of death from forced submergence for sea turtles caught in the bottom otter trawl survey or study gear. Tow times between 50 and 60 minutes may result in an escalated mortality rate compared to tow times of 50 minutes or less (Sasso and Epperly 2006 and Henwood and Stuntz 1987).

As explained above, only one sea turtle mortality has occurred since the NEFSC bottom trawl surveys began; this turtle suffered injuries (cracks to the carapace) causing death (Wendy Teas, SEFSC, pers. comm. to Linda Despres, NEFSC). All other captured sea turtles were alive and returned to the water unharmed. Based on past results and the short duration of the tows, we do not anticipate that any of the 12 sea turtles (nine loggerhead, one Kemp's ridleys, one green, and one leatherback) captured annually during the NEFSC bottom trawl surveys in 2013 and 2014 will be injured or killed. The six sea turtles (three loggerheads, one Kemp's ridley, one green, and one leatherback) captured during the topless trawl study are at greater risk of being injured or killed if tow times for the study are standardized to greater than 50 minutes in length, as indicated previously. As such, we expect one sea turtle will die as a result of topless trawl work as tows greater than 50 minutes in length may be utilized in the study design. That sea turtle could be any of the four species potentially captured in this study.

6.3.2 Capture in Trawl Gear – Atlantic Sturgeon

The capture of Atlantic sturgeon in otter trawls used in commercial fisheries is well documented (see for example, Stein *et al.* 2004 and ASMFC TC 2007). Atlantic sturgeon are also captured incidentally in trawls used for scientific studies (*e.g*., NEAMAP, NJ offshore trawl, past NEFSC bottom trawl surveys, PSB studies). The NEFSC has recorded all sturgeon interactions since the surveys began. This information allows us to predict future interactions. To date, a total of 141 Atlantic sturgeon captures have been recorded during all NEFSC BTSs.

The fall and spring trawl surveys have been ongoing since 1963. A total of 38 Atlantic sturgeon have been captured during the fall survey. Atlantic sturgeon were captured in 16 of the 49 years that sampling has occurred with the annual number of captures ranging from zero to eight (2004). Captures of Atlantic sturgeon have been more common since 1998; prior to then, only 12 individuals had been captured. A total of 102 Atlantic sturgeon have been captured during the spring survey. Atlantic sturgeon were captured in 31 of the 49 years that sampling has occurred with the annual number of captures ranging from zero to seven (1973 and 1978). This includes data on Atlantic sturgeon captured in winter surveys that are now incorporated into the spring survey work. No mortalities have been recorded in any trawl survey. As mentioned previously, Salerno and Eayrs (2010) reported the catch of five Atlantic sturgeon.

In addition to the NEFSC spring and fall bottom trawl surveys, one Atlantic sturgeon has been captured in the past in the MADMF spring trawl survey. This individual was captured in Cape Cod Bay in May 1986. The fish was released alive and uninjured.

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 and 2014 surveys. As mentioned previously, because previous PSB study work with trawls is less similar to the topless trawl study than the NEFSC spring BTS, we expect Atlantic sturgeon interactions as a result of the spring BTS to be the best available estimate for Atlantic sturgeon interactions as a result of the topless trawl study. Because the BTS survey will follow identical protocols to the past and operate in the same areas, it is reasonable to anticipate similar catch levels in 2013 and 2014. Based on this, we anticipate that 8 or fewer Atlantic sturgeon will be captured during the NEFSC fall survey and 7 or fewer Atlantic sturgeon will be captured in both the NEFSC spring survey and the PSB topless trawl study. We also expect that one Atlantic sturgeon will be captured during the spring or fall MADMF survey.

Based on the mixed stock analysis, we expect that 46% of the 50 captured Atlantic sturgeon will originate from the NYB DPS (23 individuals), 29% from the SA DPS (14 individuals), 16% from the CB DPS (8 individuals), 8% from the GOM DPS (4 individuals) and 0.5% from the Carolina DPS (1 individual).

Potential for Mortality Resulting from Capture in Trawls – Atlantic sturgeon
The short duration of the tow and careful handling of any sturgeon once on deck is likely to result in a low potential for mortality during the NEFSC BTSs. None of the 141 Atlantic sturgeon captured in the past have had any evidence of injury and there have been no recorded mortalities. Similarly, none of the Atlantic sturgeon captured in the NEAMAP surveys which operates with similar gear and tow durations have been killed. In the Hudson River, a trawl survey that incidentally captures Atlantic sturgeon has been ongoing since the late 1970s. To date, no injuries or mortalities of Atlantic sturgeon have been recorded. Based on this information, we expect that all Atlantic sturgeon captured in the NEFSC and MADMF bottom trawl surveys will be alive and will be released uninjured.

It is reasonable to expect that the mortality rate for captured Atlantic sturgeon may be higher for the topless trawl study relative to the NEFSC and MADMF BTSs because of longer potential tow times, but careful handling will aid in the survival of captured fish. Although it is possible that all seven captured Atlantic sturgeon may survive, there is the potential for mortality where tows over 50 minutes in length are potentially conducted. As such, we expect one Atlantic sturgeon may die as a result of capture in the topless trawl study. Based on the mixed stock analysis mentioned previously, we expect that the one killed Atlantic sturgeon has the potential to originate accordingly from any of the five Atlantic sturgeon DPSs.

6.4 Capture in Sink Gillnet Gear

As study activities proposed in this Opinion adhere to the same Federal regulations and may be described as identical to normal fish harvest activity that would occur in the monkfish fishery, captures of listed species of sea turtles and Atlantic sturgeon may occur in a similar fashion in the fishery as it would in the gillnet gear modification study discussed in this Opinion. 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 modification study proposed in this Opinion.

6.4.1 Capture in Sink Gillnet Gear – Sea Turtles

Past observed takes of ESA-listed species in sink gillnets were reviewed in the October 29, 2010, Opinion for the monkfish fishery. Updated information is provided herein. It is difficult to ascertain gear types responsible for entanglements when only portions of the gear or injuries resulting from entanglements are observed. Additionally it is important to note that the reported takes are likely a fraction of the total takes, which are unknown.

Loggerhead sea turtles represent the majority of sea turtles species observed incidentally taken in gillnet gear in the action area. From 1995-2006, NEFOP observers reported 41 loggerhead sea turtles as incidentally caught in Mid-Atlantic sink gillnet gear (Murray 2009a). Approximately 80% of the loggerheads captured in gillnet gear were determined to be juveniles; approximately 40% of the loggerheads captured were dead (Murray 2009a). Documented gillnet gear captures of loggerheads after the time periods analyzed in Murray (2009) are presented in Table 8.

Table 8. Documented incidental captures of loggerhead sea turtles (excluding moderately and severely decomposed turtles) in gillnet gear from 2007-2009 along with the most abundant (by weight) abundant commercial species landed per trip. Gillnet gear includes anchored sink gillnets and drift sink gillnets. Source: NEFSC FSB database.

	Gillnet			
Most Landed Species (by weight)	Sandbar Shark	Southern Flounder	Atlantic Croaker	Monkfish
Loggerhead captures	1	4	1	1
Years	2007-2009			

The estimates of loggerhead sea turtle bycatch in gillnet gear published in Murray (2009) represent the best available information and analysis for loggerhead bycatch in Mid-Atlantic commercial fisheries. Such estimates are not available for leatherback, Kemp's ridley, and green sea turtles. Therefore, observer data for these species represents the best available information. Between 2000 and 2009, the NEFOP documented five unidentified sea turtles captured in both anchored and sink gillnets (NEFSC FSB database). The number of observer recorded leatherback, Kemp's ridley, and green sea turtle captures in gillnet fishing gear between 2000 and 2009 are three leatherbacks, eight Kemps ridleys, 15 greens, and nine unidentified sea turtles (NEFSC FSB database).

Tagging studies have shown that leatherbacks, occurring seasonally for foraging in western North Atlantic continental shelf waters where the monkfish fishery operates, stay within the water column rather than near the bottom (James *et al.* 2005a). Given the largely pelagic life history of leatherback sea turtles (Rebel 1974; CeTAP 1982; NMFS and USFWS 1992), and the dive-depth information on leatherback use of western North Atlantic continental shelf waters (James *et al.* 2005a; 2005b), leatherbacks may spend more time in the water column than on the bottom. Given that leatherbacks forage within the water column rather than on the bottom, interactions between leatherback sea turtles and sink gillnet gear are not expected.

Between 2002 and 2003, scientists conducted a study of loggerhead, Kemp's ridley, and green sea turtles captured in pound nets fishing in the Peconic Bay area of New York. Sea turtles were not encountered after the last week in October in that study (Morreale 2003). Tracking studies summarized in Morreale and Standora (2005) indicate that loggerhead and Kemp's ridley sea turtles begin leaving New York waters in October and generally by the first week of November, turtles head southward past the Virginia border. Similar migratory patterns are expected for green and leatherback sea turtles (Shoop and Kenney 1992; Morreale 1999).

Observer data was summarized in Murray (2009) between 1995-2006 where although catch of loggerhead sea turtles was sufficient to model catch across all reported trips in the observed time series and catch was observed of other species of sea turtles, relatively low numbers of observations of other sea turtles (*i.e.*, leatherback, green, and Kemp’s ridley) that may be found in the action area inhibited utilization of the study’s modeling approach to estimate bycatch rates for those species. Regardless, sea turtles may occur at all times of the year from Cape Cod, southward to the southernmost extent of where U.S. fisheries observers collect data along the eastern seaboard (Murray 2009). However, lower bycatch rates are predicted in cooler waters and more northerly latitudes such as is the case in the action area (*i.e.*, statistical areas 612, 614 and 615) between November 2012 and January 2013 (observer data indicated loggerhead bycatch in waters south of Cape Cod to North Carolina in all months, except January) (Murray 2009). Murray (2009) also mentioned bycatch of leatherbacks in observer data (five leatherbacks were observed captured between 1995 and 2006) occurring north of 39°N from July to December, in waters 18 to 68 meters deep (mean =39.5 meters) and at SSTs between 12.2° and 21.1°C (mean =15.3°C). Targeting monkfish specifically, 25 loggerheads and 10 unidentified sea turtles were observed on gillnet trips between 1995 and 2006 (Murray 2009). In summary, the location where the study is proposed to take place, the limited number of sets involved (*i.e.*, 120 total strings), the short duration of the study (*i.e.*, less than 3 months), and the time of year and consequently the low water temperature during the study are all factors that serve to limit the potential for sea turtle captures as a result of the gillnet gear modification study proposed in this Opinion. As such, although the potential exists for sea turtle interactions with gillnet gear modifications proposed this Opinion, we expect the number of expected interactions to be very low (*i.e.*, only one sea turtle of any of the four species over the duration of the study).

Potential for Mortality Resulting from Capture in Sink Gillnet Gear – sea turtles
Some of the information provided previously for sea turtles forcibly submerged in any type of restrictive gear such as mentioned previously regarding the potential for sea turtle mortality as a result of capture from otter trawl gear is relevant for gillnet capture as well. However, as discussed above, sea turtles are expected to be present in the action area when gillnet gear modification study activities occur only in rare instances due to the factors of low SST at the time of year study activities are proposed to take place (*i.e.*, the middle of November to January) and the high latitude of the action area. In general, soak time may also play a role in captured sea turtle mortality where Murray (2009) indicated that soak times for gillnets in which live turtles were captured ranged between 0.6 and 96 hours (mean = 29.6 hours), and between 22.2 and 216 hours (mean = 80 hours) for gillnets in which fresh dead turtles were captured. As soak time increased, the percentage of observed live turtles decreased (Murray 2009). Two extremely decomposed leatherbacks were captured in nets soaking 72 and 114 hours, indicating these turtles may have died prior to capture, or long before being observed (Murray 2009). As mentioned previously, the soak times proposed in the gillnet gear modification study mentioned in this Opinion will be of 96 hours in duration or less. As a result, in the event that soak times in the gillnet study reach 96 hours, the up to one sea turtle capture expected to occur may be lethal.

6.4.2 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 is a continuation of cooperative research efforts that have been conducted off northern New Jersey in November/December of 2010 and 2011. These 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 close spatial (*i.e.*, stat areas 612, 614, and 615), temporal (*i.e.*, same time of year), and effort magnitude (*i.e.*, identical number of sets) similarities between the gillnet gear modification study proposed in this Opinion and the 120 haul set studies in the fall of 2010 and 2011, 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 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 2010 and 2011 to be very reliable information to use in our estimation of Atlantic sturgeon interactions for the gillnet study. However, taking into account the greater bycatch of Atlantic sturgeon observed during the 50 haul set study off Delaware in April/May of 2011 and indications from commercial fishermen who are expecting an increase in the number of Atlantic sturgeon encounters in the fall of 2012 (Dewayne Fox, DSU, pers. comm.), we anticipate that the level of bycatch of Atlantic sturgeon in the gillnet gear modification study proposed in this Opinion will be somewhere in between the levels observed in the previous 120 haul sets and that observed in the 50 haul set. As a result, we expect that the gillnet gear modification study proposed in this Opinion will capture up to 50 Atlantic sturgeon in the fall of 2012. This number is supported by Dewayne Fox of Delaware State University, who is the principal investigator for the study.

NEFOP data presented in NEFSC (2011b) utilized observed Atlantic sturgeon interactions with various gear types between 2006 and 2010 combined with VTR data to estimate total numbers of interactions and mortality rates in the fishery. The spatial coverage of observed trips was sufficient to support discard estimation at the level of two digit stat area. For extra large gillnet trips (defined in NEFSC (2011b) as greater than 8 inches in diameter), the average number of interactions per year between 2006 and 2010 in the fourth quarter only (October-December, a time period similar to the time period utilized in the study designs mentioned in Fox *et al*. (2011, 2012) as well as gillnet work proposed in this Opinion) was 44 fish in two digit stat area 61 (this includes stat area 613, not within the action area defined in this Opinion). Although this estimate appears small relative to the 23 and 37 Atlantic sturgeon interactions across only 120 hauls of gillnet work discussed in Fox *et al*. (2011, 2012), the 12 inch mesh utilized in that study is larger than the typical mesh size defined in NEFSC (2011b) as “extra large mesh.” Controlled experiments on captive fish suggest that increases in twine size, hanging ratio, and tie-down use all significantly increase the retention of Atlantic sturgeon that encounter sink gillnets (ASMFC TC 2007). As mentioned previously, the study design described in this Opinion is analogous to the design described in Fox *et al*. (2011, 2012). As such, the expectation that up to 50 Atlantic sturgeon interactions will occur as a result of the gillnet gear modification study proposed in this Opinion is reasonable.

Based on the mixed stock analysis mentioned previously, we expect that 23 captured Atlantic sturgeon will originate from the NYB DPS, 14 will originate from the SA DPS, eight 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 (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). 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 34 dead Atlantic sturgeon as a result of the gillnet gear modification study proposed in this Opinion.

Based on the mixed stock analysis mentioned previously, we expect that up to 16 dead Atlantic sturgeon will originate from the NYB DPS, ten will originate from the SA DPS, five will originate from the CB DPS, two will originate from the GOM DPS, and one will originate from the Carolina DPS.

6.5 Sea Turtle Interactions with Scallop Dredge Gear

Although no interactions have been observed in the NEFSC scallop dredge survey, commercial scallop dredges operating in the same area and season have encountered sea turtles. Between 2001-2008, 64 sea turtle interactions (47 loggerheads, one Kemp's ridley, and 16 unidentified) were observed in the commercial scallop dredge fishery while an observer was "on watch" (Murray 2011). In addition, 15 sea turtle interactions (nine loggerheads, one Kemp's ridley, and five unidentified) occurred on hauls when an observer was "off watch." Observers sampled roughly 3% of commercial fishing effort in Mid-Atlantic waters during 2001-2008, proportional in space and time to commercial effort throughout the year.

Since sea turtles are known to interact with the commercial scallop dredge fishery, we anticipate that there may be some low level of interaction likely to occur during the NEFSC scallop dredge survey. Based on past survey results, we anticipate that no more than one sea turtle will interact with the scallop dredge survey gear annually in 2013 and 2014. Based on observer data and life history information, loggerheads are the species most likely to interact with dredge gear in the action area. The other three species of sea turtles found in the action area may be prone to interactions as well, albeit in lower numbers as demonstrated in Murray (2011) and the NEFOP database. Based on observed sea turtle interaction in scallop dredges (described above), we expect that the sea turtle that interacts with the scallop dredge survey gear will be a loggerhead or Kemp's ridley. Since the dredge to be used during the surveys will not be equipped with chain mats, it is expected that the number of observed interactions will more closely mirror the number of actual interactions than if the surveys utilized a lower profile dredge or one equipped with chain mats. Interactions with those types of dredges make it more difficult to observe sea turtle interactions as the gear is designed to either deflect the turtle over the dredge frame and/or keep the turtle out of the dredge bag. Only turtles that enter the dredge bag (or are entangled in the cutting bar or bale bars) and make their way onto the deck of the vessel once the gear is hauled back are likely to be observed. Because of the high likelihood of serious injury or mortality resulting from capture in a scallop dredge, we expect that the loggerhead or Kemp's ridley potentially caught annually in the scallop dredge survey in 2013 and 2014 will die.

6.6 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 NEFSC surveys and PSB studies, 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 action 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.

Survey and study activities will involve acoustic trawl monitors that emit frequencies of sound waves to be read by computers on board the vessels. According to Henry Milliken of the NEFSC PSB, the operational frequencies of various acoustic trawl monitors that may be utilized in the topless trawl study described in this Opinion are between 28 and 200 kilohertz (kHz), a measure of sound frequency. These ranges are within the known audible frequencies of various species of listed sea turtles (Ketten and Bartol 2006, Lenhardt 1994, Lenhardt et. al 1996, McCauley et al. 2000a and 2000b, Moein et al 1994, O'Hara and Wilcox 1990, Ridgeway *et al.* 1969, and Bartol *et al.* 1999) found in the action area as well as sturgeon (Fay and Popper 2000, Lovell et al. 2005, Meyer and Popper 2002, Meyer et al. 2003, Popper 2005). However, the decibel volume used by these machines is expected to be well below the volume of noise emitted by a vessel running with a diesel powered engine of any size currently utilized in the fishery.

Furthermore, both acoustic haul monitor and vessel engine noise volumes may be within the threshold where effects to fish have been documented as a result of increases to under water noise, but certainly well below any levels capable of sustaining injury to animals in the vicinity of the vessel emitting the sound waves. For the purposes of assessing behavioral effects of pile driving at several West Coast projects, NMFS has employed a 150 dB re 1 μPa_{RMS} sound pressure level criterion at several sites, including the San Francisco-Oakland Bay Bridge and the Columbia River Crossings. As we are not aware of any studies that have considered the behavior of Atlantic sturgeon in response to pile driving noise, but given the available information from studies on other fish species (*i.e.*, Wysocki *et al.* 2007; Purser and Radford 2011), we consider 150 dB re 1 μPa_{RMS}[10] to be a reasonable estimate of the noise level at which

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[10] Root Mean Square (RMS) pressure is the square root of the time average of the squared pressure and is expressed as dB re: 1

exposure may result in behavioral modifications. We expect pile driving to result in much higher underwater noise volumes than volumes expected to be produced by acoustic haul monitors and vessel engine operation (i.e., less than 150 dB re 1 μPa_{RMS}). Furthermore, the depth NEFSC survey and PSB study activities are proposed to occur are between 50 and 200 feet. As previously mentioned, within the action area, sea turtles may be found throughout the water column and Atlantic sturgeon are most likely found near to the bottom during normal feeding and migration behavior. Regardless of location in the water column, animals encountering adverse noise will not be restricted by depth or laterally to avoid the source of the noise or based upon the natural attenuation rate of sound in water (underwater noise levels produced from the driving of timber piles will attenuate approximately 10 dB every 33 feet according to Illingworth and Rodkin, Inc. and Jones and Stoke 2009), the noise will dissipate to background levels before reaching any nearby sea turtle or Atlantic sturgeon. Sea turtles or Atlantic sturgeon attempting to avoid the noise may swim into the mouth of the net or into the active gillnet, but any such capture would not be considered outside capture research and estimations previously taken into account and mentioned previously in this Opinion. As such, we expect all effects of survey and study produced elevated levels of underwater sound on sea turtles and Atlantic sturgeon to be extremely small and discountable.

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 twenty-eight 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 (10 of 14) had injuries consistent with being struck by a large vessel (Brown and Murphy 2010). Eight of the fourteen 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 vessels operating in the open ocean is likely to be low given that the research 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)

μPa. Current thresholds for determining impacts to sea turtles typically center around RMS.

associated with the NEFSC surveys or studies is extremely small. Given the small and localized increase in vessel traffic that would result from the NEFSC surveys and studies, 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.

6.7 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 NEFSC survey or PSB study activities. 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 summer flounder trawl gear and certainly the lined codends that are used in the NEFSC bottom trawl surveys result in a greater diversity and abundance of bycatch than 12 inch mesh gillnets. 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 surveys and studies 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 studies 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 any of the surveys or studies being carried out will capture any Atlantic sturgeon prey items. Thus, the surveys and studies 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.

6.8 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 NEFSC 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 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 study action proposed in this Opinion for gillnet gear modification will be avoided during adverse weather conditions (*i.e.*, when ocean currents may be stronger) and will have soak durations of 96 hours or less, the effects are not expected from the gillnet gear modification study on bottom habitat. 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.

8.0 INTEGRATION AND SYNTHESIS OF EFFECTS

In the effects analysis outlined above, we considered potential effects from the NEFSC research vessel surveys in 2013 and 2014 as well as the PSB topless trawl study proposed for Winter/Spring 2013 and the PSB gillnet gear modification study proposed for Fall 2012/Winter 2013. These effects include fishing with (1) bottom otter trawls, (2) New Bedford style scallop dredges, and (3) sink gillnets. In addition to these gear-related effects, we considered the potential for collisions between listed species and project vessels as well as noise effects on listed species from vessels and acoustic haul monitors that will be onboard vessels participating in the gear research studies.

NMFS has estimated that the research vessel surveys to be carried out by the NEFSC will result in the capture of up to 10 NWA DPS loggerheads, two Kemp's ridleys, one green, and one leatherback sea turtle, and up to 16 Atlantic sturgeon. We expect that either the one loggerhead or one Kemp's ridley potentially captured in the scallop dredge survey will die or suffer serious injury as a result. No injuries or mortalities of green and leatherback sea turtles or Atlantic sturgeon are anticipated and all other captured loggerhead and Kemp's ridley sea turtles 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, including to their prey, will be insignificant or discountable.

NMFS has estimated that the topless trawl study to be carried out by the NEFSC in Winter/Spring 2013 will result in the capture of up to three NWA DPS loggerheads, one Kemp's ridley, one green, and one leatherback sea turtle, and up to seven Atlantic sturgeon. We expect that up to one loggerhead, one Kemp's ridley, one green, and one leatherback sea turtle will die or suffer serious injury as a result of forced submersion oxygen deprivation caused by capture in trawl gear utilized in the topless trawl study. We also expect up to one Atlantic sturgeon will die or suffer serious injuries as a result from the topless trawl study because of the potential for tows to be conducted of up to 60 minutes in duration, a stress capable of killing an Atlantic sturgeon. As explained in the *Effects of the Action* section, all other effects to sea turtles and Atlantic sturgeon, including to their prey, as a result of the topless trawl study will be insignificant or discountable.

NMFS has estimated that the gillnet gear modification study to be carried out by the NEFSC in Fall 2012/Winter 2013 will result in the capture of 23 Atlantic sturgeon, while only one sea turtle interaction (of any of the four species) is expected as a result of this study. We expect up to 11 Atlantic sturgeon and one sea turtle (any of the four species) 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 modification study. As explained in the *Effects of the Action* section, all other effects to sea turtles and Atlantic sturgeon, including to their prey, as a result of the gillnet gear modification 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 action. 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 NMFS/USFWS Section 7 Handbook, 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 Endangered Species Act.

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 action on the NWA DPS of loggerhead sea turtles. We have estimated that six loggerheads are likely to be captured in the NEFSC fall bottom trawl survey and three from the spring survey. All turtles captured in the trawl survey are expected to be safely removed from the trawl gear and returned to the ocean without any injury or mortality. We also expect that one loggerhead will be captured in the dredge survey and that this turtle may be seriously injured or killed. We have estimated that three loggerheads will be captured in the topless trawl study. We expect that one loggerhead will die from study activities as a result of the length of tow time that may be utilized in the study (*i.e.*, greater than 50 minutes in length). Up to one loggerhead sea turtle is expected to be captured in the gillnet gear modification study, which may lead to serious 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.

The lethal removal of up to three loggerhead sea turtles from the action area in 2013 as a result of the NEFSC sea scallop survey, the gillnet study, and the topless trawl study would be expected to reduce the number of loggerhead sea turtles from the recovery unit of which they originated as compared to the number of loggerheads that would have been present in the absence of the proposed actions (assuming all other variables remained the same). However, this does not necessarily mean that these recovery units will experience reductions in reproduction, numbers or distribution in response to these effects to the extent that survival and recovery would be appreciably reduced. The final revised recovery plan for loggerheads compiled the most recent information on mean number of loggerhead nests and the approximated counts of nesting females per year for four of the five identified recovery units (*i.e.*, nesting groups). They are: (1) for the NRU, a mean of 5,215 loggerhead nests per year with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year with approximately 15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year with approximately 221 females nesting per year. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was estimated from 1987-2001 (NMFS and USFWS 2007a). There are no annual nest estimates available for the Yucatán since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit.

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

Based on the genetic analysis presented in Bass *et al.* (2004) and the small number of loggerheads from the DTRU or the NGMRU likely to occur in the action area it is extremely unlikely that the loggerheads likely to be killed during the scallop dredge survey, gillnet study, and topless trawl study will originate from either of these recovery units. The majority, at least 80% of the loggerheads captured, are likely to have originated from the PFRU, with the remainder from the NRU and GCRU. As such, of the 14 loggerheads likely to be captured in 2013, 11 are expected to be from the PFRU, two from the NRU, and one from the GCRU. As explained above, only three loggerhead mortalities combined are expected to result during the scallop dredge survey, gillnet study, and topless trawl study in 2013. As it is impossible to predict whether these turtles will be from the PFRU, the NRU or the GCRU, NMFS considers below the effects of the mortality of three loggerheads from any of the these three recovery units.

As noted above, the most recent population estimates indicate that there are approximately 15,735 females nesting annually in the PFRU and approximately 1,272 females nesting per year in the NRU. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was estimated from 1987-2001 (NMFS and USFWS 2007a). There are no annual nest estimates available for the Yucatán since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit; however, the 2008 recovery plan indicates that the Yucatan nesting aggregation has at least 1,000 nesting females annually. As the numbers outlined here are only for nesting females, the total number of loggerhead sea turtles in each recovery unit is likely significantly higher. The loss of three loggerheads represents an extremely small percentage of the number of sea turtles in the PFRU. Even if the total population was limited to 15,735 loggerheads, the loss of three individuals would represent approximately 0.019% of the population. Similarly, the loss of three loggerheads from the NRU represents an extremely small percentage of the recovery unit. Even if the total population was limited to 1,272 sea turtles, the loss of three individuals would represent approximately 0.24% of the population. The loss of three loggerheads from the GCRU, which is expected to support at least 1,000 nesting females, represents less than 0.3% of the population. The loss of such a small percentage of the individuals from any of these recovery units represents an even smaller percentage of the species as a whole. As such, it is unlikely that the death of thre loggerhead sea turtles will have a detectable effect on the numbers and population trends of loggerheads in these recovery units or the number of loggerheads in the population as a whole. Additionally, this action is not likely to reduce distribution of loggerheads because the action will only result in temporary delays for foraging and migrating loggerheads and will not impede any loggerheads from accessing suitable foraging grounds and or disrupt other migratory behaviors.

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

Based on the information provided above, the death of no more than three loggerhead sea turtles during the NEFSC surveys and the PSB gillnet and topless trawl studies 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) the death of three loggerheads annually represents an extremely small percentage of the species as a whole; (2) the loss of these loggerheads will not change the status or trends of any nesting aggregation, recovery unit or the species as a whole; (3) the loss of three loggerheads annually is not likely to have an effect on the levels of genetic heterogeneity in the population; (3) the loss of three loggerheads annually is likely to have an undetectable effect on reproductive output of any nesting aggregation or the species as a whole; (4) the action will have no effect on the distribution of loggerheads in the action area or throughout its range; and, (5) the action will have no effect on the ability of loggerheads to shelter and only an insignificant effect on individual foraging loggerheads.

In certain instances, an action may not appreciably reduce the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that loggerhead 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 action 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; as explained above, the loss of three loggerheads as a result of the proposed actions will not affect the population trend. The number of loggerheads likely to die as a result of the proposed actions is an extremely small percentage of any recovery unit or the DPS as a whole. This loss will not affect the likelihood that the population will reach the size necessary for recovery or the rate at which recovery will occur. 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 action will not prevent the species from growing in a way that leads to recovery and the action will not change the rate at which recovery can occur. This is the case because while the actions may result in a small reduction in the number of loggerheads and a small reduction in the amount of potential reproduction due to the loss of these individuals, these effects will be undetectable over the long-term and the actions are not expected to have long term impacts on the future growth of the population or its potential for recovery. Therefore, based on the analysis presented above, the proposed 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 2007c).

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 2007c).

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 action on Kemp’s ridley sea turtles. We expect the capture of up to one Kemp’s ridley in either the spring or fall bottom trawl survey, one during the scallop dredge survey, one during the gillnet study, and one during the topless trawl study. The Kemp’s ridleys captured during the scallop dredge survey, gillnet study, and topless trawl study (three in total) have the potential 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 mortality of three Kemp’s ridleys represents a very small percentage of the Kemp’s ridleys worldwide. Even taking into account just nesting females, the death of three Kemp’s ridley represents less than 0.04% of the population. While the death of three Kemp’s ridleys will reduce the number of Kemp’s ridleys 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 or its stable to increasing trend as this loss represents a very small percentage of the population (less than 0.04%). Reproductive potential of Kemp’s ridleys is not expected to be affected in any other way other than through a reduction in numbers of individuals. A reduction in the number of Kemp’s ridleys would have the effect of reducing the amount of potential reproduction as any dead Kemp’s ridleys would have no potential for future reproduction. In 2006, the most recent year for which data is available, there were an estimated 7,000-8,000 nesting females. While the species is thought to be female biased, there are likely to be several thousand adult males as well. Given the number of nesting adults, it is unlikely that the loss of three Kemp’s ridleys would affect the success of nesting in any year. Additionally, this small reduction in potential nesters is expected to result in a small reduction in the number of eggs laid or hatchlings produced in future years and similarly, a very small effect on the strength of subsequent year classes. Even considering the potential future nesters 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 very small and would not change the stable to increasing trend of this species. Additionally, the proposed actions will not affect nesting beaches in any way or disrupt migratory movements in a way that hinders access to nesting beaches or otherwise delays nesting.

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 the small percentage of the species that will be killed as a result of the surveys and studies, there is not likely to be any loss of unique genetic haplotypes and no loss of genetic diversity.

Generally speaking, the loss of a small number of individuals from a subpopulation or species results in an appreciable reduction in the total numbers, the reproduction and distribution of the species is likely to occur when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of Kemp's ridleys because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity, there are several thousand individuals in the population, and the number of Kemp's ridleys is likely to be increasing and at worst is stable.

Based on the information provided above, the death of three Kemp's ridley sea turtles in 2013 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) the death of three Kemp's ridleys annually represents an extremely small percentage of the species as a whole; (3) the death of three Kemp's ridleys annually will not change the status or trends of the species as a whole; (4) the loss of these Kemp's ridleys is not likely to have an effect on the levels of genetic heterogeneity in the population; (5) the loss of these Kemp's ridleys 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; (6) 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, (7) 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 and USFWS 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[11];
2. An increase in the recruitment of hatchlings[12];
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; as explained above, the loss of three Kemp's ridley during the proposed actions will not affect the population trend. The number of Kemp's ridleys likely to die as a result of the proposed action is an extremely small percentage of the species. This loss will not affect the likelihood that the population will reach the size necessary for recovery or the rate at which recovery will occur. 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. This is the case because while the actions may result in a small reduction in the number of Kemp's ridleys and a small reduction in the amount of potential reproduction due to the loss of three individuals, these effects will be undetectable over the long-term and the action is not expected to have long term impacts on the future growth of the population or its potential for recovery. Therefore, based on the analysis presented above, the proposed 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, resulting in the potential mortality of up to three Kemp's ridley sea turtles annually, is not likely to appreciably reduce the survival and recovery of this species.

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[11] 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.

[12] 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).

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 2007d). As is also the case with the other 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 Michoacan, 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 2007d). Historically, however, greater than 20,000 females per year are believed to have nested in Michoacan alone (Cliffton *et al.* 1982; NMFS and USFWS 2007d). 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 2007d). Of the 32 index sites reviewed by Seminoff (2004), the trend in nesting was described as: increasing for 10 sites, decreasing for 19 sites, and stable (no change) for 3 sites. Of the 46 green sea turtle nesting sites reviewed for the 5-year status review, the trend in nesting was described as increasing for 12 sites, decreasing for 4 sites, stable for 10 sites, and unknown for 20 sites (NMFS and USFWS 2007d). The greatest abundance of green sea turtle nesting in the western Atlantic occurs on beaches in Tortuguero, Costa Rica (NMFS and USFWS 2007d). 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 2007d). 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 2007d). However, nesting data for this area has not been published since the 1980s and updated nest numbers are needed (NMFS and USFWS 2007d).

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 2007d).

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 NEFSC spring and fall bottom trawl surveys and up to one each in the PSB gillnet and topless trawl studies. The survey captured green will be released alive and uninjured while the gillnet and topless trawl study captured greens may be severely injured or killed. 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 NEFSC 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. Although up to two green sea turtles may be injured or killed in the PSB studies, the studies 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 may only be reduced slightly. Similarly, as the proposed actions may affect the fitness of only one individual, minor effects to reproduction are anticipated. The actions may also result in a minor reduction in distribution of green sea turtles in the action area and thus result in a minor reduction in the distribution of sea turtles throughout their range. Because effects are limited to capture, with up to two serious injuries or mortalities, the population level impacts will at most be minor in nature. 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 2014). 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.

The lethal removal of two green sea turtles, whether male or female, immature or mature, would reduce the number of green sea turtles as compared to the number of greens that would have been present in the absence of the proposed actions assuming all other variables remained the same. However, this does not necessarily mean that the species will experience reductions in reproduction, numbers, or distribution in response to these effects to the extent that survival and recovery would be appreciably reduced. The loss of two green sea turtles represents a very small percentage of the species as a whole. Even compared to the number of nesting females (17,000-37,000), which represent only a portion of the number of greens worldwide, the mortality of two green sea turtles represents less than 0.01% of the population. The loss of these sea turtles would be expected to reduce the reproduction of green sea turtles as compared to the reproductive output of green sea turtles in the absence of the proposed actions. As described in the *Status of the Species* section above, we consider the trend for green sea turtles to be stable. However, as explained below, the death of two green sea turtles will not appreciably reduce the likelihood of survival for the species for the following reasons.

Generally speaking, the loss of a small number of individuals from a subpopulation or species results in an appreciable reduction in the total numbers, the reproduction and distribution of the species is likely to occur when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of greens because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity, there are several thousand individuals in the population, and the number of greens is likely to be increasing and at worst is stable. The proposed actions are not likely to reduce distribution of greens because the actions will not impede greens from accessing foraging grounds or cause more than a temporary disruption to other migratory behaviors.

Based on the information provided above, the death of two green sea turtles 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) the death of two green sea turtles annually represents an extremely small percentage of the species as a whole; (3) the loss of two green sea turtles annually will not change the status or trends of the species as a whole; (4) the loss of two green sea turtles annually is not likely to have an effect on the levels of genetic heterogeneity in the population; (5) the loss of two green sea turtles annually is likely to have an undetectable effect on reproductive output of the species as a whole; (6) the actions will have no effect on the distribution of greens in the action area or throughout its range; and (7) 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 result in an extremely small reduction 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 likely to result in the mortality of up to two green sea turtles; however, as explained above, the loss of these individuals annually over the course of these actions is not expected to affect the persistence of green sea turtles or the species trend. The actions will not affect nesting habitat and will have only an extremely small effect on mortality. 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 actions will not change the rate at which recovery can occur. This is the case because while the actions may result in a small reduction in the number of greens and a small reduction in the amount of potential reproduction due to the loss of two individuals, these effects will be undetectable over the long-term and the actions are not expected to have long term impacts on the future growth of the population or its potential for recovery. Therefore, based on the analysis presented above, the proposed 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 mortality of up to two green sea turtles 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 2007b). 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 2007b).

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 (NMFS SEFSC 2001; NMFS and USFWS 2007b). However, declines in nesting have been noted for beaches in the western Caribbean (NMFS and USFWS 2007b). 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 2007b). 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 either the NEFSC spring or fall bottom trawl 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. We also anticipate that up to one leatherback sea turtle may be captured in both the PSB gillnet and topless trawl studies, both of which may be lethal. 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 NEFSC 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. Although up to two leatherback sea turtles may be injured or killed in the PSB studies, the studies will have 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 may only be reduced slightly. 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 2014). 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 mortality of up to two leatherback sea turtles 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 35 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 46%; SA 29%; CB 16%; GOM 8%; and Carolina 0.5%. Since only one Atlantic sturgeon mortality is likely to result from the PSB topless trawl study, the potential exists that the Atlantic sturgeon killed could originate from any of the five DPSs. As a result of the PSB gillnet gear modification study, given the above percentages, it is most likely that of the 34 Atlantic sturgeon mortalities, 16 would be fish that originate from the NYB DPS, ten from fish originating from the SA DPS, five from fish originating from the CB DPS, two from fish originating from the GOM DPS, and one from fish originating from the Carolina DPS.

8.5.2 Gulf of Maine DPS

Individuals originating from the GOM DPS are likely to occur in the action area. 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. No total population estimates are available. At this time, there is no published population estimate for the GOM DPS as a whole or for any life stage. We expect that 8% of the Atlantic sturgeon in the action area will originate from the GOM DPS. GOM 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 and/or subadult Atlantic sturgeon from the GOM DPS during the activities described in this Opinion. As noted above, we do not have an estimate of the number of adult and subadult Atlantic sturgeon in the GOM DPS, or the size of the GOM DPS as a whole. Here, we consider the effect of the annual loss of three adults and/or 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 and/or 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.

Because we do not have a population estimate for the GOM DPS, it is difficult to evaluate the effect of the mortality caused by these actions on the species. However, because 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 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 and/or subadult GOM DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (2) the loss of three adult and/or 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 and/or 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 and/or 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 46% 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. Fisheries bycatch data suggests that the ratio of subadults to adults is at least 3:1. Therefore, we estimate that there is a population of Hudson River Atlantic sturgeon at least 3,452 adults and subadults. At this time, we do not have an estimate of the number of Delaware River origin Atlantic sturgeon; however, because spawning is thought to persist in the Delaware, this river contributes additional sturgeon of all life stages to the DPS. 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 New York Bight 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 New York Bight DPS as a whole.

We have estimated that the proposed actions will result in the annual mortality of up to 17 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 17 NYB DPS fish are likely to be killed, it is reasonable to assume that they will be Hudson River origin.

The annual mortality of 17 adult and/or subadult Atlantic sturgeon from the NYB DPS represents a very small percentage of subadult/adult population (*i.e.*, approximately 0.49% of the population, just considering the minimum estimated number of Hudson River origin subadults; the percentage would be much less if the number of adults, YOY, and juveniles was considered as well as any Delaware River origin adults and subadults). While the death of 17 adult and/or 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[13] (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 four adults and 13 subadults represents an extremely small percentage of the adult population (approximately 0.46%).

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[13] 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).

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 17 adults and/or 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.

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 17 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 17 adult and/or subadult NYB DPS Atlantic sturgeon represents an extremely small percentage of the species; (2) the annual death of 17 adult and/or subadult NYB DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (3) the annual loss of 17 adult and/or 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 17 adult and/or 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. As for 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 (17 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 17 adult and/or subadult NYB DPS Atlantic sturgeon, are not likely to appreciably reduce the survival and recovery of this species.

8.5.4 Chesapeake Bay DPS

Individuals originating from the CB DPS are likely to occur in the action area. 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. No estimates of the number of spawning adults, the DPS as a whole, or any life stage have been reported. We expect that 16% of the Atlantic sturgeon in the action area will originate from the CB DPS. Chesapeake Bay 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 James River spawning population or for the DPS as a whole. Here, we consider the effect of the loss of six 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 six adults and 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.

Because we do not have a population estimate for the CB DPS, it is difficult to evaluate the effect of the mortality caused by this actions on the species. However, because the proposed actions will result in the loss of only six 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 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 six 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 six subadult and/or adult CB DPS Atlantic sturgeon represents an extremely small percentage of the species as a whole; (2) the annual death of six subadult and/or adult CB DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (3) the annual loss of six subadult and/or 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 six subadult and/or 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 (six 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 six subadult and/or 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 0.5% 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. There are no estimates of the size of the Carolina DPS. The ASSRT estimated that there were fewer than 300 spawning adults in each of the five spawning rivers. 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. Here, we consider the effect of the annual loss of two subadults and/or adults 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 two subadults and/or adults 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.

Because we do not have a population estimate for the Carolina DPS, it is difficult to evaluate the effect of the mortality caused by these actions on the species. However, because the proposed actions will result in the annual loss of only two individuals, it is unlikely that these deaths will have a detectable effect on the numbers and population trend of the Carolina DPS.

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 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 two 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 two subadult and/or adult Carolina DPS Atlantic sturgeon represents an extremely small percentage of the species as a whole; (2) the annual death of two subadult and/or adult Carolina DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (3) the annual loss of two subadult and/or 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 two subadult and/or 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 (two individuals) 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 two subadult 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 29% 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. 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); because males and females do not spawn every year, this estimate represents a portion of the total number of Altamaha adults. Males spawn every 1-5 years and females every 2-5 years; using this information and assuming a 1:1 sex ratio, we could estimate a total adult population size of 513-855 Altamaha River origin adults. Fisheries bycatch data suggests that the ratio of subadults to adults is at least 3:1. Therefore, we estimate that there are at least 2,052-3,420 Altamaha River origin subadults and adults combined. The ASSRT estimated that there are less than 300 spawning adults (total of both sexes) in each of the other river systems where spawning occurs. There are no reported population estimates for any other spawning rivers or the DPS as a whole. 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. Here, we consider the effect of the annual loss of 11 subadults and/or 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 11 subadults and/or 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 11 subadult and/or adult Atlantic sturgeon from the SA DPS represents a very small percentage of subadult and adult population (*i.e.*, no more than 0.53% of the population, just considering the minimum estimated number of Altamaha River origin subadults and adults; the percentage would be much less if the number of YOY and juveniles was considered as well as any fish from the five other spawning rivers). While the death of 11 subadult and/or 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[14] (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 3 adults and 8 subadults represents an extremely small percentage of the adult population (no more than 0.58%, just considering the Altamaha River adults).

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 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 11 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 11 subadult and/or adult SA DPS Atlantic sturgeon represents an extremely small percentage of the species as a whole; (2) the annual death of 11 subadult and/or 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 11 subadult and/or 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 11 subadult and/or 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

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[14] 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).

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 (11 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 11 subadult and/or 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). See also 16 U.S.C. 1532(13)(definition of "person"). Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the ESA provided that such taking is in compliance with the terms and conditions of this ITS.

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 U.S. Fish and Wildlife Service and National Marine Fisheries Service'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 surveys described in this Opinion to be carried out by NEFSC in 2013 and 2014 will result in the annual capture of:

- Up to 10 NWA DPS loggerhead sea turtles (3 in the NEFSC spring BTS; 6 in the NEFSC fall BTS; and 1 in the NEFSC scallop dredge survey, lethal);
- Up to 2 Kemp's ridley sea turtles (1 in the NEFSC spring and fall BTS combined; 1 in the NEFSC scallop dredge survey, lethal);
- Up to 1 green sea turtle (in the NEFSC spring and fall BTS combined);
- Up to 1 leatherback sea turtle (in the NEFSC spring and fall BTS combined); and,
- A total of no more than 16 Atlantic sturgeon (7 in the NEFSC spring BTS, 8 in the NEFSC fall BTS, and 1 in the MADMF spring and fall BTS combined). Based on mixed stock analyses, we anticipate that 8 of the Atlantic sturgeon captured will be NYB DPS origin, 3 will be SA DPS origin, 2 will be CB DPS origin, 2 will be GOM DPS origin, and 1 will be Carolina DPS origin.

In addition, we anticipate that the two cooperative gear research projects described in this Opinion to be overseen by the NEFSC PSB will result in the annual capture of:

- Up to 4 NWA DPS loggerhead sea turtles (3 in topless trawl, up to 1 lethal; 1 in gillnet, lethal);
- Up to 2 Kemp's ridley sea turtles (1 in topless trawl, lethal; 1 in gillnet, lethal);
- Up to 2 green sea turtles (1 in topless trawl, lethal; 1 in gillnet, lethal);
- Up to 2 leatherback sea turtles (1 in topless trawl, lethal; 1 in gillnet, lethal); and,
- A total of no more than 57 Atlantic sturgeon (7 in topless trawl, 1 lethal; 50 in gillnet, 34 lethal).
    - Based on mixed stock analyses, we anticipate that 3 of the Atlantic sturgeon captured in the topless trawl study will be NYB DPS origin, 1 will be SA DPS origin, 1 will be CB DPS origin, 1 will be GOM DPS origin, and 1 will be Carolina DPS origin. We further anticipate that the 1 lethal take may come from any of the five DPSs.
    - Based on mixed stock analyses, we anticipate that 23 of the Atlantic sturgeon captured in the gillnet study will be NYB DPS origin, 14 will be SA DPS origin, 8 will be CB DPS origin, 4 will be GOM DPS origin, and 1 will be Carolina DPS origin. We further anticipate that up to 16 of the lethal takes will be from the NYB DPS, up to 10 lethal takes will be from the SA DPS, up to 5 lethal takes will be from the CB DPS, up to 2 lethal takes will be from the GOM DPS, and up to 1 lethal take will be from the Carolina DPS.

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 NEFSC research vessel surveys and cooperative gear research projects must be handled and resuscitated according to established procedures.

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

3. Any sea turtles or Atlantic sturgeon caught and retrieved in trawl, gillnet, or dredge 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 B 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 research vessel survey staff and 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 research vessel survey staff and 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 NEFSC and MADMF bottom trawl survey vessels as well as the vessels participating in the two cooperative gear research projects 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 NEFSC and MADMF bottom trawl survey vessels, the NEFSC scallop dredge vessel, and the vessels participating in the two cooperative gear research projects 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 C can aid in species identification.

6. To comply with RPM #2 above, the NEFSC must ensure that research vessel survey staff and 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 D. If the NEFSC anticipates 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 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 and 2014 NEFSC 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/dredge bag; 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 E 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 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 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 part of 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 surveys and 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 NEFSC surveys and PSB studies 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 sea turtle conservation:

1. NMFS should advise the Principal Investigator for the NEFSC surveys and PSB studies 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 NEFSC's research vessel activities and two cooperative gear research projects. 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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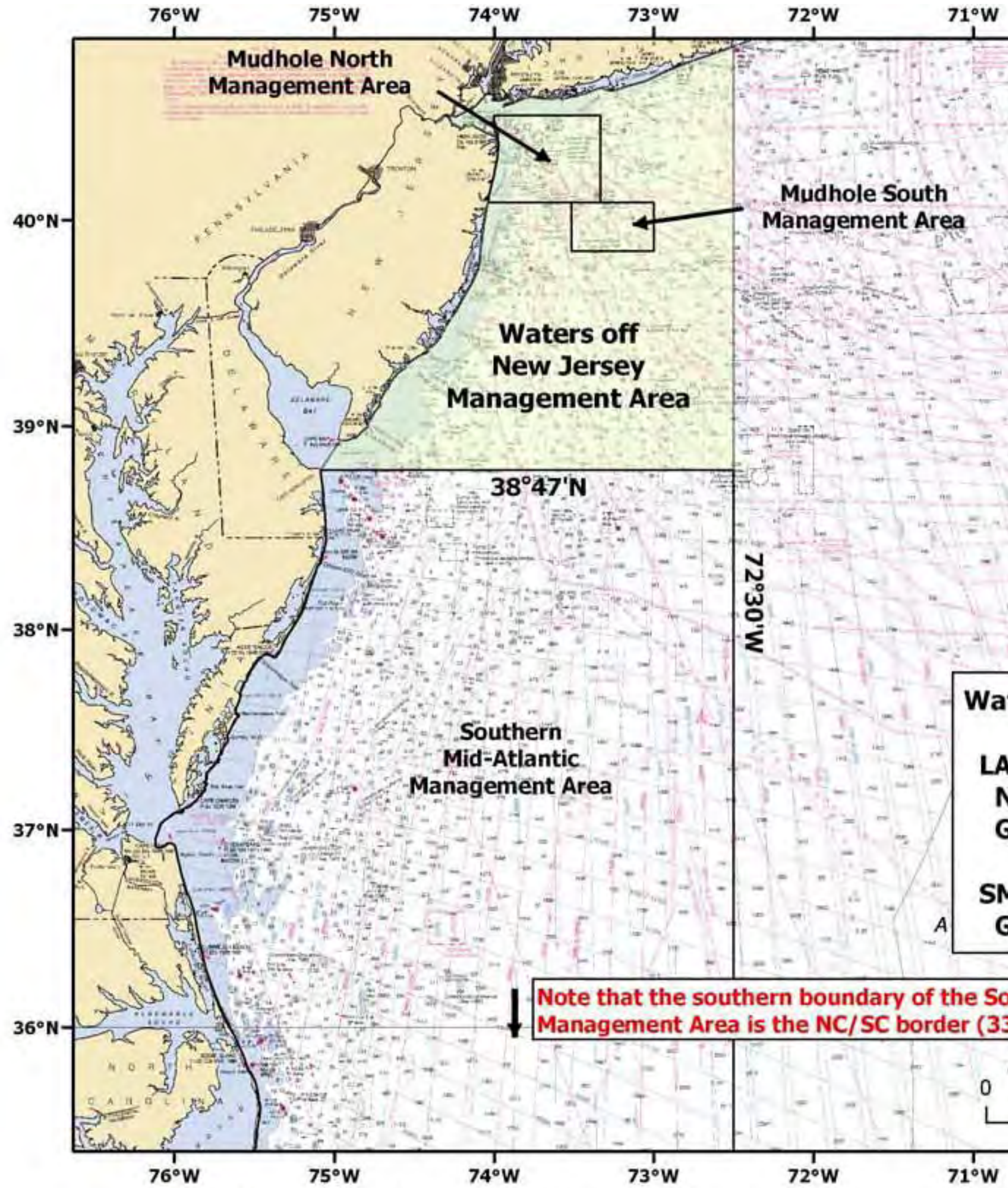


Chart Name: Cape Sable to Cape Hatteras
Chart #: 13003_1
- Not for navigational purposes - Depth units = fathoms

APPENDIX B

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.

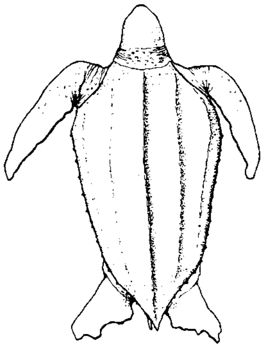
(3) sea turtles that revive and become active must be released over the stern of the boat only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels. Sea turtles that fail to 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 C

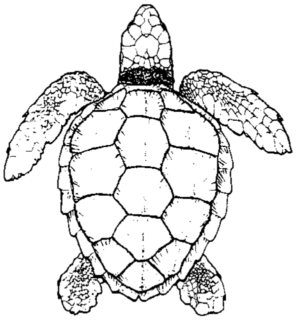
Identification Key for Sea Turtles and Sturgeon Found in Northeast U.S. Waters

SEA TURTLES



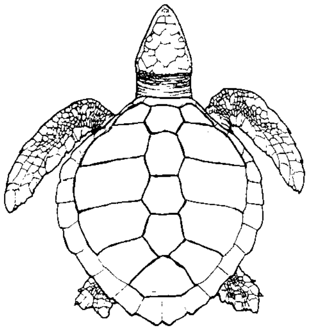
Leatherback (*Dermocheyls coriacea*)

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.



Loggerhead (*Caretta caretta*)

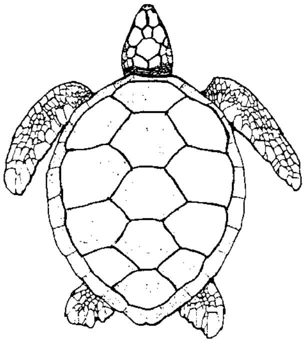
Bony shell, reddish-brown in color. Mid-sized sea turtle (2-4 feet). Commonly seen from Cape Cod to Hatteras from spring through fall, especially in southern portion of range. Head large in relation to body.



Kemp's ridley (*Lepidochelys kempi*)

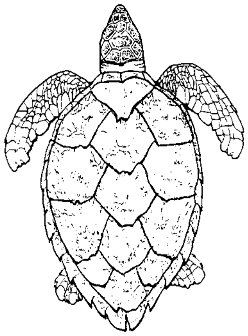
Most often found in Bays and coastal waters from Cape Cod to Hatteras from summer through fall. Offshore occurrence undetermined. Bony shell, olive green to grey in color. Smallest sea turtle in Northeast (9-24 inches). Width equal to or greater than length.

APPENDIX C, continued (**Identification Key**)



Green turtle (*Chelonia mydas*)

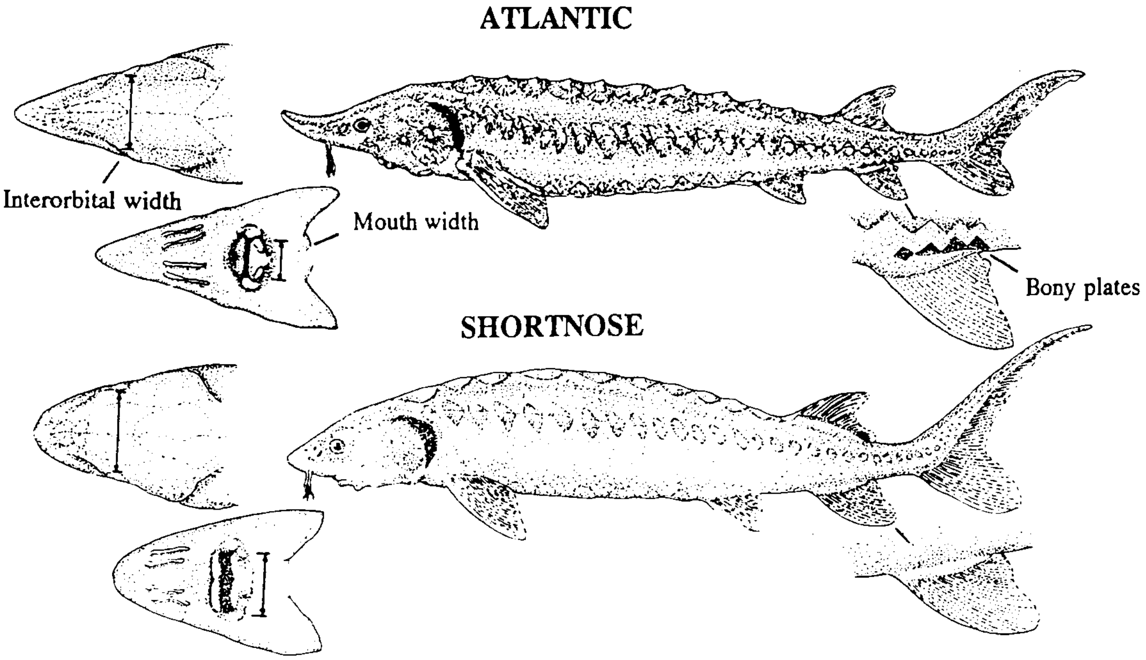
Uncommon in the Northeast. Occur in Bays and coastal waters from Cape Cod to Hatteras in summer. Bony shell, variably colored; usually dark brown with lighter stripes and spots. Small to mid-sized sea turtle (1-3 feet). Head small in comparison to body size.



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 C 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 D

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 Russ Bohl at NMFS Northeast Regional Office (978-282-8493) to report that a sample is being sent and to discuss proper shipping procedures.

APPENDIX E

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 E 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.)
____
____