ENDANGERED SPECIES ACT SECTION 7 CONSULTATION
BIOLOGICAL OPINION

Action Agency: National Marine Fisheries Service

Activity: Endangered Species Act Section 7 Consultation on NMFS Gear Regulations in the Virginia Pound Net Fishery
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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 (U.S. FWS), depending upon the species and/or critical habitats that may be affected. In instances where the NMFS or U.S. FWS authorizes, funds, or carries out an action that may affect ESA-listed species or critical habitat under their respective jurisdictions, the agency in question must conduct intra-service consultation.

The Federal actions described in this document are gear regulations that our agency, NMFS, has enacted for the pound net fishery operating in nearshore coastal and estuarine waters of Virginia, including waters inside Chesapeake Bay, since 2002. These gear regulations take the form of protected species conservation measures pursuant to the ESA as well as the Marine Mammal Protection Act (MMPA). Because of these federal actions, we are required to perform an intra-service section 7 consultation to assess their impacts on ESA-listed species and critical habitats under our jurisdiction, across the full range of fishing activities and locations where they occur.

We, the NMFS Greater Atlantic Regional Fisheries Office, Protected Resources Division (GARFO PRD), most recently completed formal consultation and issued a biological opinion (Opinion) pursuant to section 7 of the ESA for the NMFS gear regulations on the Virginia pound net fishery on April 16, 2004. In the 2004 Opinion, we concluded that the federal gear regulations governing the fishery may adversely affect, but are not likely to jeopardize the continued existence of ESA-listed species. We also concluded in the 2004 Opinion that the federal gear regulations are not likely to destroy or adversely modify designated critical habitat for ESA-listed species. This new Opinion replaces the existing 2004 Opinion and provides an updated analysis of the effects of the Federal gear regulations on ESA-listed species, including the Northwest Atlantic distinct population segment (DPS) of loggerhead sea turtles, the North Atlantic DPS of green sea turtles, and the five DPSs of Atlantic sturgeon which have been listed subsequent to the 2004 Opinion. In addition, this new Opinion will consider the best available scientific information on the incidental take of sea turtles and Atlantic sturgeon in components of the Virginia pound net fishery affected by gear regulations under both the ESA and MMPA. Finally, we will assess the impacts of the federal gear regulations on critical habitat for Atlantic sturgeon, which is designated in several rivers of the Chesapeake Bay estuary and may overlap with Virginia pound net fishing operations.

This Opinion is based on information contained in a 2015 final rule that amended the regulations and definitions for Virginia pound nets under both the Bottlenose Dolphin Take Reduction Plan (BDTRP) and the ESA for sea turtle conservation (80 FR 6925; February 9, 2015). It is also based on information from and correspondence with the Virginia Marine Resources Commission (VMRC; the state agency responsible for marine fisheries management in Virginia), information on past interactions with ESA-listed species in the Virginia and other Atlantic pound net fisheries, and other scientific data and reports cited throughout this document. In addition, we used information from past consultations on the fishery dating back to 2002. A complete administrative record of this formal ESA consultation will be kept on file at GARFO PRD.

2.0 CONSULTATION HISTORY

On May 14, 2002, we completed our first Opinion on sea turtle conservation measures for the Virginia pound net fishery pursuant to section 7 of the ESA. This consultation addressed a proposed rule that prohibited the use of all pound net leaders measuring 12 inches and greater stretched mesh and all pound net leaders with stringers in the Virginia waters of the mainstem Chesapeake Bay and portions of Virginia tributaries from May 8 to June 30 each year (67 FR 15160; March 29, 2002). An interim final rule for this action was published on June 17, 2002 (67 FR 41196). It required fishermen to report all pound net-sea turtle interactions within 24 hours of returning from trips and included a year-round requirement for fishermen to utilize NMFS-approved observers if requested by the Northeast (now Greater Atlantic) Regional Administrator.

We most recently completed formal consultation on sea turtle conservation measures for the Virginia pound net fishery on April 16, 2004. This was in response to new information on the effects of the fishery on ESA-listed sea turtles subsequent to the original 2002 Opinion as well as the issuance of a 2004 proposed rule prohibiting the use of offshore pound net leaders. In both the 2002 and 2004 Opinions, we considered the effects of the implementation of sea turtle conservation measures as well as the continued operation of the Virginia pound net fishery and its gear components (leaders, pounds, etc.). As the proposed action is our agency's regulation of gears utilized in the fishery, and because the regulations provide an exception to the prohibition on incidental take of ESA-listed sea turtles, we consider the impacts to both ESA-listed species and designated critical habitat under our jurisdiction from the continued operation of the Virginia pound net fishery inclusive of all its gear components, as fishing of the gear components are interrelated/interdependent actions resulting from the protected species conservation measures.

In the 2004 Opinion, we concluded that the implementation of sea turtle conservation regulations for the Virginia pound net fishery under the 2004 rule (which prohibited the use of offshore pound net leaders), and the continued operation of the fishery following implementation of the rule, was not likely to jeopardize the continued existence of any ESA-listed species or result in the destruction or adverse modification of any designated critical habitats under our jurisdiction. We provided an incidental take statement (ITS) in the 2004 Opinion for the anticipated incidental take of loggerhead, leatherback, Kemp's ridley, and green sea turtles in the fishery operating in compliance with the proposed measures and provided several reasonable and prudent measures and accompanying terms and conditions to minimize the impacts of incidental take. Although also assessed in the 2004 Opinion as "may be affected," shortnose sturgeon were not anticipated to be incidentally taken (or adversely affected) as a result of the proposed measures and continuation of the fishery.

In both 2006 and 2007, we conducted section 7 reviews of additional Virginia pound net related rulemaking. On June 5, 2006, we performed a section 7 review of new modified pound net leader regulations for Virginia pound nets under the ESA. The 2006 proposed rule required that any offshore pound net leader set in Pound Net Regulated Area I (see Figure 1) during the period of

May 6 - July 15 be a modified leader, and allowed the use of modified leaders in the remainder of the Virginia portion of Chesapeake Bay. We determined that reinitiation of consultation was not necessary because the proposed action provided a level of protection to listed sea turtles similar to or better than that of the restrictions already in place. The final rule for that action was published on June 23, 2006 (71 FR 36024). On January 27, 2007, we performed a section 7 review of a modified leader inspection program for Virginia pound nets. The proposed rule established an inspection program for pound net fishermen who intended to use modified pound net leaders in the Virginia portion of Chesapeake Bay at any time during the period from May 6 to July 15. We determined that the proposed action would have no effect on ESA-listed species because it would be conducted entirely on land. The final rule for that action was published on November 18, 2008 (73 FR 68348).

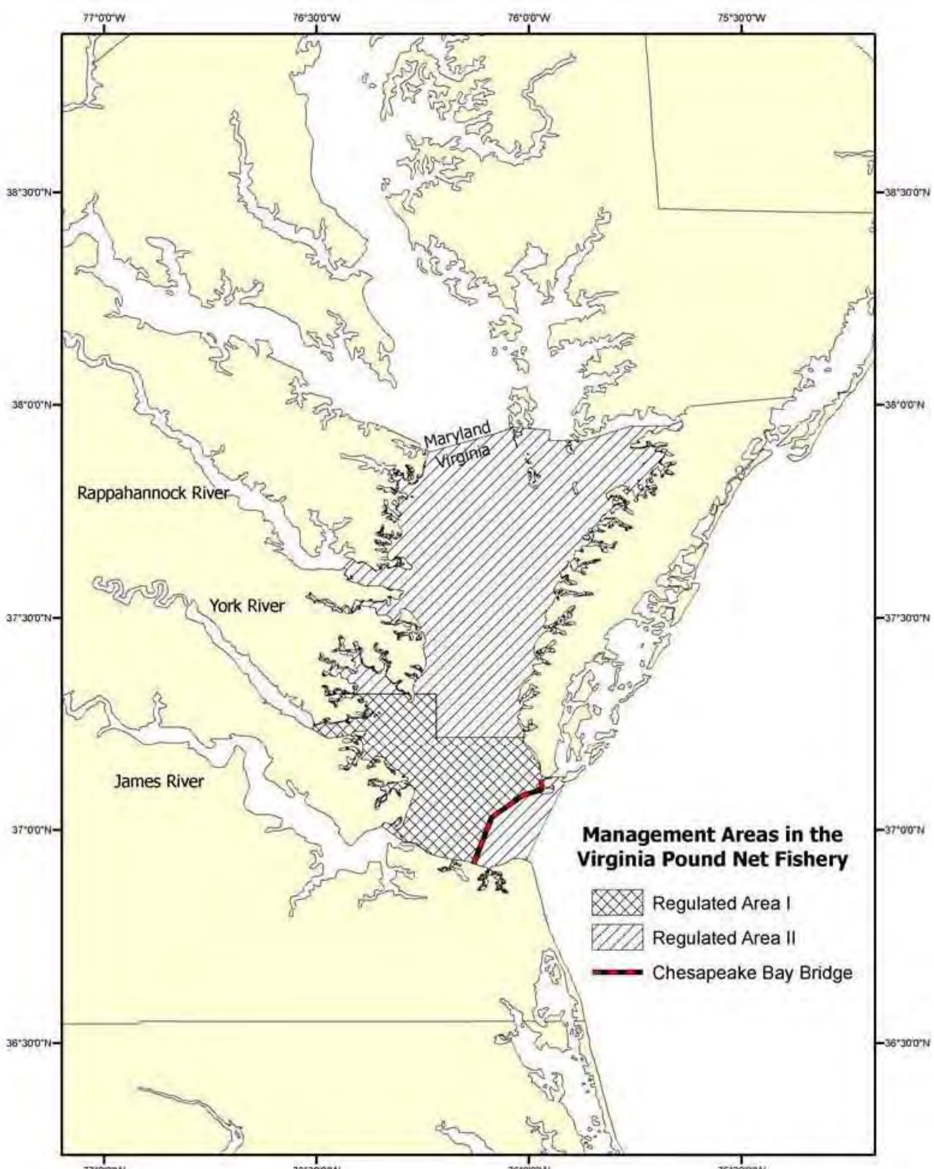

Figure 1. Pound Net Regulated Areas I and II in the Chesapeake Bay, Virginia.

On February 9, 2015, we published a final rule in the *Federal Register* amending the BDTRP and its implementing regulations under the MMPA to require year-round use of modified leaders for offshore Virginia pound nets in specified waters of the lower mainstem Chesapeake Bay and coastal state waters (80 FR 6925; Figure 2). Seasonality of modified leader use as previously required under the ESA regulations remains in place. Under both the MMPA and ESA, the final rule also included a one-time compliance training for fishermen using modified leaders, new and revised Virginia pound net-related definitions, and requirements to fish all sections of the gear at the same time. The final rule became effective on March 11, 2015, and represents a modification to the NMFS gear regulations assessed in the 2004 Opinion. In addition to these new MMPA and ESA regulations, new information is available on the effects of federally regulated gear in the Virginia pound net fishery on ESA-listed species. In light of the recent changes to the fishery, the availability of new information on the effects of the fishery on sea turtles, and the recent listing of Atlantic sturgeon, reinitiation of consultation was appropriate. This consultation will also consider effects of the action on critical habitat designated for the five DPSs of Atlantic sturgeon.

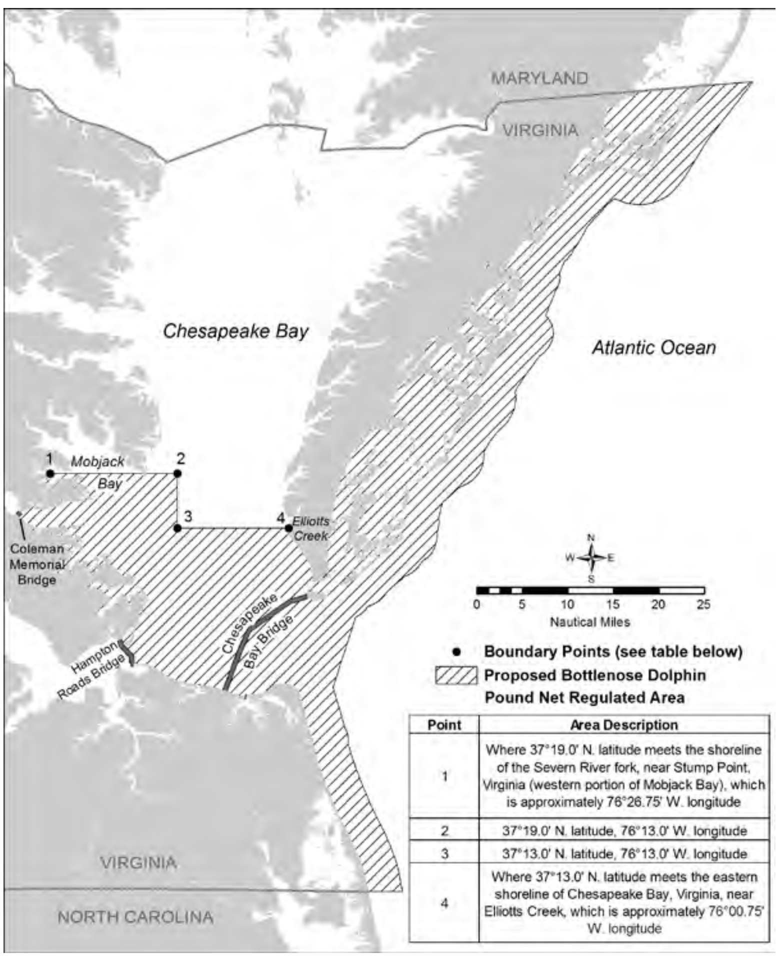

Figure 2. Bottlenose Dolphin Pound Net Regulated Area in Virginia state waters.

3.0 DESCRIPTION OF THE PROPOSED ACTION

The proposed action is NMFS's implementation of gear regulations for the Virginia pound net fishery, in the form of protected species conservation measures pursuant to the ESA and MMPA. Because the proposed action is NMFS's regulation of the fishery, and because the regulations provide an exemption to the prohibition on incidental take of listed species, we will consider the impacts to listed species from the continued operation of the pound net fishery as a whole.

3.1 Description of NMFS Gear Regulations and the Virginia Pound Net Fishery

Based upon documented sea turtle interactions with pound net leaders, NMFS issued a final rule on May 5, 2004 (69 FR 24997), that prohibited the use of offshore pound net leaders from May 6 to July 15 in an area referred to as "Pound Net Regulated Area I." Pound Net Regulated Area I is defined under the 2015 final rule (as shown in Figure 1) as the Virginia waters of the mainstem Chesapeake Bay and the portion of the James River seaward of the Hampton Roads Bridge Tunnel (Interstate Highway-64) and the York River seaward of the Coleman Memorial Bridge (Route 17), bounded to the south and east by the Chesapeake Bay Bridge Tunnel (Route 13; extending from approximately 37°07′ N. lat., 75°58′ W. long. to 36°55′ N. lat., 76°08′ W. long.), and to the north by the following points connected by straight lines and in the order listed:

Point Area	Description
1	Where 37°19.0′ N. lat. meets the shoreline of the Severn River fork, near Stump Point, Virginia (western portion of Mobjack Bay), Bay), which is approximately 76°26.75′ W. long.
2	37°19.0′ N. lat., 76°13.0′ W. long.
3	37°13.0′ N. lat., 76°13.0′ W. long.
4	Where 37°13.0′ N. lat. meets the eastern shoreline of Chesapeake Bay, Virginia, near Elliotts Creek, which is approximately 76°00.75′ W. long.

Under the 2015 final rule, an offshore pound net leader or offshore pound net means a pound net with any part of the leader (from the most offshore pole at the pound end of the leader to the most inshore pole of the leader) in water greater than or equal to 14 feet (4.3 meters) at any tidal condition.

The May 2004 rule also placed restrictions on nearshore pound net leaders in Pound Net Regulated Area I and on all pound net leaders employed in "Pound Net Regulated Area II." Pound Net Regulated Area II, as currently defined in the 2015 final rule, refers to Virginia waters of the Chesapeake Bay outside of Pound Net Regulated Area I, bounded by the Maryland-Virginia State line to the north and by the COLREGS line at the mouth of the Chesapeake Bay and 37°07′ N. lat. between Kiptopeke and Smith Island, Northampton County, Virginia to the south and east. This area includes the Great Wicomico River seaward of the Jessie Dupont Memorial Highway Bridge (Route 200), the Rappahannock River downstream of the Robert Opie Norris Jr. Bridge (Route 3), the Piankatank River downstream of the Route 3 Bridge, and all other tributaries within these boundaries (Figure 1). Under the 2015 final rule, a nearshore pound net leader or nearshore pound net means a pound net with every part of the leader (from the most offshore pole at the pound end of the leader to the most inshore pole of the leader) in less than 14 feet (4.3 meters) of water at any tidal condition. Pursuant to the 2004 rule, nearshore pound net leaders in Pound Net Regulated Area I and all pound net leaders in Pound Net Regulated Area II must have mesh size less than 12 inches (30.5 centimeters) stretched mesh and may not employ stringers.

In 2004 and 2005, NMFS implemented a coordinated research program with pound net industry participants and other interested parties to develop and test a modified pound net leader design with the goal of eliminating or reducing sea turtle interactions while retaining an acceptable level of fish catch. Based upon these results, on June 23, 2006, NMFS issued a final rule (71 FR 36024) that required any offshore pound net leader in Pound Net Regulated Area I during the period from May 6 through July 15 to meet the definition of a modified pound net leader. A modified pound net leader, as defined under the 2015 final rule, is a pound net leader that is affixed to or resting on the sea floor and made of a lower portion of mesh and an upper portion of only vertical lines such that the mesh size is equal to or less than 8 inches (20.3 centimeters) stretched mesh; at any particular point along the leader, the height of the mesh from the seafloor to the top of the mesh must be no more than one-third the depth of the water at mean lower low water directly above that particular point; the mesh is held in place by a bottom chain that forms the lowermost part of the pound net leader; the vertical lines extend from the top of the mesh up to a top line, which is a line that forms the uppermost part of the pound net leader; the vertical lines are equal to or greater than 5⁄16 inch (0.8 centimeters) in diameter and strung vertically at a minimum of every 2 feet (61 centimeters); and the vertical lines are hard lay lines.

Existing mesh size and stringer restrictions on nearshore pound net leaders in Pound Net Regulated Area I and all pound net leaders in Pound Net Regulated Area II remained in place from May 6 through July 15 of each year. However, the June 2006 rule created an exception to those restrictions by allowing the use of modified pound net leaders during that period in nearshore pound net leaders in Pound Net Regulated Area I and all pound net leaders in Pound Net Regulated Area II. The year-round reporting and monitoring requirements for this fishery and the framework mechanism under the existing regulations (50 CFR 223.206(d)(10)) also remained in effect. After the 2006 final rule was published, NMFS determined that an onshore inspection program that examines a modified leader ready for deployment would help ensure the protection of sea turtles, while limiting the difficulties of and potential costs to fishermen associated with post-deployment inspections at-sea.

In the February 2015 final rule, NMFS amended: (1) the BDTRP and its implementing regulations at 50 CFR 229.2, 229.3, and 229.35, in accordance with section 118(f) of the MMPA; and (2) current definitions and regulations issued under the ESA for sea turtle conservation at 50 CFR 222.102, 223.205, and 223.206 (d)(10). NMFS further amended the BDTRP to meet its MMPA-mandated goal of reducing incidental mortality and serious injury of strategic stocks of bottlenose dolphins from the Virginia pound net fishery. Regulations for this amendment were based on the BDTRT’s consensus recommendations, which were generally consistent with existing regulations enacted under the ESA for sea turtle conservation, with some revisions and updates. Amendments to the ESA sea turtle conservation regulations for the Virginia pound net fishery were finalized within the same rulemaking for consistency in definitions and regulations.

The final rule required the year-round use of modified pound net leaders for offshore Virginia pound nets within the Bottlenose Dolphin Pound Net Regulated Area (Figure 2). It removed the land-based inspection program for modified pound net leaders under the ESA. Instead, under both the MMPA and ESA, it required fishermen to attend a one-time compliance training before setting modified pound net leaders and to keep on board the vessel a valid modified pound net leader compliance training certificate issued by NMFS. The rule also required that all three sections of pound net gear (leader, heart, and pound) be fished at the same time with the exception of a continuous 10-day period to deploy, remove, and/or repair gear. Virginia pound net-related definitions were added/revised for effective implementation of the regulatory measures, including hard lay lines, modified pound net leader, nearshore pound net, offshore pound net, and pound net. Lastly, non-regulatory measures were finalized under the BDTRP including outreach and coordination to help with compliance and monitoring of regulatory measures for the Virginia pound net fishery.

Virginia pound net fishery

The Virginia pound net fishery is described in various documents (Mansfield *et al*. 2001; NMFS 2004a; Silva *et al.* 2011; Magnusson *et al.* 2012), and the following is a brief summary. A pound net is a fixed entrapment gear consisting of an arrangement of fiber netting supported upon stakes or pilings with the head ropes or lines above the water. Typically, there are three distinct segments: (1) the pound, which is the enclosed end with a netting floor where the fish entrapment takes place; (2) the heart, which is a net in the shape of a heart that aids in funneling the fish into the pound; and (3) the leader, which is a long straight net that leads the fish offshore towards the pound (Figure 3). There may also be an outer compartment or second heart, and pound nets fished in deeper water may have a middle compartment (round pound). Pound nets are oriented perpendicular to the shoreline, with the leader being the closest component to shore. Fish swimming along shore are turned towards the pound by the leader, guided into the heart(s), and then into the pound where they are removed periodically. Pound net leaders may consist of mesh, stringers, and/or buoys. Some pound net leaders are all mesh, while others have stringers and mesh. Stringers, also known as vertical lines, are spaced a regular distance apart and are not crossed by other lines to form mesh (Figure 4). We consider a pound net leader with stretched mesh greater than 12 inches to be a large mesh leader.

Pound nets are passive fishing devices, as they will trap the fish that swim into the pound. Pound nets have low selectivity for size, but are selective for fishes that occur in nearshore areas. The majority of pound nets are set and fished between April and November in relatively shallow water (<6 meters) and target many gamefishes (Welsh *et al.* 2002a). In order to fish the pound net, watermen will routinely use a smaller skiff to untie the crib from the poles, and begin bunting the net onto the skiff. As the bunting process continues, fish are confined to an ever decreasing space until it is easy for the watermen to remove the fish with a large, hydraulically operated dip net or small, manual one. From this point, the catch is culled. Species of fish that are caught within a net depend upon a variety of factors, including the season and the location of the pound net. Bait fish, Atlantic croaker, and menhaden often comprise the majority of the total catch by pound nets. As a result, the fishery is managed by the Atlantic States Marine Fisheries Commission (ASMFC) under the Interstate Fishery Management Plans for Atlantic Croaker and Spot. As mentioned above, gear used in the fishery is also regulated under the ESA as well as the BDTRP and its implementing regulations under the MMPA.

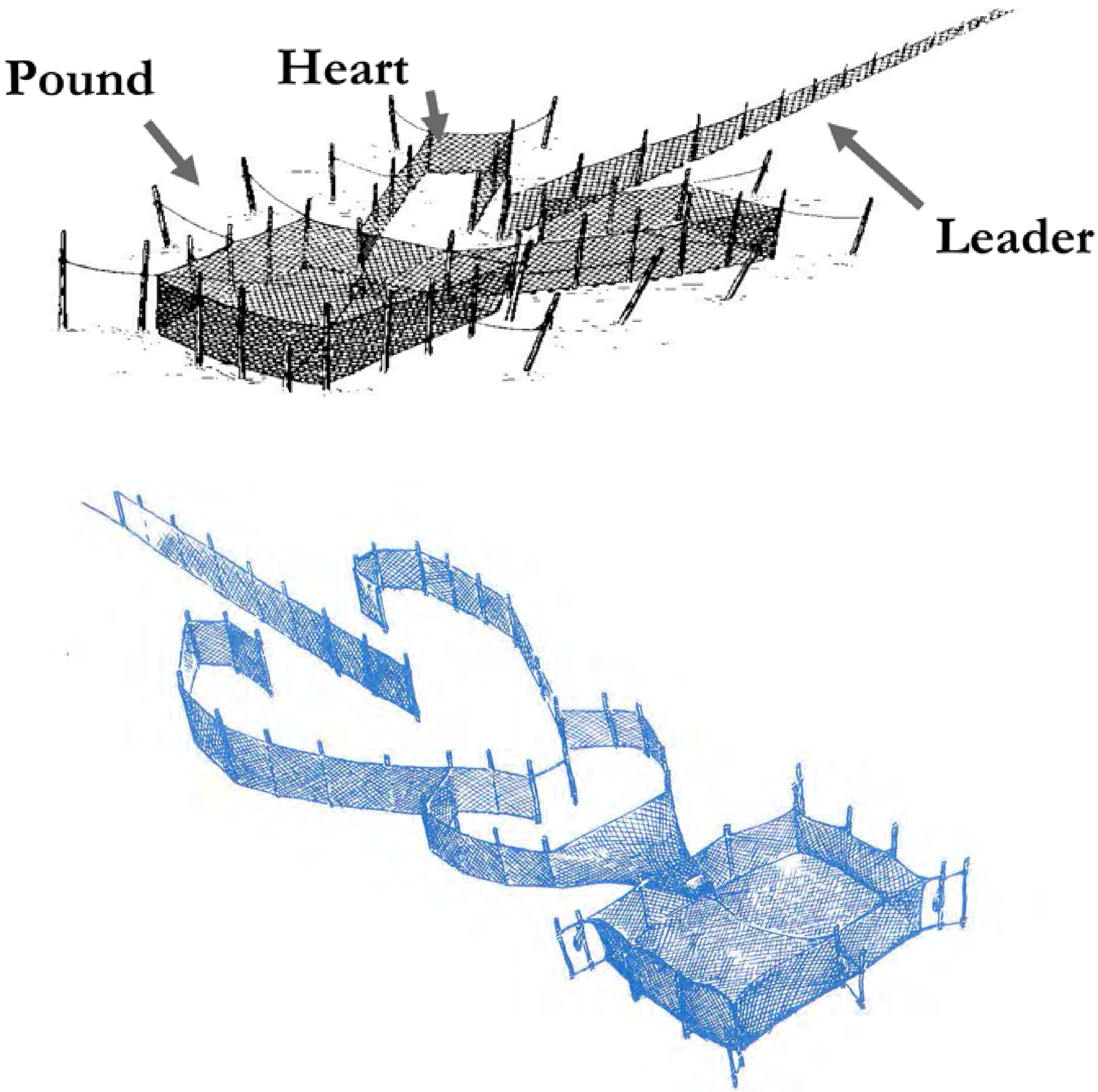

Figure 3. Generalized designs of a Virginia pound net. Adapted from Mansfield *et al*. (2001) and Silva *et al*. (2011).

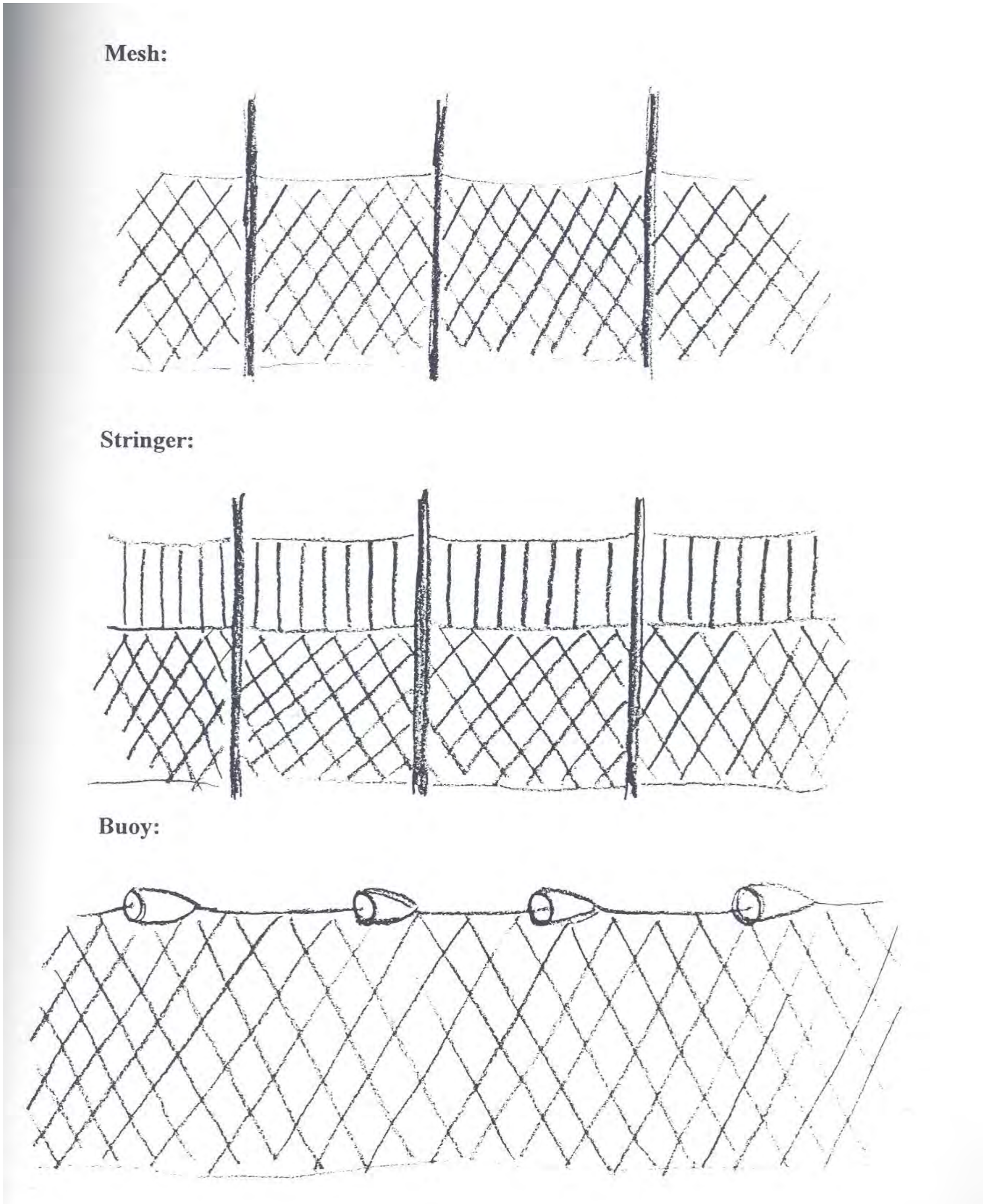

Figure 4. Pound net leader types: mesh, stringer, and buoy. Adapted from Mansfield *et al*. (2001).

Effort in this fishery occurs in nearshore coastal and estuarine waters of Virginia. This fishery includes all pound net effort in Virginia state waters, including waters inside Chesapeake Bay. Virginia has maintained a limited entry system for pound nets in the mainstem Chesapeake Bay and near reaches of the tributaries since 1994. At present, the number of available licenses in Virginia is capped at 161 (Regulation 4 VAC 20-600-10 et seq. "Limits the Sale of Pound Net Licenses"). According to the VMRC website, 158 pound net licenses are currently in effect in Virginia, where one license is assigned to each pound net that can be set (https://webapps.mrc.virginia.gov/public/maps/virginia poundnets.php). In 2017, there were 26 participants in the fishery possessing the 158 total licenses (average ~6 per participant). Annual attrition occasionally results in licenses being transferred to new participants, so it appears that the number of licenses has been relatively stable for the past twenty plus years. Separate from active nets, several of the 158 licensed pound nets are currently noted by VMRC as forfeited and therefore cannot be fished at present. Also, not all Virginia pound net fishermen hang their nets in the action area where NMFS regulations apply; therefore, we expect fewer than 158 nets in the action area.

According to VMRC, pound nets are set almost exclusively offshore of the county in which the license was purchased. In Virginia, the majority of pound net stands are located around the southern Virginia shore of the mouth of the Potomac River (south of Smith Point), around the mouth of the Rappahannock River to the mouth of the York River/Mobjack Bay, and along the Eastern shore of Virginia (https://webapps.mrc.virginia.gov/public/maps/virginia_poundnets.php and https://webapps.mrc.virginia.gov/public/maps/chesapeakebay_map.php). This geographical distribution of sites is consistent with those observed during past monitoring efforts and studies.

The choice of leader mesh size depends heavily on the currents where the nets are located. Large mesh leaders are utilized in areas of strong tidal currents to prevent flotsam from washing into the leaders and causing the overburdened nets to drift away, while small mesh leaders (approximately 6-8 inch mesh) are set closer to shore in up to 15 feet of water. Stringer leaders, which are prohibited from May 6 to July 15, have also historically been used in locations with high currents. The pounds for those stringer leaders are set in about 12-30 feet of water. Nets in shallower protected areas are usually equipped with smaller mesh leaders (<8 inches stretched mesh). Only a few pound nets are set upriver of the first bridge in the Virginia Chesapeake Bay tributaries or outside the Bay Bridge/COLREGS line.

3.2 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). We anticipate that the effects on ESA-listed species and their habitats as a result of the NMFS gear regulations in the Virginia pound net fishery include the direct effects of interactions between listed species and pound net fishing gear as well as the effects on other marine organisms (i.e., prey) on or very near to the sea floor that may result from placement/hauling of the gear or direct capture/entanglement in it. In addition, indirect effects from the operation of fishing vessels on ESA-listed species, their prey, and habitats are possible. Therefore, for the purpose of this consultation, the action area is defined by the area in which Virginia pound net fishing activities and vessel-based operations occur within nearshore coastal and estuarine waters of Virginia, including waters inside Chesapeake Bay.

Specifically, the action area for this consultation includes the Virginia waters of the mainstem Chesapeake Bay from the Maryland-Virginia state line (approximately 37° 55' N. lat., 75° 55' W. long.) to the COLREGS line at the mouth of the Chesapeake Bay; the James River downstream of the Hampton Roads Bridge Tunnel (I-64); the York River downstream of the Coleman Memorial Bridge (Route 17); the Great Wicomico River downstream of the Jessie Dupont Memorial Highway Bridge (Route 200); the Rappahannock River downstream of the Robert Opie Norris Jr. Bridge (Route 3); and the Piankatank River downstream of the Route 3 Bridge (Figure 1). The action area also includes the Bottlenose Dolphin Pound Net Regulated Area which is the southern Virginia waters of the mainstem Chesapeake Bay (i.e., Pound Net Regulated Area I) and state coastal waters to the Maryland/Virginia line and Virginia/North Carolina line (Figure 2).

4.0 STATUS OF LISTED SPECIES AND CRITICAL HABITAT

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

Federally endangered sei, sperm, and blue whales do not occur in the action area. Federally endangered North Atlantic right whales and fin whales are expected to occasionally occur in Virginia nearshore and coastal waters of the action area, including Chesapeake Bay. Pound net gear is typically set in shallow, nearshore waters at depths that are often not deep enough for these two species of large whales to enter. As a result, it is extremely unlikely that any right or fin whales would interact with pound net gear; therefore, effects are discountable.

We have also determined that the proposed action is not likely to have any adverse effects on the availability of prey for right and fin whales. Right whales feed on copepods. Pound net gear will not affect the availability of copepods for foraging right whales because copepods are very small organisms that will pass through the gear rather than being captured in it. Fin whales feed on pelagic krill as well as small schooling fish (e.g., sand lance, herring, mackerel) (Aguilar 2002). Pound net fishing gear operates on or near the bottom in shallow waters. Fish species caught in pound net gear are typically shallow water species that live in benthic habitat (on or very near the bottom) versus schooling fish and invertebrates that occur within the water column in deeper waters. As a result, the pound net fishery will not affect the availability of the pelagic prey of foraging fin whales. Since the proposed action is not likely to adversely affect right or fin whales or their prey, we will not assess them 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 Gulf of Mexico states and along the U.S. east coast as far north as Massachusetts, but sightings north of Florida are rare. Many of the strandings in states north of Florida have been 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 extremely unlikely to be present in the action area, effects to this species as a result of the proposed action are extremely unlikely and therefore, discountable. The lack of any captures of hawksbill sea turtles in Virginia pound net gear to date supports this determination.

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. The species is anadromous in the southern portion of its range (*i.e.*, south of Chesapeake Bay), while some northern populations are amphidromous (NMFS 1998a). In Chesapeake Bay, shortnose sturgeon are most often found in Maryland waters of the mainstem bay and tidal tributaries such as the Susquehanna, Potomac, and Rappahannock Rivers (Spells 1998; Litwiler 2001; Kynard et al. 2007, 2009; SSSRT 2010). Shortnose sturgeon have been captured in pound nets in Maryland waters, but we have no data suggesting that captures occur in the Virginia portion of Chesapeake Bay or in nearshore and coastal waters off Virginia. Information on the use of Virginia waters of the Chesapeake Bay by shortnose sturgeon is very limited with only two documented captures since at least the 1970s; both captures were in the James River (Balazik 2017). Given the range of the species (remaining mostly in river systems, with some coastal migrations between Northeast U.S. rivers), its limited presence outside of the upper part of Chesapeake Bay (Maryland portion), and the proposed action occurring in the southern portion of the bay and nearshore coastal waters off Virginia, shortnose sturgeon are expected to be extremely rare in areas where the pound net fishery operates. No interactions with shortnose sturgeon have been reported in Virginia fisheries, including the pound net fishery. As there are no proposed changes to the operation or distribution of the Virginia pound net fishery that would increase the likelihood of interactions between shortnose sturgeon and this gear, we do not anticipate any future interactions. As shortnose sturgeon are extremely unlikely to be present in the action area, effects of the action are also extremely unlikely and effects are discountable.

On August 17, 2017, NMFS issued a final rule designating critical habitat for the five listed DPSs of Atlantic sturgeon found in U.S. waters (82 FR 39160). The action area for this consultation overlaps slightly with the river mouths of the Rappahannock, York, and James rivers; a portion of each of these rivers is designated as critical habitat for the Chesapeake Bay DPS of Atlantic sturgeon. We have analyzed the potential impacts of the Virginia pound net fishery on this designated critical habitat, inclusive of the four physical and biological features (PBFs) described in the final rule. We have determined that the effects to these PBFs from the pound net fishery consistent with the NMFS gear regulations will be insignificant or discountable as described below.

The Virginia pound net fishery does not overlap with, and thus will not affect, hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0-0.5 ppt range) that is used for settlement of fertilized eggs, refuge, growth, and development of early life stages (PBF 1). These features occur far upstream of the areas where pound net gear is typically placed in Virginia waters of Chesapeake Bay. As there is no overlap between PBF 1 in any of the critical habitat units and the action area, there will be no effects to PBF 1.

It is extremely unlikely that the pound net fishery will affect the aquatic habitats between the river mouth and spawning sites that are used for juvenile foraging and physiological development (PBF 2). These waters are characterized by a gradual downstream salinity gradient of 0.5 up to as high as 30 ppt and soft substrate (e.g., sand, mud). As the pound net fishery only involves the deployment and hauling of net gear and occasional vessel transits to fish the gear, it is extremely unlikely to affect the salinity gradient or the natural structure of the soft bottom habitat at these river mouth locations. As such, any reduction in the capacity of the soft bottom substrate, food resources, and natural cover to meet the conservation needs of juvenile Atlantic sturgeon is extremely unlikely. In addition, the fishery is extremely unlikely to affect the forage base of juveniles, as their prey are not the target of the fishery and all netting will be hung above the benthos of the estuary where preferred prey of juvenile sturgeon subside. Therefore, effects to PBF 2 are discountable.

The pound net fishery is extremely unlikely to result in a physical barrier to Atlantic sturgeon passage, as the gear placement will only affect small portions of the shore near specific river mouths at any given time. In addition, the action will not affect the depth or flow of water. As such, effects to PBF 3 are extremely unlikely and discountable.

Finally, as the fishery only involves the deployment and hauling of net gear and occasional vessel transits to fish the gear, it is extremely unlikely to affect water quality parameters (temperature, salinity, and dissolved oxygen) that support spawning, survival, growth, development, and recruitment (PBF 4). Therefore, effects to PBF 4 are discountable. Based upon this analysis, as all effects to designated critical habitat in the action area will be insignificant or discountable, the action is not likely to adversely affect critical habitat designated for the Chesapeake Bay DPS of Atlantic sturgeon.

4.2 Species Likely to be Adversely Affected by the Proposed Action

We have determined that the proposed action considered in this Opinion may affect the following listed species in the action area in a manner that will likely result in adverse effects:

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

[1] NWA DPS = Northwest Atlantic DPS, the only loggerhead sea turtle DPS expected to occur in the action area.
[2] The North Atlantic DPS is the only green sea turtle DPS expected to occur in the action area.

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

4.2.1 Status of Sea Turtles

With the exception of loggerheads and greens, 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 and leatherback sea turtles is included to provide the status of each species overall. Information on the status of loggerhead and green sea turtles 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 U.S. FWS 1995, 2007a, 2007b, 2013; 2015; Hirth 1997; Marine Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; Conant *et al.* 2009; Seminoff *et al.* 2015), and recovery plans for the loggerhead sea turtle (NMFS and U.S. FWS 2008), Kemp's ridley sea turtle (NMFS *et al.* 2011), green sea turtle (NMFS and U.S. FWS 1991), and leatherback sea turtle (NMFS and U.S. FWS 1992, 1998b).

2010 BP Deepwater Horizon Oil Spill
The April 20, 2010, explosion of the Deepwater Horizon oil rig affected sea turtles in the Gulf of Mexico. This extensive oiling event contaminated important sea turtle foraging, migratory, and breeding habitats at the surface, in the water column, on the ocean bottom, and on beaches throughout the northern Gulf of Mexico in areas used by different life stages. Sea turtles were exposed to oil when in contaminated water or habitats; breathing oil droplets, oil vapors, and smoke; ingesting oil-contaminated water and prey; and potentially by maternal transfer of oil compounds to embryos (DWH NRDA Trustees 2016). Response activities and shoreline oiling also directly injured sea turtles and disrupted or deterred sea turtle nesting in the Gulf.

During direct at-sea capture events, more than 900 turtles were sighted, 574 of which were captured and examined for oiling (Stacy 2012). Of the turtles captured during these operations, greater than 80% were visibly oiled (DWH NRDA Trustees 2016). Most of the rescued turtles were taken to rehabilitation facilities; more than 90% of the turtles admitted to rehabilitation centers eventually recovered and were released (Stacy 2012; Stacy and Innis 2012). Recovery efforts also included relocating nearly 300 sea turtle nests from the northern Gulf to the east coast of Florida in 2010, with the goal of preventing hatchlings from entering the oiled waters of the northern Gulf. Approximately 14,000 hatchlings were released off the Atlantic coast of Florida, 95% of which were loggerheads (http://www.nmfs.noaa.gov/pr/health/oilspill/gulf2010.htm).

Direct observations of the effects of oil on turtles obtained by at-sea captures, sightings, and strandings only represent a fraction of the scope of the injury. As such, the DWH NRDA Trustees used expert opinion, surface oiling maps, and statistical approaches to apply the directly observed adverse effects of oil exposure to turtles in areas and at times that could not be surveyed. The Trustees estimated that between 4,900 and up to 7,600 large juvenile and adult sea turtles (Kemp's ridleys, loggerheads, and hard-shelled sea turtles not identified to species), and between 55,000 and 160,000 small juvenile sea turtles (Kemp's ridleys, green turtles, loggerheads, hawksbills, and hard-shelled sea turtles not identified to species) were killed by the DWH oil spill (DWH NRDA Trustees 2016). Nearly 35,000 hatchling sea turtles (loggerheads, Kemp's ridleys, and green turtles) were also injured by response activities. Despite uncertainties and some unquantified injuries to sea turtles (e.g., injury to leatherbacks, unrealized reproduction), the Trustees conclude that this assessment adequately quantifies the nature and magnitude of injuries to sea turtles caused by the DWH oil spill and related activities.

Based on this quantification of sea turtle injuries caused by the DWH oil spill, sea turtles from all life stages and all geographic areas were lost from the northern Gulf of Mexico ecosystem. The DWH NRDA Trustees (2016) conclude that the recovery of sea turtles in the northern Gulf of Mexico from injuries caused by the DWH oil spill will require decades of sustained efforts to reduce the most critical threats and enhance survival of turtles at multiple life stages. The ultimate population level effects of the spill and impacts of the associated response activities are likely to remain unknown for some period into the future.

4.2.1.1 Status of Loggerhead Sea Turtles – Northwest Atlantic DPS

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

Listing History

Loggerhead sea turtles were listed as threatened throughout their global range on July 28, 1978. Since that time, several status reviews have been conducted to review the status of the species and make recommendations regarding its ESA listing status. Based on a 2007 five-year status review of the species, which discussed a variety of threats to loggerheads including climate change, NMFS and U.S. FWS (2007a) 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 U.S. FWS 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 U.S. FWS 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 U.S. 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 U.S. FWS 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 U.S. FWS 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 U.S. FWS 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 U.S. FWS 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 U.S. FWS 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) would be designated in a future rulemaking. Information from the public related to the identification of critical habitat, essential physical or biological features for this species, and other relevant impacts of a critical habitat designation was solicited. On July 10, 2014, U.S. FWS and NMFS published two separate final rules in the Federal Register designating critical habitat for the NWA DPS of loggerhead sea turtles under the ESA (79 FR 39755 for nesting beaches under U.S. FWS jurisdiction; 79 FR 39856 for marine areas under NMFS jurisdiction). Effective August 11, 2014, NMFS's final rule for marine areas designated 38 occupied areas within the at-sea range of the DPS. These recently designated marine areas of critical habitat contain one or a combination of: nearshore reproductive habitat, overwintering habitat, breeding habitat, migratory habitat, and *Sargassum* habitat.

Presence of Loggerhead Sea Turtles in the Action Area

The effects of the proposed action are only experienced within Virginia's nearshore and coastal waters and its portion of Chesapeake Bay and associated river mouths. We have considered the available information on the distribution of the nine DPSs to determine the origin of any loggerhead sea turtles that may occur in the action area. As noted in Conant *et al.* (2009), the range of the four DPSs occurring in the Atlantic Ocean are as follows: NWA DPS – north of the equator, south of 60° N latitude, and west of 40° W longitude; Northeast Atlantic Ocean (NEA) DPS – north of the equator, south of 60° N latitude, east of 40° W longitude, and west of 5° 36' W longitude; South Atlantic DPS – south of the equator, north of 60° S latitude, west of 20° E longitude, and east of 60° W longitude; Mediterranean DPS – the Mediterranean Sea east of 5° 36' W longitude. These boundaries were determined based on oceanographic features, loggerhead sightings, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies. While adults are highly structured with no overlap, there may be some degree of overlap by juveniles of the NWA, NEA, and Mediterranean DPSs on oceanic foraging grounds (Laurent *et al.* 1993, 1998; Bolten *et al.* 1998; LaCasella *et al.* 2005; Carreras *et al.* 2006, Monzón-Argüello *et al.* 2006; Revelles *et al.* 2007). Previous literature (Bowen *et al.* 2004) has suggested that there is the potential, albeit small, for some juveniles from the Mediterranean DPS to be present in U.S. Atlantic coastal foraging grounds. These conclusions must be interpreted with caution however, as they may be representing a shared common haplotype and lack of representative sampling at Eastern Atlantic rookeries rather than an actual presence of Mediterranean DPS turtles in U.S. Atlantic coastal waters. A re-analysis of the data by the Atlantic Loggerhead Turtle Expert Working Group has found that that it is unlikely that U.S. fishing fleets are interacting with either the NEA or Mediterranean DPS (Peter Dutton, NMFS, Marine Turtle Genetics Program, Program Leader, personal communication, September 10, 2011). Given that the action area is a very small subset of the area fished by U.S. fleets, it is reasonable to assume that based on this analysis, no individuals from the NEA or Mediterranean DPS would be present in the action area. Sea turtles of the South Atlantic DPS do not inhabit the action area of this consultation (Conant *et al.* 2009). As such, the remainder of this consultation will focus on the NWA DPS, listed as threatened.

Distribution and Life History

Ehrhart *et al.* (2003) provided a summary of the literature identifying known nesting habitats and foraging areas for loggerheads within the Atlantic Ocean. Detailed information is also provided in the five-year status review for loggerheads (NMFS and U.S. FWS 2007a), the TEWG (2009) report, and the final revised recovery plan for loggerheads in the Northwest Atlantic Ocean (NMFS and U.S. FWS 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 the Gulf of Maine and the Canadian Maritimes are used for foraging by juveniles as well as adults (Shoop 1987; Shoop and Kenney 1992; Ehrhart *et al.* 2003; Mitchell *et al.* 2003; NEFSC 2011a). In U.S. Atlantic waters, loggerheads commonly occur throughout the inner continental shelf from Florida to Cape Cod, Massachusetts and in the Gulf of Mexico from Florida to Texas, although their presence varies with the seasons due to changes in water temperature (Shoop and Kenney 1992; Epperly *et al.* 1995a, 1995b; Braun and Epperly 1996; Mitchell *et al.* 2003; Braun-McNeill *et al.* 2008). Loggerheads have been observed in waters with surface temperatures of 7°C to 30°C, but water temperatures ≥11°C are most favorable (Shoop and Kenney 1992; Epperly *et al.* 1995b). The presence of loggerhead sea turtles in U.S. Atlantic waters is also influenced by water depth. Aerial surveys of continental shelf waters north of Cape Hatteras, North Carolina indicated that loggerhead sea turtles were most commonly sighted in waters with bottom depths ranging from 22 to 49 meters deep (Shoop and Kenney 1992). However, more recent survey and satellite tracking data support that they occur in waters from the beach to beyond the continental shelf (Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; Mansfield 2006; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007; Mansfield *et al.* 2009).

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

Recent studies have established that the loggerhead's life history is more complex than previously believed. Rather than making discrete developmental shifts from oceanic to neritic environments, research is showing that both adults and (presumed) neritic stage juveniles continue to use the oceanic environment and will move back and forth between the two habitats (Witzell 2002; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007; Mansfield *et al.* 2009). One of the studies tracked the movements of adult post-nesting females and found that differences in habitat use were related to body size with larger adults staying in coastal waters and smaller adults traveling to oceanic waters (Hawkes *et al.* 2006). A tracking study of large juveniles found that the habitat preferences of this life stage were also diverse with some remaining in neritic waters and others moving off into oceanic waters (McClellan and Read

2007). However, unlike the Hawkes *et al.* (2006) study, there was no significant difference in the body size of turtles that remained in neritic waters versus oceanic waters (McClellan and Read 2007).

Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd 1988; NMFS and U.S. FWS 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 U.S. FWS 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 U.S.

Population Dynamics and Status

By far, the majority of Atlantic nesting occurs on beaches of the southeastern U.S. (NMFS and U.S. FWS 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.

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).

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

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

NMFS and U.S. FWS (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 to 2017, the trend line changes, showing a strong positive trend since 2007 (http://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/). 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 U.S. FWS 2008). From 1989-2008, the PFRU had an overall declining nesting trend of 26% (95% CI: -42% to -5%; NMFS and U.S. FWS 2008). With the addition of nesting data through 2010, the nesting trend for the PFRU does not show a nesting decline statistically different from zero (76 FR 58868, September 22, 2011). The NRU, the second largest nesting assemblage of loggerheads in the U.S., has been declining at a rate of 1.3% annually since 1983 (NMFS and U.S. FWS 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 U.S. FWS 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 U.S. FWS 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 U.S. FWS 2007a). There are no annual nest estimates available for the Yucatán since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit. Note that the above values for average nesting females per year were based upon 4.1 nests per female per Murphy and Hopkins (1984).

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

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

Maier *et al.* (2004) used fishery-independent trawl data to establish a regional index of loggerhead abundance for the southeast coast of the U.S. (Winyah Bay, South Carolina to St. Augustine, Florida) during the period 2000-2003. A comparison of loggerhead catch data from this study with historical values suggested that in-water populations of loggerhead sea turtles along the southeast U.S. coast appear to be larger, possibly an order of magnitude higher than they were 25 years ago, but the authors caution a direct comparison between the two studies given differences in sampling methodology (Maier *et al.* 2004). A comparison of catch rates for sea turtles in pound net gear fished in the Pamlico-Albemarle Estuarine Complex of North Carolina between the years 1995-1997 and 2001-2003 found a significant increase in catch rates for loggerhead sea turtles for the latter period (Epperly *et al.* 2007). A long-term, on-going study of loggerhead abundance in the Indian River Lagoon System of Florida found a significant increase in the relative abundance of loggerheads over the last four years of the study (Ehrhart *et al.* 2007). However, there was no discernible trend in loggerhead abundance during the 24-year time period of the study (1982-2006) (Ehrhart *et al.* 2007). At St. Lucie Power Plant, data collected from 1977-2004 show an increasing trend of loggerheads at the power plant intake structures (FPL and Quantum Resources 2005).

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

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

As part of the Atlantic Marine Assessment Program for Protected Species (AMAPPS), line transect aerial abundance surveys and turtle telemetry studies were conducted along the U.S. Atlantic coast in the summer of 2010. AMAPPS is a multi-agency initiative to assess marine mammal, sea turtle, and seabird abundance and distribution in the Atlantic. Aerial surveys were conducted from Cape Canaveral, Florida to the Gulf of St. Lawrence, Canada. Satellite tags on juvenile loggerheads were deployed in two locations – off the coasts of northern Florida to South Carolina (n=30) and off the New Jersey and Delaware coasts (n=14). As presented in NEFSC (2011a), the 2010 survey found a preliminary total surface abundance estimate within the entire study area of about 60,000 loggerheads (CV=0.13) or 85,000 if a portion of unidentified hard-shelled sea turtles were included (CV=0.10). Surfacing times were generated from the satellite tag data collected during the aerial survey period, resulting in a 7% (5%-11% inter-quartile range) median surface time in the South Atlantic area and a 67% (57%-77% inter-quartile range) median surface time to the north. The calculated preliminary regional abundance estimate is about 588,000 loggerheads along the U.S. Atlantic coast, with an inter-quartile range of 382,000-817,000 (NEFSC 2011a). The estimate increases to approximately 801,000 (inter-quartile range of 521,000-1,111,000) when based on known loggerheads and a portion of unidentified turtle sightings. The density of loggerheads was generally lower in the north than the south; based on number of turtle groups detected, 64% were seen south of Cape Hatteras, North Carolina, 30% in the southern Mid-Atlantic Bight, and 6% in the northern Mid-Atlantic Bight. Although they have been seen farther north in previous studies (e.g., Shoop and Kenney 1992), no loggerheads were observed during the aerial surveys conducted in the summer of 2010 in the more northern zone encompassing Georges Bank, Cape Cod Bay, and the Gulf of Maine. These estimates of loggerhead abundance over the U.S. Atlantic continental shelf are considered very preliminary. A more thorough analysis will be completed pending the results of further studies related to improving estimates of regional and seasonal variation in loggerhead surface time (by increasing the sample size and geographical area of tagging) and other information needed to improve the biases inherent in aerial surveys of sea turtles (e.g., research on depth of detection and species misidentification rate). This survey effort represents the most comprehensive assessment of sea turtle abundance and distribution in many years. Additional aerial and vessel surveys as well as tagging research to improve abundance estimates of loggerheads have continued through 2017.

Threats

The diversity of a loggerhead sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the neritic environment, and in the oceanic environment. The five-year status review and 2008 recovery plan provide a summary of natural as well as anthropogenic threats to loggerhead sea turtles (NMFS and U.S. FWS 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 U.S. FWS 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; pile driving and underwater explosions; hopper dredging; offshore artificial lighting; power plant entrainment and/or impingement; entanglement in and ingestion of marine debris; marina and dock construction and operation; boat collisions; poaching; and fishery interactions (including both commercial and recreational fisheries).

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

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

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

In addition to improvements in TED designs and TED enforcement, interactions between loggerheads and the shrimp fishery have also been declining because of reductions in fishing effort unrelated to fisheries management actions. The 2002 Opinion take estimates were based in part on fishery effort levels. In recent years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of recent hurricanes in the Gulf of Mexico have all impacted the shrimp fleets; in some cases reducing fishing effort by as much as 50% for offshore waters of the Gulf of Mexico (GMFMC 2007). As a result, loggerhead interactions and mortalities in the Gulf of Mexico have been substantially less than were projected in the 2002 Opinion. In 2008, the NMFS Southeast Fisheries Science Center (SEFSC) estimated annual number of interactions between loggerheads and shrimp trawls in the Gulf of Mexico shrimp fishery to be 23,336, with 647 (2.8%) of those interactions resulting in mortality (Memo from Dr. B. Ponwith, Southeast Fisheries Science Center to Dr. R. Crabtree, Southeast Region, PRD, December 2008). However, the most recent section 7 consultation on the shrimp fishery, completed in April 2014, 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 2014).

Loggerhead sea turtles are also known to interact with non-shrimp trawl, gillnet, longline, dredge, pound net, pot/trap, and hook and line fisheries. The NRC (1990) report stated that other U.S. Atlantic fisheries collectively accounted for 500 to 5,000 loggerhead deaths each year, but recognized that there was considerable uncertainty in the estimate. The reduction of sea turtle captures in fishing operations is identified in recovery plans and five-year status reviews as a priority for the recovery of all sea turtle species. In the threats analysis of the loggerhead recovery plan, trawl bycatch is identified as the greatest source of mortality. Loggerhead bycatch in U.S. Mid-Atlantic bottom otter trawl gear has been previously estimated for the periods of 1996-2004 (Murray 2008) and 2005-2008 (Warden 2011a, 2011b), with the most recent bycatch analysis estimating the number of loggerhead sea turtle interactions with U.S. Mid-Atlantic bottom trawl gear from 2009-2013 (Murray 2015a). From 2009-2013, a total of 1,156 loggerheads (95% CI: 908-1,488) were estimated to have interacted with bottom trawl gear in the U.S. Mid-Atlantic, of which 479 resulted in mortality. That equates to an annual average of 231 loggerhead interactions (95% CI: 182-298) for the period of 2009-2013. The total number of estimated interactions from 2009-2013 was equivalent to 166 adults, of which 68 resulted in mortality (Murray 2015a). Compared to other gear types worldwide, trawls have higher adult equivalent interactions, and therefore a greater impact on loggerhead populations, due to the co-occurrence of trawling effort with larger, more mature turtles (Wallace *et al*. 2008). The trawl fishery targeting Atlantic croaker in the southern Mid-Atlantic had the highest turtle interactions among fisheries investigated, which may be due to larger mesh sizes in the mouth of the trawl and high headline height of the gear. Murray (2015a) found that retained catch, depth, latitude, and sea surface temperature (SST) were associated with the interaction rate, with the rates being highest south of 37°N latitude in warm, shallow (<50 meters deep) waters. This estimate is a decrease from the average annual loggerhead bycatch in U.S. Mid-Atlantic bottom otter trawls during the 1996-2004 and 2005-2008 time periods, which were estimated to be 616 (95% CI: 367-890) and 352 turtles (95% CI: 276-439), respectively (Murray 2008; Warden 2011a, 2011b; Murray 2015a).

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) 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 (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 (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 (95% CI: 88-163) [equivalent to 22 adults], 95 of which were loggerheads [equivalent to 16 adults]. Interaction rates of hard-shelled turtles were correlated with SST, depth, and use of a chain mat. Results from that analysis suggested that chain mats and fishing effort reductions contributed to the decline in estimated loggerhead sea turtle interactions with scallop dredge gear after 2006 (Murray 2011). A more recent analysis has indicated that the average annual observable sea turtle interactions in the Mid-Atlantic scallop dredge fishery plus unobserved, quantifiable interactions was 22 loggerheads per year (95% CI: 4-67), 9-19 of which were lethal (Murray 2015b). The 22 interactions equate to two adult equivalents per year and 1-2 adult equivalent mortalities. Thus, estimated interactions in the scallop dredge fishery have decreased relative to 2001-2008, although the utility of observers as a monitoring tool for turtle interactions in the fishery seems to be decreasing (Murray 2015b). This is due to the lack of observed turtle interactions in dredges equipped with bycatch reduction devices chain mats and turtle deflectors. Still, observers continue to monitor the scallop dredge fishery for sea turtle interactions, documenting the use of chain mats and turtle deflectors, and recording sea turtle interactions outside of the gear-regulated time and areas (Murray 2015b).

An estimate of the number of loggerheads interacting annually with U.S. Mid-Atlantic gillnet fisheries has also recently been published (Murray 2013). From 2007-2011, an annual average of 95 hard-shelled sea turtles (95% CI: 60-138) and 89 loggerheads (equivalent to nine adults) were estimated to have interacted with U.S. Mid-Atlantic gillnet gear. An estimated 52 annual loggerhead interactions (equivalent to five adults) were considered to result in mortality. Gillnet trips landing monkfish had the highest estimated number of loggerhead and hard-shelled sea turtle interactions during 2007-2011. Estimated rates and interactions have decreased relative to those from 1996-2006. Bycatch rates were correlated with latitude, SST, and mesh size. High interaction rates are estimated in the southern Mid-Atlantic, in warm surface temperature water, and in large-mesh gillnets; findings which are consistent with prior loggerhead bycatch analyses (Murray 2013).

The U.S. tuna and swordfish longline fisheries that are managed under the Highly Migratory Species (HMS) Fishery Management Plan (FMP) are estimated to capture 1,905 loggerheads (no more than 339 mortalities) for each three-year period starting in 2007 (NMFS 2004b). 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 2017). In 2015, there were 30 observed interactions between loggerhead sea turtles and longline gear used in the HMS fishery (Garrison and Stokes 2017). All of the loggerheads were released alive, with 14 out of 30 (47%) released with all gear removed. A total of 242.6 (95% CI: 161.9-363.6) loggerhead sea turtles were estimated to have interacted with the longline fisheries managed under the HMS FMP in 2015 based on the observed bycatch events (Garrison and Stokes 2017).

Including the 2015 estimate, loggerhead interactions since 2000 have been below the historical highs that occurred in the mid-1990s (Garrison and Stokes 2017). Following the implementation of regulations, the bycatch dropped in 2005, but rebounded to be similar to the pre-regulation period. There appears to be a cyclical pattern in loggerhead bycatch rate occurring at four-year intervals since 1996 with a generally increasing trend over a four-year period, followed by a sharp decline. This cycle continued during the 2010-2015 period. The 2014 and 2015 estimates remain relatively low and seem to be consistent with an overall downward trend since the late 1990s. Notably, the estimate for 2015 was consistent with that from 2014 despite a sharp decline in fishing effort (Garrison and Stokes 2017). This fishery represents just one of several longline fisheries operating in the Atlantic Ocean. Lewison *et al*. (2004) estimated that 150,000-200,000 loggerheads were taken in all Atlantic longline fisheries in 2000 (including the U.S. Atlantic tuna and swordfish longline fisheries as well as others).

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

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

Increasing temperatures are expected to result in rising sea levels (Titus and Narayanan 1995 in Conant *et al*. 2009), which could result in increased erosion rates along nesting beaches. Sea level rise could result in the inundation of nesting sites and decrease available nesting habitat (Daniels *et al*. 1993; Fish *et al*. 2005; Baker *et al*. 2006). The BRT noted that the loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis *et al*.

2006; Baker *et al*. 2006; both in Conant *et al*. 2009). Along developed coastlines, and especially in areas where erosion control structures have been constructed to limit shoreline movement, rising sea levels may cause severe effects on nesting females and their eggs as nesting females may deposit eggs seaward of the erosion control structures potentially subjecting them to repeated tidal inundation. However, if global temperatures increase and there is a range shift northwards, beaches not currently used for nesting may become available for loggerhead sea turtles, which may offset some loss of accessibility to beaches in southern portions of the range.

Climate change also has the potential to result in changes at nesting beaches that may affect loggerhead sex ratios. Loggerhead sea turtles exhibit temperature-dependent sex determination. Rapidly increasing global temperatures may result in warmer incubation temperatures and highly female-biased sex ratios (e.g., Glen and Mrosovsky 2004; Hawkes *et al*. 2009); however, to the extent that nesting can occur at beaches further north where sand temperatures are not as warm, these effects may be partially offset. The BRT specifically identified climate change as a threat to loggerhead sea turtles in the neritic/oceanic zone where climate change may result in future trophic changes, thus impacting loggerhead prey abundance and/or distribution. In the threats matrix analysis, climate change was considered for oceanic juveniles and adults as well as for eggs/hatchlings. The report states that for oceanic juveniles and adults, "although the effect of trophic level change from…climate change…is unknown it is believed to be very low." For eggs/hatchlings, the report states that total mortality from anthropogenic causes, including sea level rise resulting from climate change, is believed to be low relative to the entire life stage. However, only limited data are available on past trends related to climate effects on loggerhead sea turtles; current scientific methods are not able to reliably predict the future magnitude of climate change, associated impacts, whether and to what extent some impacts will offset others, or the adaptive capacity of this species.

While there is a reasonable degree of certainty that certain climate change related effects will be experienced globally (e.g., rising temperatures and changes in precipitation patterns), due to a lack of scientific data, the specific effects to sea turtles resulting from climate change, and the severity of and rate at which these impacts will occur, are not predictable or quantifiable at this time (Hawkes *et al*. 2009). Nonetheless, it is likely that once climate change impacts get to a certain level, there will be feedback loops that may cause indications of climate change (e.g., increases in greenhouse gas concentrations, rising global temperatures, and sea level rise) to get much worse much more quickly (Torn and Harte 2006).

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

Summary of Status for the Northwest Atlantic DPS of Loggerhead Sea Turtles
Loggerheads continue 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 U.S. FWS 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 published by NMFS and U.S. 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 stocks is limited due to a lack of fundamental life history information and specific census and mortality data.

While several documents reported the decline in nesting numbers in the NWA DPS (NMFS and U.S. FWS 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 U.S. FWS 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.

4.2.1.2 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, green, and leatherback 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 likely mature at 10-18 years of age (Caillouet *et al.* 1995; Schmid and Witzell 1997; Shaver and Wibbels 2007; Snover *et al.* 2007; NMFS and U.S. FWS 2015). Nesting occurs from April through July each year with hatchlings emerging after 45-58 days (NMFS *et al.* 2011). Females lay an average of 2.5 clutches within a season (TEWG 1998, 2000) and the mean remigration interval for adult females is two years (Márquez *et al.* 1982; TEWG 1998, 2000). Once they leave the nesting beach, hatchlings presumably enter the Gulf of Mexico where they feed on available S*argassum* and associated infauna or other epipelagic species (NMFS *et al.* 2011). The presence of juvenile turtles along both the U.S. Atlantic and Gulf of Mexico coasts, where they are recruited to the coastal benthic environment, indicates that post-hatchlings are distributed in both the Gulf of Mexico and Atlantic Ocean (TEWG 2000).

The location and size classes of dead turtles recovered by the Sea Turtle Stranding and Salvage Network (STSSN) suggests that benthic immature developmental areas occur along the U.S. coast and that these areas may change given resource quality and quantity (TEWG 2000). Developmental habitats are defined by several characteristics, including coastal areas sheltered from high winds and waves such as embayments and estuaries, and nearshore temperate waters shallower than 50 meters (NMFS and U.S. FWS 2015). 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 U.S. FWS 2015).

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 the fall, juvenile Kemp's ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus 1997). These larger juveniles are joined by juveniles of the same size from North Carolina and smaller juveniles from New York and New England to form one of the densest concentrations of Kemp's ridleys outside of the Gulf of Mexico (Epperly *et al.* 1995a, 1995b; Musick and Limpus 1997).

Adult Kemp's ridleys are found in the coastal regions of the Gulf of Mexico and southeastern U.S., but are typically rare in the northeastern U.S. waters of the Atlantic (TEWG 2000). Adults are primarily found in nearshore waters of 68 meters or less (mean 33.2 ± 25.3 kilometers from shore) that are rich in crabs and have a sandy or muddy bottom (NMFS and U.S. FWS 2015).

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 *et al.* 2011; NMFS and U.S. FWS 2015). There is a limited amount of scattered nesting to the north and south of the primary nesting beach (NMFS and U.S. FWS 2015). Nesting often occurs in synchronized emergences termed *arribadas*. The number of recorded nests reached an estimated low of 702 nests in 1985, estimated to be fewer than 250 adult females nesting in that season (TEWG 2000; NMFS *et al.* 2011; NMFS and U.S. FWS 2015). 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). From the mid-1980s to the early 2000s, the number of nests observed at Rancho Nuevo and nearby beaches increased 14-16% per year (Heppell *et al.* 2005), allowing cautious optimism that the population was on its way to recovery. The total number of nests for all of Mexico was 22,458 in 2012 (the highest nesting total recorded since 1947), but fell back to 16,944 in 2013 and 12,060 in 2014. Based on an average of 2.5 nests per female per nesting season (NMFS *et al.* 2011), the total number of nests on Mexico beaches represented about 8,984 nesting females in 2012, 6,778 in 2013, and 4,824 in 2014 (NMFS and U.S. FWS 2015). The most recent five-year review (NMFS and U.S. FWS 2015) suggested that the population growth rate (measured by numbers of nests) stopped abruptly after 2009, possibly due to the Deepwater Horizon oil spill and other anthropogenic factors such as fisheries bycatch and climate change. Given the lower nesting numbers from 2009-2014, the population was not projected to grow at former rates in 2015. Recent data, however, indicates an increase in nesting. In 2015 there were 14,006 recorded nests in Mexico, and in 2016 overall numbers increased to 18,354 recorded nests (Gladys Porter Zoo 2016). Preliminary information indicates a record high nesting season in 2017, with 24,570 nests recorded on Mexican beaches (J. Pena, pers. comm., 2017). At this time, it is unclear if future Kemp's ridley nesting will steadily and continuously increase, similar to what occurred from 1990-2009, or if nesting will continue to exhibit sporadic declines and increases as recorded in the past eight years.

A small nesting population is also emerging in the U.S., primarily at Padre Island National Seashore in Texas, rising from six nests in 1996, to 42 in 2004, to a record high of 353 nests in 2017 (https://www.nps.gov/pais/learn/nature/2017-nesting-season.htm). It is worth noting that nesting in Texas has paralleled the trends observed in Mexico, with an overall increase in nests from 2000-2009, a significant decline in 2010, an all-time high in 2012, followed by a second decline in 2013-2014, and a rebound from 2015-2017 (NMFS and U.S. FWS 2015).

Threats

Kemp's ridley sea turtles 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 Kemp's ridleys that use the more northern habitats of Cape Cod Bay and Long Island Sound. From 2009-2013, the number of cold-stunned Kemp's ridleys on Massachusetts beaches averaged 185 turtles (NMFS unpublished data). The numbers ranged from a low of 132 in 2011 to a high of 235 in 2012. However, in 2014, the number of cold-stunned Kemp's ridleys documented in Massachusetts skyrocketed to 1,179, of which 466 died (NMFS unpublished data). In 2015, the total number of Kemp's ridley cold stunning events in Massachusetts dropped to 464 (NMFS unpublished data), which is still a good deal above the annual average of cold-stunned Kemp's ridleys observed from 2009-2013. As evidenced by these recent increases, annual cold stun events can vary greatly in magnitude. The extent of episodic major cold stun events may be associated with numbers of sea 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 ridley sea turtles.

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

Although modifications to shrimp trawls have helped to reduce mortality of Kemp's ridleys, a recent assessment found that the Southeast/Gulf of Mexico shrimp trawl fishery remained responsible for the vast majority of U.S. fishery interactions (up to 98%) and mortalities (more than 80%). Finkbeiner *et al.* (2011) compiled cumulative sea turtle bycatch information in U.S. fisheries from 1990 through 2007, before and after implementation of bycatch mitigation measures. Information was obtained from peer reviewed publications and NMFS documents (e.g., Opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations. The most recent section 7 consultation on the shrimp fishery, completed in April 2014, was unable to estimate the total annual level of Kemp's ridley interactions occurring in the fishery. Instead, it qualitatively estimated that the shrimp fishery, as currently operating, would result in at least tens of thousands and possibly hundreds of thousands of interactions annually, of which at least thousands and possibly tens of thousands are expected to be lethal (NMFS 2014).

This species is also affected by other sources of anthropogenic impact (fishery and non-fishery related), similar to those discussed above. One Kemp's ridley capture in Mid-Atlantic trawl fisheries was documented by NMFS observers between 2009 and 2013 (Murray 2015b), and five Kemp's ridleys were documented by NMFS observers in Mid-Atlantic sink gillnet fisheries between 2007 and 2011 (Murray 2013). Additionally, in the spring of 2000, five Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. The cause of death for most of the turtles recovered was unknown, but the mass mortality event was suspected by NMFS to have been from a large-mesh gillnet fishery for monkfish and dogfish operating offshore in the preceding weeks (67 FR 71895, December 3, 2002). The five Kemp's ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction, since it is unlikely that all of the carcasses washed ashore. The NEFSC also documented 14 Kemp's ridleys entangled in or impinged on Virginia pound net leaders from 2002-2005. Note that bycatch estimates for Kemp's ridleys in various fishing gear types (e.g., trawl, gillnet, dredge) are not available at this time, largely due to the low number of observed interactions precluding a robust estimate. Kemp's ridley interactions in non-fisheries have also been observed; for example, the Oyster Creek Nuclear Generating Station in Barnegat Bay, New Jersey, recorded a total of 56 Kemp's ridleys (36 of which were found alive) impinged or captured on their intake screens from 1992-2011 (NMFS 2011).

The recovery plan for Kemp's ridley sea turtles (NMFS *et al*. 2011) identifies climate change as a threat; however, as with the other species discussed above, no significant climate change-related impacts to Kemp's ridley sea turtles have been observed to date. Atmospheric warming could cause habitat alteration which may change food resources such as crabs and other invertebrates. It may increase hurricane activity, leading to an increase in debris in nearshore and offshore waters, which may result in an increase in entanglement, ingestion, or drowning. In addition, increased hurricane activity may cause damage to nesting beaches or inundate nests with sea water. Atmospheric warming may change convergence zones, currents, and other oceanographic features that are relevant to Kemp's ridleys, as well as change rain regimes and levels of nearshore runoff.

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

Another potential impact from global climate change is sea level rise, which may result in increased beach erosion at nesting sites. Beach erosion may be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents. In the case of the Kemp's ridley where most of the critical nesting beaches are undeveloped, beaches may shift landward and still be available for nesting. The Padre Island National Seashore shoreline is accreting, unlike much of the Texas coast, and with nesting increasing and sand temperatures slightly cooler than at Rancho Nuevo, Padre Island could become an increasingly important source of males for the population.

As with the other sea turtle species discussed in this section, while there is a reasonable degree of certainty that certain climate change related effects will be experienced globally (e.g., rising temperatures and changes in precipitation patterns), due to a lack of scientific data, the specific effects of climate change on this species are not predictable or quantifiable at this time (Hawkes *et al*. 2009). Based on the most recent five-year status review (NMFS and U.S. FWS 2015), and following from the climate change discussion on loggerheads, significant impacts from climate change in the future are to be expected, but the severity of and rate at which these impacts will occur is currently unknown.

Summary of Status for Kemp's Ridley Sea Turtles

The majority of Kemp's ridleys nest along a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; NMFS *et al.* 2011; NMFS and U.S. FWS 2015). 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 and 2000s (NMFS and U.S. FWS 2015). Based on an average of 2.5 nests per female per nesting season (NMFS *et al.* 2011), the total number of nests on Mexico beaches represented about 4,824 nesting females in 2014 (NMFS and U.S. FWS 2015).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 U.S. FWS 2015). While there is still potential for recovery, factors such as the Deepwater Horizon oil spill, an overall decrease in the number of nests since 2009, climate change, and stranding events associated increased skimmer trawl use and poor TED compliance in the northern Gulf of Mexico may have dampened recent population growth.

As with the other sea turtle species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like dredging, pollution, and habitat destruction also contribute to annual human caused mortality, but the levels are unknown. A revised bi-national recovery plan was published in September 2011 by the NMFS, U.S. FWS, and the Secretary of Environment and Natural Resources, Mexico (SEMARNAT) to address these ongoing threats. Based on their recent five-year status review of the species, NMFS and U.S. FWS (2015) determined that Kemp's ridley sea turtles should remain classified as endangered under the ESA and that the Recovery Priority Number for the species be changed from a '5' to a '1.' A recovery priority 1 is defined as a species whose extinction is almost certain in the immediate future because of a rapid population decline or habitat destruction, whose limiting factors and threats are well understood and the needed management actions are known and have a high probability of success, and is a species that is in conflict with construction or other developmental projects or other forms of economic activity.

4.2.1.3 Status of Green Sea Turtles – North Atlantic DPS

Green sea turtles are distributed circumglobally, occurring throughout tropical, subtropical waters, and, to a lesser extent, temperate waters. They can be found in the Pacific, Indian, and Atlantic Oceans as well as the Mediterranean Sea (NMFS and U.S. FWS 1991, 2007b; Seminoff 2004; Seminoff *et al.* 2015). Their movements within the marine environment are not fully understood, but it is believed that green sea turtles inhabit coastal waters of over 140 countries (Groombridge and Luxmoore 1989).

Listing History
The green sea turtle was originally listed under the ESA on July 28, 1978 (43 FR 32800). Breeding populations of the green sea turtle in Florida and along the Pacific coast of Mexico were listed as endangered; while all other populations were listed as threatened. The major factors contributing to its status at the time included human encroachment and associated activities on nesting beaches; commercial harvest of eggs, subadults, and adults; predation; lack of comprehensive and consistent protective regulations; and incidental take in fisheries. Marine critical habitat for the green sea turtle was designated on September 2, 1998, for the waters surrounding Culebra Island, Puerto Rico, and its outlying keys (63 FR 46693).

On April 6, 2016, NMFS and U.S. FWS issued a final determination that the green sea turtle is comprised of eleven DPSs, constituting the "species," to be listed as threatened or endangered under the ESA (81 FR 20058). Effective May 6, 2016, three DPSs were listed as endangered, eight as threatened. The April 2016 final rule replaced the 1978 global listing of green sea turtles.

In the final ESA listing decision, NMFS and U.S. FWS listed eleven green sea turtle DPSs distributed globally: (1) North Atlantic (threatened), (2) Mediterranean (endangered), (3) South Atlantic (threatened), (4) Southwest Indian (threatened), (5) North Indian (threatened), (6) East Indian-West Pacific (threatened), (7) Central West Pacific (endangered), (8) Southwest Pacific (threatened), (9) Central South Pacific (endangered), (10) Central North Pacific (threatened), and (11) East Pacific (threatened) (81 FR 20058; April 6, 2016). Based on the best available scientific and commercial data, only one listed DPS is likely to occur in the action area, the threatened North Atlantic DPS. The range of the North Atlantic DPS extends from the boundary of South and Central America, north along the coast to include Panama, Costa Rica, Nicaragua, Honduras, Belize, Mexico, and the U.S. It extends due east across the Atlantic Ocean at 48°N and follows the coast south to include the northern portion of the Islamic Republic of Mauritania (Mauritania) on the African continent to 19°N. It extends west at 19°N to the Caribbean basin to 65.1°W, then due south to 14°N, 65.1°W, then due west to 14°N, 77°W, and due south to 7.5°N, 77°W, the boundary of South and Central America. It includes Puerto Rico, the Bahamas, Cuba, Turks and Caicos Islands, Republic of Haiti, Dominican Republic, Cayman Islands, and Jamaica. The North Atlantic DPS includes the Florida breeding population, which was originally listed as endangered under the ESA (43 FR 32800; July 28, 1978).

In regards to discreteness, North Atlantic DPS populations of green sea turtles exhibit minimal mixing with the adjacent South Atlantic DPS and no mixing with the adjacent Mediterranean DPS. Occasionally, juvenile turtles from the North Atlantic may settle into foraging grounds in the South Atlantic or Mediterranean, while adult turtles nesting at sites in the equatorial region of the North Atlantic may travel to, and reside at, foraging grounds in the South Atlantic (Troëng *et al*. 2005). However, the reverse (i.e., turtles from the South Atlantic or Mediterranean DPS settling in North Atlantic waters) has yet to be documented. Furthermore, green sea turtles from the Mediterranean DPS appear to be spatially separated from populations in the Atlantic Ocean (Seminoff *et al*. 2015).

Distribution and Life History

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

In the North Atlantic, large juvenile and adult green sea turtles are largely herbivorous, occurring in habitats containing benthic algae and seagrasses from Massachusetts to Central America, including the Gulf of Mexico and Caribbean (Wynne and Schwartz 1999). Green sea turtles occur seasonally in U.S. 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 North 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 Fort 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, and the Caribbean coast of Panama (Hirth 1971).

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

Population Dynamics and Status

Nest count information for green sea turtles provides information on the relative abundance of nesting, and the contribution of each nesting group to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The North Atlantic DPS contains an estimated 167,424 females nesting at 73 sites (81 FR 20058).

In 2015, the Green Turtle Status Review Team (SRT) identified those 73 nesting sites within the North Atlantic DPS, although some represent numerous individual beaches. There are four regions that support high density nesting concentrations for which data were available: Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, and Quintana Roo), U.S. (Florida), and Cuba. Nester abundance was assessed by the SRT for 48 nesting sites within the North Atlantic DPS. Abundance was estimated using the best scientific information available. Remigration intervals and clutch frequencies were used to estimate total nester abundance when counts of nesters were not available. In terms of nester distribution, the largest nesting site (Tortuguero, Costa Rica) hosts 79% of total nester abundance (167,528 nesters). There were also 26 nesting sites for which there were qualitative reports of nesting activity but no nesting data: three in the Bahamas, three in Belize, one in Costa Rica, four in Cuba, one in the Dominican Republic, one in Haiti, six in Honduras, two in Jamaica, one in Mauritania, one in Panama, and three in the Turks and Caicos Islands (Seminoff *et al.* 2015). Green turtle nesting populations in the North Atlantic are some of the most studied in the world, with time series exceeding 40 years in Costa Rica and 35 years in Florida. There are seven sites for which ten years or more of recent data are available for annual nester abundance.

By far, the most important nesting concentration for green sea turtles in the North Atlantic DPS is in Tortuguero, Costa Rica (Seminoff *et al.* 2015). This population has been studied since the 1950s and nesting has increased markedly since the early 1970s. From 1971 to 1975, there were approximately 41,250 nesting emergences per year and from 1992 to 1996 there were approximately 72,200 nesting emergences per year (Bjorndal *et al.* 1999). From 1999 to 2003, about 104,411 nests/year were deposited, which corresponds to approximately 17,402-37,290 nesting females each year (Troëng and Rankin 2005). An estimated 180,310 nests were laid during 2010, the highest level of green sea turtle nesting estimated since the start of nesting track surveys in 1971. This equates to 30,052-64,396 nesters in 2010. This increase has occurred despite substantial human impacts to the population at the nesting beach and at foraging areas (Troëng 1998; Campbell and Lagueux 2005; Troëng and Rankin 2005). The number of females nesting per year on beaches in Mexico, Florida, and Cuba number in the hundreds to low thousands, depending on the site (Seminoff *et al.* 2015).

The status of the Florida breeding population was also evaluated in the 2015 status review (Seminoff *et al.* 2015). In Florida, nesting occurs in coastal areas of all regions except the Big Bend area of west central Florida. The bulk of nesting occurs along the Atlantic coast of eastern central Florida, where a mean of 5,055 nests were deposited each year from 2001 to 2005 (Meylan *et al.* 2006) and 10,377 each year from 2008 to 2012 (B. Witherington, Florida Fish and Wildlife Conservation Commission, pers. comm., 2013). Nesting has increased substantially over the last 20 years and peaked in 2011 with 15,352 nests statewide (Chaloupka *et al.* 2008; B. Witherington, Florida Fish and Wildlife Conservation Commission, pers. comm., 2013). The estimated total nester abundance for Florida is 8,426 turtles.

The pattern of green sea turtle nesting shows biennial peaks in abundance, with a generally positive trend since establishment of the Florida index beach surveys in 1989. This trend is perhaps due to increased protective legislation throughout the Caribbean (Meylan *et al.* 1995), as well as protections in Florida and throughout the U.S. (Seminoff *et al.* 2015). The statewide Florida index beach surveys (1989-2017) have shown that green sea turtle nest counts have increased over one hundredfold since 1989, from a low of 267 to a high of almost 39,000 in 2017 (http://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/). The last four odd-numbered years (2011, 2013, 2015, and 2017) have all broken previous records for the highest numbers of green sea turtle nests on Florida's index beaches.

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.

Similar to the nesting trend found in Florida, in-water studies in Florida have also recorded increases in green sea turtle captures at the Indian River Lagoon site, with a 661% increase over 24 years (Ehrhart *et al.* 2007), and the St Lucie Power Plant site, with a significant increase in the annual rate of capture of immature green sea turtles (SCL<90 centimeters) from 1977 to 2002 or 26 years (3,557 green sea turtles total; Witherington *et al.* 2006).

Threats

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

Incidental fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches. Witherington *et al.* (2009) observed that because green sea turtles spend a shorter time in oceanic waters, and as older juveniles occur on shallow seagrass pastures (where benthic trawling is unlikely), they avoid high mortalities in pelagic longline and benthic trawl fisheries. Although the relatively low number of observed green sea turtle captures makes it difficult to estimate bycatch rates and annual levels of interactions, green sea turtles have been observed captured in the pelagic driftnet, pelagic longline, southeast shrimp trawl, and Mid-Atlantic trawl and gillnet fisheries. Two green sea turtle captures in Mid-Atlantic trawl fisheries was documented by NMFS observers between 2009 and 2013 (Murray 2015b), while Murray (2009a) indicated that there were 12 observed captures of green sea turtles in Mid-Atlantic sink gillnet gear between 2007 and 2011.

Finkbeiner *et al.* (2011) compiled cumulative sea turtle bycatch information in U.S. fisheries from 1990 through 2007, before and after implementation of bycatch mitigation measures. Information was obtained from peer reviewed publications and NMFS documents (e.g., Opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). The Southeast/Gulf of Mexico shrimp trawl fishery was responsible for the vast majority of U.S. interactions (up to 98%) and mortalities (more than 80%). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations. The most recent section 7 consultation on the shrimp fishery, completed in April 2014, was unable to estimate the total annual level of green sea turtle interactions occurring in the fishery. Instead, it qualitatively estimated that the shrimp fishery, as currently operating, would result in at least hundreds and possibly low thousands of interactions annually, of which hundreds are expected to be lethal (NMFS 2014).

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

The most recent five-year status review for green sea turtles (Seminoff *et al.* 2015) notes that global climate change is affecting the species and will likely continue to be a threat. There is an increasing female bias in the sex ratio of green sea turtle hatchlings. While this is partly attributable to imperfect egg hatchery practices, global climate change is also implicated as a likely cause, as warmer sand temperatures at nesting beaches are likely to result in the production of more female embryos. Climate change may also impact nesting beaches through sea level rise which may reduce the availability of nesting habitat and increase the risk of nest inundation. Loss of appropriate nesting habitat may also be accelerated by a combination of other environmental and oceanographic changes, such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion. Oceanic changes related to rising water temperatures could result in changes in the abundance and distribution of the primary food sources of green sea turtles, which in turn could result in changes in behavior and distribution of this species. Seagrass habitats may suffer from decreased productivity and/or increased stress due to sea level rise, as well as salinity and temperature changes (Short and Neckles 1999; Duarte 2002).

As noted above, the increasing female bias in green sea turtle hatchlings is thought to be at least partially linked to increases in temperatures at nesting beaches. However, due to a lack of scientific data, the specific future effects of climate change on green sea turtles species are not predictable or quantifiable to any degree at this time (Hawkes *et al*. 2009). For example, information is not available to predict the extent and rate to which sand temperatures at the nesting beaches used by green sea turtles may increase in the short-term future and the extent to which green sea turtles may be able to cope with this change by selecting cooler areas of the beach or shifting their nesting distribution to other beaches at which increases in sand temperature may not be experienced. Based on the most recent five-year status review (Seminoff *et al.* 2015), and following from the climate change discussions on the other hard-shelled sea turtle species, significant impacts from climate change in the future are to be expected, but the severity of and rate at which these impacts will occur is currently unknown.

Summary of Status for the North Atlantic DPS of Green Sea Turtles
In the North Atlantic, nesting groups are considered to be doing relatively well (i.e., the number of sites with increasing nesting are greater than the number of sites with decreasing nesting) (Seminoff *et al.* 2015). However, given the late age to maturity for green sea turtles, caution is urged regarding the status of nesting groups in the North Atlantic DPS since no area has a dataset spanning a full green sea turtle generation (Seminoff *et al.* 2015).

Seminoff *et al.* (2015) concluded that green sea turtle abundance is increasing for four nesting sites in the North Atlantic. They also concluded that nesting at Tortuguero, Costa Rica represents the most important nesting area for green sea turtles in the North Atlantic and that nesting at Tortuguero has increased markedly since the 1970s (Seminoff *et al.* 2015). However, the five-year status review also noted that the Tortuguero nesting stock continues to be affected by ongoing directed captures at their primary foraging area in Nicaragua. The breeding population in Florida appears to be increasing rapidly in recent years based upon index nesting data from 1989-2015.

As with the other sea turtle species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like hopper dredging, pollution, and habitat destruction also contribute to human caused mortality, though the level is unknown.

4.2.1.4 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 U.S. FWS 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 U.S. FWS 1998, 2013; Sarti *et al.* 2000). The western Pacific major nesting beaches are in Papua New Guinea, Indonesia, Solomon Islands, and Vanuatu, with an approximate 2,700-4,500 total breeding females, estimated from nest

counts (Dutton *et al.* 2007). While there appears to be overall long term population decline, the Indonesian nesting aggregation at Jamursba-Medi is currently stable (since 1999), although there is evidence to suggest a significant and continued decline in leatherback nesting in Papua New Guinea and Solomon Islands over the past 30 years (NMFS 2011). Leatherback sea turtles disappeared from India before 1930, have been virtually extinct in Sri Lanka since 1994, and appear to be approaching extinction in Malaysia (Spotila *et al.* 2000). In Fiji, Thailand, and Australia, leatherbacks have only been known to nest in low densities and scattered sites.

The largest, extant leatherback nesting group in the Indo-Pacific lies on the North Vogelkop coast of West Papua, Indonesia, with 3,000-5,000 nests reported annually in the 1990s (Suárez *et al.* 2000). However, in 1999, local villagers started reporting dramatic declines in sea turtles near their villages (Suárez 1999). Declines in nesting groups have been reported throughout the western Pacific region where observers report that nesting groups are well below abundance levels that were observed several decades ago (e.g., Suárez 1999).

Leatherback sea turtles in the western Pacific are threatened by poaching of eggs, killing of nesting females, human encroachment on nesting beaches, incidental capture in fishing gear, beach erosion, and egg predation by animals.

In the eastern Pacific Ocean, major leatherback nesting beaches are located in Mexico and Costa Rica, where nest numbers have been declining. According to reports from the late 1970s and early 1980s, beaches located on the Mexican Pacific coasts of Michoacán, Guerrero, and Oaxaca sustained a large portion, perhaps 50%, of all global nesting by leatherbacks (Sarti *et al.* 1996). A dramatic decline has been seen on nesting beaches in Pacific Mexico, where aerial survey data was used to estimate that tens of thousands of leatherback nests were laid on the beaches in the 1980s (Pritchard 1982), but a total of only 120 nests on the four primary index beaches (combined) were counted in the 2003-2004 season (Sarti Martinez *et al.* 2007). Since the early 1980s, the Mexican Pacific population of adult female leatherback turtles has declined to slightly more than 200 during 1998-1999 and 1999-2000 (Sarti *et al.* 2000). Spotila *et al.* (2000) reported the decline of the leatherback nesting at Playa Grande, Costa Rica, which had been the fourth largest nesting group in the world and the most important nesting beach in the Pacific. Between 1988 and 1999, the nesting group declined from 1,367 to 117 female leatherback sea turtles. An analysis of the Costa Rican nesting beaches indicates a decline in nesting during 15 years of monitoring (1989-2004) with approximately 1,504 females nesting in 1988-1989 to an average of 188 females nesting in 2000-2001 and 2003-2004 (NMFS and U.S. FWS 2013), indicating that the reductions in nesting females were not as extreme as the reductions predicted by Spotila *et al.* (2000).

On September 26, 2007, NMFS received a petition to revise the critical habitat designation for leatherback sea turtles to include waters along the U.S. West Coast. On December 28, 2007, NMFS published a positive 90-day finding on the petition and convened a critical habitat review team. On January 26, 2012, NMFS published a final rule to revise the critical habitat designation to include three particular areas of marine habitat. The designation includes approximately 16,910 square miles along the California coast from Point Arena to Point Arguello east of the 3,000 meter depth contour, and 25,004 square miles from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 meter depth contour. The areas comprise approximately 41,914 square miles of marine habitat and include waters from the ocean surface down to a maximum depth of 262 feet. The designated critical habitat areas contain the physical or biological feature essential to the conservation of the species that may require special management conservation or protection. In particular, the team identified one Primary Constituent Element: the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae, of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

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

Indian Ocean

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

Mediterranean Sea

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

Atlantic Ocean

Distribution and Life History

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

Tagging and satellite telemetry data indicate that leatherbacks from the western North Atlantic nesting beaches use the entire North Atlantic Ocean (TEWG 2007). For example, leatherbacks tagged at nesting beaches in Costa Rica have been found in Texas, Florida, South Carolina, Delaware, and New York (STSSN database). Leatherback sea turtles tagged in Puerto Rico, Trinidad, and the Virgin Islands have also been subsequently found on U.S. beaches of southern, Mid-Atlantic, and northern states (STSSN database). Leatherbacks from the South Atlantic nesting assemblages (West Africa, South Africa, and Brazil) have not been re-sighted in the western North Atlantic (TEWG 2007).

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

In 1979, the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands were designated as critical habitat for the leatherback sea turtle. On February 2, 2010, NMFS received a petition from the Sierra Club 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 again denied the petitioned revision in a 12-month finding on June 4, 2012 (77 FR 32909).

Leatherbacks are a long lived species (>30 years). They were originally believed to mature at a younger age than loggerhead sea turtles, with a previous estimated age at sexual maturity of about 13-14 years for females with nine years reported as a likely minimum (Zug and Parham 1996) and 19 years as a likely maximum (SEFSC 2001). However, new sophisticated analyses suggest that leatherbacks in the Northwest Atlantic may reach maturity at 24.5-29 years of age (Avens *et al.* 2009). In the U.S. and Caribbean, female leatherbacks nest from March through July. In the Atlantic, most nesting females average between 150-160 centimeters curved carapace length (CCL), although smaller (<145 centimeters CCL) and larger nesters are observed (Stewart *et al.* 2007; TEWG 2007). They nest frequently (up to seven nests per year) during a nesting season and nest about every two to three years. They produce 100 eggs or more in each clutch and can produce 700 eggs or more per nesting season (Schultz 1975). However, a significant portion (up to approximately 30%) of the eggs can be infertile. As is the case with other sea turtle species, leatherback hatchlings enter the water soon after hatching. Based on a review of all sightings of leatherback sea turtles of <145 centimeters CCL, Eckert (1999) found that leatherback juveniles remain in waters warmer than 26°C until they exceed 100 centimeters CCL.

Population Dynamics and Status

As described earlier, sea turtle nesting survey data is important because it provides information on the relative abundance of nesting, and the contribution of each population/subpopulation to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually, and as an indicator of the trend in the number of nesting females in the nesting group. The most recent five-year review for leatherback sea turtles (NMFS and U.S. FWS 2013) compiled the most recent information on mean number of leatherback nests per year for each of the seven leatherback populations or groups of populations that were identified by the Leatherback TEWG as occurring within the Atlantic. These are: Florida, North Caribbean, Western Caribbean, Southern Caribbean, West Africa, South Africa, and Brazil (TEWG 2007).

In the U.S., the Florida Statewide Nesting Beach Survey program has documented an increase in leatherback nesting numbers from 98 nests in 1988 to between 800 and 900 nests in the early 2000s (NMFS and U.S. FWS 2013). Stewart *et al.* (2011) evaluated nest counts from 68 Florida beaches over 30 years (1979-2008) and found that nesting increased at all beaches with trends ranging from 3.1%-16.3% per year, with an overall increase of 10.2% per year. An analysis of Florida's index nesting beach sites from 1989-2006 shows a substantial increase in leatherback nesting in Florida during this time, with an annual growth rate of approximately 1.17 (TEWG 2007). However, leatherback nest numbers on index beaches in Florida have recently been in decline, from 657 in 2014 to 205 in 2017 (http://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/). The TEWG reports an increasing or stable nesting trend for all of the seven populations or groups of populations, with the exceptions of the Western Caribbean and West Africa groups. The leatherback rookery along the northern coast of South America in French Guiana and Suriname supports the majority of leatherback nesting in the western Atlantic (TEWG 2007), and represents more than half of total nesting by leatherback sea turtles worldwide (Hilterman and Goverse 2004). Nest numbers in Suriname have shown an increase and the long-term trend for the Suriname and French Guiana nesting group seems to show an increase (Hilterman and Goverse 2004). In 2001, the number of nests for Suriname and French Guiana combined was 60,000, one of the highest numbers observed for this region in 35 years (Hilterman and Goverse 2004). The TEWG (2007) report indicates that a positive population growth rate was found for French Guinea and Suriname using nest numbers from 1967-2005, a 39-year period, and that there was a 95% probability that the population was growing. Given the magnitude of leatherback nesting in this area compared to other nest sites, negative impacts in leatherback sea turtles in this area could have profound impacts on the entire species.

The CeTAP aerial survey conducted from 1978-1982 estimated the summer leatherback population for the northeastern U.S. at approximately 300-600 animals (from near Nova Scotia, Canada to Cape Hatteras, North Carolina) (Shoop and Kenney 1992). However, the estimate was based on turtles visible at the surface and does not include those that were below the surface out of view. Therefore, it likely underestimated the leatherback population for the northeastern U.S. at the time of the survey. Estimates of leatherback abundance of 1,052 turtles and 1,174 turtles were obtained from surveys conducted from Virginia to the Gulf of St. Lawrence in 1995 and 1998, respectively (Palka 2000). However, since these estimates were also based on sightings at the surface, the author considered the estimates to be negatively biased and the true abundance of leatherbacks may be 4.27 times higher (Palka 2000).

Threats

The five-year status review (NMFS and U.S. FWS 2013) and TEWG (2007) report provide summaries of natural as well as anthropogenic threats to leatherback sea turtles. Of the Atlantic sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear, trap/pot gear in particular. This susceptibility may be the result of their body type (large size, long pectoral flippers, and lack of a hard shell), their diving and foraging behavior, their distributional overlap with the gear, their possible attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, and perhaps to the lightsticks used to attract target species in longline fisheries. Leatherbacks entangled in fishing gear generally have a reduced ability to feed, dive, surface to breathe, or perform any other behavior essential to survival (Balazs 1985). In addition to drowning from forced submergence, they may be more susceptible to boat strikes if forced to remain at the surface, and entangling lines can constrict blood flow resulting in tissue necrosis. The long-term impacts of entanglement on leatherback health remain unclear. Innis *et al.* (2010) conducted a health evaluation of leatherback sea turtles during direct capture (n=12) and disentanglement (n=7). They found no significant difference in many of the measured health parameters between entangled and directly captured turtles. However, blood parameters, including but not limited to sodium, chloride, and blood urea nitrogen, for entangled turtles showed several key differences that were most likely due to reduced foraging and associated seawater ingestion, as well as a general stress response.

Finkbeiner *et al.* (2011) compiled cumulative sea turtle bycatch information in U.S. fisheries from 1990 through 2007, before and after implementation of bycatch mitigation measures. Information was obtained from peer reviewed publications and NMFS documents (e.g., Opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). The Southeast/Gulf of Mexico shrimp trawl fishery was responsible for the vast majority of U.S. interactions (up to 98%) and mortalities (more than 80%). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations. The most recent section 7 consultation on the shrimp fishery, completed in April 2014, was unable to estimate the total annual level of leatherback interactions occurring in the fishery at present. Instead, it qualitatively estimated that the shrimp fishery, as currently operating, would result in a few hundred interactions annually, of which a subset are expected to be lethal (NMFS 2014).

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 2004b). In 2015, there were 43 observed interactions between leatherback sea turtles and longline gear used in the HMS fishery (Garrison and Stokes 2017). All but one of the leatherbacks were released alive, with all gear removed in 10 (23%) of the 43 captures. A total of 300.0 (95% CI: 199.7-450.5) leatherback sea turtles are estimated to have interacted with the longline fisheries managed under the HMS FMP in 2015 based on the observed bycatch events (Garrison and Stokes 2017). Compared to historical highs in 2004, the estimated take of leatherbacks in the U.S. Atlantic pelagic longline fishery remained low and generally trended downward from 2007-2011, but then sharply increased in 2012 associated with an increase in reported fishing effort. The estimates have returned to a downward trend in recent years. The estimate for 2015 is consistent with that for 2014, despite a sharp decrease in reported fishing effort, and is consistent with estimates during the period from 2004-2011 (Garrison and Stokes 2017). 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[3]), whelk/conch (15), black sea bass (10), crab (2), and research pot gear (1). A review of leatherback mortality documented by the STSSN in Massachusetts suggests that vessel strikes and entanglement in fixed gear (primarily lobster pots and whelk pots) are the principal sources of this mortality (Dwyer *et al.* 2002).

Leatherback interactions with the U.S. South Atlantic and Gulf of Mexico shrimp fisheries are also known to occur (NMFS 2002). Leatherbacks are likely to encounter shrimp trawls working in the coastal waters off the U.S. Atlantic coast (from Cape Canaveral, Florida through North Carolina) as they make their annual spring migration north. For many years, TEDs that were required for use in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries were less effective for leatherbacks as compared to the smaller, hard-shelled turtle species, because the TED openings were too small to allow leatherbacks to escape. To address this problem, NMFS issued a final rule on February 21, 2003, to amend the TED regulations (68 FR 8456, February 21, 2003). Modifications to the design of TEDs are now required in order to exclude leatherbacks as well as large benthic immature and sexually mature loggerhead and green sea turtles. Given those modifications, Epperly *et al.* (2002) anticipated an average of 80 leatherback mortalities a year in shrimp gear interactions, dropping to an estimate of 26 leatherback mortalities in 2009 due to effort reduction in the Southeast shrimp fishery (Memo from Dr. B. Ponwith, SEFSC, to Dr. R. Crabtree, SERO, January 5, 2011).

Other trawl fisheries are also known to interact with leatherback sea turtles on a much smaller scale. In October 2001, for example, a NMFS fisheries observer documented the capture of a

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

leatherback in a bottom otter trawl fishing for *Loligo* squid off Delaware. TEDs are not currently required in this fishery. In November 2007, fisheries observers reported the capture of a leatherback sea turtle in bottom otter trawl gear fishing for summer flounder. Four leatherback sea turtle captures in Mid-Atlantic trawl fisheries were documented by NMFS observers between 2009 and 2013 (Murray 2015b).

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 Northeast Fisheries Observer Program (NEFOP) from 1994-1998 (excluding 1997) indicate that a total of 37 leatherbacks were incidentally captured (16 lethally) in drift gillnets set in offshore waters from Maine to Florida during this period. Observer coverage for this period ranged from 54-92%. In North Carolina, six additional leatherbacks were reported captured in gillnet sets in the spring (SEFSC 2001). In addition to these, in September 1995, two dead leatherbacks were removed from an 11-inch (28.2-centimeter) monofilament shark gillnet set in the nearshore waters off of Cape Hatteras (STSSN unpublished data reported in SEFSC 2001). Lastly, Murray (2013) reported one observed leatherback capture in Mid-Atlantic sink gillnet fisheries between 2007 and 2011.

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

Leatherbacks may be more susceptible to marine debris ingestion than other sea turtle species due to the tendency of floating debris to concentrate in convergence zones that juveniles and adults use for feeding (Shoop and Kenney 1992; Lutcavage *et al.* 1997). Investigations of the necropsy results of leatherback sea turtles revealed that a substantial percentage (34% of the 408 leatherback necropsies' recorded between 1885 and 2007) reported plastic within the turtle's stomach contents, and in some cases (8.7% of those cases in which plastic was reported), blockage of the gut was found in a manner that may have caused the mortality (Mrosovsky *et al.* 2009). An increase in reports of plastic ingestion was evident in leatherback necropsies conducted after the late 1960s (Mrosovsky *et al.* 2009). Along the coast of Peru, intestinal contents of 19 of 140 (13%) leatherback carcasses were found to contain plastic bags and film (Fritts 1982). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items (e.g., jellyfish) and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that plastic objects may resemble food items by their shape, color, size, or even movements as they drift about, and induce a feeding response in leatherbacks.

Global climate change has been identified as a factor that may affect leatherback habitat and biology (NMFS and U.S. FWS 2013); however, no significant climate change related impacts to leatherback sea turtle populations have been observed to date. Over the long term, climate change related impacts will likely influence biological trajectories in the future on a century scale (Parmesan and Yohe 2003). Changes in marine systems associated with rising water temperatures, changes in ice cover, salinity, oxygen levels and circulation including shifts in ranges and changes in algal, plankton, and fish abundance could affect leatherback prey distribution and abundance. Climate change is expected to expand foraging habitats into higher latitude waters and some concern has been noted that increasing temperatures may increase the female:male sex ratio of hatchlings on some beaches (Mrosovsky *et al*. 1984 and Hawkes *et al*. 2007 in NMFS and U.S. FWS 2013). However, due to the tendency of leatherbacks to have individual nest placement preferences and deposit some clutches in the cooler tide zone of beaches, the effects of long-term climate on sex ratios may be mitigated (Kamel and Mrosovsky 2004 in NMFS and U.S. FWS 2013). Additional potential effects of climate change on leatherbacks include range expansion and changes in migration routes as increasing ocean temperatures shift range-limiting isotherms north (Robinson *et al*. 2008). Leatherbacks have expanded their range in the Atlantic north by 330 kilometers in the last few decades as warming has caused the northerly migration of the 15°C SST isotherm, the lower limit of thermal tolerance for leatherbacks (McMahon and Hays 2006). Leatherbacks are speculated to be the best able to cope with climate change of all the sea turtle species due to their wide geographic distribution and relatively weak beach fidelity. Leatherback sea turtles may be most affected by any changes in the distribution of their primary jellyfish prey, which may affect leatherback distribution and foraging behavior (NMFS and U.S. FWS 2013). Jellyfish populations may increase due to ocean warming and other factors (Brodeur *et al*. 1999; Attrill *et al*. 2007; Richardson *et al*. 2009). However, any increase in jellyfish populations may or may not impact leatherbacks as there is no evidence that any leatherback populations are currently food-limited.

As discussed for the other three sea turtle species, increasing temperatures are expected to result in rising sea levels (Titus and Narayanan 1995 in Conant *et al*. 2009), which could result in increased erosion rates along nesting beaches. Sea level rise could result in the inundation of nesting sites and decrease available nesting habitat (Fish *et al*. 2005). This effect would potentially be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents. While there is a reasonable degree of certainty that climate change related effects will be experienced globally (e.g., rising temperatures and changes in precipitation patterns), due to a lack of scientific data, the specific effects of climate change on this species are not predictable or quantifiable at this time (Hawkes *et al*. 2009). Based on the most recent five-year status review (NMFS and U.S. FWS 2013), and following from the climate change discussion in the previous sections on sea turtles, significant impacts from climate change in the future are to be expected, but the severity of and rate at which these impacts will occur is currently unknown.

Summary of Status for Leatherback Sea Turtles

In the Pacific Ocean, the abundance of leatherback sea turtles on nesting beaches has declined dramatically during the past 10 to 20 years. Nesting groups throughout the eastern and western Pacific Ocean have been reduced to a fraction of their former abundance due to human activities that have reduced the number of nesting females and reduced the reproductive success of females (for example, by egg poaching) (NMFS and U.S. FWS 2013). 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 U.S. FWS 2013).

Nest counts in many areas of the Atlantic Ocean show increasing trends, including for beaches in Suriname and French Guiana, which support the majority of leatherback nesting in this region (NMFS and U.S. FWS 2013). The species as a whole continues to face numerous threats in nesting and marine habitats. As with the other sea turtle species, mortality due to fisheries interactions accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like pollution and habitat destruction account for an unknown level of other anthropogenic mortality. The long term recovery potential of this species may be further threatened by observed low genetic diversity, even in the largest nesting groups (NMFS and U.S. FWS 2013).

Based on its five-year status review of the species, NMFS and U.S. FWS (2013) determined that endangered leatherback sea turtles should not be delisted or reclassified. However, it also was determined that an analysis and review of the species should be conducted in the future to determine whether DPSs should be identified (NMFS and U.S. FWS 2013).

4.2.2 Status of Atlantic Sturgeon

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

The Atlantic sturgeon is a subspecies of sturgeon distributed along the east coast of North America from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida (Scott and Scott 1988; ASSRT 2007). We have delineated U.S. populations of Atlantic sturgeon into five DPSs: Gulf of Maine (GOM), New York Bight (NYB), Chesapeake Bay (CB), Carolina, and South Atlantic (SA) (77 FR 5880 and 77 FR 5914; Figure 4)[4]. The results of genetic studies suggest that natal origin influences the distribution of Atlantic sturgeon in the marine environment (Wirgin and King 2011). However, satellite tracking and tagging data along with other genetic data demonstrate that Atlantic sturgeon from all five DPSs and Canada occur throughout the full range of the subspecies. Therefore, Atlantic sturgeon originating from any of the five DPSs can be affected by threats in the marine, estuarine, and riverine environment that occur far from natal spawning rivers.

At present, the NYB, CB, Carolina, and SA DPSs are listed as endangered, while the GOM DPS is listed as threatened (77 FR 5880 and 77 FR 5914; February 6, 2012). 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 all five listed DPSs are likely to occur in the action area. Information general to all Atlantic sturgeon as well as information specific to each DPS is provided below.

Life history

Atlantic sturgeon are long lived (approximately 60 years), late maturing, estuarine dependent, anadromous[5] fish (Bigelow and Schroeder 1953; Vladykov and Greeley 1963; Mangin 1964; Pikitch *et al.* 2005; Dadswell 2006; ASSRT 2007). They are relatively large fish, even amongst sturgeon species (Pikitch *et al.* 2005) and can grow to over 14 feet and weigh up to 800 pounds. Atlantic sturgeon are bottom feeders that suck food into a ventral protruding mouth (Bigelow and Schroeder 1953). Four barbels in front of the mouth assist the sturgeon in locating prey (Bigelow and Schroeder 1953). Diets of adult and migrant subadult Atlantic sturgeon include mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (Bigelow and Schroeder 1953; ASSRT 2007; Guilbard *et al.* 2007; Savoy 2007). Juvenile Atlantic sturgeon feed on aquatic insects, larvae, and other invertebrates (Bigelow and Schroeder 1953; ASSRT 2007; Guilbard *et al.* 2007). The life history of Atlantic sturgeon can be divided into five general categories as described in Table 2 below (adapted from ASSRT 2007).

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[4] 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.”

[5] 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)

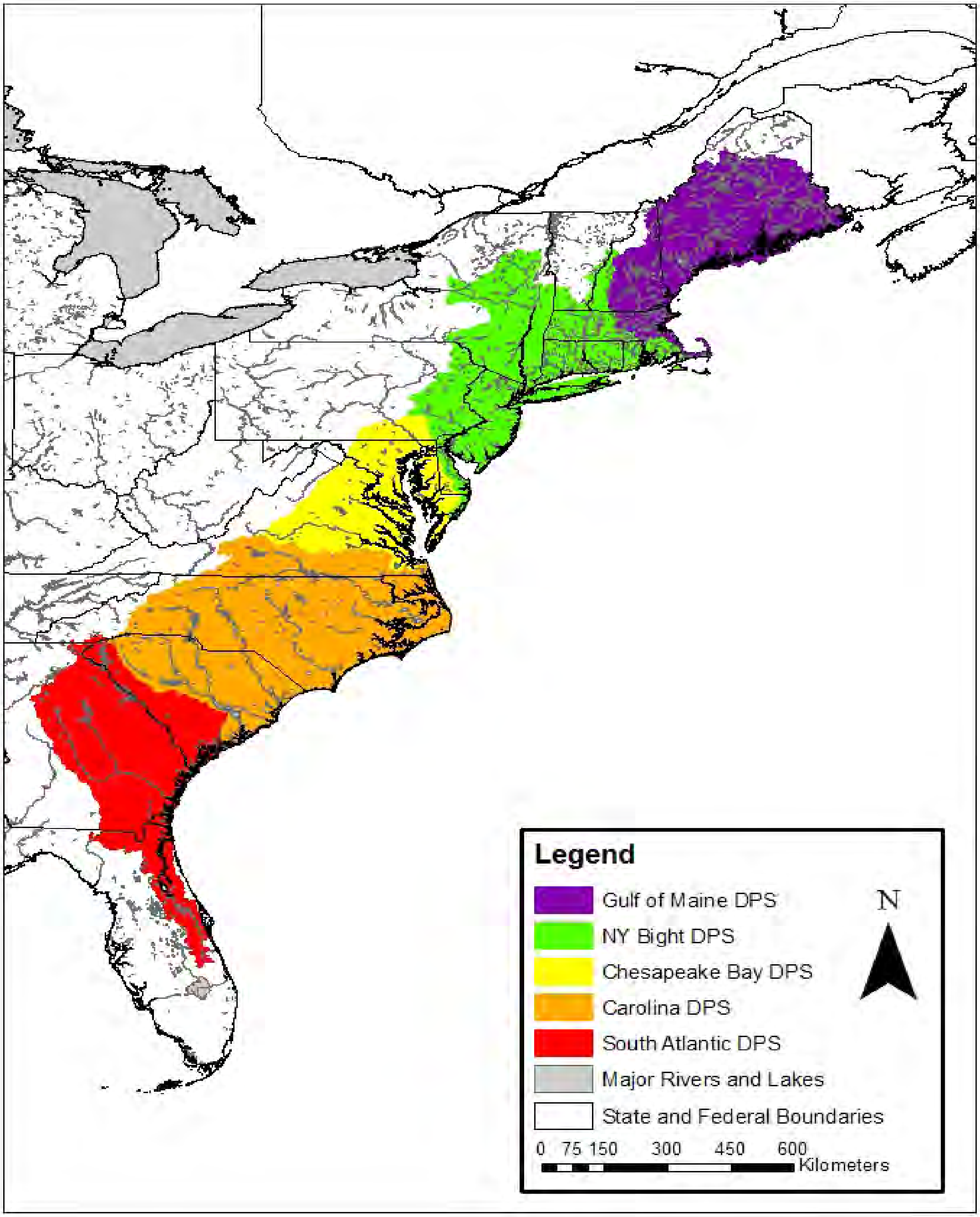

Figure 4. Map depicting the five Atlantic sturgeon DPSs.

Table 2. Descriptions of Atlantic sturgeon life history stages.

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

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

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

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

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

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

Determination of DPS Composition in the Action Area

As explained above, the range of all five DPSs overlaps and extends from Canada through Cape Canaveral, Florida. The Chesapeake Bay is known to be used by Atlantic sturgeon originating from all five DPSs. We have considered the best available information from a recent mixed stock analysis 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 51.7%; SA 21.9%; CB 11.8%; GOM 10.1%; and Carolina 2.4%. Approximately 2.2% of the Atlantic sturgeon in the action area originate from Canadian rivers or management units. These percentages are based on genetic sampling of all individuals (n=173) captured during observed fishing trips along the Atlantic coast from Maine through North Carolina, and the results of the genetic analyses for these 173 fish were compared against a reference population of 411 fish and results for an additional 790 fish from other sampling efforts. Therefore, they represent the best available information on the likely genetic makeup of individuals occurring in the action area. The genetic assignments have corresponding 95% confidence intervals. However, for purposes of section 7 consultation, we have selected the reported values without their associated confidence intervals. The reported values, which approximate the mid-point of the range, are 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 Wirgin *et al.* (2015).

Distribution and Abundance

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

DPS	Estimated Ocean Population Abundance	Estimated Ocean Population of Adults	Estimated Ocean Population of Subadults (of size vulnerable to capture in fisheries)
GOM	7,455	1,864	5,591
NYB	34,566	8,642	25,925
CB	8,811	2,203	6,608
Carolina	1,356	339	1,017
SA	14,911	3,728	11,183
Canada	678	170	509

The ASMFC released a new benchmark stock assessment for Atlantic sturgeon in October 2017 (ASMFC 2017a). The assessment used both fishery-dependent and fishery-independent data, as well as biological and life history information. Fishery-dependent data came from commercial fisheries that formerly targeted Atlantic sturgeon (before the moratorium), as well as fisheries that catch sturgeon incidentally. Fishery-independent data were collected from scientific research and survey programs.

Table 1: Stock status determination for the coastwide stock and DPSs (from the ASMFC's Atlantic Sturgeon Stock Assessment Overview, October 2017)

	Mortality Status	**Biomass/Abundance Status**	
Population	**Probability that $Z > Z_{50\%EPR}$ 80%**	**Relative to Historical Levels**	**Average probability of terminal year of indices > 1998* value**
Coastwide	7%	Depleted	95%
Gulf of Maine	74%	Depleted	51%
New York Bight	31%	Depleted	75%
Chesapeake Bay	30%	Depleted	36%
Carolina	75%	Depleted	67%
South Atlantic	40%	Depleted	Unknown (no suitable indices)

* For indices that started after 1998, the first year of the index was used as the reference value.

At the coastwide and DPS levels, the stock assessment concluded that Atlantic sturgeon are depleted relative to historical levels. The low abundance of Atlantic sturgeon is not due solely to effects of historic commercial fishing, so the 'depleted' status was used instead of 'overfished.' This status reflects the array of variables preventing Atlantic sturgeon recovery (e.g., bycatch, habitat loss, and ship strikes).

As described in the Assessment Overview, Table 7 shows "the stock status determination for the coastwide stock and DPSs based on mortality estimates and biomass/abundance status relative to historic levels, and the terminal year (i.e., the last year of available data) of indices relative to the start of the moratorium as determined by the ARIMA[6] analysis."

Despite the depleted status, the assessment did include signs that the coastwide index is above the 1998 value (95% chance). The GOM, NYB, and Carolina DPS indices also all had a greater than 50% chance of being above their 1998 value; however, the index from the CB DPS (highlighted red) only had a 36% chance of being above the 1998 value. There were no representative indices for the SA DPS. Total mortality from the tagging model was very low at the coastwide level. Small sample sizes made mortality estimates at the DPS level more difficult. The NYB, CB, and SA DPSs all had a less than 50% chance of having a mortality rate higher than the threshold. The GOM and Carolina DPSs (highlighted red) had 74%-75% probability of being above the mortality threshold (ASMFC 2017a).

Threats

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

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

Based on the best available information, we have concluded that unintended catch in fisheries, vessel strikes, poor water quality, freshwater availability, dams, lack of regulatory mechanisms for protecting the fish, and dredging are the most significant threats to Atlantic sturgeon (77 FR 5880 and 77 FR 5914; February 6, 2012). While all the threats are not necessarily present in the

6 "The ARIMA (Auto-Regressive Integrated Moving Average) model uses fishery-independent indices of abundance to estimate how likely an index value is above or below a reference value" (ASMFC 2017a).

same area at the same time, given that Atlantic sturgeon subadults and adults use ocean waters from Labrador, Canada to Cape Canaveral, Florida, as well as estuaries of large rivers along the U.S. East Coast, activities affecting these water bodies are likely to impact more than one Atlantic sturgeon DPS. In addition, because Atlantic sturgeon depend on a variety of habitats, every life stage is likely affected by one or more of the identified threats.

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

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

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

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

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

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

Based on the results of a NEFSC climate vulnerability analysis, diadromous fish are amongst the functional groups with the highest overall climate vulnerability (data quality is moderate; Hare et al. 2016). Specifically, the overall vulnerability of Atlantic sturgeon to climate change is very high (Hare et al. 2016). The contributing factors to climate exposure included ocean surface temperature, air temperature and ocean acidification, and contributing biological sensitivity attributes included stock status, population growth rate, habitat specialization, and dispersal and early life history (Hare et al. 2016). Hare et al. (2016) noted some of the following studies related to climate change effects on abundance and distribution: 1) juvenile metabolism and survival were impacted by increasing hypoxia in combination with increasing temperature (Secor and Gunderson; 1998); and 2) a 1°C temperature increase reduced productivity by 65% when a multivariable bioenergetics and survival model was used to generate spatially explicit maps of potential production in the Chesapeake Bay (Niklitschek and Secor, 2005).

4.2.2.1 Gulf of Maine DPS of Atlantic sturgeon

The GOM DPS includes the following: all anadromous Atlantic sturgeon that spawn or are spawned in the watersheds from the Maine/Canadian border and, extending southward, all watersheds draining into the Gulf of Maine as far south as Chatham, Massachusetts. The marine range of Atlantic sturgeon from the GOM DPS extends from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the GOM DPS and the adjacent portion of the marine range are shown in Figure 4. Within this range, Atlantic sturgeon historically spawned in the Androscoggin, Kennebec, Merrimack, Penobscot, and Sheepscot Rivers (ASSRT 2007). Spawning still occurs in the Kennebec and Androscoggin Rivers, and it is possible that it still occurs in the Penobscot River as well. Spawning in the Androscoggin River was just recently confirmed by the Maine Department of Marine Resources when they captured a larval Atlantic sturgeon during the 2011 spawning season below the Brunswick Dam. There is no evidence of recent spawning in the remaining rivers. In the 1800s, construction of the Essex Dam on the Merrimack River at river kilometer (rkm) 49 blocked access to 58% of Atlantic sturgeon habitat in the river (Oakley 2003; ASSRT 2007). However, the accessible portions of the Merrimack seem to be suitable habitat for Atlantic sturgeon spawning and rearing (i.e., nursery habitat) (Kieffer and Kynard 1993). Therefore, the availability of spawning habitat does not appear to be the reason for the lack of observed spawning in the Merrimack River. Studies are on-going to determine whether Atlantic sturgeon are spawning in the Penobscot and Saco Rivers. Atlantic sturgeon that are spawned elsewhere continue to use habitats within all of these rivers as part of their overall marine range (ASSRT 2007).

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

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

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

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

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

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

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

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

There are no direct in-river abundance estimates for the GOM DPS. The Atlantic Sturgeon Status Review Team (ASSRT 2007) presumed that the GOM DPS was comprised of less than 300 spawning adults per year, based on extrapolated abundance estimates from the Hudson and Altamaha riverine populations of Atlantic sturgeon. Surveys of the Kennebec River over two time periods, 1977-1981 and 1998-2000, resulted in the capture of nine adult Atlantic sturgeon (Squiers 2004). However, since the surveys were primarily directed at capture of shortnose sturgeon, the capture gear used may not have been selective for the larger-sized, adult Atlantic sturgeon; several hundred subadult Atlantic sturgeon were caught in the Kennebec River during these studies. As described earlier in Section 4.2.2, we have estimated that there are a minimum of 7,455 GOM DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in U.S. Atlantic waters We note further that this estimate is predicated on the assumption that fish in the GOM DPS would be available for capture in the NEAMAP surveys which extend from Block Island Sound, Rhode Island southward. Recoveries of tagged sturgeon do not support this migration pattern.

Summary of the Gulf of Maine DPS

Spawning for the GOM DPS is known to occur in two rivers (Kennebec and Androscoggin). Spawning may be occurring in other rivers, such as the Sheepscot, Merrimack, and Penobscot, but has not been confirmed. There are indications of potential increasing abundance of Atlantic sturgeon belonging to the GOM DPS. Atlantic sturgeon continue to be present in the Kennebec

River; in addition, they are captured in directed research projects in the Penobscot River, and are observed in rivers where they were unknown to occur or had not been observed to occur for many years (e.g., Saco, Presumpscot, and Charles Rivers). These observations suggest that abundance of the GOM DPS of Atlantic sturgeon is sufficient such that recolonization to rivers historically suitable for spawning may be occurring. However, despite some positive signs, there is not enough information to establish a trend for this DPS.

Some of the impacts from the threats that contributed to the decline of the GOM DPS have been removed (e.g., directed fishing), or reduced as a result of improvements in water quality and removal of dams (e.g., the Edwards Dam on the Kennebec River in 1999 and the Veazie Dam on the Penobscot River in 2013). In Maine state waters, there are strict regulations on the use of fishing gear that incidentally catches sturgeon. In addition, in the last several years there have been reductions in fishing effort in state and Federal waters, which most likely would result in a reduction in bycatch mortality of Atlantic sturgeon. A significant amount of fishing in the Gulf of Maine is conducted using trawl gear, which is known to have a much lower mortality rate for Atlantic sturgeon caught in the gear compared to sink gillnet gear (ASMFC TC 2007). Atlantic sturgeon from the GOM DPS are not commonly taken as bycatch in areas south of Chatham, Massachusetts, with only 8% (e.g., 7 of 84 fish) of interactions observed south of Chatham being assigned to the GOM DPS (Wirgin and King 2011). Tagging results also indicate that GOM DPS fish tend to remain within the waters of the Gulf of Maine and only occasionally venture to points south.

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

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

4.2.2.2 New York Bight DPS of Atlantic sturgeon

The NYB DPS includes the following: all anadromous Atlantic sturgeon that spawn or are spawned in the watersheds that drain into coastal waters from Chatham, Massachusetts to the Delaware-Maryland border on Fenwick Island. The marine range of Atlantic sturgeon from the NYB DPS extends from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the NYB DPS and the adjacent portion of the marine range are shown in Figure 4. Within this range, Atlantic sturgeon historically spawned in the Connecticut, Delaware, Hudson, and Taunton Rivers (Murawski and Pacheco 1977; Secor 2002; ASSRT 2007).

Spawning still occurs in the Delaware and Hudson Rivers, but there is no recent evidence (within the last 15 years) of spawning in the Connecticut and Taunton Rivers (ASSRT 2007). Atlantic sturgeon that are spawned elsewhere continue to use habitats within the Connecticut and Taunton Rivers as part of their overall marine range (ASSRT 2007; Savoy 2007; Wirgin and King 2011).

The abundance of the Hudson River Atlantic sturgeon riverine population before the over-exploitation of the 1800s is unknown, but has been conservatively estimated at 6,000 adult females (Secor 2002). Current abundance is likely at least one order of magnitude smaller than historical levels (Secor 2002; ASSRT 2007; Kahnle *et al.* 2007). As described above, an estimate of the mean annual number of mature adults (863 total; 596 males and 267 females) was calculated for the Hudson riverine population based on fishery-dependent data collected from 1985-1995 (Kahnle *et al.* 2007). Kahnle *et al.* (1998, 2007) also showed that the level of fishing mortality from the Hudson River Atlantic sturgeon fishery during the period of 1985-1995 exceeded the estimated sustainable level of fishing mortality for the riverine population and may have led to reduced recruitment. All available data on abundance of juvenile Atlantic sturgeon in the Hudson River Estuary indicate a substantial drop in production of young since the mid-1970s (Kahnle *et al.* 1998). A decline appeared to occur in the mid to late 1970s followed by a secondary drop in the late 1980s (Kahnle *et al.* 1998; Sweka *et al.* 2007; ASMFC 2010). Catch-per-unit-effort (CPUE) data suggests that recruitment has remained depressed relative to catches of juvenile Atlantic sturgeon in the estuary during the mid-late 1980s (Sweka *et al.* 2007; ASMFC 2010). The CPUE data from 1985-2011 show significant fluctuations. There appears to be a decline in the number of juveniles between the late 1980s and early 1990s and then a slight increase in the 2000s, but, given the significant annual fluctuation, it is difficult to discern any trend. Despite the CPUEs from 2000-2011 being slightly higher than those from 1990-1999, they are low compared to the late 1980s (Figure 5). There is currently not enough information regarding any life stage to establish a trend for the Hudson River population.

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

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

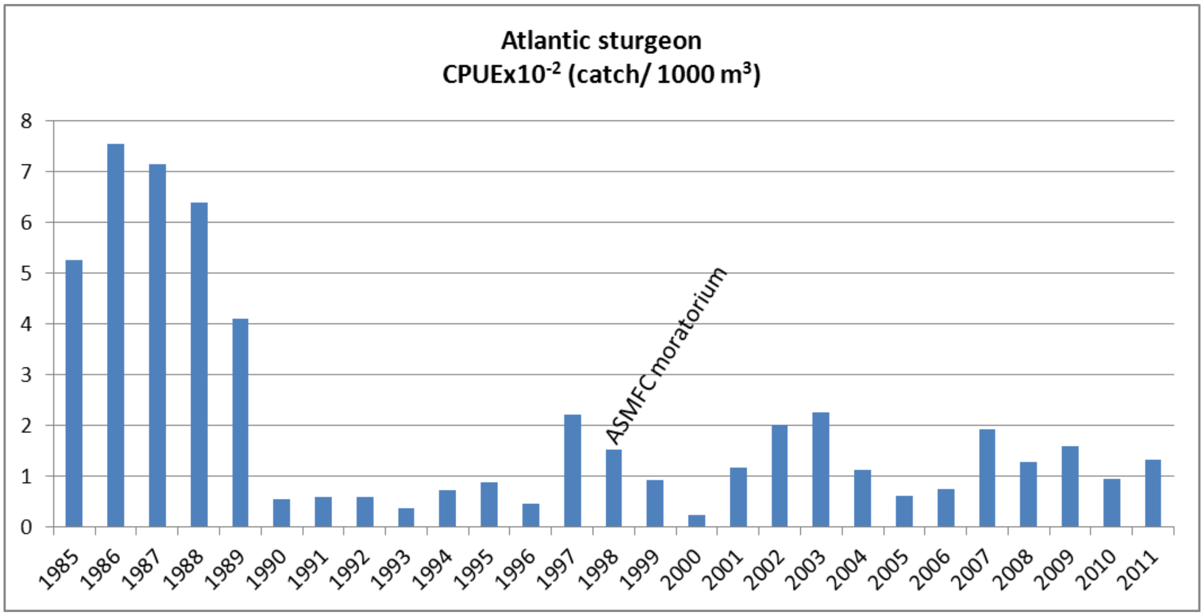

Figure 5. Hudson River Atlantic sturgeon CPUE juvenile index (1985-2011).

Summary of the New York Bight DPS

Atlantic sturgeon originating from the NYB DPS have been documented to spawn in the Hudson and Delaware Rivers and may spawn in the Connecticut and Housatonic Rivers, although that has not been confirmed. While genetic testing can differentiate between individuals originating from the Hudson or Delaware River, the available information suggests that the straying rate is relatively high between these rivers. Some of the impact from the threats that contributed to the decline of the NYB DPS have been removed (e.g., directed fishing) or reduced as a result of improvements in water quality since passage of the Clean Water Act (CWA). In addition, there have been reductions in fishing effort in state and Federal waters, which may result in a reduction in bycatch mortality of Atlantic sturgeon. Nevertheless, areas with persistent, degraded water quality, habitat impacts from dredging, continued bycatch in state and federally-managed fisheries, and vessel strikes remain significant threats to the NYB DPS.

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

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

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

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

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

Studies have shown that to rebuild, Atlantic sturgeon can only sustain low levels of anthropogenic mortality (Boreman 1997; ASMFC TC 2007; Kahnle *et al.* 2007; Brown and Murphy 2010). There are no empirical abundance estimates of the number of Atlantic sturgeon in the NYB DPS. As described in Section 4.2.2, we have estimated that there are a minimum of

34,566 NYB DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in U.S. Atlantic waters. We have determined that the NYB DPS is currently at risk of extinction due to: (1) precipitous declines in population sizes and the protracted period in which sturgeon populations have been depressed; (2) the limited amount of current spawning; and (3) the impacts and threats that have and will continue to affect population recovery.

4.2.2.3 Chesapeake Bay DPS of Atlantic sturgeon

The CB DPS includes the following: all anadromous Atlantic sturgeon that spawn or are spawned in the watersheds that drain into the Chesapeake Bay and into coastal waters from the Delaware-Maryland border on Fenwick Island to Cape Henry, Virginia. The marine range of Atlantic sturgeon from the CB DPS extends from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the CB DPS and the adjacent portion of the marine range are shown in Figure 4. Within this range, Atlantic sturgeon historically spawned in the Susquehanna, Potomac, James, York, Rappahannock, and Nottoway Rivers (ASSRT 2007). Based on the review by Oakley (2003), 100% of Atlantic sturgeon habitat is currently accessible in these rivers since most of the barriers to passage (i.e., dams) are located upriver of where spawning is expected to have historically occurred (ASSRT 2007). Spawning still occurs in the James River, and the presence of juvenile and adult sturgeon in the York River suggests that spawning may occur there as well (Musick *et al.* 1994; ASSRT 2007; Greene *et al*. 2009). However, conclusive evidence of current spawning is only available for the James River, where a recent study found evidence of Atlantic sturgeon spawning in the fall (Balazik *et al*. 2012a). Atlantic sturgeon that are spawned elsewhere are known to use the Chesapeake Bay for other life functions, such as foraging and as juvenile nursery habitat (Vladykov and Greeley 1963; Wirgin *et al.* 2000; ASSRT 2007; Grunwald *et al.* 2008).

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

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

Decreased water quality also threatens Atlantic sturgeon of the CB DPS, especially since the Chesapeake Bay system is vulnerable to the effects of nutrient enrichment due to a relatively low tidal exchange and flushing rate, large surface-to-volume ratio, and strong stratification during the spring and summer months (Pyzik *et al.* 2004; ASMFC 1998a; ASSRT 2007; EPA 2008). These conditions contribute to reductions in dissolved oxygen levels throughout the Bay. The availability of nursery habitat, in particular, may be limited given the recurrent hypoxia (low dissolved oxygen) conditions within the Bay (Niklitschek and Secor 2005, 2010). Heavy industrial development during the 20th century in rivers inhabited by sturgeon impaired water quality and impeded these species' recovery.

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

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

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

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

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

Summary of the Chesapeake Bay DPS

Spawning for the CB DPS is known to occur in only the James and Pamunkey Rivers. Spawning may be occurring in other rivers, such as the York, Rappahannock, Potomac, Nanticoke, and Susquehanna, but has not been confirmed for any of those. There are anecdotal reports of increased sightings and captures of Atlantic sturgeon in the James River. However, this information has not been comprehensive enough to develop a population estimate for the James

River or to provide sufficient evidence to confirm increased abundance. Some of the impact from the threats that facilitated the decline of the CB DPS have been removed (e.g., directed fishing) or reduced as a result of improvements in water quality since passage of the CWA. As described in Section 4.2.2, we have estimated that there are a minimum of 8,811 CB DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in U.S. Atlantic waters.

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

4.2.2.4 Carolina DPS of Atlantic sturgeon

The Carolina DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) from Albemarle Sound southward along the southern Virginia, North Carolina, and South Carolina coastal areas to Charleston Harbor. The marine range of Atlantic sturgeon from the Carolina DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the Carolina DPS and the adjacent portion of the marine range are shown in Figure 4. Sturgeon are commonly captured 40 miles offshore (D. Fox, Delaware State University, pers. comm.). Records providing fishery bycatch data by depth show the vast majority of Atlantic sturgeon bycatch via gillnets is observed in waters less than 50 meters deep (Stein *et al*. 2004b, ASMFC TC 2007), but Atlantic sturgeon are recorded as bycatch out to 500 fathoms.

Rivers known to have current spawning populations within the range of the Carolina DPS include the Roanoke, Tar-Pamlico, Cape Fear, Waccamaw, and Pee Dee Rivers. We determined spawning was occurring if YOY were observed or mature adults were present in freshwater portions of a system (Table 8). However, in some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development. There may also be spawning populations in the Neuse, Santee, and Cooper Rivers, though it is uncertain. Historically, both the Sampit and Ashley Rivers were documented to have spawning populations at one time. However, the spawning population in the Sampit River is believed to be extirpated, and the current status of the spawning population in the Ashley River is unknown. Both rivers may be used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. Fish from the Carolina DPS likely use other river systems than those listed here for their specific life functions.

Historical landings data indicate that between 7,000 and 10,500 adult female Atlantic sturgeon were present in North Carolina prior to 1890 (Armstrong and Hightower 2002; Secor 2002). Secor (2002) estimates that 8,000 adult females were present in South Carolina during that same time frame. Prior reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the Carolina DPS. Currently, the Atlantic sturgeon spawning population in at least one river system within the Carolina DPS has been extirpated, with potential extirpation in an additional system. The abundances of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, are estimated to be less than 3% of what they were historically (ASSRT 2007). As described in Section 4.2.2, we have estimated that there are a minimum of 1,356 Carolina DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in U.S. Atlantic waters.

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

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

Threats

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

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

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

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

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

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

Summary of the Status of the Carolina DPS of Atlantic Sturgeon

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

The presence of dams has resulted in the loss of more than 60% of the historical sturgeon habitat on the Cape Fear River and in the Santee-Cooper system. Dams are contributing to the status of the Carolina DPS by curtailing the extent of available spawning habitat and further modifying the remaining habitat downstream by affecting water quality parameters (such as depth, temperature, velocity, and dissolved oxygen) that are important to sturgeon. Dredging is also contributing to the status of the Carolina DPS by modifying Atlantic sturgeon spawning and nursery habitat. Habitat modifications through reductions in water quality are contributing to the status of the Carolina DPS due to nutrient-loading, seasonal anoxia, and contaminated sediments. Interbasin water transfers and climate change threaten to exacerbate existing water quality issues. Bycatch is also a current threat to the Carolina DPS that is contributing to its status. Fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may use multiple river systems for nursery and foraging habitat in addition to their natal spawning river, they are subject to being caught in multiple fisheries throughout their range. In addition to direct mortality, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins). This may result in either reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality. While many of the threats to the Carolina DPS have been ameliorated or reduced due to existing regulatory mechanisms, such as the moratorium on directed fisheries for Atlantic sturgeon, bycatch and habitat alterations are currently not being addressed through existing mechanisms. Further, despite NMFS's authority under the Federal Power Act to prescribe fish passage and existing controls on some pollution sources, access to habitat and improved water quality continues to be a problem. The inadequacy of regulatory mechanisms to control bycatch and habitat alterations is contributing to the status of the Carolina DPS.

4.2.2.5 South Atlantic DPS of Atlantic sturgeon

The SA DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) of the Ashepoo, Combahee, and Edisto Rivers (ACE) Basin southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. The marine range of Atlantic sturgeon from the SA DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the SA DPS and the adjacent portion of the marine range are shown in Figure 4. Sturgeon are commonly captured 40 miles offshore (D. Fox, Delaware State University, pers. comm.). Records providing fishery bycatch data by depth show the vast majority of Atlantic sturgeon bycatch via gillnets is observed in waters less than 50 meters deep (Stein *et al.* 2004b, ASMFC TC 2007), but Atlantic sturgeon are recorded as bycatch out to 500 fathoms (900 meters).

Rivers known to have current spawning populations within the range of the South Atlantic DPS include the Combahee, Edisto, Savannah, Ogeechee, Altamaha, and Satilla Rivers. We determined spawning was occurring if YOY were observed, or mature adults were present, in freshwater portions of a system (Table 9). However, in some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development. Historically, both the Broad-Coosawatchie and St. Marys Rivers were documented to have spawning populations at one time; there is also evidence that spawning may have occurred in the St. Johns River or one of its tributaries. However, the spawning population in the St. Marys River, as well as any historical spawning population present in the St. Johns, is believed to be extirpated, and the status of the spawning population in the Broad-Coosawatchie is unknown. Both the St. Marys and St. Johns Rivers are used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. The use of the Broad-Coosawatchie by sturgeon from other spawning populations is unknown at this time. The presence of historical and current spawning populations in the Ashepoo River has not been documented; however, this river may currently be used for nursery habitat by young Atlantic sturgeon originating from other spawning populations. Fish from the SA DPS likely use other river systems than those listed here for their specific life functions.

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

Georgia. Reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the South Atlantic DPS. Currently, the Atlantic sturgeon population in at least two river systems within the SA DPS has been extirpated. As described in Section 4.2.2, we have estimated that there are a minimum of 14,911 SA DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in U.S. Atlantic waters.

Table 9. Major rivers, tributaries, and sounds within the range of the SA DPS and currently available data on the presence of an Atlantic sturgeon spawning population in each system.

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

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

The modification and curtailment of Atlantic sturgeon habitat resulting from dredging and degraded water quality is contributing to the status of the SA DPS. Dredging is a present threat to the SA DPS and is contributing to its status by modifying the quality and availability of Atlantic sturgeon habitat. Maintenance dredging is currently modifying Atlantic sturgeon nursery habitat in the Savannah River and modeling indicates that the proposed deepening of the navigation channel will result in reduced dissolved oxygen and upriver movement of the salt wedge, curtailing spawning habitat. Dredging is also modifying nursery and foraging habitat in the St. Johns Rivers. Reductions in water quality from terrestrial activities have modified habitat used by the SA DPS. Low dissolved oxygen is modifying sturgeon habitat in the Savannah due to dredging, and non-point source inputs are causing low dissolved oxygen in the Ogeechee River and in the St. Marys River, which completely eliminates juvenile nursery habitat in summer. Low dissolved oxygen has also been observed in the St. Johns River in the summer. Sturgeon are more sensitive to low dissolved oxygen and the negative (metabolic, growth, and feeding) effects caused by it increase when water temperatures are concurrently high, as they are within the range of the SA DPS. Additional stressors arising from water allocation and climate change threaten to exacerbate water quality problems that are already present throughout the range of the SA DPS. Large withdrawals of over 240 million gallons per day mgd of water occur in the Savannah River for power generation and municipal uses. However, permits for users withdrawing less than 100,000 gallons per day (gpd) are not required to get permits, so actual water withdrawals from the Savannah and other rivers within the range of the SA DPS are unknown, but likely much higher. The removal of large amounts of water from the system will alter flows, temperature, and dissolved oxygen. Water shortages and “water wars” are already occurring in the rivers occupied by the SA DPS and will likely be compounded in the future by population growth and, potentially, by climate change. Climate change is also predicted to elevate water temperatures and exacerbate nutrient-loading, pollution inputs, and lower dissolved oxygen, all of which are current stressors to the SA DPS.

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

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

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

As described in Section 4.2.2, we have estimated that there are a minimum of 14,911 SA DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in U.S. Atlantic waters. The DPS’s freshwater range occurs in the watersheds (including all rivers and tributaries) of the ACE Basin southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. Recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon. Their late age at maturity provides more opportunities for individuals to be removed from the population before reproducing. While a long life-span also allows multiple opportunities to contribute to future generations, this is hampered within the SA DPS by habitat alteration, bycatch, and from the inadequacy of existing regulatory mechanisms to address and reduce habitat alterations and bycatch.

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

5.0 ENVIRONMENTAL BASELINE

Environmental baselines for biological opinions include the past and present impacts of all state, federal, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR 402.02). The environmental baseline for this Opinion includes the effects of several activities that may affect the survival and recovery of ESA-listed species in the action area. The activities that shape the environmental baseline in the action area of this consultation generally include: commercial and recreational fisheries, hopper dredging operations, sand mining and beach nourishment activities, commercial shipping and other vessel activities, military operations, scientific research, projects affecting water quality and pollution, global climate change, and recovery activities associated with reducing impacts to listed species.

5.1 Federal Actions that have Undergone Section 7 Consultation

We have undertaken a number of section 7 consultations to address the effects of Federal actions on threatened and endangered species in the action area. Each of those consultations sought to develop ways to reduce 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 nearshore 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 Greater Atlantic Region (Maine through Virginia), a formal ESA section 7 consultation has been conducted on the Northeast multispecies, monkfish, spiny dogfish, Northeast skate complex, Atlantic bluefish, Atlantic mackerel/squid/butterfish, and summer flounder/scup/black sea bass fisheries, the last three of which may overlap in part with the action area for the Virginia pound net fishery. This consultation (the "batched fisheries Opinion") considered adverse effects to loggerhead, green, Kemp's ridley, and leatherback sea turtles. In the batched fisheries Opinion, we concluded that the seven fisheries were likely to adversely affect but were not likely to jeopardize the continued existence of any sea turtle species. The Opinion included an ITS exempting a certain amount of lethal or non-lethal take resulting from interactions with the fisheries. The ITS is summarized in the table below (Table 10).

Table 10. Sea turtle incidental take information from the most recent NMFS GARFO Opinion for seven federally managed fisheries, three of which (in bold) overlap with the action area.

Opinion	**Date**	**Loggerhead**	**Kemp's ridley**	**Green**	**Leatherback**
Northeast Multispecies, Monkfish, Spiny Dogfish, **Atlantic Bluefish**, Northeast Skate Complex, **Atlantic Mackerel/Squid/Butterfish**, and **Summer Flounder/ Scup/Black Sea Bass** (Batched Fisheries)	December 16, 2013 (ITS amended March 10, 2016)	1,345 (835 lethal) every 5 years in gillnets; 1,020 (335 lethal) every 5 years in bottom trawls; 1 (lethal or non-lethal) annually in pot/trap gear	4 (3 lethal) annually in gillnets; 3 (2 lethal) annually in bottom trawls	4 (3 lethal) annually in gillnets; 3 (2 lethal) annually in bottom trawls	4 (3 lethal) annually in gillnets; 4 (2 lethal) annually in bottom trawls; 4 (lethal or non-lethal) annually in pot/trap gear

Although there are documented incidental takes of sea turtles in these fisheries, the action area for them includes the entire EEZ along the U.S. Atlantic coast from Maine through Florida. The nearshore and coastal waters of Virginia and those inside Chesapeake Bay represent a small fraction of the action area assessed and for which interactions of sea turtles are anticipated in the batched fisheries Opinion. Thus, the amount of incidental take of sea turtles that occurs in

Virginia state waters as a result of Federal fisheries is also a small fraction of the amount exempted in that Opinion. Furthermore, very little commercial and recreational fishing effort for those species occurs in Virginia state waters, and even less occurs within Chesapeake Bay. Scup and summer flounder have a larger state waters recreational component, but that effort is often exerted offshore and outside of the bay, where very few Virginia pound nets are expected to be set and fished. In the batched fisheries Opinion, we also 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 their prey and/or habitat would be insignificant and discountable.

Atlantic sturgeon originating from each the five listed DPSs are captured and killed in otter trawl, sink gillnet, and hook and line fisheries operating in the action area. At the time of this writing, the batched fisheries Opinion covers Atlantic sturgeon interactions in most commercial trawl and gillnet gear in the Greater Atlantic Region. 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 indicated that from 2006-2010, an annual average of 3,118 Atlantic sturgeon were captured in these fisheries with 1,569 in sink gillnet and 1,548 in otter trawls. The mortality rate in sink gillnets was estimated at approximately 20% and the mortality rate in otter trawls was estimated at 5%. Based on this estimate, a total of 391 Atlantic sturgeon were estimated to be killed annually in these fisheries that are prosecuted in the Greater Atlantic Region. Again, nearshore and coastal waters of Virginia and those inside Chesapeake Bay represent a small fraction of the action area assessed and for which interactions of Atlantic sturgeon are anticipated in the batched fisheries Opinion. Nonetheless, any Federal fisheries that use sink gillnets, otter trawls, or hook and line gear are likely to interact with Atlantic sturgeon and be an additional, albeit minor, source of incidental take and mortality in the action area. An updated Atlantic sturgeon bycatch estimate in Northeast sink gillnet and otter trawl fisheries for 2011-2015 was prepared by the NEFSC in 2016. Using this information, the authors of the recent ASMFC (2017) Atlantic Sturgeon Benchmark Stock Assessment estimated that 1,139 fish (295 lethal; 25%) were caught in gillnet fisheries and 1,062 fish (41 lethal; 4%) were caught in otter trawl fisheries per year from 2000-2015. Atlantic sturgeon bycatch estimates for Northeast gillnet and trawl gear from 2011-2015 (approximately 761 fish per year for gillnets, 777 for trawls) are substantially lower than those from 2006-2010 (approximately 1,074 fish per year for gillnets, 1,016 for trawls) (ASMFC 2017).

5.1.2 Hopper Dredging, Sand Mining, and Beach Nourishment

The construction and maintenance of Federal navigation channels, sand mining ("borrow") activities, beach nourishment, and shoreline restoration/stabilization projects are sources of sea turtle and Atlantic sturgeon incidental take and mortality in the action area. The majority of these projects in the action area are authorized and carried out by the U.S. Army Corps of Engineers (ACOE), with a few facility-specific projects overseen by the National Aeronautics and Space Administration (NASA) and U.S. Navy. In the action area, ACOE projects are under the jurisdiction of the Baltimore and Norfolk District of the North Atlantic Division. From 1993-2017, hopper dredging projects in the Chesapeake Bay area have resulted in the recorded incidental take of 66 loggerheads, 6 Kemp's ridleys, 1 green, and 4 unidentified hard shell turtles. Nearly all of these interactions have occurred in nearshore coastal waters with very few interactions in the open ocean. Few interactions between hopper dredges and Atlantic sturgeon have been reported, with just two records documenting interactions between hopper dredges and Atlantic sturgeon in the action area (in Virginia near the Chesapeake Bay entrance).

We have completed several ESA section 7 consultations with the ACOE to consider effects of these dredging, sand mining, and nourishment projects on listed sea turtles and Atlantic sturgeon. In an Opinion issued to the ACOE in 2012, we estimated that over a 50-year period of the ACOE's maintenance dredging of the Chesapeake Bay entrance channels and use of sand borrow areas for beach nourishment (from 2012-2062), up to 937 loggerhead (452 lethal), 275 Kemp's ridley (48 lethal), and 38 green (11 lethal) sea turtles will be incidentally taken. We also anticipated that up to 750 Atlantic sturgeon (124 lethal) will be incidentally taken during the same action over the same period. Non-lethal takes of Atlantic sturgeon were anticipated as a result of relocation trawling that is sometimes required in association with channel dredging. Up to 50 lethal sea turtle takes (37 loggerheads, 11 Kemp's ridleys, and 2 greens) were anticipated during the same relocation trawling activities over the 50-year maintenance dredging period.

In two other 2012 Opinions, we determined that the U.S. Navy's Dam Annex Shoreline Protection System Repairs project and Joint Expeditionary Base (JEB) Little Creek/Fort Story Shoreline Restoration and Protection project would both result in the lethal entrainment of up to one loggerhead or Kemp's ridley sea turtle and up to one Atlantic sturgeon from any of the five DPSs during hopper dredging operations at the Sandbridge Shoal borrow area, located a short distance offshore of the installations. Both projects were also anticipated to result in the lethal entrainment of up to one Atlantic sturgeon from any of the five DPSs during mechanical dredging operations at the installations themselves. Table 11 below provides information on Opinions covering dredging, beach nourishment, and shoreline restoration/stabilization projects in the action area and the associated ITS for sea turtles (unless otherwise noted, take estimates are per dredge cycle). Takes of sea turtles and Atlantic sturgeon during relocation trawling activities are also included in the ACOE consultation. Relocation trawling has been successful at temporarily displacing loggerhead, Kemp's ridley, leatherback, and green sea turtles, and more recently Atlantic sturgeon, from navigation channels and nearshore mining/borrow areas in both the Atlantic and Gulf of Mexico during periods when hopper dredging was imminent or ongoing.

Table 11. Information on NMFS GARFO consultations for dredging, nourishment, and shoreline restoration/stabilization projects that occur in the action area, and their ITSs for sea turtles.

Project	Date of Opinion	Loggerhead	Kemp's ridley	Green	Leatherback	Notes
U.S. Navy Shoreline Restoration and Protection Project, JEB Little Creek/ Fort Story, VA Beach	7/13/2012	1 loggerhead or Kemp's ridley		0	0	

<table>
<tr><td>U.S. Navy Shoreline Protection Sys Repairs, Naval Air Station Oceana, Dam Neck Annex, VA Beach</td><td>7/20/2012</td><td colspan="2">1 loggerhead or Kemp's ridley</td><td>0</td><td>0</td><td></td></tr>
<tr><td rowspan="2">ACOE Dredging of Chesapeake Bay Entrance Channels and Beach Nourishment</td><td rowspan="2">10/16/2012</td><td>937 non-lethal captures, 452 mortalities</td><td>275 non-lethal captures, 48 mortalities</td><td>38 non-lethal captures, 11 mortalities</td><td>0</td><td rowspan="2">total takes over 50-year project life</td></tr>
<tr><td colspan="4">Relocation Trawling: up to 938 captures (37 mortalities) of loggerheads, 275 captures (11 mortalities) of Kemp’s ridleys, and 37 captures (2 mortalities) of green sea turtles</td></tr>
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5.1.3 Vessel Activity and Military Operations

Potential sources of adverse effects to sea turtles and Atlantic sturgeon from Federal vessel operations in the action area include operations of the U.S. Navy (USN) and the U.S. Coast Guard (USCG), which maintain the largest Federal fleets, as well as the Bureau of Ocean Energy Management (BOEM), Maritime Administration (MARAD), Environmental Protection Agency (EPA), NOAA, and ACOE. We have conducted formal consultations with the USN, USCG, EPA, and NOAA on their vessel-based operations. We have also conducted section 7 consultations with BOEM and MARAD on vessel traffic related to energy projects in the Greater Atlantic Region and 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. 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 these species in marine, estuarine, and riverine environments. However, because of a lack of information on the effects of these activities on sturgeon, the discussion below focuses on sea turtles.

Although consultations on individual Navy and USCG activities have been completed, only a few formal consultations on overall military activities along the U.S. Atlantic coast have been completed at this time. In June 2009, NMFS prepared an Opinion on Navy activities in each of their four training range complexes along the U.S. Atlantic coast—Northeast, Virginia Capes, Cherry Point, and Jacksonville (NMFS 2009). The Virginia Capes Operating Area overlaps with the action area for this consultation. In August 2017, NMFS prepared an Opinion on the operation of the Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) sonar onboard four Navy vessels (NMFS 2017). In addition, the following Opinions for the Navy (NMFS 1996, 1997, 2008b) and USCG (NMFS 1995, 1998b) contain details on the scope of vessel operations for these agencies and the conservation measures that are being implemented as standard operating procedures. In the U.S. Atlantic, the operation of USCG boats and cutters is estimated to take no more than one individual sea turtle, of any species, per year (NMFS 1995).

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

NMFS has also conducted section 7 consultations on Navy explosive ordnance disposal, mine warfare, sonar testing (e.g., AFAST, SURTASS LFA), and other major training exercises (e.g., bombing, Naval gunfire, combat search and rescue, anti-submarine warfare, and torpedo and missile exercises) in the Atlantic Ocean. These consultations have determined that the proposed Navy activities may adversely affect but would not jeopardize the continued existence of ESA-listed sea turtles (NMFS 2008b, 2009, 2017). NMFS estimated that five loggerhead and six Kemp's ridley sea turtles were likely to be harmed as a result of training activities in the Virginia Capes Range Complex from June 2009 to June 2010, and that nearly 1,500 sea turtles, including ten leatherbacks, were likely to experience harassment (NMFS 2009). For SURTASS LFA sonar testing, NMFS was unable to estimate the number of sea turtles of each species occurring in USN mission areas that could be incidentally taken, although all takes were expected to result in behavioral harassment rather than post-interaction mortality (NMFS 2017).

Similarly, operations of vessels by other Federal agencies within the action area (BOEM, MARAD, EPA, and ACOE) may adversely affect sea turtles and Atlantic sturgeon. 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.

5.1.4 Research and Other Permitted Activities

Research activities either conducted or funded by Federal agencies within the action area may adversely affect ESA-listed sea turtles and fish, and may require a section 7 consultation. Several section 7 consultations on research activities have recently been completed, as described below.

Fish Surveys funded by the U.S. FWS
U.S. FWS Region 5 provides funds to 13 states and the District of Columbia under the Dingell-Johnson Sport Fish Restoration Grant program and the State Wildlife Grant Program, including Virginia. We completed a Biological Opinion in 2013 which bundled the eleven independent actions carried out by U.S. FWS (i.e., awarding of each grant fund to each state is an independent action). The Opinion provides an ITS by activity and provided a summary by state. Studies occurring in Virginia state waters including juvenile fish trawl surveys, juvenile striped bass beach seine surveys, and the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) surveys. These surveys have resulted in the non-lethal capture of both sea turtles (eight loggerheads and one Kemp's ridley) and Atlantic sturgeon (seven total) since 2013. The only mortalities that we anticipate for the surveys that take place in Virginia state waters are

three Atlantic sturgeon (originating from any of the five DPSs) during striped bass and shad gillnet surveys in the action area.

Section 10(a)(1)(A) Permits
NMFS has issued additional research permits under section 10(a)(1)(A) of the ESA, which authorizes activities for scientific purposes or to enhance the propagation or survival of the affected species. The permitted activities aim to benefit the investigated species in the long-term and are consistent with the purposes of the ESA, as outlined in section 2 of the Act. A total of 13 section 10(a)(1)(A) permits are currently in effect for sea turtles and Atlantic sturgeon within the action area for this consultation. Four of the permitted projects in the action area are allowed a small number of 'unintentional' mortalities of sea turtles or Atlantic sturgeon caught in fishing gear during sampling activities or gear modification studies. Two of the projects are permitted a small number of 'intentional' mortalities via egg mat sampling of early life stages (eggs, larvae).

5.2 Non-Federally Regulated Fisheries

Sea turtles and Atlantic sturgeon may be vulnerable to capture, injury, and mortality in fisheries occurring in Virginia state waters. Information on the number of sea turtles and Atlantic sturgeon captured or killed in Virginia state fisheries is extremely limited and as such, efforts are currently underway to obtain more information on the numbers of these species captured and killed in state water fisheries. We are currently working with the Northeast Fisheries Observer Program (NEFOP), Atlantic States Marine Fisheries Commission (ASMFC), the Virginia Marine Resources Commission (VMRC), and the Virginia Aquarium and Marine Science Center to assess the impacts of state authorized fisheries on sea turtles and Atlantic sturgeon. We are also currently working with Virginia on applications for ESA section 10(a)(1)(B) Incidental Take Permits to cover their fisheries. Below, we discuss the different fisheries authorized by the state of Virginia and any available information on interactions between these fisheries and sea turtles/Atlantic sturgeon.

American eel fishery
American eel is exploited in fresh, brackish, and coastal waters from the southern tip of Greenland to northeastern South America. Eel fisheries are conducted primarily in tidal and inland waters. Eels are typically caught with hook and line or with eel traps and may also be caught with fyke nets. Sturgeon and sea turtles are not known to interact with the eel fishery.

Atlantic croaker fishery
An Atlantic croaker fishery using trawl and gillnet gear also occurs within the action area and sea turtle interactions have been observed in the fishery. The average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the Atlantic croaker fishery was estimated to be 92 loggerhead sea turtles (with a 95% CI of 63-121) from 2009-2013 (Murray 2015a). Additional information on sea turtle interactions with gillnet gear used in the Atlantic croaker fishery has also been recently published by Murray (2013). The average annual bycatch of loggerhead sea turtles in gillnet gear used in the Atlantic croaker fishery, based on VTR data from 2007-2011, was estimated to be 6 per year with a 95% CI of 2-10 (Murray 2013). These estimates encompass the bycatch of loggerheads in the Atlantic croaker fishery in both state and Federal waters. Bycatch of the other three sea turtle species likely occurs in the Atlantic croaker fishery as well,

and is occasionally documented by the NEFOP, but at much lower frequencies such that calculating an annual bycatch estimate is difficult due to the small sample size of events.

Atlantic sturgeon interactions have also been observed in the Atlantic croaker fishery, but a quantitative assessment of the number of Atlantic sturgeon captured in the croaker fishery is not available. A mortality rate of Atlantic sturgeon in commercial trawls has been estimated at 5%. A review of the NEFOP 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 trips that included a NEFOP observer onboard.

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 gillnets, pound nets, haul seines, flynets, and trawls, with the majority of landings occurring in the fall and winter months (ASMFC 2002). Weakfish landings were dominated by the trawl fishery through the mid-1980s, after which gillnet landings began to account for most weakfish landed (ASMFC 2002). Virginia has ranked second among U.S. Atlantic states in annual landings since 1972 (ASMFC 2002). Sea turtle bycatch in the weakfish fishery has occurred (Murray 2013, 2015a) and NMFS originally assessed the impacts of the fishery on sea turtles in an Opinion back in 1997 (NMFS 1997b). Currently, the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the weakfish fishery is estimated to be 0 loggerheads (with a 95% CI of 0-1) from 2009-2013 (Murray 2015a). Additional information on loggerhead sea turtle interactions with gillnet gear 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 per year with a 95% CI of 0-1 (Murray 2009b), although the more recent Murray (2013) gillnet bycatch estimate for 2007-2011 does not include a loggerhead bycatch estimate for the weakfish gillnet fishery. These estimates encompass the bycatch of loggerheads in the weakfish fishery in both state and Federal waters. Bycatch of the other three sea turtle species likely occurs in the weakfish fishery as well, and is occasionally documented by the NEFOP, but at even lower frequencies such that calculating an annual bycatch estimate is difficult due to the small sample size of events.

A quantitative assessment of the number of Atlantic sturgeon captured in the weakfish fishery is not available. A mortality rate 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, and most inshore fisheries are not observed. An earlier review of bycatch rates and landings for the weakfish fishery reported that the weakfish-striped bass fishery had an Atlantic sturgeon bycatch rate of 16% from 1989-2000; the weakfish-Atlantic croaker fishery had an Atlantic sturgeon bycatch rate of 0.02%, and the weakfish fishery had an Atlantic sturgeon bycatch rate of 1.0% (ASSRT 2007).

Whelk fishery

A whelk fishery using pot/trap gear is known to occur in Virginia waters of Chesapeake Bay. 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). Loggerhead, leatherback, and green sea turtles are known to become entangled in lines associated with pot/trap gear used in several fisheries including lobster, whelk, and crab species (SEFSC 2001; Dwyer *et al*. 2002: NMFS 2007). Whelk fisheries in Virginia have been verified as the fisheries involved in a handful of loggerhead, leatherback, and green sea turtle entanglements since 2001, averaging around one per year (Northeast Region Sea Turtle Disentanglement Network [STDN] database). 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 Virginia state waters. Loggerhead, leatherback, and green sea turtles are known to become entangled in lines associated with pot/trap gear used in several fisheries including lobster, whelk, and crab species (SEFSC 2001; Dwyer *et al*. 2002: NMFS 2007). The Virginia blue crab fishery has been verified as the fishery involved in a handful of loggerhead and leatherback sea turtle entanglements since 2001 (Northeast Region STDN database). In 2017, crab fisheries in Virginia accounted for two live and possibly one dead leatherbacks entangled in vertical lines of the 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 to 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), coincident 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.

Atlantic sturgeon are known to be caught in state water horseshoe crab fisheries, which currently operate in all Northeast U.S. states except New Jersey. Along the U.S. East Coast, hand, trawl, and dredge fisheries account for more than 85% of the commercial horseshoe crab landings in the bait fishery. Other methods used are gillnets, pound nets, and traps (ASMFC 2016). State waters from Delaware to Virginia are closed to horseshoe crab harvest and landing from January 1 to June 7 (ASMFC 2016). The majority of horseshoe crab landings in 2010 came from Massachusetts, Virginia, and Delaware. Stein *et al*. (2004b) examined bycatch of Atlantic sturgeon using the NMFS sea-sampling/observer database (1989-2000) and found that the bycatch rate for horseshoe crabs was low, at 0.05%. An Atlantic sturgeon "reward program," where commercial fishermen were provided monetary rewards for reporting captures of Atlantic sturgeon in the Maryland waters of Chesapeake Bay, operated from 1996 to 2012 (Mangold *et al*. 2007).[7] The data from this program during the 11-year period of 1996-2006 show that one of 1,395 wild Atlantic sturgeon was found caught in a crab pot (Mangold *et al*. 2007).

Fish trap, seine, and channel net fisheries
Incidental captures of loggerheads in fish traps have been reported from several states along the U.S. Atlantic coast (Shoop and Ruckdeschel 1989; W. Teas, NMFS, pers. comm.), while leatherbacks have been documented as entangled in the buoy line systems of conch and sea bass traps off Massachusetts (Northeast Region STDN database). Long haul seines, purse seines, and channel nets are also known to incidentally capture sea turtles in sounds and other inshore waters along the U.S. Atlantic coast, although no lethal interactions have been reported (SEFSC 2001). No information on interactions between Atlantic sturgeon and fish traps, long haul seines, purse 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.

Striped bass fishery
The striped bass fishery occurs in only in state waters, as Federal waters have been closed to the harvest and possession of striped bass since 1990, except that possession is allowed in a defined area around Block Island, Rhode Island (ASMFC 2017b). The ASMFC has managed striped bass since 1981, and provides guidance to states from Maine to North Carolina through an ISFMP. All states are required to have recreational and commercial size limits, recreational creel limits, and commercial quotas. The commercial striped bass fishery is closed in Maine, New Hampshire, and Connecticut, but open in Massachusetts (hook and line only), Rhode Island, New Jersey (hook and line only), Delaware, Maryland, Virginia, and North Carolina. Recreational striped bass fishing occurs all along the U.S. East Coast.

Since 1989, only two sea turtle bycatch events (one loggerhead, one Kemp's ridley) have been documented on NEFOP observed trips where the primary species landed was striped bass. Thus, this fishery likely results in a very low level of sea turtle bycatch (NMFS and ASMFC 2013).

Several states have reported incidental catch of Atlantic sturgeon (NMFS Sturgeon Workshop 2011). Data from the Atlantic Coast Sturgeon Tagging Database (2000-2004) shows that the striped bass fishery accounted for 43% of Atlantic sturgeon recaptures (ASSRT 2007). The striped bass-weakfish fishery also had one of the highest bycatch rates of 30 directed fisheries according to NMFS Observer Program data from 1989-2000 (ASSRT 2007). However, greater rates of bycatch do not necessarily translate into high mortality rates. Other factors, such as gear, season, and soak times, may be important variables in understanding Atlantic sturgeon mortality.

[7] The program was terminated in February 2012, with the listing of Atlantic sturgeon under the ESA.

State gillnet fisheries
Two 10- to 14-inch (25.6- to 35.9-centimeter) mesh gillnet fisheries, the black drum and sandbar shark gillnet fisheries, occur in Virginia state waters along the tip of the eastern shore. Given the gear type, these fisheries may capture or entangle sea turtles. Entanglements of sea turtles in gillnet sets targeting and/or landing both species have been recorded in the NEFOP database. Similarly, sea turtles are thought to be vulnerable to capture in small mesh gillnet fisheries occurring in Virginia state waters. 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), yet no sea turtle captures were observed (NMFS 2004c). Based on gear type (i.e., gillnets), it is likely that Atlantic sturgeon would be vulnerable to capture in these fisheries. An Atlantic sturgeon "reward program" where fishermen were provided monetary rewards for reporting captures of Atlantic sturgeon, operated in the late 1990s in Virginia. The majority of reports of Atlantic sturgeon captures were in drift gillnets and pound nets. No quantitative information on the number of Atlantic sturgeon captured or killed in Virginia fisheries is currently available.

State recreational fisheries
Observations of state recreational fisheries in Virginia have shown that loggerhead, leatherback, Kemp's ridley, 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 with both single rigs and bottom longlines (SEFSC 2001). A summary of known impacts of hook-and-line captures on loggerhead sea turtles can be found in the TEWG (1998, 2000, 2009) reports. Stranding data also provide some evidence of interactions between recreational hook-and-line gear and sea turtles, but assigning the gear to a specific fishery is rarely, if ever, possible. In 2017, the Northeast STDN documented one dead Kemp's ridley sea turtle in Virginia waters with a circle hook in its mouth and wrapped around the neck in monofilament line, strong indications that a recreational fisherman may have been the cause.

Atlantic sturgeon have also been observed captured in hook-and-line gear, yet the number of interactions that occur annually is unknown. While most Atlantic sturgeon are likely to be released alive, we currently have no information on post-release survival. NMFS is currently working on a project to assess the extent of sea turtle interactions that occur in recreational fisheries of the Southeast (North Carolina to Florida) and believes that the survey platform and questionnaire may also be applicable for determining the amount of Atlantic sturgeon interactions as well.

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. During 2007-2010, researchers documented 31 carcasses of adult Atlantic sturgeon in the tidal freshwater portion of the James River, Virginia. Twenty-six of the carcasses had gashes from vessel propellers, and the remaining five carcasses were too decomposed to allow determination of the cause of death. The types of vessels responsible for these mortalities were not explicitly demonstrated. Most (84%) of the carcasses were found in a relatively narrow reach that was modified to increase shipping efficiency (Balazik *et al*. 2012b). 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 and 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 sea turtles and Atlantic sturgeon.

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 sea turtles and Atlantic sturgeon if it disturbs or degrades foraging habitats or otherwise affects the ability of these species to use coastal habitats. At present, only limited nesting of sea turtles occurs on Virginia beaches, primarily in the southernmost part of the state. Virginia represents the northernmost extreme of loggerhead sea turtle nesting along the U.S. Atlantic coast. From 1970-2015, 166 loggerhead nests have been documented on Virginia's ocean-facing beaches. The state's first and only green sea turtle nest was reported in 2005 and its first and second Kemp's ridley nests were documented in 2012 and 2014, respectively (Virginia DGIF 2016).

5.3.4 Global Climate Change and Ocean Acidification

In addition to the information on climate change presented in the *Status of the Species* section for sea turtles and Atlantic sturgeon, the discussion below presents further background information on global climate change as well as past and projected effects of global climate change throughout the range of the ESA-listed species considered in this Opinion. Below is the available information on projected effects of climate change in the action area and how listed sea turtles and Atlantic sturgeon may be affected by those projected environmental changes. Since the proposed action is assumed to go on in perpetuity, at least until a reinitiation trigger is met or the regulations are eliminated, the effects are summarized over a time span for which we can realistically analyze impacts, yet are discussed and considered for longer time periods when feasible.

In its Fifth Assessment Report (AR5) from 2014, the Intergovernmental Panel on Climate Change (IPCC) stated that the globally averaged combined land and ocean surface temperature data has shown a warming of 0.85°C (likely range: 0.65° to 1.06°C) over the period of 1880-2012. Similarly, the total increase between the average of the 1850-1900 period and the 2003-2012 period is 0.78°C (likely range: 0.72° to 0.85°C). On a global scale, ocean warming has been largest near the surface, with the upper 75 meters of the world's oceans having warmed by 0.11°C (likely range: 0.09° to 0.13°C) per decade over the period of 1971-2010 (IPCC 2014). In regards to resultant sea level rise, it is very likely that the mean rate of global averaged sea level rise was 1.7 millimeters/year (likely range: 1.5 to 1.9 millimeters/year) between 1901 and 2010, 2.0 millimeters/year (likely range: 1.7 to 2.3 millimeters/year) between 1971 and 2010, and 3.2 millimeters/year (likely range: 2.8 to 3.6 millimeters/year) between 1993 and 2010.

Climate model projections exhibit a wide range of plausible scenarios for both temperature and precipitation over the next several decades. The global mean surface temperature change for the period 2016-2035 relative to 1986-2005 will likely be in the range of 0.3° to 0.7°C (medium confidence). This assessment is based on multiple lines of evidence and assumes there will be no major volcanic eruptions or secular changes in total solar irradiance. Relative to natural internal variability, near-term increases in seasonal mean and annual mean temperatures are expected to be larger in the tropics and subtropics than in mid- and high latitudes (high confidence). 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 also resulted in increased river discharge and glacial and sea-ice melting (Greene *et al.* 2008). The strongest ocean warming is projected for the surface in tropical and Northern Hemisphere subtropical regions. At greater depths, the warming will be most pronounced in the Southern Ocean (high confidence). Best estimates of ocean warming in the top 100 meters are about 0.6° to 2.0°C, and about 0.3° to 0.6°C at a depth of about 1,000 meters by the end of the 21st century (IPCC 2014).

Under Representative Concentration Pathway (RCP) 8.5, the projected change in global mean surface air temperature and global mean sea level rise for the mid- and late 21st century relative to the reference period of 1986-2005 is as follows. Global average surface temperatures are likely to be 2.0°C higher (likely range: 1.4° to 2.6°C) from 2046-2065 and 3.7°C higher (likely range: 2.6° to 4.8°C) from 2081-2100. Global mean sea levels are likely to be 0.30 meters higher (likely range: 0.22 to 0.38 meters) from 2046-2065 and 0.63 meters higher (likely range: 0.45 to 0.82 meters) from 2081-2100, with a rate of sea level rise during 2081-2100 of 8 to 16 millimeters/year (medium confidence).

The past three decades have witnessed major changes in ocean circulation patterns in the Arctic, and these were accompanied by climate associated changes as well (Greene *et al.* 2008). Shifts in atmospheric conditions have altered Arctic Ocean circulation patterns and the export of freshwater to the North Atlantic (IPCC 2007; Greene *et al.* 2008). With respect specifically to the North Atlantic Oscillation (NAO), changes in salinity and temperature are thought to be the result of changes in the Earth's atmosphere caused by anthropogenic forces (IPCC 2007). The NAO impacts climate variability throughout the Northern Hemisphere (IPCC 2007). Data from the 1960s through the 2000s showed that the NAO index increased from minimum values in the 1960s to strongly positive index values in the 1990s and somewhat declined since (IPCC 2007). This warming extends over 1,000 meters deep and is deeper than anywhere in the world's oceans and is particularly evident under the Gulf Stream/North Atlantic Current system (IPCC 2007). On a global scale, large discharges of freshwater into the North Atlantic subarctic seas can lead to intense stratification of the upper water column and a disruption of North Atlantic Deepwater (NADW) formation (IPCC 2007; Greene *et al.* 2008). There is evidence that the NADW has already freshened significantly (IPCC 2007). This in turn can lead to a slowing down of the global ocean thermohaline (large-scale circulation in the ocean that transforms low-density upper ocean waters to higher density intermediate and deep waters and returns those waters back to the upper ocean), which can have climatic ramifications for the entire world (Greene *et al.* 2008).

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 2007). These trends have been most apparent over the past few decades, although this may also be due to increased research. Information on future impacts of climate change in the action area is discussed below.

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 U.S. Additional information on potential effects of climate change specific to the action area is discussed below. Warming is very likely to continue in the U.S. over the next 50 years regardless of reduction in greenhouse gases, 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 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).

Expected consequences of climate change for river systems 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 along the U.S. Atlantic coast 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°C per decade; and 3) a rise in sea level (NAST 2000). Sea level is expected to continue rising; during the 20th century global sea level has increased 15 to 20 centimeters. It is also important to note that ocean temperature in the U.S. Northeast Shelf and surrounding Northwest Atlantic waters have warmed faster than the global average over the last decade (Pershing *et al.* 2015). New projections for the U.S. Northeast Shelf and Northwest Atlantic Ocean suggest that this region will warm two to three times faster than the global average and thus existing projections from the IPCC may be too conservative (Saba *et al.* 2015).

Effects on sea turtles and Atlantic sturgeon globally

<u>Sea turtles</u>

Sea turtle species 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 been a problem for sea turtle species. As explained in the *Status of the Species* sections above, sea turtles are most likely to be affected by climate change due to (1) changing air temperature and rainfall at nesting beaches, which in turn could impact nest success (hatching success and hatchling emergence rate) and sex ratios among hatchlings; (2) sea level rise, which could result in a reduction or shift in available nesting beach habitat and increased risk of nest inundation; (3) changes in the abundance and distribution of forage species, which could result in changes in the foraging behavior and distribution of sea turtle species; and (4) changes in water temperature, which could possibly lead to a northward shift in their range and changes in phenology (timing of nesting seasons, timing of migrations). Over the time period of this action considered in this Opinion, sea surface temperatures are expected to rise less than 1°C. It is unknown if that is enough of a change to contribute to shifts in the range, distribution, and recruitment of sea turtles. Theoretically, we expect that as waters in the action area warm, more sea turtles could be present or sea turtles could be present for longer periods of time.

It has been speculated that the nesting range of some sea turtle species may shift northward. Nesting in the Mid-Atlantic generally is extremely rare and no nesting has been documented at any beach in the Northeast. In 2010, one green sea turtle came up on the beach in Sea Isle City, New Jersey; however, it did not lay any eggs. In August 2011, a loggerhead came up on the beach in Stone Harbor, New Jersey, but did not lay any eggs. On August 18, 2011, a green sea turtle laid one nest at Cape Henlopen Beach in Lewes, Delaware, near the entrance to Delaware Bay. The nest contained 190 eggs and was transported indoors to an incubation facility on October 7. A total of 12 eggs hatched, with eight hatchlings surviving. In December, seven of the hatchlings were released in Cape Hatteras, North Carolina. It is important to consider that in order for nesting to be successful in the Mid-Atlantic, fall and winter temperatures need to be warm enough to support the successful rearing of eggs and sea temperatures must be warm enough for hatchlings not to die when they enter the water. The projected increase in ocean temperature over the next five years is not great enough to allow successful rearing of sea turtle eggs in the any new parts of the action area. Therefore, it is unlikely that over the time period considered here, that there would be an increase in nesting activity in the action area.

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

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

Changes in water temperature may also alter the forage base and thus, foraging behavior of sea turtles. Changes in the foraging behavior of sea turtles in the action area could lead to either an increase or decrease in the number of sea turtles in the action area, depending on whether there was an increase or decrease in the forage base and/or a seasonal shift in water temperature. For example, if there was a decrease in sea grasses in the action area resulting from increased water temperatures or other climate-change related factors, it is reasonable to expect that there may be a decrease in the number of foraging green sea turtles in the action area. Likewise, if the prey base for loggerhead, Kemp's ridley, or leatherback sea turtles was affected, there may be changes in the abundance and distribution of these species in the action area. However, as noted above, because we do not know the adaptive capacity of these individuals or how much of a change in temperature would be necessary to cause a shift in distribution, it is not possible to predict changes to the foraging behavior of sea turtles over the next ten years. If sea turtle distribution shifted along with prey distribution, it is likely that there would be minimal, if any, impact on the availability of food. Similarly, if sea turtles shifted to areas where different forage was available and sea turtles were able to obtain sufficient nutrition from that new source of forage, any effect would be minimal. The greatest potential for effect to forage resources would be if sea turtles shifted to an area or time where insufficient forage was available; however, the likelihood of this happening seems low because sea turtles feed on a wide variety of species and in a wide variety of habitats. Finally, it is important to note that ocean temperature in the U.S. Northeast continental shelf and surrounding Northwest Atlantic waters have warmed faster than the global average over the last decade (Pershing *et al.* 2015). New projections for the U.S. Northeast shelf and Northwest Atlantic Ocean suggest that this region will warm two to three times faster than the global average and thus existing projections from the IPCC may be too conservative (Saba *et al.* 2015).

Atlantic sturgeon

Atlantic sturgeon have persisted for millions of years and have experienced wide variations in global climate conditions, to which they have successfully adapted. Climate change at historical rates (thousands of years) is not thought to have been a problem for sturgeon species. However, at the current rate of global climate change, future effects to sturgeon are possible. Rising sea level may result in the salt wedge moving upstream in affected rivers. Atlantic sturgeon spawning occurs in fresh water reaches of rivers because early life stages have little to no tolerance for salinity. Similarly, juvenile sturgeon have limited tolerance to salinity and remain in waters with little to no salinity. If the salt wedge moves further upstream, sturgeon spawning and rearing habitat could be restricted. In river systems with dams or natural falls that are impassable by sturgeon, the extent that spawning or rearing may be shifted upstream to compensate for the shift in the movement of the salt wedge would be limited. While there is an indication that an increase in sea level rise would result in a shift in the location of the salt wedge, at this time there are no predictions on the timing or extent of any shifts that may occur; thus, it is not possible to predict any future loss in spawning or rearing habitat. However, in all river systems, spawning occurs miles upstream of the salt wedge. It is unlikely that shifts in the location of the salt wedge would eliminate freshwater spawning or rearing habitat. If habitat was severely restricted, productivity or survivability may decrease.

The increased rainfall predicted by some models in some areas may increase runoff and scour spawning areas and flooding events could cause temporary water quality issues. Rising temperatures predicted for all of the U.S. could exacerbate existing water quality problems with dissolved oxygen (DO) and temperature. While this occurs primarily in rivers in the southeast U.S. and the Chesapeake Bay, it may start to occur more commonly in the northern rivers.

Atlantic sturgeon are tolerant to water temperatures up to approximately 28°C (82.4°F); these temperatures are experienced naturally in some areas of rivers during the summer months. If river temperatures rise and temperatures above 28°C are experienced in larger areas, sturgeon may be excluded from some habitats.

Increased droughts (and water withdrawal for human use) predicted by some models in some areas may cause loss of habitat including loss of access to spawning habitat. Drought conditions in the spring may also expose eggs and larvae in rearing habitats. If a river becomes too shallow or flows become intermittent, all sturgeon life stages, including adults, may become susceptible to strandings or habitat restriction. Low flow and drought conditions are also expected to cause additional water quality issues. Any of the conditions associated with climate change are likely to disrupt river ecology causing shifts in community structure and the type and abundance of prey. Additionally, cues for spawning migration and spawning could occur earlier in the season causing a mismatch in prey that are currently available to developing sturgeon in rearing habitat.

Atlantic sturgeon in the action area are most likely to experience the effects of global climate change in warming water temperatures, which could change their range and migratory patterns. Warming temperatures predicted to occur over the next 100 years would likely result in a northward shift/extension of their range (i.e., into the St. Lawrence River, Canada) while truncating the southern distribution, thus affecting the recruitment and distribution of sturgeon rangewide. In the next five years, this increase in sea surface temperature is expected to be minimal, and thus, it is unlikely that this expanded range will be observed in the near future. If any shift does occur, it is likely to be minimal and thus, it seems unlikely that this small increase in temperature will cause a significant effect to shortnose and Atlantic sturgeon or a significant modification to the number of sturgeon likely to be present in the action area over the life of the proposed action. However, even a small increase in temperate can affect DO concentrations. A one degree change in temperature in Chesapeake Bay could make parts of Chesapeake Bay inaccessible to sturgeon due to decreased levels of DO (Batiuk *et al.* 2009).

Although the action area does not include spawning grounds for Atlantic sturgeon, sturgeon are migrating through the action area to reach their natal rivers to spawn. Elevated temperatures could modify cues for spawning migration, resulting in an earlier spawning season, and thus, altering the time of year sturgeon may or may not be present within the action area. This may cause an increase or decrease in the number of sturgeon present in the action area. However, because spawning is not triggered solely by water temperature, but also by day length (which would not be affected by climate change) and river flow (which could be affected by climate change), it is not possible to predict how any change in water temperature alone will affect the seasonal movements of sturgeon through the action area.

In addition, changes in water temperature may also alter the forage base and thus, foraging behavior of sturgeon. Any forage species that are temperature-dependent may also shift in distribution as water temperatures warm and cause a shift in the distribution of sturgeon. However, because we do not know the adaptive capacity of these species or how much of a change in temperature would be necessary to cause a shift in distribution, it is not possible to predict how these changes may affect foraging sturgeon. If sturgeon distribution shifted along with prey distribution, it is likely that there would be minimal, if any, impact on the availability of food. Similarly, if sturgeon shifted to areas where different forage was available and sturgeon were able to obtain sufficient nutrition from that new source of forage, any effect would be minimal. The greatest potential for effect to forage resources would be if sturgeon shifted to an area or time where insufficient forage was available; however, the likelihood of this happening seems low because sturgeon feed on a wide variety of species and in a wide variety of habitats.

5.4 Reducing Threats to ESA-listed Species

5.4.1 Education and Outreach Activities

Education and outreach activities are considered some of the primary tools that will effectively reduce the threats to all protected species. For example, NMFS has been active in public outreach to educate fishermen about handling and resuscitation techniques for sea turtles and sturgeon, and educates recreational fishermen and boaters on how to avoid interactions with these species. NMFS also has a program called “SCUTES” (Student Collaborating to Undertake Tracking Efforts for Sturgeon), which offers educational programs and activities about the movements, behaviors, and threats to sturgeon. NMFS intends to continue these outreach efforts in the action area in an attempt to reduce interactions with protected species, and to reduce the likelihood of injury to protected species when interactions do occur.

5.4.2 Stranding and Salvage Programs

The NMFS-managed Sea Turtle Stranding and Salvage Network (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, reducing mortality of injured or sick animals. Data collected by the STSSN are used to monitor stranding levels, to identify areas where unusual or elevated mortality is occurring, and to identify sources of mortality. These data are also used to monitor incidence of disease, study toxicology and contaminants, and conduct genetic studies to determine population structure. All of the states that participate in the STSSN tag live turtles when encountered (either via the stranding network through incidental takes or in-water studies). Tagging studies help improve our understanding of sea turtle movements, longevity, and reproductive patterns, all of which contribute to our ability to reach recovery goals for the species.

A salvage program is also in place for sturgeon. Sturgeon carcasses can provide pertinent life history data and information on new or evolving threats. Their use in scientific research studies can reduce the need to collect live sturgeon. The NMFS Sturgeon Salvage Program is a network of individuals qualified to retrieve and/or use sturgeon carcasses and parts for scientific research and education. All carcasses and parts are retrieved opportunistically and participation in the network is voluntary.

5.4.3 Sea Turtle Disentanglement Network

The NMFS Greater Atlantic Region established the Northeast Sea Turtle Disentanglement Network (STDN) in 2002 in response to the high number of leatherback sea turtles found entangled in pot gear along the U.S. Northeast Atlantic coast. The STDN is considered a component of the larger STSSN program, and it operates in all states in the region. The STDN responds to entangled sea turtles and disentangles and releases live animals, thereby reducing post-interaction mortality. In addition, the STDN collects data on live and dead sea turtle entanglement events, providing valuable information for management purposes. The NMFS Greater Atlantic Regional Office oversees the STDN program and manages the STDN database. As knowledge of the network and number of participants involved in the network has increased, so have reports of sea turtle entanglements in Virginia waters increased over the past several years. In 2017, the STDN documented eleven sea turtle entanglements in the state of Virginia in gears such as pound nets, the vertical lines of crab traps, and monofilament or unknown line.

5.4.4 Regulatory Measures for 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 TEDs in the southern part of the summer flounder trawl fishery and mesh size restrictions in Virginia's gillnet fisheries. The summaries below discuss all of these measures in more detail.

Large Mesh Gillnet Requirements in the Mid-Atlantic
In March 2002, NMFS published new restrictions for the use of gillnets with larger than 8-inch (20.3 cm) stretched mesh, in Federal waters (3-200 nautical miles) off of North Carolina and Virginia. These restrictions were published in an interim final rule under the authority of the ESA (67 FR 13098) and were implemented to reduce the impact of the monkfish and other large-mesh gillnet fisheries on ESA-listed sea turtles in areas where sea turtles are known to concentrate. Following review of public comments submitted on the interim final rule, NMFS published a final rule on December 3, 2002, that established the restrictions on an annual basis. As a result, gillnets with larger than 8-inch (20.3 cm) stretched mesh are not allowed in Federal waters (3-200 nautical miles) in the areas described as follows: (1) North of the North Carolina/South Carolina border at the coast to Oregon Inlet at all times; (2) north of Oregon Inlet to Currituck Beach Light, NC from March 16 through January 14; (3) north of Currituck Beach Light, NC, to Wachapreague Inlet, VA, from April 1 through January 14; and (4) north of Wachapreague Inlet, VA, to Chincoteague, VA, from April 16 through January 14. On April 26, 2006, NMFS published a final rule (71 FR 24776) that included modifications to the large-mesh gillnet restrictions. The new final rule revised the gillnet restrictions to apply to stretched mesh that is ≥7 inches (17.9 cm). Federal waters north of Chincoteague, VA, remain unaffected by the large-mesh gillnet restrictions. These measures are in addition to the HPTRP measures that prohibit the use of large-mesh gillnets in southern Mid-Atlantic waters (territorial and Federal waters from Delaware through North Carolina out to 72°30'W longitude) from February 15 through March 15, annually. The measures are also in addition to comparable North Carolina and Virginia regulations for large-mesh gillnet fisheries in their respective state waters that were enacted in 2005.

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

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

To eliminate confusion, the seasons and areas for these two gear measures designed to protect sea turtles were later aligned through the final rule for Framework 26 to the Atlantic Sea Scallop FMP (80 FR 22119; April 21, 2015). Following the enactment of the final rule, sea turtle chain mats and TDDs are now required west of 71°W longitude from May through November.

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 in the U.S. Southeast shrimp trawl fisheries.

Sea Turtle Entanglements and Rehabilitation
A final rule (70 FR 42508) published on July 25, 2005, allows any agent or employee of NMFS, U.S. FWS, USCG, or any other Federal land or water management agency, or any agent or employee of a state agency responsible for fish and wildlife, when acting in the course of his or her official duties, 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)).

5.4.5 Regulatory Measures for Atlantic Sturgeon

Sturgeon Recovery Planning
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 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 for sturgeon, involving NMFS and other Federal, state, and academic partners, to obtain more information on the distribution and abundance of sturgeon throughout their range, including in the action area. Efforts are also underway to better understand threats faced by sturgeon 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.

Research Activity Guidelines
Research activities aid in the conservation of listed species by furthering our understanding of the species' life history and biological requirements. We recognize, however, that many scientific research activities involve capture and may pose some level of risk to individuals or to the species. Therefore, it is necessary for research activities to be carried out in a manner that minimizes the adverse impacts of the activities on individuals and the species while obtaining crucial information that will benefit the species. Guidelines developed by sturgeon researchers in cooperation with NMFS staff (Moser *et al.* 2000; Damon-Randall *et al.* 2010; Kahn and Mohead 2010) provide standardized research protocols that minimize the risk to sturgeon from capture, handling, and sampling. These guidelines must be followed by any entity receiving a federal permit to do research on Atlantic sturgeon.

Protections for the GOM DPS of Atlantic Sturgeon
The prohibitions listed under section 9(a)(1) of the ESA automatically apply when a species is listed as endangered but not when listed as threatened. When a species is listed as threatened, section 4(d) of the ESA requires the Secretary of Commerce (Secretary) to issue regulations, as deemed necessary and advisable, to provide for the conservation of the species. The Secretary may, with respect to any threatened species, issue regulations that prohibit any act covered under section 9(a)(1). Whether section 9(a)(1) prohibitions are necessary and advisable for a threatened species is largely dependent on the biological status of the species and the potential impacts of various activities on the species. On June 10, 2011, we proposed protective measures for the GOM DPS of Atlantic sturgeon (76 FR 34023). On November 19, 2013 we published a preliminary final rule that applied all prohibitions of section 9(a)(1) to the GOM DPS beginning on December 19, 2013 (78 FR 69310).

5.5 Summary of Available Information on Listed Species Likely to be Adversely Affected by the Proposed Action in the Action Area

5.5.1 Sea Turtles

As described in sections 4.2.1.1 - 4.2.1.4, the occurrence of loggerhead, Kemp's ridley, green, and leatherback sea turtles along the U.S. Atlantic coast is primarily temperature dependent (Thompson 1984; Keinath *et al.* 1987; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998, 2005; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a). In general, sea turtles move up the U.S. Atlantic coast from southern wintering areas as water temperatures warm in the spring (Keinath *et al.* 1987; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998, 2005; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a). The trend is reversed in the fall as water temperatures cool. By December, sea turtles have passed Cape Hatteras, returning to more southern waters for the winter (Keinath *et al.* 1987; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998, 2005; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a). Recreational anglers have reported sightings of sea turtles in waters defined as inshore waters (bays, inlets, rivers, or sounds; Braun-McNeill and Epperly 2004) as far north as New York as early as March-April, but in relatively low numbers (Braun-McNeill and Epperly 2004). Greater numbers of loggerheads, Kemp's ridleys, and greens are found in inshore, nearshore, and offshore waters of North Carolina (north of Cape Hatteras) 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). Leatherback sea turtles have a similar seasonal distribution but have a more extensive range in the Gulf of Maine and further north into Canadian waters 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). 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).

Sea turtles are generally present in Virginia waters from May to November each year, with the highest number of individuals present from June to October. Sea turtles occur throughout the Virginia portion of Chesapeake Bay, from shallow waters along the shoreline and near river mouths to deeper waters in the bay's interior and near its confluence with the Atlantic Ocean. One of the main factors influencing sea turtle presence in Mid-Atlantic waters is seasonal temperature patterns (Ruben and Morreale 1999). Temperature is correlated with the time of year, with warmer waters in the late spring, summer, and early fall being the most suitable for cold-blooded sea turtles. Sea turtles are most likely to occur in the action area when water temperatures are above 11°C, although depending on seasonal weather patterns and prey availability, they could be also present in months when water temperatures are cooler (as evidenced by fall and winter cold stunning records as well as year round stranding records). Sea turtles have also been documented in the action area through aerial and vessel surveys, satellite tracking programs, and by fisheries observers. The majority of sea turtle observations in the Chesapeake Bay and vicinity are of loggerhead sea turtles, yet all four species of sea turtles have been recorded in the action area.

To some extent, water depth also dictates the number of sea turtles occurring in a particular area. Satellite tracking studies of sea turtles in the Northeast U.S. found that foraging turtles mainly occurred in areas where the water depth was between approximately 16 and 49 feet (Ruben and Morreale 1999). This depth was interpreted not to be as much an upper physiological depth limit for turtles, as a natural limiting depth where light and food are most suitable for foraging turtles (Morreale and Standora 1990). The areas to be fished by pound net gear and the depths preferred by sea turtles do overlap, suggesting that if suitable forage is present, adult and juvenile loggerhead, leatherback, and green sea turtles as well as juvenile Kemp's ridley sea turtles may be foraging in the areas where Virginia pound net fishing will occur.

5.5.2 Atlantic Sturgeon

The marine and estuarine range of all five Atlantic sturgeon DPSs overlaps and extends from Canada through Cape Canaveral, Florida. Based on the best available information, Atlantic sturgeon originating from any of five DPSs could occur in the Virginia portion of Chesapeake Bay and nearshore waters off the state (Damon-Randall et al. 2013; Wirgin *et al*. 2015). The Virginia pound net fishery does not overlap with freshwater; therefore, eggs and early life stages will not be present in the action area. Juvenile, subadult, and adult Atlantic sturgeon are likely to occur in the Virginia portion of Chesapeake Bay and nearshore waters off the state as they have been documented throughout the bay in spring, summer, and fall and in coastal ocean waters of the Mid-Atlantic year round. Atlantic sturgeon are known to use the action area for spawning migrations, foraging, and as juvenile development habitat prior to entering marine waters as subadults and adults.

Atlantic sturgeon from all five DPSs can be found in Virginia nearshore and coastal waters and within Chesapeake Bay, typically from spring through fall. Migratory behaviors occur from April to November for adults and subadults and year round for juveniles (Dovel and Berggren 1983; Secor *et al.* 2000; Welsh *et al.* 2002b; Horne and Stence 2016). Each of these life stages are expected to wander among coastal and estuarine habitats of the bay. Foraging behaviors typically occur in areas where suitable forage and appropriate habitat conditions are present. These areas include tidally influenced flats and mud, sand, and mixed cobble substrates (Stein *et al.* 2004a). The areas to be fished by pound net gear and the depths preferred by Atlantic sturgeon do overlap, suggesting that if suitable forage and/or habitat features are present, adult and subadults from any of the five listed DPSs may be foraging or undertaking migrations in the areas where Virginia pound net fishing will occur.

6.0 EFFECTS OF THE ACTION

As discussed earlier in section 3, the proposed action is NMFS's implementation of gear regulations for the Virginia pound net fishery, in the form of protected species conservation measures pursuant to the ESA and MMPA. This consultation considers the continued operation of the Virginia pound net fishery as a whole into the foreseeable future or until such time that one of the four triggers for reinitiation of section 7 consultation is met. Sea turtles and Atlantic sturgeon may be adversely affected by the proposed action in a number of ways. These include: (1) direct entrapment or entanglement in pound net fishing gear, (2) behavioral modification due to the placement or operation of pound net fishing gear, (3) interactions with or disturbance from fishing vessels, and (4) effects to prey and/or habitat due to the placement or hauling of pound net fishing gear. The following effects analysis will be organized along these four topics, with the majority of the analysis focusing on entrapment/entanglement in the gear as it is the adverse effect from the fishery and its regulations that is most easily documented and monitored. For both sea turtles and Atlantic sturgeon, we have estimated future incidental takes in the Virginia pound net fishery based on past interactions in pound net fishing gear as well as other types of gears used in parts of the action area where future pound net fishing activities are anticipated.

6.1 Effects to Sea Turtles from Entrapment/Entanglement

Given the seasonal occurrence patterns and depth preferences of sea turtles off the U.S. Atlantic coast, we expect the distribution of all four species will overlap with the Virginia pound net fishery primarily from May through November, although interactions could occur year round as sea turtle strandings in Virginia waters have been documented in all four seasons (Barco and Swingle 2014). The year round presence of sea turtles in the action area, with a peak from May through November, is also confirmed by past captures of sea turtles in Virginia pound net gear as well as other commercial and recreational fishing gear in the action area (e.g., trawls, gillnets, dredges, hook and line), as documented through NEFOP and state specific incidental take data.

Direct and indirect effects of the Virginia pound net fishery and its regulations on sea turtles may include: (1) stress, injury, or mortality due to entrapment/entanglement in specific components of the gear (leaders, hearts, or pounds), (2) stress, injury, or mortality due to fishing vessel activities (e.g., acoustic disturbance or vessel strikes), (3) disturbance or changes in sea turtle behavior due to placement of the gear itself, and (4) removal of sea turtle prey and/or habitat due to setting or hauling of the gear. In regards to these potential effects, effects from entanglement, entrapment, and impingement in pound net gear are the most easily measurable and quantifiable. Loggerhead, Kemp's ridley, green, and leatherback sea turtles are at most risk in areas of Chesapeake Bay where pound net fishing is abundant and where the zone of passage is relatively small. Sea turtles may become entangled in any portion of the pound net, most commonly around their head and front flippers; this is anticipated to happen almost exclusively in the leaders versus other parts of the gear. Entanglements can result in bodily injury or drowning. Entrapment occurs when a sea turtle finds its way into a pound net but cannot get out. Sea turtles may also become pinned against the netting (called an impingement) in a fast moving current and drown if they cannot free themselves.

Captures in Pound Net Gear – Pounds and Hearts

Sea turtles are occasionally found swimming in the pound portion of pound net gear, and one loggerhead sea turtle was documented in the heart portion of the gear (on August 20, 2013). Sea turtles documented in pounds and hearts are almost always alive, as the mesh used for these gear components is small (i.e., 2-4 inches stretched mesh), precluding most sea turtle entanglements, and the top of the pounds and hearts are open, allowing turtles to surface for air. Therefore, although the continued operation of the pound net fishery may result in the capture of sea turtles in the pounds and hearts, the likelihood that these turtles will be injured or killed is very low. The duration of time of in which Virginia pound net gear is left sitting prior to monitoring and hauling fish is a short duration (a few days at a time), which greatly reduces the risk of lethal or injurious effects to sea turtles from restricted movements or potential drowning.

Researchers have documented the repeated capture of previously tagged sea turtles in pounds, occasionally documenting the same turtle in the same pound in the same season. This suggests that these sea turtles may be returning to the pounds to forage. If sea turtles are entering the pounds on their own volition and continue to reoccupy pounds despite their repeated release, this is still considered a take under the ESA definition (e.g., capture). However, we are not aware of any instances in which these captures resulted in the serious injury or morality of the sea turtle. Nonetheless, post-interaction mortality of sea turtles due to forced submergence resulting from entanglement or impingement in pounds and hearts cannot be ruled out since unfavorable environmental conditions (e.g., strong currents or tidal cycles, sudden drops in water temperature below a sea turtle's thermal tolerance), the physical condition of an animal (e.g., small size, poor health, prior entanglement in other gear or lines), and infrequent monitoring/hauling of gear by fishermen can all make a sea turtle more susceptible to a lethal entanglement or impingement.

From 1980 to 1999, the annual average number of sea turtles captured in pound nets set near the mouth of the Potomac River was approximately five loggerheads and one Kemp's ridley per net (NMFS 2004a). Based on these previously recorded captures in Chesapeake Bay, which still represent the best available information on pound net and heart captures at this time, we anticipate that up to five loggerhead and one Kemp's ridley sea turtles per licensed net will be captured annually in the pound or heart portion of Virginia pound net gear. There are 161 total licenses issued in Virginia, where one license is assigned to each pound net. As this consultation considers the effects of the proposed action year round, there is the potential that all 161 nets could be fished throughout the year. This likely overestimates the number of active pound nets in Virginia waters, but it is difficult to know exactly how many nets will be fished throughout the year based upon the available data. As described above, 158 of the 161 licenses for pound nets were active in 2017. Given the best available data on the number of pound nets set throughout the action area (n=161) and the expected interaction rate for loggerheads and Kemp's ridleys mentioned above, we expect the capture of up to 805 loggerhead and 161 Kemp's ridley sea turtles per year. Nearly all of these captures are anticipated to be of live animals. As the likelihood of a lethal capture is low, yet still reasonably certain to occur for the reasons mentioned in the prior paragraph above, we anticipate that up to one sea turtle of each species per year could be killed as a result of entanglement or impingement in a pound or heart.

Green sea turtles are less likely to occur in the action area than loggerheads or Kemp's ridleys, but are nonetheless susceptible to capture in pounds and hearts throughout the year for the same reasons as their hard-shelled cousins. Green sea turtles have been captured in pounds in the Potomac River, albeit at a much lower rate than loggerheads and Kemp's ridleys (only two were documented over the course of twenty years from 1980 to 1999; NMFS 2004a). They have also been captured during hopper dredging operations at the mouth of the Chesapeake Bay and have occasionally stranded on Virginia beaches (NMFS 2004a). An annual estimate from the historic Potomac River pound net data equates to 0.1 turtles per year. By multiplying that estimate with the maximum number of pound nets set throughout the action area (n=161), we anticipate that up to 16 green sea turtles could be captured in the pounds or hearts of pound net gear annually. Like loggerheads and Kemp's ridleys, nearly all of these captures are anticipated to be of live animals. As the likelihood of a lethal capture is low, yet still reasonably certain to occur for the reasons mentioned in the paragraphs above, we anticipate that up to one green sea turtle per year could be killed as a result of entanglement or impingement in a pound or heart.

Leatherback sea turtles have been documented in Virginia waters and have stranded on Virginia beaches during the spring, summer, and fall. However, it is highly unlikely that leatherbacks will be found in the pound or heart of a pound net, as the individuals anticipated to be found in Virginia waters would likely be too large to enter these components. Further, leatherbacks forage on different species than loggerhead, Kemp's ridley, and green sea turtles and are likely not attracted to the fish and invertebrate species that are either caught or wander in the pounds or hearts. As such, captures of leatherbacks in pounds/hearts of pound net gear are not anticipated.

Summarized below are the number of estimated captures and post-interaction mortalities of sea turtles in the semi-enclosed pound and heart portions of Virginia pound net gear. Most of the estimated captures are of loggerhead sea turtles, as they are the most common sea turtle present in Chesapeake Bay. For captures in pounds and hearts, we expect:

- Up to 805 loggerhead sea turtles may be captured per year and up to one of those loggerheads may die due to forced submergence;
- Up to 161 Kemp's ridley sea turtles may be captured per year and up to one of those Kemp's ridleys may die due to forced submergence; and
- Up to 16 green sea turtles may be captured per year and up to one of those turtles may die due to forced submergence.

<u>Entanglements in Pound Net Gear – Leaders</u>

As described previously, sea turtles have been documented entangled in and impinged on leaders with greater than or equal to 12 inches stretched mesh and leaders with stringers in the Virginia Chesapeake Bay. The modified pound net leader regulations that were issued by NMFS in the early 2000s reduced the number of interactions compared to the time period before the regulations were in place. Recently however, there have been leatherback sea turtle entanglements in in the hard lay vertical line component of modified leaders with mesh less than 12 inches. The VMRC also disentangled an unidentified sea turtle in an inshore leader in September 2017. While interactions with pound net leaders and sea turtles are highest in the spring, which is the season with the most historical pound net monitoring and highest rates of sea turtle strandings in Virginia waters, entanglements and impingements may theoretically occur whenever sea turtle distribution and the use of these leaders overlap. Note that the typical sea turtle residency period in Virginia waters occurs from approximately May to November. Pound nets are set in Virginia's coastal waters and in Chesapeake Bay during the period of May through November, which coincides with the time when the majority of sea turtles are found in this area.

Sea turtles entangled in pound net leaders likely remain entangled until the tissue anchoring it has deteriorated (Bellmund *et al*. 1987) or until a fisherman or responder can free them from the mesh or lines. Due to the increased education of fishermen regarding sea turtle entanglements as well as increased reporting of sea turtle entanglements in Virginia pound leaders over the past 15 years, we have determined that the majority of sea turtle entanglements in leaders will be observed and reported to us. We anticipate that only an extremely small number of sea turtles would either free themselves from a leader prior to being observed or would not be reported to us in the event a fisherman did not inspect their leaders while setting or hauling their pounds.

To this point, only leatherback sea turtles have been documented as entangled in modified pound net leaders in Virginia waters, and all of them but one have occurred in the Cape Henry area of Chesapeake Bay (Figure 6). Table 12 provides a summary of all leatherback sea turtle interactions in modified Virginia pound net leaders since 2013. Sixteen leader entanglements have been documented from 2013-2017, with two of those being lethal. The previous 2004 Opinion anticipated up to two leatherback sea turtle entanglements in pound net leaders per year.

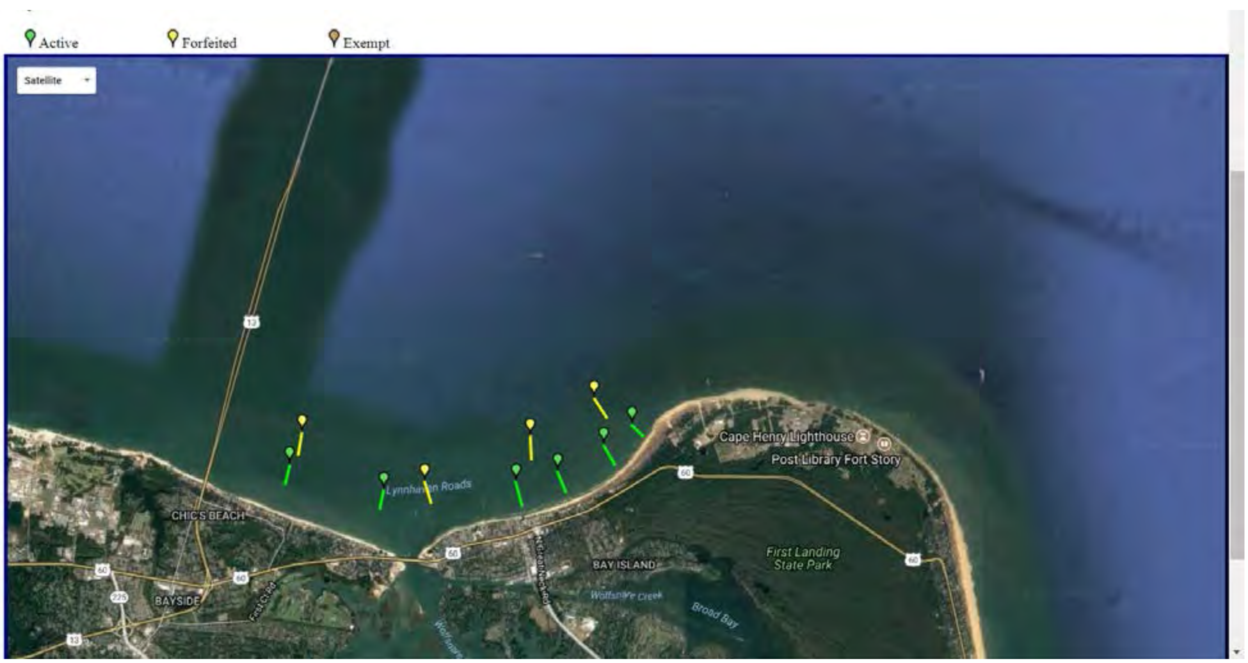

Figure 6. Virginia pound nets in the Cape Henry area where most leatherback entanglements in modified leaders have occurred. Source: https://webapps.mrc.virginia.gov/public/maps/virginia_poundnets.php.

Table 12. Leatherback Interactions in Virginia Modified Pound Net Leaders – Through 2017 (Source: NMFS Northeast Sea Turtle Disentanglement Network, unpublished data).

DATE		**STATUS**	**TOTAL**
2013			2
	17-May	alive	
	16-Jun	alive	
2014			1
	12-Jun	dead	
2015			2
	19-May	alive	
	2-Jun	alive	
2016			6
	27-May	alive	
	29-May	alive	
	4-Jun	alive	
	4-Jun	alive	
	9-Jun	alive	
	10-Jun	alive	
2017			5
	2-Jun	alive	
	9-Jun	alive	
	11-Jun	dead	
	14-Jun	alive	
	28-Jun	alive	
			16

Information available since that time, including the entanglements recorded since 2013, indicate that the current and future annual entanglement rate is likely to be higher. Taking into account the previous maximum number of leatherback entanglements in leaders per year (six) and our assumption that leatherback interactions are likely to increase due to expected increases in the presence of both leatherbacks and their preferred jellyfish prey in the action area (https://www.delmarvanow.com/story/news/local/2017/08/11/jellyfish-season-begins-early-climate-change/519681001/), we expect up to eight leatherback sea turtles may be entangled in Virginia pound net leaders per year and that up to half of those may result in mortality.

A pound net characterization study by VIMS documented the entanglement of one dead juvenile loggerhead sea turtle in a pound net leader (approximately 11 inches) in October of 2000 (Mansfield *et al.* 2001), while another dead loggerhead was found entangled in a pound net leader in August 2001 (Mansfield *et al.* 2002a). It was not known if those animals were dead prior to entanglement or if the interaction with the pound net leader resulted in their death. Nonetheless, these two past incidents indicate that pound net leader entanglements of hard-shelled sea turtles are possible. Given the presence of three hard-shelled sea turtle species in the action area, we expect that any of these species could be entangled. Based on this information, we anticipate the entanglement of one green, loggerhead, and Kemp's ridley sea turtle in pound net leaders each year.

Summarized below are the number of estimated entanglements and post-interaction mortalities of sea turtles in the leader portions of Virginia pound net gear (modified or otherwise). Most of the estimated entanglements are of leatherback sea turtles, as they are the species most commonly entangled in pound net leaders in Chesapeake Bay. For entanglements in leaders, we expect:

- Up to eight leatherback sea turtles may be entangled per year and four of those takes may be lethal; and
- Up to one each of loggerhead, Kemp's ridley, and green sea turtles may be entangled per year and up to one each of those takes may be lethal.

Conclusion

Table 13 provides a summary of the estimated future takes of sea turtles per year in all portions of Virginia pound net gear. Results from Barco *et a*l. (2016) suggest that the majority of fishery interaction mortalities of sea turtles are of normal, healthy turtles in the population versus those that may be compromised. Thus, although possible, it is extremely unlikely that a dead sea turtle entrapped or entangled in pound net gear would be one that died previously from other causes.

Table 13. Estimated Future Interactions with Sea Turtles in Virginia Pound Net Fishing Gear

Gear component	**Pounds and Hearts**		**Leaders**		**Totals**	
Species	**Captures per year**	**Mortalities per year**	**Captures per year**	**Mortalities per year**	**Captures per year**	**Mortalities per year**
Loggerhead	**805**	**1**	**1**	**1**	806	2
Kemp's ridley	**161**	**1**	**1**	**1**	162	2
Green	**16**	**1**	**1**	**1**	17	2
Leatherback	**0**	**0**	**8**	**4**	8	4

6.2 Effects to Atlantic Sturgeon from Entrapment/Entanglement

The Virginia pound net fishery is not typically prosecuted upstream of the mouths of major Chesapeake Bay rivers, so eggs and early life stages of Atlantic sturgeon will not be present in the action area and thus will not be affected by the proposed action. Juvenile, subadult, and adult Atlantic sturgeon occur in Chesapeake Bay and Virginia coastal waters throughout the year, with adults and subadults most prevalent from April to November (Dovel and Berggren 1983; Secor *et al*. 2000; Welsh *et al*. 2002b; Horne and Stence 2016). Each of these life stages is known to be present in many coastal and estuarine areas throughout Virginia. Diets of adult and 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). Because of the benthic nature of their prey, it is likely that foraging Atlantic sturgeon could swim into and ultimately be entrapped or entangled in pound net gear operating in the action area. Because pound nets and leaders are not baited, Atlantic sturgeon are unlikely to be attracted to pound nets or leaders, which reduces the likelihood of entrapment/entanglement.

Atlantic sturgeon are known to become entrapped in pound nets and were routinely observed in Maryland waters, primarily through the U.S. FWS reward program (U.S. FWS 2007). We have only anecdotal reports of Atlantic sturgeon entrapped in pound nets in Virginia. Before 1996, very little information was known about the abundance or occurrence of Atlantic sturgeon in the Chesapeake Bay. In 1996, commercial fishermen in Maryland were offered a monetary award for live sturgeon that would be turned over to U.S. FWS biologists for tagging. Atlantic sturgeon captures were reported throughout the Maryland portion of the Chesapeake Bay from the Maryland/Virginia line north to the Susquehanna Flats, including bay tributaries. The majority of captures occurred during the spring months of April, May, and June. This time period corresponds to the peak of commercial pound net activity in the Chesapeake Bay. From 1996-2006, 260 different fishermen participated in the reward program. Commercial pound nets accounted for the majority of wild Atlantic sturgeon captures (58.9%, n=822) followed by gill nets (40.7%, n=568), with very few fish captured in fyke nets, trawls, and crab pots. The Atlantic sturgeon captures in the reward program were dominated by juveniles, with over 75% measuring less than 850 millimeters (U.S. FWS 2007).

Given that Atlantic sturgeon are present in the Virginia portion of Chesapeake Bay, interactions with pound nets, although not historically documented, are reasonably certain to occur in Virginia waters of the bay as well. Due to the available quantitative data on sturgeon interactions with pound nets in Maryland waters and assuming that the risk of entrapment in a pound net is the same for an Atlantic sturgeon in Maryland waters of the Chesapeake Bay compared to Virginia waters, we have determined that the Maryland data represents the best available information to determine the effects of the Virginia pound net fishery on Atlantic sturgeon.

<u>Anticipated Interactions of Atlantic Sturgeon in Pound Net Gear</u>
Data pertaining to the Virginia pound net fishery, relative to interactions with Atlantic sturgeon are limited, so we must make assumptions to overcome the limits in the available information. Much of the information used to estimate interaction levels for this fishery was generated from

past available data. The analysis of potential future incidental captures uses capture rates from the aforementioned reward program and the estimated number of annual pound nets in the two states to estimate future captures.

The following paragraphs describe the data used, the processes, and the results of our analyses for estimating the number or amount of Atlantic sturgeon interactions in the Virginia pound net fishery. When calculating the Atlantic sturgeon interaction rate, we used U.S. FWS reward program data documented during 1996-2006 in Maryland waters. We believe this approach is reasonable for a number of reasons. First, Atlantic sturgeon that occur in the action area are all highly migratory and found in both Maryland and Virginia waters (Horne and Stence 2016). Second, pound net construction and fishing methods are very similar in the both states, and effort throughout the seasons is similar (U.S. FWS 2007; Eyler *et al*. 2009; Piavis *et al*. 2012). Although Virginia has specific federal regulations in place related to its pound net leaders, those are solely based on sea turtle interactions at this time, since Atlantic sturgeon interactions in leaders have only recently documented in the last year. In addition, the vast majority of pound net fishing effort in both states occurs in nearshore waters where Atlantic sturgeon are known to occur frequently. Thus, neither fishery is expected to have a disproportionate rate of Atlantic sturgeon interactions based on the distributions of Atlantic sturgeon and pound net fishery effort. This estimate of interactions provides a quantitative association between the sturgeon encounters and gear types and represents the most accurate predictor of annual Atlantic sturgeon interactions in the Virginia pound net fishery that can be generated based on the best available information.

The formation of the sturgeon reward program in 1996 has increased the detail and accuracy of data on sturgeon interactions with pound nets. For the purposes of this Opinion, the estimate of Atlantic sturgeon interactions by the Virginia pound net fishery is calculated using sturgeon reported captured in a pound net in Maryland waters to the U.S. FWS between the years 1996 and 2006. Any of the estimates that produced fractional numbers were rounded up to whole numbers to complete the final estimates.

From 1996-2006, 822 Atlantic sturgeon were captured in Maryland pound nets (U.S. FWS 2007). The annual captures ranged from 3 (2000) to 225 (1998). This results in an average annual bycatch estimate of 74.72 Atlantic sturgeon captured in Maryland pound nets per year. For the purposes of this Opinion, we are rounding the annual average of 74.72 to 75 since a partial sturgeon take is not possible.

In 2017, 1,096 pound net sites were registered in Maryland (http://dnr.maryland.gov/fisheries/Pages/poundnets/index.aspx). Assuming the number of active pound net sites in Maryland has not increased since 1996, the current number of pound net sites in Maryland represents a conservative estimate for estimating the average number of sturgeon captured per pound net registered. Given that an average of 75 sturgeon were captured annually, one pound net is expected to capture 0.068 sturgeon per year.

The number of pound net licenses issued in Virginia has remained the same since 1994, due to a limited entry program, and one license is assigned to each pound net. So while the number of pound nets has apparently decreased since the 1980s, the number of licenses issued (n=161) has been approximately the same since 1994. This suggests that the number of pound nets in the Virginia portion of Chesapeake Bay has been approximately the same since 1994.

The Virginia pound net fishery has a limit of 161 licenses that can be sold and fished per year. This represents the maximum amount of fishing effort in the Virginia pound net fishery. We recognize that in both states the number of active nets may vary among years. However, for the purpose of this Opinion, we assume that all 161 licenses in Virginia and 1,096 registered sites in Maryland are fished each year. Given the similarities of the Virginia pound net fishery to Maryland pound net fishery, we expect 0.068 Atlantic sturgeon to be captured per net in the Virginia pound net fishery. Therefore, 161 pound nets are expected to capture 10.948 Atlantic sturgeon per year. Since a partial sturgeon take is not possible, this number is rounded up to 11.

This estimate of 11 Atlantic sturgeon interactions per year with Virginia pounds and hearts provides the best available information for determining the anticipated bycatch of Atlantic sturgeon in that gear component in the action area. This represents the total number of interactions we are expecting annually in the Virginia pound net fishery and not just the number observed.

In regards to Virginia pound net leaders, two Atlantic sturgeon were documented as being entangled in a pound net leader at Cape Henry on June 10, 2017. One was determined to be deceased, while the other was released alive (2017 JEA Pound Net Inspections; VMRC 2017c). No genetic information is available for these fish, so we assume that they could be from any of the five listed DPSs. This represents the best available information on Atlantic sturgeon entanglements in Virginia pound net leaders. As nearly all sea turtle-pound net leader entanglements are ultimately observed, unless the animal can somehow free itself on its own (which we believe to be rare and have not documented in recent times), we assume the same will hold true for Atlantic sturgeon. As a result, we anticipate up to two Atlantic sturgeon entanglements in leaders annually, with one of those likely to result in mortality. The two entanglements and one mortality could be from any of the five listed DPSs of Atlantic sturgeon, although based on a mixed stock analysis described below, they are likely to be from some DPSs more than others.

Shortly after the ESA listing of Atlantic sturgeon by DPS, Damon-Randall *et al.* (2013) used information on Atlantic sturgeon interactions in conjunction with genetic testing results from Atlantic sturgeon sampled through the NEFOP to calculate the percentages of each DPS that end up as bycatch in fisheries in the Northeast region. The percentages for Marine Mixing Zone 2, which represented the U.S. Mid-Atlantic from roughly Cape Cod, Massachusetts, to Cape Hatteras, North Carolina, were as follows: GOM DPS - 11%; NYB DPS - 51%; CB DPS - 13%; Carolina DPS - 2%; SA DPS - 22%; and Canada - 1% (from the St. Lawrence and St. John rivers). More recently, Wirgin *et al*. (2015) updated these percent DPS breakdowns for Atlantic sturgeon bycatch along the Northeast U.S. coast as follows (rounded to the nearest whole number): GOM - 10%, NYB - 52%, CB - 12%, Carolina - 2%, SA - 22%, and non-listed Canada management units - 2%. We believe the Wirgin *et al*. (2015) analysis is the best available information on the DPS breakdown of Atlantic sturgeon taken as bycatch in U.S. Atlantic coast fisheries, including the Virginia pound net fishery.

Based on the mixed-stock analysis, we expect that of the 13 Atlantic sturgeon that could be captured annually in Virginia pound net gear, 10% (1.30 individuals) would be from the GOM DPS, 52% (6.76 individuals) from the NYB DPS, 12% (1.56 individuals) from the CB DPS, 2% (0.26 individuals) from the Carolina DPS, 22% (2.86 individuals) from the SA DPS, and 2% from Canadian management units (0.26 individuals). As these numbers represent fractions of fish, we are choosing to round some values up and others down based up the relative proximity of the action area to the spawning rivers of the DPSs in question. Overall, we anticipate that of the 13 captures per year, seven would be from the NYB DPS, three would be from the SA DPS, two would be from the CB DPS, and one would be from either the GOM or Carolina DPS.

Estimated Mortalities and Age Classes of Atlantic Sturgeon that Interact with Pound Nets

Captures in the pound/heart configuration likely occur with survival estimated to be 100% (Kahnle *et al*. 1998). The short duration of the net haul and handling/release of any Atlantic sturgeon once encountered in the pounds or hearts is likely to result in a low potential for mortality. Based on this information, we expect that all Atlantic sturgeon entrapped in Virginia pounds and hearts will be released alive. Additionally, there has never been a documented entanglement of an Atlantic sturgeon in the mesh or netting of a Virginia pound net (Mark Swingle, Virginia Aquarium Stranding Database, pers. comm., 2013). Therefore, the continued operation of the pound net fishery may result in the capture of Atlantic sturgeon in the pounds or hearts, but it is unlikely that these sturgeon will be killed. However, we anticipate that half of all Atlantic sturgeon entangled in Virginia pound net leaders will die. The one Atlantic sturgeon mortality expected annually in pound net leaders is most likely to be a NYB DPS fish. Based on the mixed stock analysis, for every ten pound net leader mortalities (i.e., over a ten-year period), we expect five to be from the NYB DPS, two from the SA DPS, and one apiece from the GOM, CB, and Carolina DPS.

Atlantic sturgeon entrapped in Virginia pound nets are expected to be subadults or adults, although juveniles could be captured on rare occasions. Data from the U.S. FWS indicates that of the Atlantic sturgeon interactions that have been observed in Chesapeake Bay, approximately 75% were subadults and 25% were adults based on length (n=726; subadults less than 150 centimeters, adults 150 centimeters or longer). More specifically, the encountered ratios for gillnet gear were approximately 72% subadults to 28% adults and the ratios for trawl gear were 79% subadults to 21% adults.

6.3 Effects due to Interactions with Pound Net Fishing Vessels

Vessel strikes are a threat to a number of marine species worldwide including sea turtles and Atlantic sturgeon (Hazel *et al.* 2007; Brown and Murphy 2010; Work *et al.* 2010; Balazik *et al.* 2012b; Barco *et al*. 2016). Sea turtles are known to be injured or killed as a result of being struck by commercial and recreational vessels on the water. Interactions between vessels and sea turtles occur and can take many forms, from the most severe (death or bisection of an animal or penetration to the viscera), to severed limbs or cracks to the carapace which can also lead to mortality directly or indirectly. Sea turtle stranding data for the U.S. Gulf of Mexico and Atlantic coasts, Puerto Rico, and the U.S. Virgin Islands show that between 1986 and 1993, about 9% of living and dead stranded sea turtles had propeller or other boat strike injuries (Lutcavage *et al.* 1997). According to 2001 STSSN stranding data, at least 33 sea turtles (including loggerhead, green, Kemp's ridley and leatherbacks) that stranded on beaches within the Northeast (Maine through North Carolina) were struck by a boat. However, these numbers underestimate the actual number of boat strikes that occurred since not every boat-struck turtle will strand, every stranded turtle will not be found, and many stranded turtles are too decomposed to determine whether the turtle was struck by a boat. It should be noted, however, that it is not known whether all boat strikes were the cause of death or whether they occurred post-mortem (NMFS SEFSC 2001). More recently, boat strike wounds were confirmed to be ante-mortem in over 75% of sea turtles that were found dead or stranded along the U.S. Atlantic coast (B. Stacy, NMFS, pers. comm., 2017) and a majority of sea turtles struck in Virginia waters were healthy prior to those collisions (Barco *et al.* 2016).

Information is lacking on the type or speed of vessels involved in turtle vessel strikes. However, there does appear to be a correlation between the number of vessel struck turtles and the level of recreational boat traffic (NRC 1990). Although little is known about a sea turtle's reaction to vessel traffic, it is generally assumed that sea turtles are more likely to avoid collisions with slower moving vessels since the turtle has more time to maneuver and avoid the vessel. In addition, the risk of ship strike will be influenced by the amount of time the animal remains near the surface of the water. With respect to the proposed action, 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 are extremely unlikely to strike sea turtles in the action area given that: (a) the vessels will operate/travel at a slow speed such that sea turtles would have the speed and maneuverability to avoid contact with the vessel and (b) sea turtles spend part of their time at depths out of range of a vessel collision.

As noted in the status review and listing rules for the species (ASSRT 2007; 77 FR 5880 and 77 FR 5914; February 6, 2012), vessel strikes have been identified as a threat to Atlantic sturgeon in certain regions. While the exact number of sturgeon killed as a result of being struck by boat hulls or propellers is unknown, it is an area of concern in many areas including the Delaware and James Rivers. Brown and Murphy (2010) examined 28 dead Atlantic sturgeon observed in the Delaware River from 2005-2008. Fifty-percent of the mortalities resulted from apparent vessel strikes and 71% of these (ten of 14) had injuries consistent with being struck by a large vessel (Brown and Murphy 2010). Eight of the 14 vessel struck sturgeon were adult-sized fish (Brown and Murphy 2010). Given the time of year in which the fish were observed (predominantly May through July; Brown and Murphy 2010), it is likely that many of the adults were migrating through the river to the spawning grounds.

The factors relevant to determining the risk to Atlantic sturgeon from vessel strikes are currently unknown, but they may be related to size and speed of the vessels, navigational clearance (i.e., depth of water and draft of the vessel) in the area where the vessel is operating, and the behavior of sturgeon in the area (e.g., foraging, migrating, etc.). The risk of vessel strikes between sturgeon and fishing vessels operating in the open ocean or large estuaries is likely to be low given that the vessels are likely to be operating at slow speeds and there are no restrictions forcing Atlantic sturgeon into close proximity with the vessel as may be present in some rivers.

Adding small fishing vessels to the existing baseline will not increase the risk that any vessel in the area will strike an Atlantic sturgeon, or will increase it to such a small extent that the effect of the action (i.e., any increase in risk of a strike caused by the action) cannot be meaningfully measured or detected. The baseline risk of a vessel strike within Virginia waters is unknown. The increase in traffic associated with the proposed action is extremely small, as all the fishermen affected by NMFS regulations have been and would be fishing their gear anyway. During the proposed action, a minimal number of vessels could be added to the baseline if the number of Virginia pound net permits is increased in future years. However, most pound net fishermen hold multiple permits at a time and would use the same vessel to tend multiple gear sites in close proximity. The addition of any vessels will also be intermittent, temporary, and restricted to a small portion of the overall action area on any given day. As such, any increased risk of a vessel strike caused by the proposed action will be too small to be meaningfully measured or detected. As a result, the effect of the action on the risk of a vessel strike in the action area is insignificant.

6.4 Effects to Prey

Sea turtles could be negatively affected by the loss of prey as a result of pound net fishing that removes or incidentally kills such prey. However, the amount of potential sea turtle prey that will be disturbed or removed is minimal. The species targeted by pound net fishermen in Virginia waters are typically weakfish, spot, and Atlantic croaker, which are not preferred prey items for sea turtles. Thus, the proposed action considered here is expected to have an insignificant effect on the availability of prey for sea turtles, which most often include other organisms such as crabs (loggerheads and Kemp's ridleys), jellyfish (leatherbacks), and algae/seagrass (greens).

Atlantic sturgeon use the action area as a migratory route and for overwintering and foraging. Any effects on habitat due to pound net fishing gear are most likely to be on sturgeon prey items, as discussed below. Atlantic sturgeon are known to aggregate in certain areas and at certain times of the year, and some of these areas experience high fishing effort. Despite the overlap in aggregations with some areas of high fishing effort, we have no information that indicates negative effects on sturgeon prey items.

Atlantic sturgeon feed primarily on benthic invertebrates and occasionally on small fish. Because of the small size or benthic nature of these prey species, it is unlikely that the proposed action will result in the capture of any sturgeon prey items. Thus, the proposed action will not affect the availability of prey for sturgeon. Again, any effects to prey will be limited to minor disturbances to the river/estuary/ocean bottom from the pound net gear. Because of this, we have determined that any effects to sturgeon prey or foraging sturgeon will be insignificant.

6.5 Effects to Habitat

As pound nets are a form of fixed gear (i.e., stationary, not moving) in which contact with the seafloor is limited to a small area, limited effects to bottom habitat are possible as a result of utilizing these forms of fish harvest gear. The gear is anchored to the bottom by poles and is capable of getting pushed by slow moving currents, or, when the gear is in process of being retrieved. Yet since pound net gear hauls are rarely conducted during adverse weather conditions (i.e., when winds and currents may be stronger) and the gear is frequently checked while in the water, adverse effects on habitat are not expected. As stated above, the effects on sea turtle and Atlantic sturgeon benthic prey items from these fixed gears are expected to be insignificant.

In regards to effects on the pelagic habitat of some sea turtles (e.g., leatherbacks) and Atlantic sturgeon, we do not anticipate any adverse effects from pound net gear on those areas since the gears and vessels to be used are not expected to affect the prevailing currents, water quality, or other environmental conditions of those habitats.

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, underwater noise, and global climate change. 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 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 U.S. FWS 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.

Debris, Pollution, and Contaminants - Human activities in the action area causing marine debris and 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 ESA-listed species 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.

Underwater Noise - In past consultations, NMFS has concluded that phenomena like sound do not accumulate, although phenomena like the acreage of habitat destroyed and concentrations of toxic chemicals, sediment, and other pollutants do accumulate. Here, we have concluded that the effects of multiple exposures to active acoustic sources are not likely to accumulate through altered energy budgets caused by avoidance behavior (reducing the amount of time available to forage), physiological stress responses, or the costs of changing behavioral states (small decreases in the current and expected reproductive success of individuals exposed to the stressors) because these costs primarily occur because of avoidance behavior and altered energy budgets. The number of individuals "taken" gets larger when we accumulative them through addition, but the effect of that "take" on the survival or reproductive success of the animals themselves would not accumulate in the same way. To the contrary, we do not expect the effects of the "take" to have any additive, interactive, or synergistic effect on the individual animals, the populations those individuals represent, or the species those populations comprise.

In the future, *global climate change* is expected to continue and may impact ESA-listed species and their habitat in the action area. As noted in the *Status of the Species* and *Environmental Baseline* sections, the likely rate of change associated with climate impacts is on a century scale, which makes the ability to discern changes in the abundance, distribution, or behavior of these species in the action area as a result of climate change impacts challenging in the short term.

8.0 INTEGRATION AND SYNTHESIS OF EFFECTS

In the effects analysis outlined above, we considered the potential effects to ESA-listed species from NMFS' implementation of gear regulations for the Virginia pound net fishery over the foreseeable future. These effects primarily include direct entrapment or entanglement of sea turtles and Atlantic sturgeon in pound net fishing gear, specifically the pounds, hearts, and leaders. In addition to these gear-related effects, we considered the potential for interactions between ESA-listed species and fishing vessels as well as impacts to their habitats and prey.

We have estimated that the Virginia pound net fishery will result in the capture of up to 806 NWA DPS loggerheads, 162 Kemp's ridleys, 17 green sea turtles, 8 leatherbacks, and up to 13 Atlantic sturgeon from a combination of the five listed DPSs per year. Up to two loggerhead, two Kemp's ridley, two green, four leatherback, and one Atlantic sturgeon interactions per year are expected to result in post-interaction mortality. As explained in the *Effects of the Action* section, all other effects to sea turtles and Atlantic sturgeon from the proposed action, including to their prey and habitat, will be insignificant or discountable.

In the discussion below, we consider whether the effects of the proposed action reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the listed species in the wild by reducing the reproduction, numbers, or distribution of the listed species that will be adversely affected by the actions. The purpose of this analysis is to determine whether the proposed action, 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 U.S. FWS/NMFS Section 7 Handbook (U.S. FWS and NMFS 1998), for the purposes of determining jeopardy, survival is defined as, "the species' persistence as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. Said in another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter."

Recovery is defined as, "Improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act." We summarize below the status of the species and consider whether the proposed action will result in reductions in reproduction, numbers or distribution of these species and then considers whether any reductions in reproduction, numbers or distribution resulting from the proposed action would reduce appreciably the likelihood of both the survival and recovery of these species, as those terms are defined for purposes of the ESA.

8.1 Northwest Atlantic DPS of Loggerhead Sea Turtles

The Northwest Atlantic DPS of loggerhead sea turtles is listed as "threatened" under the ESA. It takes decades for loggerhead sea turtles to reach maturity. Once they have reached maturity, females typically lay multiple clutches of eggs within a season, but do not typically lay eggs every season (NMFS and U.S. FWS 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 U.S. FWS 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, we have considered the potential impacts of the proposed action on the NWA DPS of loggerhead sea turtles. We have estimated that 806 loggerheads are likely to be captured as a result of the proposed action annually and that up to two of those turtles may suffer post-interaction mortality. All other effects to loggerhead sea turtles including effects to prey are expected to be insignificant and discountable.

Capture in pound net gear 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 two loggerhead sea turtles from the action area annually would reduce the number of loggerhead sea turtles from the recovery unit of which they originated as compared to the number of loggerheads that would have been present in the absence of the proposed action (assuming all other variables remained the same). However, this does not necessarily mean that these recovery units will experience reductions in reproduction, numbers or distribution in response to these effects to the extent that survival and recovery would be appreciably reduced. The final revised recovery plan for loggerheads compiled the most recent information on mean number of loggerhead nests and the approximated counts of nesting females per year for four of the five identified recovery units (i.e., nesting groups). They are: (1) for the NRU, a mean of 5,215 loggerhead nests per year with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year with approximately 15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year with approximately 221 females nesting per year. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was estimated from 1987-2001 (NMFS and U.S. FWS 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 in Virginia pound net gear 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 as a result of the proposed action will originate from either of these recovery units. The majority of the loggerheads captured are likely to originate from the PFRU, with the remainder from the NRU and GCRU. As explained above, only two loggerhead mortalities are expected to result due to the proposed action every year. As it is impossible to predict whether these turtles will be from the PFRU, the NRU or the GCRU without invasive genetic sampling of the captured individual, we consider below the effects of the mortality of two loggerheads per year 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 U.S. FWS 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 two loggerheads per year 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 two individuals would represent approximately 0.013% of the population. Similarly, the loss of two 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 two individuals would represent approximately 0.16% of the population. The loss of two loggerheads from the GCRU, which is expected to support at least 1,000 nesting females, represents just 0.2% 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 two 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 two loggerhead sea turtles per year as a result of the proposed action 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 up to two loggerheads per year 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 these loggerheads is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of these loggerheads is likely to have an undetectable effect on reproductive output of any nesting aggregation or the species as a whole; (5) the actions will have no effect on the distribution of loggerheads in the action area or throughout its range; and (6) the actions 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 U.S. FWS issued a recovery plan for the Northwest Atlantic population of loggerheads (NMFS and U.S. FWS 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 two loggerheads as a result of the proposed action will not affect the population trend. The number of loggerheads likely to die as a result of the proposed action 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 action 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 action will also not affect the ability of any of the recovery tasks to be accomplished.

In summary, the effects of the proposed action will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the action will not prevent the species from growing in a way that leads to recovery and the action will not change the rate at which recovery can occur. This is the case because while the 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 action will not appreciably reduce the likelihood that loggerhead sea turtles can be brought to the point at which they are no longer listed as endangered or threatened.

Despite the threats faced by individual loggerhead sea turtles inside and outside of the action area, the proposed action will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. We have considered the effects of the proposed action 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 action is 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; U.S. FWS and NMFS 1992; NMFS and U.S. FWS 2015).

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 (U.S. FWS 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). Recent population abundance for Kemp's ridleys, based on nests and hatchling recruitment, was estimated by Gallaway *et al*. (2013). They estimated the female population size for age-2 and older in 2012 to be 188,713 (SD = ±32,529). Assuming females comprise 76%

(sex ratio = 0.76; TEWG 1998, 2000) of the population, they estimated the total population of age 2 years and over at 248,307. Based on the number of hatchlings released in 2011 and 2012 (1+ million) and recognizing mortality over the first two years is high, Gallaway *et al.* (2013) thought the total population, including hatchlings younger than 2 years, may exceed 1 million turtles (NMFS and U.S. FWS 2015).

The most recent five-year review of the Kemp's ridley suggests that the population growth rate (as measured by numbers of nests) stopped abruptly after 2009. Given the recent lower nest numbers, the population is not projected to grow at former rates. As a result, the status review team determined that the population is not recovering and cannot meet recovery goals unless survival rates improve (NMFS and U.S. FWS 2015). However, some positive outlooks for the species include 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 (NMFS and U.S. FWS 2015). There is also the recent record nesting year in Mexico and Texas for Kemp's ridleys in 2017.

In this Opinion, we have considered the potential impacts of the proposed action on Kemp's ridley sea turtles. We expect the annual capture of up to 161 Kemp's ridleys in Virginia pound net hearts and pounds as well as one Kemp's ridley in pound net leaders. Up to two Kemp's ridleys per year have the potential to be killed following an interaction with pound net gear.

Capture as a result of the proposed action 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 two Kemp's ridleys annually represents a very small percentage of the Kemp's ridleys worldwide. Even taking into account just nesting females, the death of two Kemp's ridleys represents less than 0.04% of the population. While the death of two Kemp's ridleys per year will reduce the number of Kemp's ridleys compared to the number that would have been present absent the proposed action, 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 0.02%). 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 two Kemp's ridleys per year 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 action, 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 action 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 action is not likely to reduce distribution because the action 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 proposed action, there is not likely to be any loss of unique genetic haplotypes and no loss of genetic diversity.

Generally speaking, while the loss of a small number of individuals from a subpopulation or species may result in an appreciable reduction in the total 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 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 up to two Kemp's ridleys sea turtle per year as a result of the proposed action 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 death of two Kemp's ridleys annually represents an extremely small percentage of the species as a whole; (2) the loss of these Kemp's ridleys will not change the status or trends of the species as a whole; (3) the loss of these Kemp's ridleys is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) 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; (5) 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 (6) 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 action 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 action will affect the likelihood that Kemp's ridleys can rebuild to a point where listing is no longer appropriate. In 2011, NMFS and U.S. FWS issued a recovery plan for Kemp's ridleys (NMFS and U.S. FWS 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[8];
2. An increase in the recruitment of hatchlings[9];
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.

Although Kemp's ridleys have shown a decreasing trend over the last several years, as explained above, the loss of two per year as a result of the proposed action 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 action 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 action 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 action will have no effect on the likelihood that criteria five will be met.

The effects of the proposed action 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 two individuals per year, these effects will be undetectable over the long-term and the action is not expected to have long term impacts on the future growth of the population or its potential for recovery. Therefore, based on the analysis presented above, the proposed action will not appreciably reduce the likelihood that Kemp's ridley sea turtles can be brought to the point at which they are no longer listed as endangered or threatened.

[8] 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.

[9] 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).

Despite the threats faced by individual Kemp's ridley sea turtles inside and outside of the action area, the proposed action will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. We have considered the effects of the proposed action 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 action, resulting in the potential mortality of up to two Kemp's ridley sea turtles annually, is not likely to appreciably reduce the survival and recovery of this species.

8.3 North Atlantic DPS of Green Sea Turtles

The North Atlantic DPS of green sea turtles is listed as threatened under the ESA. As is also the case with the other sea turtle species, North Atlantic DPS green sea turtles face numerous threats on land and in the water that affect the survival of all age classes.

The greatest abundance of green sea turtle nesting in the North Atlantic occurs on beaches in Tortuguero, Costa Rica. Nesting in the area has increased considerably since the 1970s and nest count data from 1999-2003 suggested that 17,402-37,290 females nested there per year Seminoff *et al*. 2015). In 2010, an estimated 180,310 nests were laid at Tortuguero, the highest level of green sea turtle nesting estimated since the start of nesting track surveys in 1971. This equated to somewhere between 30,052 and 64,396 nesters in 2010 (Seminoff *et al*. 2015).

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. 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 U.S. FWS 2007b).

In this Opinion, we have considered the potential impacts of the proposed action on green sea turtles. We expect that up to 17 green sea turtles will be captured as a result of the proposed action per year, 2 of which may be lethal while the other 15 will be released alive. As there will be very few mortalities to green sea turtles as a result of the proposed action and no effects to the prey base that would cause sea turtles to leave the action area to forage elsewhere, the proposed action is not likely to reduce the numbers of green sea turtles in the action area or the DPS as a whole. The proposed action will have no effects to the prey base that would cause sea turtles to leave the action area to forage elsewhere and the green sea turtle's numbers in the action area and as part of any subpopulation as a whole will not be reduced. Similarly, as the proposed action will not affect the fitness of any individuals, no effects to reproduction are anticipated.

The action is not expected to result in a reduction in the distribution of green sea turtles in the action area or throughout their range. Because effects are limited to capture, the population level impacts will be insignificant. Despite the threats faced by individual green sea turtles inside and outside of the action area, the proposed action will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. While we are 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 action. We have considered the effects of the proposed action in light of cumulative effects explained above, including climate change, and has concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

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

Based on the information provided above, the death of up to two green sea turtles per year as a result of the proposed action 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) few mortalities are expected as a result of captures at present and into the future; (3) the actions will have no effect on the distribution of green sea turtles in the action area or throughout its range; and (4) the actions will have no effect on the ability of green sea turtles to shelter and only a minor and temporary 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 action 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 action 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 U.S. FWS 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 action will not appreciably reduce the likelihood of survival of green sea turtles. Also, they are not expected to modify, curtail, or destroy the range of the species since they will not cause any reductions in the number of green sea turtles in any geographic area and since they will not affect the overall distribution of green sea turtles other than to cause minor temporary adjustments in movements in the action area. As explained above, the proposed action is likely to result in only two mortalities per year, and thus is not expected to affect the persistence of green sea turtles or the species trend. The action will not affect nesting habitat and 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. Therefore, based on the analysis presented above, the proposed action 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 action will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. We have considered the effects of the proposed action 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 action, resulting in the lethal capture of up to two green sea turtles per year, 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 U.S. FWS 2013). 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 U.S. FWS 2013).

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 U.S. FWS 1995). Data collected for some nesting beaches in the western Atlantic, including leatherback nesting beaches in the U.S., clearly indicate increasing numbers of nests (SEFSC 2001; NMFS and U.S. FWS 2013). However, declines in nesting have been noted for beaches in the western Caribbean (NMFS and U.S. FWS 2013). 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 30 years (NMFS and U.S. FWS 2013). 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, we have considered the potential impacts of the proposed action on leatherback sea turtles. We anticipate that up to eight leatherbacks will be captured in the leaders of Virginia pound net gear annually. Half of the captured leatherbacks are expected to be safely removed from the gear being used and returned to the ocean without lethal effects, while the other four are expected to suffer post-interaction mortality. All other effects to leatherback sea turtles, including effects to prey, are expected to be insignificant and discountable.

As there will be post-interaction mortality to only four individual leatherback sea turtles per year and no effects to the prey base that would cause sea turtles to leave the action area to forage elsewhere, the proposed action is not likely to significantly reduce the numbers of leatherback sea turtles in the action area, the numbers of leatherbacks in any subpopulation, or the species as a whole. In addition, the fishery will cause no effects to the prey base that would cause sea turtles to leave the action area to forage elsewhere and the leatherbacks sea turtle's numbers in the action area and as part of any subpopulation as a whole will not be reduced. Similarly, as the proposed action will affect the fitness of only a few individuals, little to no effects on 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 action will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. While we are 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 action. We have considered the effects of the proposed action in light of cumulative effects explained above, including climate change, and has concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

Based on the information provided above, the annual post-interaction mortality of up to four leatherback sea turtles as a result of the proposed action 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). The actions will not affect leatherbacks 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 leatherbacks from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of up to four leatherbacks annually represents an extremely small percentage of the species as a whole; (2) the loss of these leatherbacks will not change the status or trends of any nesting aggregation, recovery unit, or the species as a whole; (3) the loss of these leatherbacks is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of these leatherbacks is likely to have an undetectable effect on reproductive output of any nesting aggregation or the species as a whole; (5) the actions will have no effect on the distribution of leatherbacks in the action area or throughout its range; and (6) the actions will have no effect on the ability of leatherbacks to shelter and only an insignificant effect on individual foraging leatherbacks.

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

The proposed action is not expected to modify, curtail, or destroy the range of the species since it will not result in a significant 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 action will not use leatherback sea turtles for recreational, scientific, or commercial purposes or affect the adequacy of existing regulatory mechanisms to protect this species. The proposed action is 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 only a minor 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 action 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 action 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 action 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 action is not likely to appreciably reduce the survival and recovery of this species.

8.5 Atlantic Sturgeon

As explained above, the proposed action is likely to result in the capture of up to 13 Atlantic sturgeon and the mortality of one Atlantic sturgeon annually. We expect that the Atlantic sturgeon captured will be either adults or subadults, although juveniles could be captured on rare occasions. No capture of eggs or larvae is anticipated. All other effects to Atlantic sturgeon, including effects from vessel traffic and effects to habitat and prey resources due to the Virginia pound net fishery and its associated gear regulations, will be insignificant and discountable. The 13 Atlantic sturgeon captured in Virginia pound net gear per year are anticipated to come from a mix of the five listed DPSs, and as such, we will assess the impacts of those takes annually in the DPS proportions as determined in the effects analysis by the mixed stock approach.

8.5.1 Gulf of Maine DPS

The GOM DPS is listed as threatened, and while Atlantic sturgeon occur in several rivers of the Gulf of Maine region, recent spawning has only been physically documented in the Kennebec River. However, spawning is suspected to occur in the Androscoggin, Piscataqua, and Merrimack Rivers. No estimate of the number of Atlantic sturgeon in any river or for any life stage or the total population is available although the ASSRT stated that there were likely less than 300 spawners per year. Gulf of Maine origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. While there are some indications that the status of the GOM DPS may be improving, there is currently not enough information to establish a trend for any life stage or for the DPS as a whole.

We have estimated that the proposed action may result in the capture of up to one GOM DPS Atlantic sturgeon per year. We anticipate the mortality of up to one individual every ten years; no post-interaction mortality of any other captured GOM DPS Atlantic sturgeon is anticipated.

With the exception of up to one GOM DPS Atlantic sturgeon mortality in pound net gear every ten years, all sturgeon captured in pound net gear are anticipated to fully recover from entrapment without any impact on fitness or future reproductive potential. The short duration of most captures and handling will not cause a delay or disruption of any essential behavior including spawning and there will be no reduction in individual fitness or any future reduction in numbers of individuals. Additionally, given the location of the action area, we do not anticipate the capture or handling of any spawning individuals. The proposed action will also not affect their spawning habitat in any way and will not create any barrier to pre-spawning sturgeon accessing foraging or overwintering sites or the spawning grounds. Any effects to distribution will be minor and temporary and limited to the temporary capture and handling of individuals.

Here, we consider the effect of the loss of up to one Atlantic sturgeon from the GOM DPS every ten years. 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 up to one individual each decade 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, 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 action, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. As noted above, reproductive potential of Atlantic sturgeon captured and not killed is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior of captured fish 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 action will also not affect the spawning grounds within the rivers where GOM DPS fish spawn. The action 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 this action on the species. However, because the proposed action will result in the loss of no more than one individual every ten years, it is unlikely that this death will have a detectable effect on the numbers and population trend of the GOM DPS.

The proposed action is 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 GOM DPS subadults or adults. Further, the action is 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 area where suspended sediment levels are high.

Based on the information provided above, the death of up to one GOM DPS Atlantic sturgeon each decade, 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 action 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 up to one GOM DPS Atlantic sturgeon in any ten-year period will not change the status or trends of the species as a whole; (2) the loss of this GOM DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (3) the loss of this GOM 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; (4) the action 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 action 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 action 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 action 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. The Recovery Plan will outline 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 action will affect the population size and/or trend in a way that would affect the likelihood of recovery.

We do not expect the proposed action to modify, curtail, or destroy the range of the species since it will result in an extremely small reduction in the number of GOM DPS Atlantic sturgeon and since it 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 action will result in an extremely small amount of mortality (up to one individual every ten years) and a subsequent small reduction in future reproductive output. For these reasons, we do not expect the action to affect the persistence of the GOM DPS of Atlantic sturgeon. This action 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 action will not reduce the likelihood of improvement in the status of the GOM DPS of Atlantic sturgeon. The effects of the proposed action will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed action 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 action 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 action is 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 action 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 action. We have considered the effects of the proposed action 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 action, resulting in the mortality of up to one GOM DPS Atlantic sturgeon every ten years, is not likely to appreciably reduce the survival and recovery of this species.

8.5.2 New York Bight DPS

The NYB DPS is listed as endangered, and while Atlantic sturgeon occur in several rivers in the New York Bight, recent spawning has only been physically documented in the Hudson and Delaware Rivers. The capture of age-0 Atlantic sturgeon in the Connecticut River in 2014 indicates that spawning may also occur in this river. However, as these young sturgeon represent the only evidence of spawning since the population began being studied in the 1980s, and we do not have any information on the genetic identity of these individuals, we do not know if these represent a unique Connecticut River population or were spawned by migrants from the Hudson River. Spawning may also occur in the Housatonic River due to the presence of features necessary to support reproduction and recruitment (82 FR 39160; August 17, 2017). Nonetheless, based on existing data, we expect any NYB DPS Atlantic sturgeon in the action area to originate from the Hudson or Delaware River. There is limited information on the demographics of the Hudson River population of Atlantic sturgeon. Spawning still occurs in the Delaware River, however, this are no abundance estimates for this population of Atlantic sturgeon (ASSRT 2007). An annual mean estimate of 863 mature adults (596 males and 267 females) was calculated for the Hudson River based on fishery-dependent data from 1985-1995 (Kahnle *et al.* 2007). As discussed in Section 4.2.2, the NEAMAP based methodology estimates a total of 34,566 sub-adult and adult NYB DPS Atlantic sturgeon in the ocean.

We have estimated that the proposed action may result in the capture of up to seven NYB DPS Atlantic sturgeon annually. We anticipate the mortality of up to five individuals every ten years; no post-interaction mortality of any other captured NYB DPS Atlantic sturgeon is anticipated. Effects are anticipated when fish encounter or are trapped by the pound net gear. These effects consist of alterations in normal behavior, such as a temporary startle or avoidance of the sampling area; minor physiological stress; and minor physical injury from abrasion associated with physically interacting with the trap, main lead or wings. Non-lethal behavioral responses are expected to be temporary and spatially limited to the area and time fish interact with or are restricted by pound net gear.

With the exception of up to five NYB DPS Atlantic sturgeon mortalities in pound net gear per decade, all sturgeon captured in pound net gear are anticipated to fully recover from capture without any impact on fitness or future reproductive potential. The short duration of most captures and handling will not cause a delay or disruption of any essential behavior including spawning, there will be no reduction in individual fitness or any future reduction in numbers of individuals. Additionally, given the location of the action area, we do not anticipate the capture or handling of any spawning individuals. The proposed action will also not affect their spawning habitat in any way and will not create any barrier to pre-spawning sturgeon accessing foraging or overwintering sites or the spawning grounds. Any effects to distribution will be minor and temporary and limited to the temporary capture and handling of individuals.

Here, we consider the effect of the loss of up to five Atlantic sturgeon from the NYB DPS every ten years. The reproductive potential of the NYB DPS will not be affected in any way other than through a reduction in numbers of individuals. The loss of up to five individuals every ten years 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. However, 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 action, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. As noted above, reproductive potential of Atlantic sturgeon captured and not killed is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior of captured fish 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 action will also not affect the spawning grounds within the rivers where NYB DPS fish spawn. The action will also not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds used by NYB DPS fish.

Because we do not have a population estimate for the NYB DPS, it is difficult to evaluate the effect of the mortality caused by this action on the species. However, because the proposed action will result in the loss of no more than five individuals per decade, it is unlikely that this death will have a detectable effect on the numbers and population trend of the NYB DPS.

Based on the information provided above, the death of up to five NYB DPS Atlantic sturgeon every ten years 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 action 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 death of five NYB DPS Atlantic sturgeon every ten years will not change the status or trends of the species as a whole; (2) the loss of these NYB DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (3) the loss of these 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; (4) the action 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, (5) the action 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 action will not appreciably reduce the likelihood that the NYB 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 action will affect the likelihood that the NYB DPS can rebuild to a point where listing is no longer appropriate. No Recovery Plan for the NYB DPS has been published.

The Recovery Plan will outline 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 action will affect the population size and/or trend in a way that would affect the likelihood of recovery.

The proposed action is not expected to modify, curtail, or destroy the range of the species since it will result in an extremely small reduction in the number of NYB DPS Atlantic sturgeon and since it 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 action will result in a small amount of mortality (no more than five individuals every ten years) and a subsequent small reduction in future reproductive output. For these reasons, it is not expected to affect the persistence of the NYB DPS of Atlantic sturgeon. These action 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 action will not reduce the likelihood of improvement in the status of the NYB DPS of Atlantic sturgeon. The effects of the proposed action will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed action 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 action 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 action is not likely to appreciably reduce the survival and recovery of this species.

Despite the threats faced by individual NYB DPS Atlantic sturgeon inside and outside of the action area, the proposed action 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 action. Based on the analysis presented herein, the proposed action, resulting in the mortality of up to five NYB DPS Atlantic sturgeon every ten years, is not likely to appreciably reduce the survival and recovery of this species.

8.5.3 Chesapeake Bay DPS

The CB DPS is listed as endangered, and while Atlantic sturgeon occur and may potentially spawn in several rivers of the Chesapeake Bay, recent spawning has only been physically documented in the James River. Chesapeake Bay origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently not enough information to establish a trend for any life stage, for the James River spawning population, or for the DPS as a whole.

We have estimated that the proposed action will result in the capture of up to two CB DPS Atlantic sturgeon annually. We anticipate the mortality of up to one individual every ten years; no post-interaction mortality of any other captured CB DPS Atlantic sturgeon is anticipated.

With the exception of up to one CB DPS Atlantic sturgeon mortality in pound net gear every ten years, all sturgeon captured in pound net gear are anticipated to fully recover from capture without any impact on fitness or future reproductive potential. The short duration of most captures and handling will not cause a delay or disruption of any essential behavior including spawning, there will be no reduction in individual fitness or any future reduction in numbers of individuals. Additionally, given the location of the action area, we do not anticipate the capture or handling of any spawning individuals. The proposed action will also not affect their spawning habitat in any way and will not create any barrier to pre-spawning sturgeon accessing foraging or overwintering sites or the spawning grounds. Any effects to distribution will be minor and temporary and limited to the temporary capture and handling of individuals.

Here, we consider the effect of the loss of up to one Atlantic sturgeon per decade from 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 up to one individual every ten years 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. However, 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 action, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. As noted above, reproductive potential of Atlantic sturgeon captured and not killed is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior of captured fish 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 action will also not affect the spawning grounds within the rivers where CB DPS fish spawn. The action 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 these action on the species. However, because the proposed action will result in the loss of no more than one individual every ten years, it is unlikely that this death will have a detectable effect on the numbers and population trend of the CB DPS.

The proposed action is 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 action is 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 area where suspended sediment levels are high.

Based on the information provided above, the death of up to one CB DPS Atlantic sturgeon every ten years 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 action 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 death of one CB DPS Atlantic sturgeon every ten years will not change the status or trends of the species as a whole; (2) the loss of this CB DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (3) the loss of this CB 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; (4) the action 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, (5) the action will have no effect on the ability of CB DPS Atlantic sturgeon to shelter and only an insignificant effect on any 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 action will not appreciably reduce the likelihood that the CB 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 action will affect the likelihood that the CB DPS can rebuild to a point where listing is no longer appropriate. No Recovery Plan for the CB DPS has been published. The Recovery Plan will outline 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 action will affect the population size and/or trend in a way that would affect the likelihood of recovery.

We do not expect the proposed action to modify, curtail, or destroy the range of the species since it will result in an extremely small reduction in the number of CB DPS Atlantic sturgeon and since it 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 action will result in an extremely small amount of mortality each year and a subsequent small reduction in future reproductive output. For these reasons, we do not expect the action to affect the persistence of the CB DPS of Atlantic sturgeon. This action 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 action will not reduce the likelihood of improvement in the status of the CB DPS of Atlantic sturgeon. The effects of the proposed action will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed action 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 action 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 action is 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 action 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 action. We have considered the effects of the proposed action 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 action, resulting in the mortality of up to one CB DPS Atlantic sturgeon every ten years, is not likely to appreciably reduce the survival and recovery of this species.

8.5.4 Carolina DPS

The Carolina DPS is listed as endangered and consists of Atlantic sturgeon originating from at least five rivers where spawning is still thought to occur. Carolina DPS origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range.

We have estimated that the proposed action will result in the capture of up to one Carolina DPS Atlantic sturgeon annually. We anticipate the mortality of only one individual every ten years; no post-interaction mortality of any other captured Carolina DPS Atlantic sturgeon is anticipated.

With the exception of up to one Carolina DPS Atlantic sturgeon mortality in pound net gear per decade, all sturgeon captured in pound net gear are anticipated to fully recover from capture without any impact on fitness or future reproductive potential. The short duration of most captures and handling will not cause a delay or disruption of any essential behavior including spawning, there will be no reduction in individual fitness or any future reduction in numbers of individuals. Additionally, given the location of the action area, we do not anticipate the capture of handling of any spawning individuals. The proposed action will also not affect their spawning habitat in any way and will not create any barrier to pre-spawning sturgeon accessing foraging or overwintering sites or the spawning grounds. Any effects to distribution will be minor and temporary and limited to the temporary capture and handling of individuals.

Here, we consider the effect of the loss of up to one Atlantic sturgeon from the Carolina DPS every ten years. The reproductive potential of the Carolina DPS will not be affected in any way other than through a reduction in numbers of individuals. The loss of up to one individual every ten years 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. However, 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 action, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. As noted above, reproductive potential of Atlantic sturgeon captured and not killed is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior of captured fish 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 action will also not affect the spawning grounds within the rivers where Carolina DPS fish spawn. The action 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 this action on the species. However, because the proposed action will result in the loss of no more than one individual every ten years, it is unlikely that this death will have a detectable effect on the numbers and population trend of the Carolina DPS.

The proposed action is 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 Carolina DPS subadults or adults. Further, the action is 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 area where suspended sediment levels are high.

Based on the information provided above, the death of up to one Carolina DPS Atlantic sturgeon every ten years 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 action 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 death of one Carolina DPS Atlantic sturgeon every ten years will not change the status or trends of the species as a whole; (2) the death of this Carolina DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (3) the loss of this Carolina DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of this Carolina DPS Atlantic sturgeon each decade 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 action 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 action will have no effect on the ability of Carolina DPS Atlantic sturgeon to shelter and only an insignificant effect on any 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 action will not appreciably reduce the likelihood that the Carolina 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 action 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. The Recovery Plan will outline 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 action will affect the population size and/or trend in a way that would affect the likelihood of recovery.

We do not expect the proposed action to modify, curtail, or destroy the range of the species since it will result in an extremely small reduction in the number of Carolina DPS Atlantic sturgeon and since it 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 action will result in an extremely small amount of mortality per year (one individual) and a subsequent small reduction in future reproductive output. For these reasons, we do not expect the action to affect the persistence of the Carolina DPS of Atlantic sturgeon. This action 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 action will not reduce the likelihood of improvement in the status of the Carolina DPS of Atlantic sturgeon. The effects of the proposed action will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed action 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 action 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 action is 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 action 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 action. We have considered the effects of the proposed action 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 action, resulting in the mortality of up to one Carolina DPS Atlantic sturgeon every ten years, is not likely to appreciably reduce the survival and recovery of this species.

8.5.5 South Atlantic DPS

The SA DPS is listed as endangered and consists of Atlantic sturgeon originating from at least six rivers where spawning is still thought to occur. Schueller and Peterson (2006) estimate that there were 343 adults spawning in the Altamaha River, Georgia, in 2004 and 2005. This represents a percentage of the total adult population for the Altamaha River. Males spawn every

1-5 years and females spawn every 2-5 years; thus, the total Altamaha River adult population, assuming a 2:1 ratio of males to females as seen in the Hudson River, could range from 457-1,715. Spawning occurs in at least five other rivers in this DPS. Therefore, the number of Atlantic sturgeon in the Altamaha River population is only a portion of the total DPS. No estimate of the number of Atlantic sturgeon in any of the other spawning rivers or for the DPS as a whole is available.

We have estimated that the proposed action will result in the capture of up to three SA DPS Atlantic sturgeon annually. We anticipate the mortality of up to two individuals every ten years; no post-interaction mortality of any other captured Atlantic sturgeon is anticipated.

With the exception of up to two SA DPS Atlantic sturgeon mortalities in pound net gear every ten years, all sturgeon captured in pound net gear are anticipated to fully recover from capture without any impact on fitness or future reproductive potential. The short duration of most captures and handling will not cause a delay or disruption of any essential behavior including spawning, there will be no reduction in individual fitness or any future reduction in numbers of individuals. Additionally, given the location of the action area, we do not anticipate the capture or handling of any spawning individuals. The proposed action will also not affect their spawning habitat in any way and will not create any barrier to pre-spawning sturgeon accessing foraging or overwintering sites or the spawning grounds. Any effects to distribution will be minor and temporary and limited to the temporary capture and handling of individuals.

Here, we consider the effect of the loss of up to two Atlantic sturgeon from the SA DPS each decade. The reproductive potential of the SA DPS will not be affected in any way other than through a reduction in numbers of individuals. The loss of up to two individuals every ten years 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. However, 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 action, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. As noted above, reproductive potential of Atlantic sturgeon captured and not killed is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior of non-lethally captured fish 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 action will also not affect the spawning grounds within the rivers where SA DPS fish spawn. The action will also not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds used by SA DPS fish.

Because we do not have a population estimate for the SA DPS, it is difficult to evaluate the effect of the mortality caused by this action on the species. However, because the proposed action will result in the loss of no more than two individuals every ten years, it is unlikely that this death will have a detectable effect on the numbers and population trend of the SA DPS.

The proposed action is 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 SA DPS subadults or adults. Further, the action is 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 area where suspended sediment levels are high.

Based on the information provided above, the death of up to two SA DPS Atlantic sturgeon every ten years 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 action 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 death of two SA DPS Atlantic sturgeon every ten years will not change the status or trends of the species as a whole; (2) the loss of these SA DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (3) the loss of these SA DPS Atlantic sturgeon annually 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 action will have only a minor and temporary effect on the distribution of SA DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and, (5) the action will have no effect on the ability of SA DPS Atlantic sturgeon to shelter and only an insignificant effect on any 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 action will not appreciably reduce the likelihood that the SA 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 action will affect the likelihood that the SA DPS can rebuild to a point where listing is no longer appropriate. No Recovery Plan for the SA DPS has been published. The Recovery Plan will outline 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 action will affect the population size and/or trend in a way that would affect the likelihood of recovery.

We do not expect the proposed action to modify, curtail, or destroy the range of the species since it will result in an extremely small reduction in the number of SA DPS Atlantic sturgeon and since it 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 will also be insignificant. The proposed action will result in an extremely small amount of mortality (up to two individuals every ten years) and a subsequent small reduction in future reproductive output. For these reasons, we do not expect the action to affect the persistence of the SA DPS of Atlantic sturgeon. These action 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 action will not reduce the likelihood of improvement in the status of the SA DPS of Atlantic sturgeon. The effects of the proposed action will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed action 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 action 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 action is 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 action 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 action. We have considered the effects of the proposed action 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 action, resulting in the mortality of up to two SA DPS Atlantic sturgeon every ten years, is 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 our jurisdiction, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action may adversely affect but is not likely to jeopardize the continued existence of NWA DPS loggerhead sea turtles, Kemp’s ridley sea turtles, North Atlantic DPS green sea turtles, leatherback sea turtles, or the GOM, NYB, CB, Carolina, and SA DPSs of Atlantic sturgeon.

10.0 INCIDENTAL TAKE STATEMENT

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

The measures described below are non-discretionary, and must be undertaken by NMFS so that they become binding conditions for the exemption in section 7(o)(2) to apply. NMFS has a continuing duty to regulate the activity covered by this ITS. If NMFS (1) fails to assume and implement the terms and conditions or (2) fails to require Virginia pound net fishermen and responders to adhere to the terms and conditions of the ITS through enforceable terms that are added to permits 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. FWS/NMFS Joint Endangered Species Act Section 7 Consultation Handbook (1998) at 4-49).

10.1 Anticipated Amount or Extent of Incidental Take

Even with the implementation of the proposed action, which sets forth gear regulations and protected species conservation measures for the Virginia pound net fishery, the incidental take of sea turtles and Atlantic sturgeon in the fishery may still occur. Incidental takes of these species may take the form of live or lethal takes of individuals in the pounds, hearts, or leaders. While it is difficult to ascertain future take of sea turtles and Atlantic sturgeon in the fishery, we have based the anticipated take levels on previous takes in pound net gear in Virginia waters, the previous level of takes in leaders, and the distribution and estimated number of sea turtles and Atlantic sturgeon in Virginia nearshore and coastal waters, inclusive of Chesapeake Bay.

We anticipate that the following level of incidental take will occur annually in the pound and heart portions of the pound net gear set throughout the action area:

- Up to 805 loggerhead sea turtles (up to 1 lethal),
- Up to 161 Kemp's ridley sea turtles (up to 1 lethal),
- Up to 16 green sea turtles (up to 1 lethal), and
- Up to 11 Atlantic sturgeon (none lethal).

Nearly all of these takes are anticipated to be live animals. Sea turtles may be killed due to interactions with the pounds and hearts, but at a rate of no more than one mortality per sea turtle species per year. No incidental take of leatherback sea turtles in the pounds and hearts is anticipated or exempted.

We anticipate that the following level of incidental take of sea turtles and Atlantic sturgeon will occur in pound net leaders each year:

- Up to 1 loggerhead sea turtle (up to 1 lethal),
- Up to 1 Kemp's ridley sea turtle (up to 1 lethal),
- Up to 1 green sea turtle (up to 1 lethal),
- Up to 8 leatherback sea turtles (up to 4 lethal); and
- Up to 2 Atlantic sturgeon (up to 1 lethal).

All of the hard-shelled sea turtle captures in pound net leaders are assumed to result in mortality, while half of the leatherback and Atlantic sturgeon takes are expected to be lethal.

In summary, based on the information presented in the Opinion, we anticipate that the Virginia pound net fishery and its associated regulations will result in the annual capture of:

- Up to 806 NWA DPS loggerhead sea turtles (up to 2 lethal);
- Up to 162 Kemp's ridley sea turtles (up to 2 lethal);
- Up to 17 North Atlantic DPS green sea turtles (up to 2 lethal);
- Up to 8 leatherback sea turtles (up to 4 lethal);
- Up to 13 Atlantic sturgeon (up to 1 lethal) from a combination of the five listed DPSs as follows[10]:
    - 7 from the NYB DPS (5 lethal every 10 years)
    - 3 from the SA DPS (2 lethal every 10 years)
    - 2 from the CB DPS (1 lethal every 10 years)
    - 1 from either the GOM or Carolina DPS (1 lethal for both DPS every 10 years).

Again, we have determined that this level of anticipated take is not likely to result in jeopardy to any species of sea turtle or any DPS of Atlantic sturgeon.

10.2 Reasonable and Prudent Measures, Terms and Conditions, and Justifications

We believe the following reasonable and prudent measures (RPMs) and associated terms and conditions listed in Table 14 below are necessary and appropriate to minimize and monitor impacts of incidental take resulting from the proposed action. In order to be exempt from prohibitions of section 9 of the ESA, NMFS must comply with all terms and conditions identified below, which implement the RPMs 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)).

[10] It should be noted that monitoring of Atlantic sturgeon takes by DPS will not be required under the Reasonable and Prudent Measures and Terms and Conditions of this opinion, as most pound net fishermen and responders are not trained in genetic sampling techniques. Only those with sufficient training and/or an ESA section 10 permit for sturgeon sampling will be permitted to take fin clip samples of Atlantic sturgeon to determine the DPS origin of the fish. Instead, we will use the best available mixed stock analysis to estimate which DPSs the incidentally taken sturgeon come from and will assume that all reported takes occur under those percentages. In the event new information becomes available on the DPS by DPS distribution of takes, we would consider that in our monitoring scheme as to whether any triggers for reinitiation of consultation have been met.

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 action. Specifically, these RPMs and Terms and Conditions will keep us informed of when and where sea turtle and Atlantic sturgeon interactions with Virginia pound nets are taking place and will require fishermen and/or responders to report any takes in a reasonable amount of time, as well as implement measures to monitor for entrapment or entanglement in specific components of pound net gear. The third column below explains why each of these RPMs and Terms and Conditions are necessary and appropriate to minimize or monitor the level of incidental take associated with the proposed action and how they represent only a minor change to the proposed action.

In order to effectively monitor the effects of the proposed action, it is necessary to monitor the impacts of the action to document the amount of incidental take (i.e., the number of sea turtles and Atlantic sturgeon captured, injured, or killed) and to assess 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 ESA-listed species. We do not anticipate any additional injury or mortality to be caused by handling, assessing, and ultimately releasing sea turtles and Atlantic sturgeon as required in the RPMs listed below. Unless pound net fishermen or responders have received the proper disentanglement training or are under the direct guidance of regional stranding or disentanglement experts, all live animals are to be released back into the water following the required documentation.

We will be sending out a permit holder bulletin to all Virginia pound net licensees soon after this Opinion is signed, so that they are aware of their responsibilities under this Opinion and our protected species regulations. Similar to our previous March 6, 2017, mailing to them, this bulletin will contain updated protective measures and reporting guidelines for both sea turtles and Atlantic sturgeon. We will also be sharing a copy of this Opinion with the VMRC and the Virginia Aquarium Stranding Response Program (VAQS) so that they are also aware of their continuing responsibilities in responding to protected species takes in pound net gear.

Table 14: RPMs, Terms and Conditions, and Justifications

Reasonable and Prudent Measures (RPMs)	**Terms and Conditions (T&Cs)**	**Justifications for RPMs and T&Cs**
1. PROTECTED SPECIES DISENTANGLEMENT TRAINING MATERIALS: NMFS must ensure that Virginia pound net fishermen and responders who intend to disentangle sea turtles from pound net gear receive or possess sea turtle disentanglement training materials to be provided by NMFS, VAQS, or VMRC. Individuals from these three agencies are routinely the ones responding to sea turtle entanglements in Virginia pound net gear.	1. GARFO PRD must ensure that sea turtle disentanglement responders and pound net fishermen intending to disentangle sea turtles on their own receive or possess adequate sea turtle disentanglement training materials. Responders or fishermen with adequate disentanglement training materials are authorized through this Opinion to disentangle sea turtles according to the Northeast Atlantic Coast STDN Disentanglement Guidelines at http://www.greateratlantic.fisheries.noaa.gov/protected/stranding/disentanglements/turtle/stdn.html. Responders or Virginia pound net fishermen should contact the NMFS Greater Atlantic Region Sea Turtle Stranding and Disentanglement Coordinator (Kate Sampson; 978-282-8470) or the GARFO PRD Sea Turtle Program (978-281-9328) for information on required disentanglement protocols and equipment. All disentanglement must be done in accordance with protocols in the Disentanglement placard provided or the procedures described in "Careful Release Protocols for Sea Turtle Release with Minimal Injury" (NOAA Technical Memorandum 580; http://www.sefsc.noaa.gov/turtles/TM_580_SEFSC_CRP_2008.pdf).	RPM #1 and the accompanying Term and Condition establishes the sea turtle disentanglement training materials that responders and Virginia pound net fishermen must receive or possess prior to responding to the incidental take of sea turtles in Virginia pound net fishing gear. These training materials will provide responders and fishermen with adequate experience in the handling, resuscitation, release, and reporting of sea turtles that may be incidentally captured over the course of the proposed action.

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (T&Cs)	Justifications for RPMs and T&Cs
2. HANDLING AND RESUSCITATION: Any sea turtles or Atlantic sturgeon caught and retrieved in Virginia pound net fishing gear covered under this Opinion must be handled and resuscitated (if unresponsive) according to established protocols and whenever environmental conditions are safe for those handling and resuscitating the animal(s) to do so.	2. GARFO PRD must ensure that all Virginia pound net fishermen and disentanglement responders have copies of the sea turtle handling and resuscitation requirements found at 50 CFR 223.206(d)(1) and in Appendix A (and as reproduced in the wheelhouse card in Appendix B) prior to the start of the next fishing season. Virginia pound net fishermen or responders must carry out these handling and resuscitation procedures any time a sea turtle is incidentally captured and brought onboard a vessel during the proposed action. If possible, it is requested that only trained fishermen or responders perform the handling and resuscitation of captured sea turtles. 3. GARFO PRD must ensure that fishermen and responders give priority to the handling and resuscitation of any sea turtles that are captured or entangled in pound net fishing gear, if environmental conditions are safe to do so. Handling times for sea turtles should be minimized (i.e., kept to 15 minutes or less) to limit the amount of stress placed on the animals. 4. For sea turtles encountered in Virginia pound net fishing gear that appear injured, sick, distressed, or dead (including stranded or entangled individuals), fishermen or	RPM #2 and the accompanying Terms and Conditions establish the requirements for handling and resuscitating sea turtles and Atlantic sturgeon captured in Virginia pound net fishing gear in order to avoid the likelihood of injury or mortality to these species from the hauling, handling, and emptying of the gear.

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (T&Cs)	Justifications for RPMs and T&Cs
	responders must immediately contact the Greater Atlantic Region Marine Animal Hotline at 866-755-NOAA (6622) for further instructions and guidance on handling, retention, and/or disposal of the animal. If unable to contact the hotline (e.g., due to distance from shore or lack of ability to communicate via phone), the USCG should be contacted via VHF marine radio on Channel 16. If required, hard-shelled sea turtles (i.e., non-leatherbacks) may be held onboard a vessel for up to 24 hours provided that conditions during holding are approved by GARFO PRD and safe handling practices are followed. If the hotline or an available veterinarian cannot be contacted and the injured animal cannot be taken to a rehabilitation center, fishermen or responders must cease activities that could further stress the animal, allow it to rest and recuperate as conditions dictate, and then return the animal to the sea. 5. GARFO PRD must ensure that fishermen and responders who attempt to handle and resuscitate any entangled Atlantic sturgeon are aware of the NMFS guidelines for doing so, which are included in Appendix C. If an entangled Atlantic sturgeon is determined to be unresponsive or comatose, fishermen or responders should attempt to resuscitate the	

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (T&Cs)	Justifications for RPMs and T&Cs
	fish by placing it in oxygenated water or providing a running source of water over the gills. Resuscitation should be attempted on all nonresponsive fish for at least 30 minutes. If the fish remains nonresponsive after 30 minutes, the fish should be considered dead and the carcass returned to the water.	
3. <u>DATA COLLECTION, SAMPLING, AND TAGGING</u>: Any sea turtles or Atlantic sturgeon caught or retrieved in Virginia pound net fishing gear covered under this Opinion must first be identified to species or species group. Each ESA-listed species caught or retrieved must then be properly documented using appropriate equipment and data collection forms provided by NMFS, VAQS, or VMRC. Finally, biological, external tagging, and gear description data must be collected or estimated for all sea turtles and Atlantic sturgeon caught and retrieved from Virginia	6. GARFO PRD must ensure that fishermen and responders are educated as to the identification of sea turtles and Atlantic sturgeon. Although the NEFOP training manuals found at http://www.nefsc.noaa.gov/fsb/training/ are the best resource for species identification, we have also provided information in Appendix D to assist fishermen and responders. 7. GARFO PRD must ensure that all fishermen and responders take or estimate measurements of and either photograph or video all sea turtles or Atlantic sturgeon incidentally captured in pound net gear. The condition of each animal and any potential injuries must be documented to the best of the individual's ability. These data must be entered into the species specific reporting forms provided in Appendix E (sea turtles) or F (Atlantic sturgeon) for each incidental take.	RPM #3 and the accompanying Terms and Conditions specify the collection of information for any sea turtles or Atlantic sturgeon observed captured in Virginia pound net fishing gear. This is essential for monitoring the impacts of the proposed action and level of incidental take associated with them. Sampling of sea turtle and Atlantic sturgeon tissue is used for genetic sampling. The taking of biopsy samples for sea turtles and fin clips for Atlantic sturgeon allows us to fund or conduct genetic analysis to determine the nesting beach/DPS origin of sea turtles and the DPS origin of Atlantic sturgeon. This allows us to determine if the actual level of take has been exceeded. These procedures do not harm sea turtles or Atlantic sturgeon and are a

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (T&Cs)	Justifications for RPMs and T&Cs
pound net fishing gear. Internal or external tags may be applied to the animals if it is determined that they have not been tagged already and the responder is permitted to do so. Biological samples may also be taken if the responder has a permit to do so.	8. Any invasive sampling (e.g., biopsy samples, fin clips) or tagging (e.g., flipper, PIT) of incidentally captured sea turtles and Atlantic sturgeon can only be performed by individuals possessing a valid ESA section 10 permit authorizing those activities. Fin clip sampling procedures for Atlantic sturgeon must be done in accordance with the protocols in Appendix G.	common practice in fisheries science. Tissue sampling does not appear to impair an animal's ability to swim and is not thought to have any long-term adverse impact. We have received no reports of injury or mortality to any sea turtles or Atlantic sturgeon sampled in this way.
4. RELEASE OR RETENTION: Any live sea turtles or Atlantic sturgeon caught and retrieved in Virginia pound net fishing gear covered under this Opinion must ultimately be released according to guidance provided by our Marine Animal hotline or established protocols and whenever environmental conditions are safe for those releasing the animal(s) to do so. Injured sea turtles may be transferred to an appropriately permitted facility identified by and at the suggestion of the NMFS Marine Animal hotline or	9. All live, uninjured sea turtles and live Atlantic sturgeon that are incidentally captured in Virginia pound net fishing gear must be released from the gear and back into the water as quickly as possible to minimize stress to the animal. All injured sea turtles should be reported to the NMFS Marine Animal hotline or Virginia stranding network partner for further guidance on handling and transport, if necessary, to a rehabilitation facility. 10. In the event of any lethal takes of sea turtles or Atlantic sturgeon, any dead specimens or body parts retained by individuals with appropriate permits should be preserved (frozen is preferred, although refrigerated is permitted as well if a freezer is not available) until retention or disposal procedures are discussed with GARFO PRD. In the event a permitted stranding or salvage	RPM #4 and the accompanying Terms and Conditions establish the requirements for releasing or retaining sea turtles and Atlantic sturgeon captured in Virginia pound net fishing gear in order to provide live animals with the best chance for survival post-capture and to gather additional information on the cause of death of dead animals.

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (T&Cs)	Justifications for RPMs and T&Cs
Virginia stranding network partner. Any <u>dead</u> sea turtles or Atlantic sturgeon must be retained, if logistically feasible and instructed by GARFO PRD to do so, and then transferred to an appropriately permitted research facility either GARFO PRD 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. Sea turtle and Atlantic sturgeon carcasses should be held in cold storage until shipping or transfer.	network recipient is not available or the carcass is severely damaged or decayed to the point at which a necropsy would not be feasible, the animal should be disposed of at sea. It is up to the fisherman or responder to contact the Marine Animal hotline for assistance in determining the state of damage/decay and to see whether a necropsy or salvage of the carcass is needed. The form included as Appendix G (sturgeon salvage form) should be completed and submitted to us for any dead sturgeon captured.	
5. <u>REPORTING</u>: GARFO PRD must be notified of all observed takes of sea turtles and Atlantic sturgeon resulting from Virginia pound net fishing activities covered under this Opinion.	11. NMFS must ensure that GARFO PRD is notified within 24 hours of any interaction with a sea turtle or Atlantic sturgeon. These reports, included in Appendices E and F, must be sent via e-mail to Incidental.take@noaa.gov (preferred), sent by fax to (978) 281-9394, or called in to GARFO PRD. <u>The report must include at a minimum</u>: (1) reporter name and affiliation; (2) GPS coordinates (in decimal degrees or degrees/minutes/seconds) or a geographic	RPM #5 and the accompanying Terms and Conditions specify protocols for the reporting of information to GARFO PRD for any sea turtles and Atlantic sturgeon observed captured in Virginia pound net fishing gear. This is essential for monitoring the level of incidental take associated with the proposed action and ensuring that we can track any exceedance of the ITS.

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (T&Cs)	Justifications for RPMs and T&Cs
	description describing the specific location of the interaction; (3) portion and details of the gear involved (e.g., leader, heart, pound); (4) time and date of the interaction; and (5) identification of the animal to the species level. We also request the following information be provided: (1) a link to or acknowledgement that a clear photograph or video of the animal was taken (multiple photographs are suggested, including at least one photograph of the head scutes); (2) exact or estimated length/width of the animal; (3) ID numbers of external or internal tags either recorded from or applied to the animal; (4) condition of the animal upon retrieval and release/retention (e.g., alive uninjured, alive potentially injured, comatose or unresponsive, fresh dead, decomposed); and (5) a description of any care or handling provided. 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 fisherman or responder is in a position to do so and absolutely no later than 24 hours after the vessel returns to port. 12. NMFS must ensure that the Greater Atlantic Region's Sea Turtle Stranding and Disentanglement coordinator and Atlantic	

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (T&Cs)	Justifications for RPMs and T&Cs
	sturgeon coordinator provide GARFO PRD section 7 staff with tabular summaries of sea turtle and Atlantic sturgeon interactions that were reported to them or documented in the Virginia pound net fishery each year.	

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 use their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. Conservation Recommendations are discretionary activities designed to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The following additional measures are recommended regarding incidental take and conservation of sea turtles and Atlantic sturgeon:

1. NMFS and VMRC should advise Virginia pound net fishermen before the start of each fishing season about: (a) the presence of sea turtles and Atlantic sturgeon in the action area, (b) care to be taken when hauling 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 need to routinely check gear and haul it as quickly as possible in order to determine whether sea turtles or Atlantic sturgeon are present in the gear.
2. NMFS should continue to explore alterations of modified pound net leaders to reduce leatherback sea turtle interactions in the gear.
3. NMFS should expand education and outreach and establish an award program to promote incentives to assist in prevention activities. Outreach focuses on providing information to fishermen and the public about conditions, causes, and solutions to protecting endangered species and continuing commercial fishing. Involvement engages people to solicit their ideas and comments to help direct conservation ideas and participate meaningfully in decision-making processes. Parties that demonstrate innovation and leadership in resource protection should be rewarded and used as models for others.
4. NMFS should continue to support research on the seasonal distribution, abundance, movements, and health of both sea turtles and Atlantic sturgeon in Chesapeake Bay to better understand the ecology of the animals incidentally captured in pound net gear.
5. NMFS should work with the state of Virginia and pound net fishermen to determine the catch species composition in pounds and hearts and the bottom substrate types where pound nets are usually set to better assess the potential motivation for sea turtles and Atlantic sturgeon to enter and/or interact with pound nets.
6. NMFS should continue to support research to better understand the ecological function of Chesapeake Bay and sea turtle and Atlantic sturgeon prey availability over time. This information may provide information on the foraging ecology of these species and the potential for increased foraging in and around pound net gear.
7. Due to a lack of long-term data on the seasonal presence of Atlantic sturgeon in the lower Chesapeake Bay, and their use of it, NMFS should continue to coordinate and collaborate with U.S. FWS on sturgeon research efforts in Virginia waters.

12.0 REINITIATION OF CONSULTATION

This concludes formal consultation on the NMFS gear regulations for the Virginia pound net fishery. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In the event that the amount or extent of incidental take is exceeded section 7 consultation must be reinitiated immediately.

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APPENDIX A

Sea turtle handling 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.

SEA TURTLE HANDLING AND RESUSCITATION REQUIREMENTS

IF YOU ENCOUNTER AN ENTANGLED, INJURED OR UNRESPONSIVE SEA TURTLE, please immediately call the National Marine Fisheries Service Northeast Region Hotline:

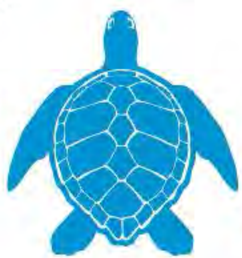
866-755-NOAA (6622)

Any sea turtle taken incidentally during fishing must be handled with care to prevent injury, observed for activity, and returned to the water according to the following procedures:

A A SEA TURTLE THAT IS ACTIVELY MOVING OR IS DEAD (THAT IS, IF MUSCLES ARE STIFF AND/OR THE FLESH HAS BEGUN TO ROT) MUST BE RELEASED OVER THE VESSEL'S STERN ONLY:

- When fishing gear is not in use,
- When the engine is in neutral, and
- In areas where the turtle is unlikely to be recaptured or injured by vessels.

OTHERWISE, YOU MUST CONSIDER THE TURTLE UNRESPONSIVE AND ATTEMPT RESUSCITATION AS DESCRIBED IN B.



You are strongly encouraged to read the full regulation, which can be found at 50 CFR 223.206(d)(1).

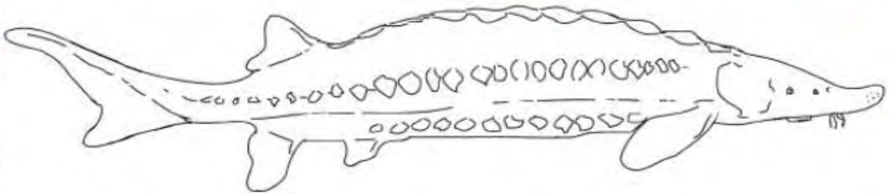
B YOU MUST ATTEMPT RESUSCITATION ON SEA TURTLES THAT ARE UNRESPONSIVE AS FOLLOWS:

1. Place the turtle top shell up* and elevate its hindquarters at least 6" (or 15-30°) for at least 4 hours and up to 24 hours.
   - The amount of elevation depends on the turtle's size; larger turtles require greater elevation.
   - In warm weather (over 60 °F), keep the turtle shaded and moist, preferably by placing a damp towel over the head, shell, and flippers. You must NOT place the turtle into a container of water.
2. Periodically rock the turtle gently side to side by holding the outer edge of the shell and lifting one side about 3", then alternate to the other side.
3. Periodically gently touch the eye and pinch the tail (reflex tests) to see if there is a response.

C IF THE TURTLE REVIVES AND BECOMES ACTIVE DURING RESUSCITATION EFFORTS, you must release it over the vessel's stern as described in A. If the turtle does not respond to the reflex test (as described in B 3) or move within 4 hours (up to 24 hours, if possible), you must return the turtle to the water in the same manner.

Atlantic Sturgeon

ESA Listed Species



Picture Credit: picture by Tom Savoy (top), line drawing by Sarah Walsh Laporte (middle), and illustration by Duane Raver (bottom)

Atlantic Sturgeon are Protected

If you incidentally catch an Atlantic sturgeon which is responsive and lively, return the fish to the water immediately. However:

- **If the fish is nonresponsive, it is important that you try to resuscitate the fish**

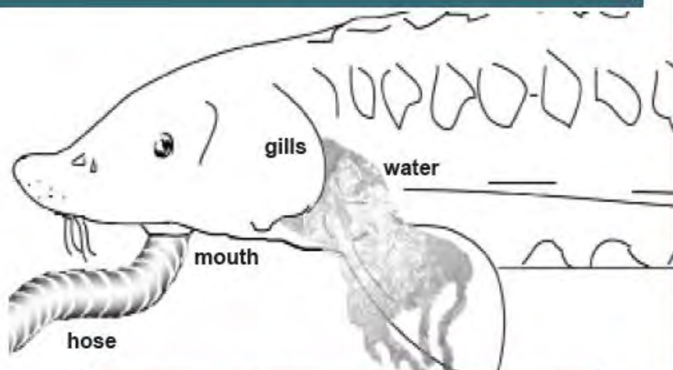
Atlantic sturgeon that have appeared nonresponsive, have been successfully resuscitated after being placed in oxygenated water or set up with a hose of water running out and over the gills for at least 30 minutes.

For a complete description of the prohibitions and exemptions for Atlantic sturgeon, call NOAA's National Marine Fisheries Service Northeast Region Protected Resources Division at 978-281-9328, or visit the Atlantic sturgeon recovery website at http://www.nero.noaa.gov/prot_res/atlsturgeon/.

Atlantic Sturgeon

ESA Listed Species

Atlantic sturgeon removed from fishing gear may be nonresponsive. It is often possible to resuscitate these fish by flushing water, over the gills until recovery is obvious. The most effective way to resuscitate fish is through the mouth, as if the fish were swimming forward.



Hose inserted up through mouth and to the side to allow water to flow over gills.

Picture Credit: Line drawing by Sarah Walsh Laporte

Resuscitation with a Hose

- Use wet hands or wet rag and support the belly when handling.
- Use a pump and hose with water (For example: $1^{1/2}$” engine-driven wash down pump).
- Place the hose into the mouth and to the side, using a soft piece of sponge/cloth to keep the metal/hard plastic from injuring the inside of the fish’s mouth.
- Use enough water pressure to gently flush water over gills. Heavy water pressure can harm the fish.
- Make sure water is running out and over the gills and NOT down the throat into the digestive tract.

Resuscitation should be attempted on all nonresponsive fish for at least **30 minutes**. If the fish remains nonresponsive after 30 minutes, the fish should be considered dead and the carcass returned to the water.

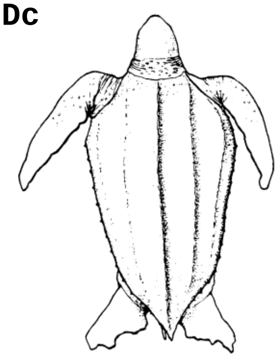
For a complete description of the prohibitions and exemptions for Atlantic sturgeon, call NOAA’s National Marine Fisheries Service Northeast Region Protected Resources Division at 978-281-9328, or visit the Atlantic sturgeon recovery website at http://www.nero.noaa.gov/prot_res/atlsturgeon/.

APPENDIX D

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

SEA TURTLES

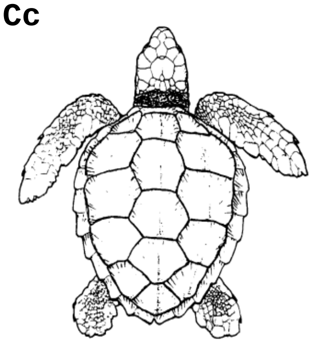
Dc



Leatherback (*Dermocheyls coriacea*)

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

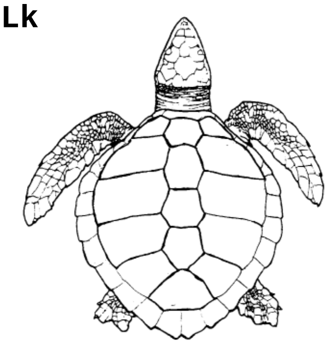
Cc



Loggerhead (*Caretta caretta*)

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

Lk

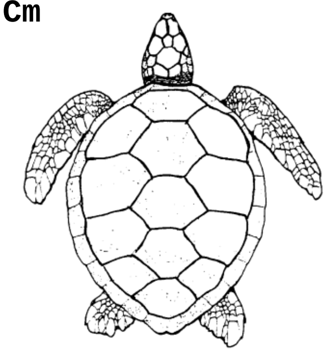


Kemp's ridley (*Lepidochelys kempi*)

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

APPENDIX D, continued

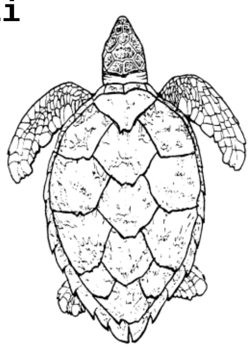
Cm



Green turtle (*Chelonia mydas*)

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

Ei

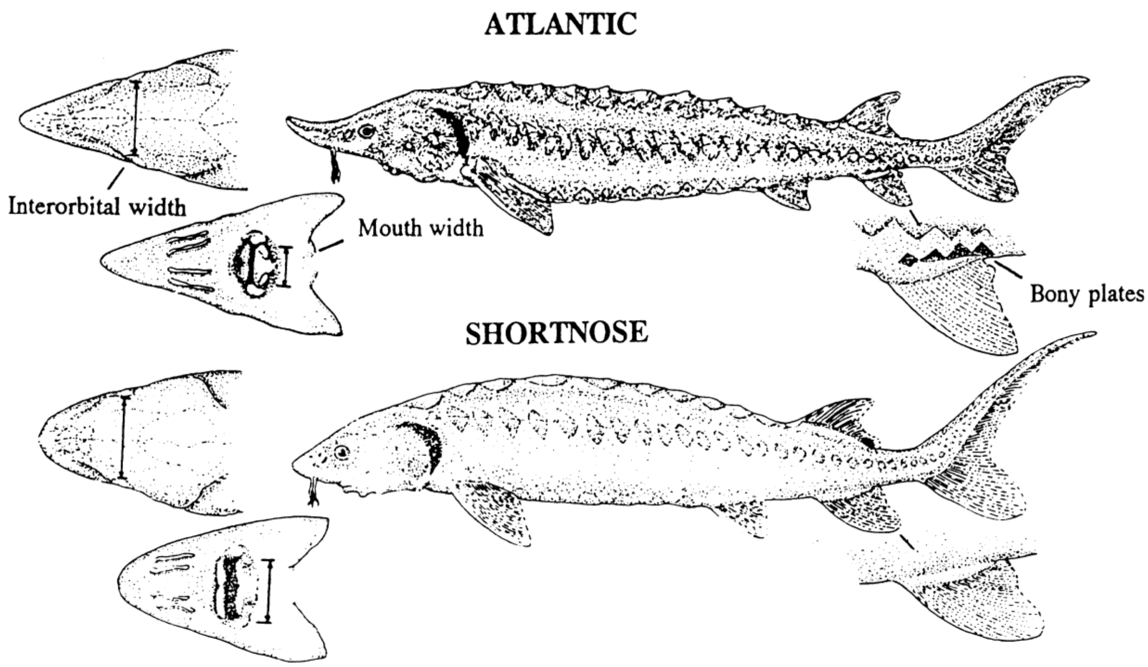


Hawksbill (*Eretmochelys imbricata*)

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

APPENDIX D, continued

SHORTNOSE AND ATLANTIC STURGEON



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 E

SEA TURTLE STRANDING AND SALVAGE NETWORK – STRANDING REPORT

OBSERVER'S NAME / ADDRESS / PHONE:
First ______________ M.I.____ Last ______________
Affiliation ______________
Address ______________
____
Area code/Phone number ______________

STRANDING DATE:
Year 20☐☐ Month ☐☐Day☐☐
Turtle number by day ☐☐

State coordinator must be notified within 24 hrs; this was done by ☐*phone* ☐*email* ☐*fax* ☐*stranding hotline*

SPECIES: (check one)
☐ CC = Loggerhead
☐ CM = Green
☐ DC = Leatherback
☐ EI = Hawksbill
☐ LK = Kemp's Ridley
☐ LO = Olive Ridley
☐ UN = Unidentified
Check Unidentified if not positive. Do Not Guess.

STRANDING LOCATION: ☐Offshore (Atlantic or Gulf beach) ☐Inshore (bay, river, sound, inlet, etc)
State ______________ County ______________
Descriptive location (be specific)______________
____
____
Latitude ______________ Longitude ______________

Carcass necropsied? ☐Yes☐No
Photos taken? ☐Yes ☐No
Species verified by state coordinator? ☐ Yes ☐ No

CONDITION: (check one)
☐ 0 = Alive
☐ 1 = Fresh dead
☐ 2 = Moderately decomposed
☐ 3 = Severely decomposed
☐ 4 = Dried carcass
☐ 5 = Skeleton, bones only

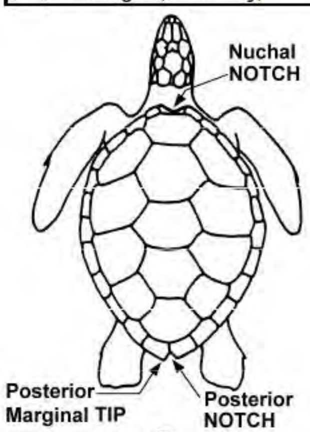
FINAL DISPOSITION: (check)
☐1 = Left on beach where found; painted? ☐Yes* ☐No(5)
☐2 = Buried: ☐ on beach / ☐ off beach; carcass painted before buried? ☐ Yes* ☐ No
☐3 = Salvaged: ☐ all / ☐ part(s), what/why? ________
____
____
☐4 = Pulled up on beach/dune; painted? ☐Yes* ☐No
☐6 = Alive, released
☐7 = Alive, taken to rehab. facility, where? ________
____
☐8 = Left floating, not recovered; painted? ☐Yes* ☐No
☐9 = Disposition unknown, explain ________
____
**If painted, what color?* ________

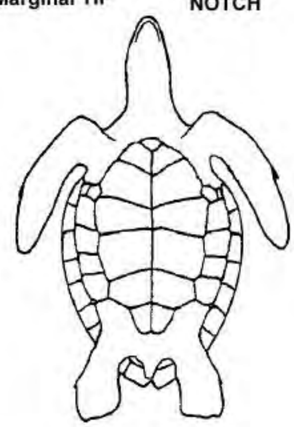
SEX:
☐ Undetermined
☐ Female ☐ Male
Does tail extend beyond carapace?
☐ Yes; how far?______ cm / in
☐ No
How was sex determined?
☐ Necropsy
☐ Tail length (adult only)

TAGS: ***Contact state coordinator before disposing of any tagged animal!!***
Checked for flipper tags? ☐ Yes ☐ No
Check all 4 flippers. If found, record tag number(s) / tag location / return address
____
____
____
PIT tag scan? ☐ Yes ☐ No
If found, record number / tag location
____
____
Coded wire tag scan? ☐ Yes ☐ No
If positive response, record location (flipper)
____
Checked for living tag? ☐Yes ☐ No
If found, record location (scute number & side)
____

CARAPACE MEASUREMENTS: (*see drawing*)

Using calipers		**Circle unit**
Straight length (NOTCH-TIP)	________	cm / in
Minimum length (NOTCH-NOTCH)	________	cm / in
Straight width (Widest Point)	________	cm / in
Using non-metal measuring tape		**Circle unit**
Curved length (NOTCH–TIP)	________	cm / in
Minimum length (NOTCH-NOTCH)	________	cm / in
Curved width (Widest Point)	________	cm / in
		Circle unit
Weight ☐ actual / ☐ est.	________	kg / lb





Mark wounds / abnormalities on diagrams at left and describe below (note tar or oil, gear or debris entanglement, propeller damage, epibiota, papillomas, emaciation, etc.). **Please note if no wounds / abnormalities are found.**
____
____
____
____
____
____

SEA TURTLE ENTANGLEMENT REPORT FORM

OMB Control No. 0648-0496; Exp Date: 08/31/2020

FIELD #: ____________________

Shaded area for NOAA Fisheries Service (NMFS) use only **EVENT CONFIRMATION:** ☐ Confirmed ☐ Probable ☐ Not confirmed

INITIAL OBSERVATION: Observer name: ____________________ Phone: ____________________

Observer affiliation: ____________________

Observation date: ____________________ (mm / dd / yyyy) Time: ____________________ ☐ am ☐ pm

Turtle condition: ☐ Alive ☐ Fresh dead ☐ Moderately decomposed ☐ Severely decomposed ☐ Dried carcass ☐ Skeleton ☐ Unknown

EXAMINATION / RESPONSE: Responder name: ____________________ Phone: ____________________

Responder affiliation: ____________________

Response date: ____________________ (mm / dd / yyyy) Time responder arrived on scene: ____________________ ☐ am ☐ pm

Turtle condition: ☐ Alive ☐ Fresh dead ☐ Moderately decomposed ☐ Severely decomposed ☐ Dried carcass ☐ Skeleton ☐ Unknown

PHOTO DOCUMENTATION: Photos taken: ☐ Yes ☐ No Video taken: ☐ Yes ☐ No

Documentation of: ☐ Turtle in gear ☐ Injuries / entanglement site ☐ Buoy colors, numbers and any other identifiable feature(s)

LOCATION: State: __________ County: ____________________ Nearest port / town: ____________________

Locality details: ____________________ Stranded ashore: ☐ Yes ☐ No

Latitude: ____________________ N Longitude: ____________________ W

TURTLE DATA: Species or description: ____________________

Straight carapace length:** ____________________ ☐ cm ☐ in ☐ actual ☐ est.

Curved carapace length:** ____________________ ☐ cm ☐ in ☐ actual ☐ est.

***Carapace length is measured from nuchal notch to posterior tip (see diagram in instructions)*

Weight: ____________________ ☐ kg ☐ lb ☐ actual ☐ est.

Sex: ☐ Male ☐ Female ☐ Not examined ☐ CBD

Does tail extend beyond carapace? ☐ Yes ☐ No

If Yes, how far? __________ ☐ cm ☐ in ☐ actual ☐ est.

Sex determined by: ☐ Necropsy ☐ Tail length *(adults only)* ☐ N/A

GEAR TYPE: *Indicate the primary (in contact with turtle) entangling gear with a "P" and secondary gear with an "S". Fill out all applicable details.*

____ **Vertical Line with Surface Buoy**

Line attached to bottom gear: ☐ Yes ☐ No If Yes, bottom gear: ☐ Pot(s) ☐ Net ☐ Unknown ☐ Other: ____________________

Length of line between turtle and surface buoy: ____________________ ☐ cm ☐ in ☐ actual ☐ est.

____ **Line Only (no buoy)**

Type: ☐ Monofilament ☐ Multifilament (e.g. nylon or poly rope) ☐ Unknown

Hook(s) present: ☐ Yes ☐ No If Yes, where attached to turtle: ☐ Not attached ☐ Mouth ☐ Ingested (past mouth) ☐ Soft tissue (not mouth)

Line attached to bottom gear : ☐ Yes ☐ No If Yes, bottom gear: ☐ Pot(s) ☐ Net ☐ Unknown ☐ Other: ____________________

____ **Net**

Type: ☐ Monofilament ☐ Multifilament (e.g. nylon) ☐ Unknown

____ **Fish Trap (pound net / weir)**

Location: ☐ Free-swimming in trap ☐ Entangled in leader ☐ Entangled in trap ☐ Other *(describe in Additional Remarks)*

____ **Other** Describe: ____________________

GEAR DETAILS:

Net Estimated stretched mesh size: ____________________ ☐ cm ☐ in ID number(s): ____________________

Pot(s) Number of pots: __________ ID Number(s): ____________________

Buoy(s) Number of buoys: __________

	Buoy 1	Buoy 2	Buoy 3
Type			
Color/Pattern			
ID Number(s) / Letter(s)			

Line(s)

Number of lines: __________ Color 1: ____________________ Color 2: ____________________ Color 3: ____________________

Biofouling present on gear: ☐ Yes ☐ No If Yes, % of visible gear covered by biofouling: __________ % *(describe type of biofouling in Additional Remarks)*

Gear retrieved: ☐ Yes- all ☐ Yes- partially ☐ No If Yes, disposition: ☐ Initial observer ☐ STDN member ☐ State agency ☐ NMFS Gear Team

DISENTANGLEMENT OUTCOME: (*Check one*)

☐ Disentangled and released
☐ Partially disentangled and released
☐ Collected for treatment at: ____________________
☐ Entangled / no action taken
☐ Entangled / not relocated
☐ Lost during disentanglement
☐ Relocated to: ____________________
☐ Euthanized
☐ Other: ____________________

CARCASS / SAMPLE DISPOSITION: (*Check all that apply*)

☐ Left at site
☐ Towed ashore
☐ Buried ☐ Off beach ☐ On beach
☐ Necropsied
☐ Scientific collection
☐ Educational collection
☐ Biopsied
☐ Other: ____________________
☐ Unknown

TAG / MARK DATA: Checked for flipper tags: ☐ Yes ☐ No Scanned for PIT tags: ☐ Yes ☐ No

Tag / mark type	Numbers	Location on animal	Applied	Present
____________	____________	____________	☐	☐
____________	____________	____________	☐	☐
____________	____________	____________	☐	☐

ENTANGLEMENT / WOUND DESCRIPTION: *Use table below to describe the entanglement configuration and any wounds associated with the entanglement site. Check all that apply. Note the specific location, # wraps, partial or complete circumference, tight vs. loose, etc).*

Body area involved	Movement impaired	Indentation	Skin abraded	Muscle exposed	Bone exposed	Swelling	Discoloration	Tissue necrotic/ sloughing
☐ Head / neck	☐ Description:	☐	☐	☐	☐	☐	☐	☐
☐ Front flippers	☐ Description:	☐	☐	☐	☐	☐	☐	☐
☐ Carapace / plastron	☐ Description:	☐	☐	☐	☐	☐	☐	☐
☐ Rear flippers	☐ Description:	☐	☐	☐	☐	☐	☐	☐

BEHAVIORAL OBSERVATIONS

Response to Approach and Handling: *Check one.*

☐ Vigorous movement ☐ Movement slow, sluggish, or weak ☐ Unconscious / Unresponsive ☐ Could not evaluate

Response Upon Release: *Check one from each row below.*

☐ Vigorous movement ☐ Movement slow, sluggish, or weak ☐ Movements abnormal (e.g. uncoordinated, circling, listing) ☐ Could not evaluate

☐ Dives and/or swims away within 1 minute ☐ Remains at surface and/or does not swim deliberately away within 1 minute

Describe Behavior:

EVENT SUMMARY AND ADDITIONAL REMARKS:

____
____
____
____
____
____
____
____
____
____
____
____

DISCLAIMER

These data should not be used out of context or without verification. This should be strictly enforced when reporting signs of human interaction.

The collection of information on sea turtle entanglement is necessary to ensure sea turtles are being conserved and protected, as mandated by the Endangered Species Act of 1973, as amended. Your voluntary collection and submission of this information will help achieve this objective. The public reporting burden for this collection of information is estimated to average one hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless that collection of information displays a currently valid OMB Control Number. Personal identifiers and any commercial information will be kept confidential to the extent permitted under the Freedom of Information Act (FOIA) (5 U.S.C. 552), the Department of Commerce FOIA regulations (15 CFR Part 4, Subpart A), the Trade Secrets Act (18 U.S.C. 1905), and NOAA Administrative Order 216-100. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to (NMFS, Greater Atlantic Regional Fisheries Office Protected Resources Division, 55 Great Republic Drive, Gloucester, MA 01930).

Northeast Region Sea Turtle Disentanglement Network
Instructions for Completing the Sea Turtle Entanglement Report Form

<u>FIELD #</u>: Indicate the field number given to the animal / event by the response organization. This number should be a unique identifier. It is possible for more than one agency to respond to an individual animal, in which case a single event may have more than one field number.

Shaded area is for NOAA Fisheries Service (NMFS) use only
<u>EVENT CONFIRMATION</u>: NMFS will determine if an event was confirmed, probable, or not confirmed and describe how that decision was made. *Please leave this section blank.*

<u>INITIAL OBSERVATION</u>: The initial observation is the first time the entangled turtle was sighted. The observer is the individual who encountered the entangled turtle first-hand and reported it to the Sea Turtle Disentanglement Network (STDN) or NMFS either directly or through another individual or agency.

- **Observer name and phone number**: Record the full name and contact phone number for the initial observer. If the report was relayed to the STDN by an intermediate source, do not put the intermediate source as the initial observer.
- **Observer affiliation**: Record the affiliation, if applicable, for the initial observer. If no affiliation, please indicate a general description of the initial observer (e.g., recreational boater, commercial fisherman, etc.).
- **Observation date and time**: Record the full date and time of the initial observation, i.e., the time the animal was actually sighted. This is *not* the date and time of the report, i.e., when the initial observer contacted the STDN or NMFS.
- **Turtle condition**: Check the box for the condition code that best describes the turtle during the initial observation. If the turtle was dead and seemed intermediate between two codes, choose the most appropriate option. Fresh dead turtles should have no foul smell; moderately decomposed turtles have a foul smell, but skin and scutes are intact or only beginning to peel, internal organs are still distinguishable; severely decomposed turtles have scutes lifting or gone and skin beginning to peel or liquefy, with hard to distinguish internal organs; dried carcasses are leathery, with internal organs completely decomposed. If uncertain about the condition check unknown and provide a description of the turtle's condition in Event Summary and Additional Remarks (herein Additional Remarks) on back.

<u>EXAMINATION / RESPONSE</u>: The responder is the person who examined, handled, disentangled and/or collected data on the turtle in the field or attempted to do so.

- **Responder name and phone number**: Record the full name and contact phone number for the responder. The responder may be the initial observer if the initial observer also disentangled the turtle, either on their own or with direction from the STDN.
- **Responder affiliation**: Record the affiliation of the responder.
- **Response date and time responder arrived on scene**: Please record the full date and time when the response team arrived on scene, i.e., the disentanglement or examination was initiated.
- **Turtle condition**: Check the box for the condition code that best describes the turtle when the response team arrived on scene. See Turtle Condition above for more details.

<u>PHOTO DOCUMENTATION</u>:

- **Photos taken**: Please indicate if photos were taken. All photos and video should be sent to NMFS at the same time as submission of the STERF.
- **Video taken**: Please indicate if video was taken. Documentation of turtle behavior through video is invaluable in post interaction mortality determination.
- **Documentation**: The following list indicates the photos that should be taken during each entanglement event. Please check the appropriate boxes to indicate that these photos were taken.
    - The sea turtle in the entangling gear, showing overall gear configuration and confirming species;
    - Close-ups of the entanglement site(s), showing any injuries and detailed gear configuration; and
    - Any identifiable features of the gear, e.g., buoy color, tags and/or numbers.

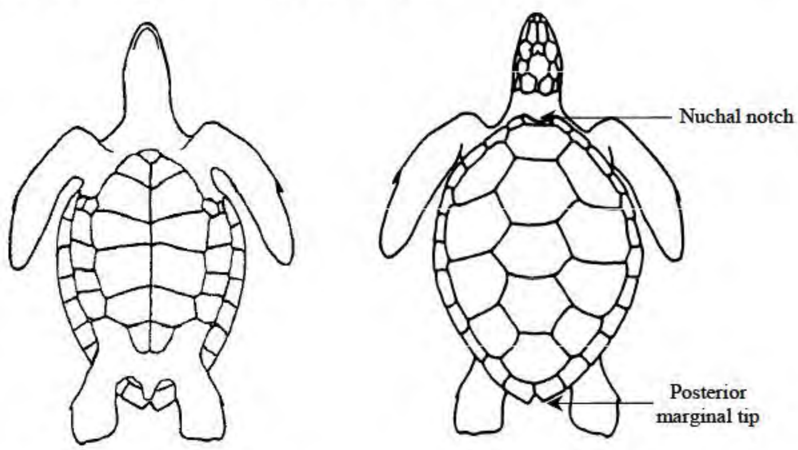
<u>LOCATION</u>: Fill in all fields in this section.

- **State**: Provide the two letter abbreviation for the state where the entanglement occurred. If the entanglement occurred in the EEZ, outside the three-mile boundary of state waters, indicate the closest state to the entanglement location.
- **County**: Indicate the county where the entanglement occurred. If the entanglement occurred in the EEZ, indicate EEZ waters.

- **Nearest port / town**: Indicate the nearest port or town.
- **Locality details**: Include a general description of the event location, including proximity to land. Please only reference places that can be readily found on maps; do not use "local" names.
- **Stranded ashore**: Please check "yes" if the animal stranded on land naturally. Please check "no" if the animal was in the water and was not brought to shore *or* if the animal was collected from the water and brought to a rehab or necropsy facility. If this was the case, make sure you indicate that the animal was collected for treatment or necropsy under Disentanglement Outcome or Carcass Disposition.
- **Latitude and longitude**: Make every effort to collect the GPS location for all entanglement events. Provide latitude / longitude in decimal degrees (e.g., 42.5321ºN). If you are given Loran units by the initial observer, please convert it to latitude / longitude, but also provide the original Loran numbers.

TURTLE DATA:

- **Species or description**: Record the turtle species only if *definitively* identified by a trained responder or photo documentation. If species is unknown or not confirmed by one of the two above methods, please provide a description of the turtle (including features such as coloration and number of vertebral and/or costal scutes). Every effort should be made to take photos of the turtle for species verification. Photos of the carapace and head are most useful. If you are unsure about the species ID, take several photos from different angles. Do not guess. Please contact NMFS if you need sea turtle identification materials.
- **Straight carapace length**: Straight carapace length is measured using calipers from the nuchal notch to the posterior marginal tip (see drawing below). Indicate whether measurement is in inches or centimeters and whether it is actual or estimated. Please indicate that length is an estimate if the reporting party provides a total length rather than a carapace length.



- **Curved carapace length**: Curved carapace length is measured using a soft tape measure from the nuchal notch to the posterior tip, following the curvature of the dorsal centerline.
- **Weight**: Indicate the turtle's weight, as well as whether weight is in kilograms or pounds and whether it is actual or estimated. Please leave blank if unsure.
- **Sex**: Check whether the turtle was male or female; check unknown if you are unsure. Immature sea turtles cannot be sexed externally, so please check unknown if dealing with a live immature turtle. Adult male turtles have a tail that extends well beyond the posterior tip of the carapace. Check whether the tail extends beyond the carapace. If you document a turtle with a long tail, please measure the length of the tail beyond the carapace and record the measurement. Please be aware that juvenile males may not show this characteristic; therefore, if unsure about the age class of the animal, do not use tail length for sex determination. Indicate how sex was determined; if sex was marked unknown, check N/A in this field.

GEAR TYPE: Please indicate the primary entangling gear by putting a "P" in the space next to the appropriate gear type. Primary entangling gear is that which was *in direct contact with* the turtle. There can be more than one set and/or type of primary gear. Please indicate any secondary gear by putting an "S" in the space next to the appropriate gear type. Secondary gear is any gear that was present, but *not* in direct contact with the turtle. For example, if a turtle was entangled in vertical line, which itself was tangled with monofilament, you would put a "P" next to Vertical Line with Surface Buoy and an "S" next to Line Only and check Monofilament.

- **Vertical Line with Surface Buoy**: Indicate this gear type if the entangling gear included line and a surface buoy. Check whether or not the buoy and line were attached to gear on the bottom, meaning that the line was attached to something heavy below the surface. If yes, indicate whether it was weighted by a pot, net, other item (please describe), or it is unknown. Indicate the length of line between the turtle (i.e., the entanglement site) and the surface buoy, as well as whether this length is in centimeters or inches and whether it is actual or estimated.

- **Line Only (no buoy)**: Indicate this option if the entangling gear was only an expanse of line with no buoys attached. Check whether the line was monofilament, multifilament (such as nylon or polypropylene rope), or unknown. Check whether there was a hook(s) associated with the entangling line and, if so, if and where it was attached to the turtle. As above, check whether or not the buoy and line were attached to gear on the bottom, meaning that the line was attached to something heavy below the surface. If yes, indicate whether it was weighted by a pot, net, other item (please describe), or it is unknown.
- **Net**: Indicate this option if the entangling gear was netting or mesh. Check whether the net was monofilament (e.g., gillnet) or multifilament (e.g., nylon or poly mesh as in a trawl net). *NOTE: If turtle was entangled in the vertical line of a gill net, you should check Vertical Line with Surface Buoy and then indicate that the gear was weighted with a net.*
- **Fish Trap (pound net / weir)**: Indicate this gear type if the turtle was caught in any part of a fish trap. Check whether the turtle was free-swimming in the trap, entangled in the trap leader, entangled in the trap, or other. If other, please describe nature of the interaction in Additional Remarks.
- **Other**: Indicate this option if the entangling gear did not fit into any of the above categories. Describe the gear as much as possible; continue in Additional Remarks, if necessary.

GEAR DETAILS: Record any of the applicable gear details.

- **Net**
  - Estimated stretched mesh size: Record the length between opposite corners / knots of the mesh when pulled taut, as well as whether this measurement is in centimeters or inches.
  - ID number(s): Document any net numbers that were present.
- **Pot(s)**
  - Number: Provide the number of pots involved with the entanglement, with as specific information as possible. If there was a pot trawl, but the exact number of pots is unknown, write ">1" or "trawl".
  - ID Number(s): Document any pot numbers that were present.
- **Buoy(s)**
  - Number: Record the number of buoys associated with the entanglement.
  - Space is available to provide addition buoy information for up to three buoys. Provide any further information in Additional Remarks.
    - Type: Please specify the buoy shape: Bullet, Acorn, Round, Polyball, Other. Also note whether it is a single or double buoy (Double Bullet, Double Acorn, or Bullet/Acorn) and whether there is a stick, flag, and/or radar reflector present on the buoy(s).
    - Color/Pattern: Please provide an overall description of the buoy coloration / pattern, in particular noting the color on the bottom (side attached to the vertical line) of the buoy.
    - ID Number(s) / Letter(s): Please record the ID number(s) / letter(s) on the buoy.
- **Line(s)**
  - Number: Provide the number of different lines involved in the entanglement.
  - Space is available to provide the line color for up to three lines. Provide any further information in Additional Remarks.
- **Biofouling present on gear**: Check whether there was biofouling (e.g., sponges, tunicates, bivalves, algae, etc.) visible on the entangling gear. If so, estimate the percentage of the visible gear that was covered by biofouling. Please describe the type of biofouling present in Additional Remarks.
- **Gear retrieved**: Check if all, some, or none of the gear was collected. If gear was collected, indicate its disposition, i.e., where the gear is located at the time this form is submitted to NMFS. If the location of the gear changes after the form is submitted, please contact NMFS with the updated gear location or update this information on the STERF and resubmit.
  - Gear collected from endangered or threatened sea turtles requires a Chain of Custody form.
  - Every effort should be made to send gear to NMFS *immediately* with the chain-of-custody form (address below).

Unless otherwise authorized, gear should only be collected if it is not actively fishing (i.e., only collect derelict, incomplete or displaced gear). Do not create derelict gear by collecting surface buoys, thereby leaving bottom gear unmarked.

DISENTANGLEMENT OUTCOME: This section pertains to LIVE animals only; if the event involved a dead sea turtle, leave this section blank and go to Carcass Disposition. Please check ONE of the listed options to describe the disposition of the live animal at the time of this report being submitted to NMFS. If the turtle was disentangled by the reporting party and it is not clear whether it was completely freed of gear, check unknown and describe in Additional Remarks. If the turtle was collected for treatment, please provide the name of the rehabilitation facility. If the turtle was relocated, please provide the latitude and longitude and/or locality details of the release site.

CARCASS DISPOSITION: This section pertains to DEAD animals only; if the event involves a live sea turtle, leave this section blank and go to Disentanglement Outcome. Please choose one *or more* of the listed options to describe the disposition of the carcass and/or samples at the time of this report being submitted to NMFS. In the marine environment, biopsy samples are only authorized to be collected from dead turtles.

TAG / MARK DATA: Space is provided for three tags / marks; if necessary continue in Additional Remarks.

- **Checked for flipper tags**: Please indicate whether or not all four flippers of the turtle were examined for the presence of flipper tags.
- **Scanned for PIT tags**: Please indicate whether or not the turtle was scanned, using a PIT tag scanner, for the presence of PIT tags.
- **Tag / mark type**: In this column, please indicate the type of any tags or marks that were either applied during response or discovered upon examination. Examples include, but are not limited to, inconel tag, PIT tag, paint mark, living tag, or satellite tag.
- **Numbers**: In this column, please indicate any numbers associated with tags or marks that were either applied during response or discovered upon examination.
- **Location on animal**: Use this column to indicate the location on the animal of tags or marks that were either applied during response or discovered upon examination.
- **Applied or Present**: Check whether the tag or mark referred to in that row was applied during response or present at the time of examination.

.

ENTANGLEMENT / WOUND DESCRIPTION:
Use the table to describe the entanglement configuration and any wounds associated with the entanglement site.

- **Body area involved**: In this column, please check the box(es) corresponding to the areas of the body directly involved with the entanglement.
- For each body area, there are eight boxes (see below) that may be checked to describe the nature of injury at the entanglement site. In addition, there is space for a description of the entanglement configuration and wounds. Use this space to describe the exact location of wraps in that body area, the number of wraps, whether they were complete or partial circumference, whether they were tight (i.e., no space between tissue and gear) or loose (some space between tissue and gear), and any other details that describe the entanglement. Continue in Additional Remarks if necessary.
    - **Movement impaired**: movement in this body area is abnormal.
    - **Indentation**: a depression in the tissue at the entanglement site; skin was not missing or broken.
    - **Skin abraded**: wearing away / erosion of the upper layer of skin at the entanglement site as a result of friction from the gear; an abrasion involves only the skin and not the underlying tissue.
    - **Muscle exposed**: muscle is visible at the entanglement site.
    - **Bone exposed**: bone is visible at the entanglement site.
    - **Swelling**: tissue swollen at the entanglement site.
    - **Discoloration**: skin is discolored pale, white, brown, red, green, or anything beyond normal limits.
    - **Tissue necrotic / sloughing**: tissue necrotic, i.e. skin and underlying tissue discolored (pale, white, brown, red, or green) and easily falling apart or splitting.

BEHAVIORAL OBSERVATIONS

- **Response to Approach and Handling**: Choose one of the four options to best describe the turtle's behavior during approach and disentanglement. If behavior is unknown, please check Could not evaluate.
- **Response Upon Release**:
    - Choose one of the four options in the first row to best describe the turtle's behavior once the gear was removed. If behavior is unknown, please check Could not evaluate.
    - Choose one of the two options in the second row to best describe how soon the turtle swam away after disentanglement.
- **Describe Behavior**: Use this space to elaborate on behavior during disentanglement or upon release. Use the Additional Remarks section if need be.

EVENT SUMMARY AND ADDITIONAL REMARKS: *Do not leave this section blank*! Please provide a summary of the disentanglement event, including progression of events, overall behavior of the animal and amount of time spent on scene. Detail any other unusual circumstances, entanglement configuration, behavior, gear description, tag information or wounds not yet accounted for. Include any other information or remarks on the case.

<u>NMFS CONTACT INFORMATION:</u>

Electronic submission of photos, video and STERFs (preferred means of submission):

Kate.Sampson@noaa.gov

Mailing address:

NOAA Fisheries Service, Greater Atlantic Regional Fisheries Office, Protected Resources Division
55 Great Republic Drive, Gloucester, MA 01930
Fax: 978-281-9394
Photos, video, STERFs, and/or biopsy samples: Attn: Kate Sampson, Sea Turtle Disentanglement Coordinator
Gear with chain of custody forms: Attn: David Morin, Atlantic Entanglement Response Program

Please address any questions to:

Ph: 978-282-8470, Kate.Sampson@noaa.gov

OMB Control No: 0648-0496; Exp Date: 08/31/2020

APPENDIX F

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 ____/_____/20____

APPENDIX G

Procedure for obtaining fin clips from sturgeon for genetic analysis

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. Place fin clips in small screw top vials (2 mL screw top plastic vials are preferred) with preservative. Avoid using glass vials.
4. Label each vial with fish's unique ID number that matches the ID number you record on the metadata sheet. This is critical for accurate tracking and record keeping.
5. RNAlater™ is the preferred preservative and is not hazardous. Ninety-five percent absolute ETOH (un-denatured) is an accepted alternative. Note that ETOH is a Class 3 Hazardous Material due to its flammable nature.
6. If non-screw top vials are used, seal individual vials with leak proof positive measure (e.g., tape).
7. Package vials together (e.g., in one box) with an absorbent material within a double-sealed container (e.g., zip lock baggie).
8. If using excepted quantities of ETOH, follow DOT and IATA packaging regulations, including affixing ETOH warning label to air package. Accepted quantities of ETOH is 30 mL per inner package and 1 L for the total package.
9. A sub-sample of the fin clip must be sent to the sturgeon genetics archive at the USGS facility in Leetown, WV.
   a. Submit sample metadata to rjohnson1@usgs.gov with a cc to incidental.take@noaa.gov. Electronic metadata must be provided in order to properly identify and archive samples. A copy of the electronic metadata was emailed to the Federal agency point of contact for this Opinion and a list of the metadata fields is included below. Retain a copy of metadata sheets for your records.
   b. Mail samples to:

      Robin Johnson
      U.S. Geological Survey
      Leetown Science Center
      Aquatic Ecology Branch
      11649 Leetown Road
      Kearneysville, WV 25430
10. Send a subsample and associated metadata to the NMFS-approved lab for processing to determine DPS or river of origin per the agreement you have with that facility.

Metadata to be recorded for each genetic sample submitted to USGS and other NMFS-approved lab:

- Collection Date
- Species (ATS/SNS)
- Collector
- Collector Email
- Collector Phone Number
- Permit/Biological Opinion Number
- Permit Holder, Responsible Party (RP), or Principal Investigator (PI)
- Holder, RP, or PI Email
- Holder, RP, or PI Phone Number
- Unique Fish ID
- PIT Tag Number
- Location Collected
- Latitude
- Longitude
- Fork Length (mm)
- Total Length (mm)
- Weight (g)
- Sex
- Preservative
- Tag Info Available (Y/N)
- Tag Info
- Mortality (Y/N)
- Mortality Type
- Release of Information to Interested Party
- Recapture (Y/N)
- Comments

APPENDIX H

STURGEON DATA COLLECTION FORM

For use in documenting dead sturgeon in the wild under ESA permit no. 17273 (version 7-24-2015)

INVESTIGATORS'S CONTACT INFORMATION
Name: First ________________ Last ________________________
Agency Affiliation ________________ Email________________________
Address ____
____
Area code/Phone number ______________________________

UNIQUE IDENTIFIER (Assigned by NMFS)

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

SPECIES: (check one)
☐ shortnose sturgeon
☐ Atlantic sturgeon
☐ Unidentified *Acipenser* species
Check "Unidentified" if uncertain .
See reverse side of this form for aid in identification.

LOCATION FOUND: ☐Offshore (Atlantic or Gulf beach) ☐Inshore (bay, river, sound, inlet, etc)
River/Body of Water________________ City________________________ State ____
Descriptive location (be specific)________________________________
____
____
Latitude _____________ N (Dec. Degrees) Longitude _____________ W (Dec. Degrees)

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

SEX:
☐ Undetermined
☐ Female ☐ Male
How was sex determined?
☐ Necropsy
☐ Eggs/milt present when pressed
☐ Borescope

MEASUREMENTS: Circle unit
Fork length ________ cm / in
Total length ________ cm / in
Length ☐ actual ☐ estimate
Mouth width (inside lips, see reverse side) ________ cm / in
Interorbital width (see reverse side) ________ cm / in
Weight ☐ actual ☐ estimate ________ kg / lb

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

Tag #	Tag Type	Location of tag on carcass

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

Carcass Necropsied?
☐Yes ☐No
Date Necropsied:____________
Necropsy Lead:
____

PHOTODOCUMENTATION:
Photos/video taken? ☐ Yes ☐ No
Disposition of Photo/Video:__________
____
____

SAMPLES COLLECTED? ☐ Yes ☐ No

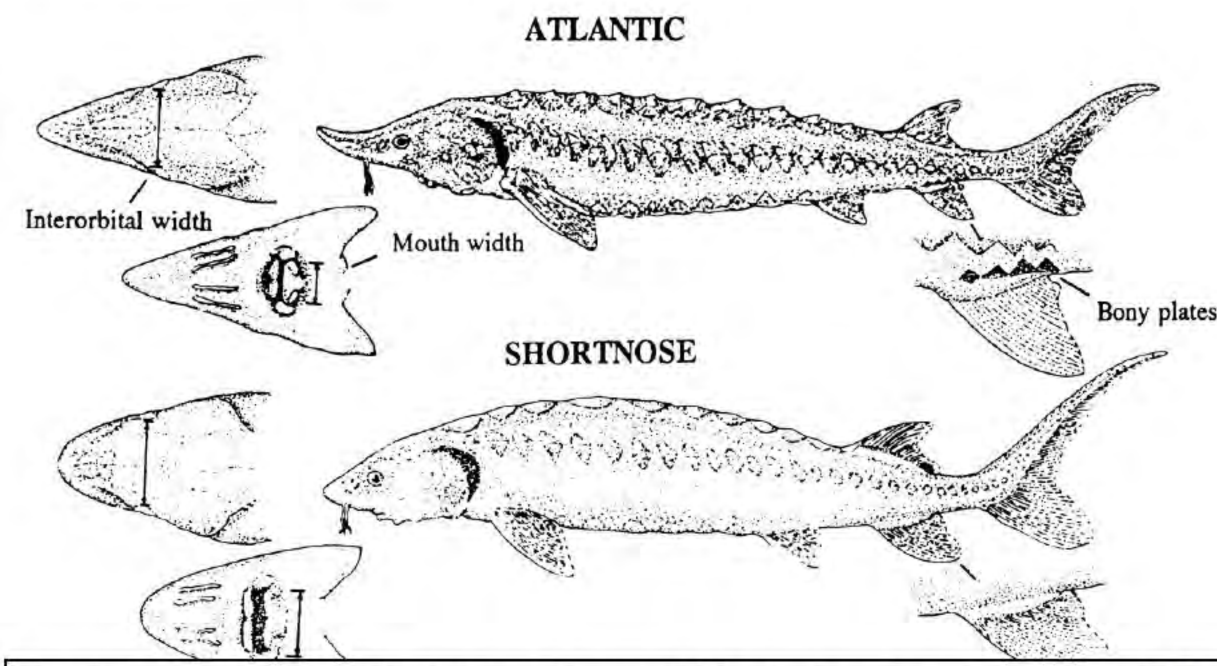
Sample	How preserved	Disposition (person, affiliation, use)

Comments:
____
____
____

Distinguishing Characteristics of Atlantic and Shortnose Sturgeon (version 7-24-2015)

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



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

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

Submit completed forms (within 30 days of date of investigation) to: **Greater Atlantic Regional Fisheries Office Contacts** – Edith Carson (Edith.Carson@noaa.gov , 978-282-8490) or Lynn Lankshear (Lynn.Lankshear@noaa.gov, 978-282-8473); **Southeast Region Contact-** Stephania Bolden (Stephania.Bolden@noaa.gov, 727-551-5768).