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Endangered and Threatened Wildlife and Plants; Final Listing Determinations for Two Distinct Population Segments of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Southeast; Final Rule

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 224

[Docket No. 090219208–1762–02]

RIN 0648–XN50

Endangered and Threatened Wildlife and Plants; Final Listing Determinations for Two Distinct Population Segments of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Southeast

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Final rule.

SUMMARY: We, NMFS, issue a final determination to list the Carolina and South Atlantic distinct population segments (DPSs) of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) as endangered under the Endangered Species Act (ESA) of 1973, as amended. We have reviewed the status of the species and conservation efforts being made to protect the species, considered public and peer review comments, and we have made our determination that the Carolina and South Atlantic DPSs are in danger of extinction throughout their ranges, and should be listed as endangered, based on the best available scientific and commercial data.

DATES: This final rule is effective April 6, 2012.

ADDRESSES: Assistant Regional Administrator for Protected Resources, NMFS, Southeast Regional Office, 263 13th Avenue South, St. Petersburg, FL 33701–5505.

FOR FURTHER INFORMATION CONTACT: Kelly Shotts, NMFS, Southeast Regional Office (727) 824–5312 or Lisa Manning, NMFS, Office of Protected Resources (301) 427–8466.

SUPPLEMENTARY INFORMATION:

Background

We first identified Atlantic sturgeon as a candidate species in 1991. On June 2, 1997, NMFS and U.S. Fish and Wildlife Service (USFWS; collectively, the Services) received a petition from the Biodiversity Legal Foundation requesting that we list Atlantic sturgeon in the United States, where it continues to exist, as threatened or endangered and designate critical habitat within a reasonable period of time following the listing. A notice was published in the **Federal Register** on October 17, 1997, stating that the Services had determined substantial information existed indicating the petitioned action may be warranted (62 FR 54018). In 1998, after completing a comprehensive status review, the Services published a 12-month determination in the **Federal Register** announcing that listing was not warranted at that time (63 FR 50187; September 21, 1998). We retained Atlantic sturgeon on the candidate species list (and subsequently transferred it to the Species of Concern List (69 FR 19975; April 15, 2004)). Concurrently, the Atlantic States Marine Fisheries Commission (ASMFC) completed Amendment 1 to the 1990 Atlantic Sturgeon Fishery Management Plan (FMP) that imposed a 20- to 40-year moratorium on all Atlantic sturgeon fisheries until the Atlantic Coast spawning stocks could be restored to a level where 20 subsequent year classes of adult females were protected (ASMFC, 1998). In 1999, pursuant to section 804(b) of the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA) (16 U.S.C. 5101 *et seq.*), we followed this action by closing the Exclusive Economic Zone (EEZ) to Atlantic sturgeon retention. In 2003, we sponsored a workshop in Raleigh, North Carolina, with USFWS and ASMFC entitled, ''The Status and Management of Atlantic Sturgeon,'' to discuss the status of sturgeon along the Atlantic Coast and determine what obstacles, if any, were impeding their recovery. The workshop revealed mixed results in regards to the status of Atlantic sturgeon riverine populations, despite the coastwide fishing moratorium. Some populations seemed to be recovering while others were declining. Bycatch and habitat degradation were noted as possible causes for continued population declines.

Based on the information gathered from the 2003 workshop on Atlantic sturgeon, we decided that a new review of Atlantic sturgeon status was needed to determine if listing as threatened or endangered under the ESA was warranted. The Atlantic sturgeon status review team (ASSRT), consisting of four NMFS, four USFWS, and three U.S. Geological Survey (USGS) biologists prepared a draft status review report. The draft report was then reviewed and supplemented by eight state and regional experts who provided their individual expert opinions on the scientific facts contained in the report and provided additional information to ensure the report provided the best available data. Lastly, the report was peer reviewed by six experts from academia. A Notice of Availability of the final status review report was published in the **Federal Register** on April 3, 2007 (72 FR 15865). On October 6, 2009, we received a petition from the Natural Resources Defense Council to list Atlantic sturgeon as endangered under the ESA. As an alternative, the petitioner requested that the species be delineated and listed as the five DPSs described in the 2007 Atlantic sturgeon status review report (ASSRT, 2007): Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs, with the Gulf of Maine and South Atlantic DPSs listed as threatened, and the remaining three DPSs listed as endangered. The petitioner also requested that critical habitat be designated for Atlantic sturgeon under the ESA. We published a Notice of 90-Day Finding on January 6, 2010 (75 FR 838), stating that the petition presented substantial scientific or commercial information indicating that the petitioned actions may be warranted. On October 6, 2010, we published a proposed rule (75 FR 61904) to list the Carolina and South Atlantic DPSs, the two DPSs that spawn in the NMFS Southeast Region, as endangered. We originally solicited written public comments via email, fax, and letter on the proposed listing rule for 90 days and extended it for an additional 30 days by public request. We also accepted written and verbal comments at two public hearings in Wilmington, North Carolina, and Atlanta, Georgia, in December 2010. A separate proposed rule (75 FR 91872) was published on October 6, 2010, for the three DPSs of Atlantic sturgeon that spawn in the NMFS Northeast Region.

Listing Determinations Under the Endangered Species Act

We are responsible for determining whether Atlantic sturgeon are threatened or endangered under the ESA (16 U.S.C. 1531 *et seq.*). To be considered for listing under the ESA, a group of organisms must constitute a ''species,'' which 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.'' On February 7, 1996, the Services adopted a policy describing what constitutes a DPS of a taxonomic species (61 FR 4722). The joint DPS policy identified two elements that must be considered when identifying a DPS: (1) The discreteness of the population segment in relation to the remainder of the species (or subspecies) to which it belongs; and (2) the significance of the population segment to the remainder of the species (or subspecies) to which it

belongs. As stated in the joint DPS policy, Congress expressed its expectation that the Services would exercise authority with regard to DPSs sparingly and only when the biological evidence indicates such action is warranted.

Section 3 of the ESA defines an endangered species as ''any species which is in danger of extinction throughout all or a significant portion of its range'' and a threatened species as one ''which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' The statute requires us to determine whether any species is endangered or threatened as a result of any one or a combination of the following five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence (section 4(a)(1)(A)(E)). Section 4(b)(1)(A) of the ESA requires us to make listing determinations based solely on the best scientific and commercial data available after conducting a review of the status of the species and after taking into account efforts being made to protect the species. Accordingly, we have followed a stepwise approach in making our listing determination for Atlantic sturgeon. Considering biological evidence, such as the separation between river populations during spawning and the possibility of multiple distinct interbreeding Atlantic sturgeon populations, we evaluated whether Atlantic sturgeon population segments met the DPS Policy criteria. We then determined the status of each DPS (each ''species'') and identified the factors and threats contributing to their status per section 4(a)(1) of the ESA. Finally, we assessed efforts being made to protect the species, determining if these efforts are adequate to mitigate impacts and threats to the species' statuses. We evaluated ongoing conservation efforts using the criteria outlined in the Policy for Evaluating Conservation Efforts (PECE; 68 FR 15100; March 28, 2003) to determine their certainties of implementation and effectiveness.

Finally, section 4(b)(1)(B) of the ESA requires us to give consideration to species which: (1) Have been designated as requiring protection from unrestricted commerce by any foreign nation or pursuant to an international agreement; or (2) have been identified as in danger of extinction, or likely to become so within the foreseeable future, by any state agency or by any agency of a foreign nation.

Peer Review and Public Comments

In December 2004, the Office of Management and Budget (OMB) issued a Final Information Quality Bulletin for Peer Review establishing minimum standards for peer review. Similarly, a joint NMFS/FWS policy (59 FR 34270; July 1, 1994) requires us to solicit independent expert review from at least three qualified specialists. We solicited peer review comments on the proposed listing rule from three peer reviewers, two from academia and one from a Federal resource agency, with expertise on Atlantic sturgeon. Written public comments were received from 59 commenters and 7 commenters provided verbal comments at the public hearings. Peer review comments are treated in the next section. In the following sections of the document, the public comments are categorized in the following areas: (1) The delineation of DPSs; (2) abundance and trends; (3) differences between the proposed rule and the conclusions in the 2007 and 1998 status reviews; (4) the need to list Atlantic sturgeon under the ESA and consequences of listing; (5) the analysis of threats (habitat modification and destruction, overutilization, disease and predation, the inadequacy of regulatory mechanisms, other natural and manmade factors); (6) recovery; (7) critical habitat; and (8) adequacy of the public hearing. Many comments were complex and had multiple inferences, and thus individual statements are addressed in multiple comments and responses below. Information and data provided by commenters supported or did not conflict with our findings for the Carolina and South Atlantic DPSs. Some information submitted by commenters as ''new'' information was information already included and evaluated in our proposed listing rule determination. Some commenters asked us to consider information, such as increased compliance responsibilities and economic costs on agencies and the public, that the ESA and its implementing regulations prohibit us from considering in making listing determinations. Many commenters stated that NMFS should postpone a listing determination until the results of recent research are available, further research can be undertaken, state and Federal moratoria on the harvest and possession of Atlantic sturgeon have been in effect for the full planned duration, and/or until non-listing alternatives (*e.g.,* entering into multi-agency partnerships and expanding existing programs) have been explored. Because we were petitioned to list the Atlantic sturgeon, we cannot delay an assessment of the status of Atlantic sturgeon. We were required to evaluate the status of the species and the threats it is currently facing and make a finding on whether the petitioned action was warranted within 12 months, which resulted in our proposed listing determination of endangered for the Carolina and South Atlantic DPSs of Atlantic sturgeon. We believe the current body of information on the declines of Atlantic sturgeon, the failure of their population numbers to rebound despite harvest prohibitions, and the ongoing impacts from bycatch, habitat modification, and the inadequacy of existing regulatory mechanisms or protective efforts to control or mitigate for these impacts, warrant listing the Carolina and South Atlantic DPSs as endangered. The information provided in the peer review and public comments did not provide a basis for revising our evaluation of the status of Atlantic sturgeon, the nature and significance of the threats and impacts they face, or our listing determinations. In the following sections of the document, we summarize the comments pertaining to the proposed listing rule for the Carolina and South Atlantic DPSs and provide our responses to those comments. Complete copies of the peer review comments, the written public comments, and transcripts of the public hearings are available on the Internet at *www.regulations.gov.*

Peer Review Comments

In this section, we refer to peer reviewers 1, 2, and 3, which correspond to the way the peer reviewers are identified on *http://www.regulations.gov.*

Comment 1 (definitions of endangered and threatened): Two of the three peer reviewers disagreed, all or in part, with our proposed listing of the Carolina and South Atlantic DPSs as endangered. Each peer reviewer provided their own definitions of endangered and threatened.

Peer reviewer 1 believed that a DPS warranted an endangered listing only if no single historical spawning river within the DPS sustained an abundant and regularly reproducing Atlantic sturgeon population. Peer reviewer 1 stated that no substantive biological justification or new evidence is presented in the proposed listing of the Carolina and South Atlantic DPSs as endangered to change the conclusions presented in the 2007 status review, which concluded that the Carolina DPS should be listed as threatened and made

no conclusion with regard to the South Atlantic DPS due to lack of information to allow a full assessment of subpopulations within the DPS. Peer reviewer 1 stated that an endangered listing would be appropriate if no single historical spawning river within that DPS appeared to sustain both a relatively abundant and simultaneously regularly-reproducing Atlantic sturgeon population.

Based on the available information on abundance, reproduction, and the presence of early life history stages, the reviewer stated that the Carolina DPS comes closest to conforming to the standard of an endangered species. The reviewer cited data from the proposed listing rule that two of the original three major spawning populations (the Roanoke and Santee-Cooper populations) in the Carolina DPS appear to remain functional, and not particularly vulnerable to extinction. The reviewer also stated the proposed listing of the South Atlantic DPS did not appear to be supported by the best available scientific information, since there is evidence of at least one viable, reproducing, and increasing Atlantic sturgeon population in the South Atlantic DPS, the Altamaha River population (Schueller and Peterson, 2006, 2010). The reviewer further cited both the Savannah River and the ACE (Ashepoo, Combahee, and Edisto Rivers) Basin systems as appearing to support reproducing Atlantic sturgeon populations, and stated Atlantic sturgeon appear to be abundant in the ACE system. The reviewer questioned whether the remaining South Atlantic DPS river populations in the smaller and less well-studied Ogeechee and Satilla rivers together constitute a significant portion of the species' range over which extinction is probable in order to justify an ''endangered'' designation for the entire DPS. The reviewer noted that the 2007 status review report deferred from such a designation and that it appears the South Atlantic DPS does not closely conform to the standard of being endangered. Based on the available scientific evidence concerning population size and reproduction in the historically most important populations, the resilience of sturgeons to extirpation, and their capacity for re-population from small effective population size, the reviewer believed the appropriate ESA designation for both DPSs would seem to be threatened. The reviewer suggested that the threatened status would provide protection for the species from direct take of any kind and a basis for habitat restoration, while providing greater flexibility for scientific sampling, tissue analyses, and experimental manipulation than would endangered status. The reviewer stated the downside is that threatened status would provide a lower level of legal leverage relative to the larger industrial impacts, *e.g.,* dams and bycatch, either of which may represent an insurmountable impasse to sturgeon recovery. The reviewer offered that under existing direct harvest prohibitions, threatened status has worked effectively for Gulf sturgeon recovery in rivers where dams and bycatch are not significant issues. It has not worked effectively where dams and bycatch are significant issues (*e.g.,* the Pearl, Pascagoula, and Apalachicola rivers), although none of those populations seem in danger of extinction.

Peer reviewer 2 stated that implicit in the definition of ''endangered'' is that the species must be on a significant downward trend, or at least there is cause to believe that such a trend is happening now, or will happen soon, and concluded that is not the case on the Altamaha River in Georgia. However, this reviewer also commented that every single Atlantic sturgeon population has been decimated by overfishing and habitat degradation and that we have very little quantified evidence that the species as a whole has recovered, despite 14 years of the protection afforded under the current moratorium on harvest and possession. Peer reviewer 2 recommended that a ''threatened'' listing would seem appropriate for almost every Atlantic coast river, including the St. Marys, Satilla, Ogeechee, and Savannah Rivers in Georgia, with the Altamaha being the one exception, and an endangered listing would be difficult to support.

Response: We must rely on the definition of ''endangered'' and ''threatened'' species provided in section 3 of the ESA, the implementing regulations, and case law in applying the definitions to marine and anadromous species. Section 3 of the ESA defines an endangered species as one that is in danger of extinction throughout all or a significant portion of its range, and a threatened species as one that is likely to become endangered within the foreseeable future. Recent case law (*In Re Polar Bear Endangered Species Act Listing and § 4(d) Rule Litigation,* D.D.C. WL 2601604 (June 30, 2011 Order); 748 F.Supp.2d 19 (D.D.C. 2010)) regarding USFWS's listing of the polar bear as threatened provides a thorough discussion of the ESA's definitions and the Services' broad discretion to determine on a case by case basis whether a species is in danger of extinction. Upon listing the polar bear as threatened, USFWS's rule was challenged by a number of parties who claimed that the polar bear was in danger of extinction and should have been listed as endangered, and by others who conversely argued that the bear did not warrant listing even as threatened. The Court determined that neither the ESA nor its legislative history compels the interpretation of ''endangered'' as a species being in ''imminent'' risk of extinction, finding instead that the phrase ''in danger of extinction'' is ambiguous. The Court held that there is a temporal distinction between endangered and threatened species in terms of the proximity of the ''danger'' of extinction, noting that the definition of ''endangered species'' is phrased in the present tense, whereas a threatened species is ''likely to become'' so in the future. Thus, in the context of the ESA, the Services interpret an ''endangered species'' to be one that is presently at risk of extinction. A ''threatened species,'' on the other hand, is not currently at risk of extinction, but is likely to become so. In other words, a key statutory difference between a threatened and endangered species is the timing of when a species may be in danger of extinction, either now (endangered) or in the foreseeable future (threatened). The Court concluded, however, that the distinction is not based ''solely and unambiguously'' on the imminence of the species' anticipated extinction,'' and that Congress delegated responsibility to the Services to determine whether a species is presently 'in danger of extinction' in light of the five ESA section 4(a)(1) factors and the best available science for that species. The Court ruled that although imminence of harm is clearly one factor that the Services weigh in their decision-making process, it is not necessarily a limiting factor. In many cases, the Services might appropriately find that the imminence of a particular threat is the dispositive factor that warrants listing a species as 'threatened' rather than 'endangered,' or vice versa. The Services have broad discretion to decide that other factors outweigh the imminence of the threat. In conclusion, the Court confirmed that the Services have flexibility to determine ''endangerment'' on a case-by-case basis. Congress did not intend to make any single factor controlling when drawing the distinction between endangered and threatened species, nor did it seek to limit the applicability of the endangered

category to only those species facing imminent extinction.

Thus, contrary to the peer reviewers' comments, there is no per se requirement that a species be experiencing current or imminent significant downward trends, or that there are no single historical spawning river populations within the DPSs that are relatively abundant and simultaneously regularly-reproducing, in order to be listed as endangered (we discuss the status and data on the Altamaha River population in more detail in Comment 2 below). Our determination of endangerment for the Carolina and South Atlantic DPSs is based on the exercise of our expert professional judgment on the basis of the best available information for each DPS. In addition, we agree with the USFWS' judgment, discussed in its supplemental explanation filed in the polar bear litigation, that to be listed as endangered does not require that extinction be certain or probable, and that it is possible for a species validly listed as ''endangered'' to actually persist indefinitely.

We determined that the Carolina and South Atlantic DPSs of Atlantic sturgeon are currently in danger of extinction throughout their ranges, on the basis of precipitous declines to population sizes, the protracted period in which sturgeon populations have been depressed, the limited amount of current spawning, and the impacts and threats that have and will continue to prevent population recovery. Populations of Atlantic sturgeon declined precipitously decades ago due to directed commercial fishing. The failure of Atlantic sturgeon numbers within the Carolina and South Atlantic DPSs to rebound even after the moratorium on directed fishing was established in 1998 indicates that impacts and threats from limits on habitat for spawning and development, habitat alteration, and bycatch are responsible for the risk of extinction faced by both DPSs. In addition, the persistence of these impacts and threats points to the inadequacy of existing regulatory mechanisms to address and reduce habitat alterations and bycatch. As described in the proposed listing rule, the Carolina DPS is estimated to number less than 3 percent of its historical population size; the South Atlantic DPS is estimated to number less than 6 percent of its historical population size, with all river populations except the Altamaha estimated to be less than 1 percent of historical abundance. There are an estimated 343 adults that spawn annually in the Altamaha River and less than 300 adults spawning annually (total of both sexes) in the river systems where spawning still occurs for each DPS (not all of the river systems occupied by the two Southeast DPSs currently support spawning, or effective spawning leading to recruitment).

In light of threats and impacts, the low population numbers of every river population in the Carolina and South Atlantic DPSs suggests that the DPSs are currently in danger of extinction throughout their ranges; none of the populations are large or stable enough to alone or in combination provide any level of certainty for continued existence of either DPS, and thus, the peer reviewer's suggestion that these DPSs may not be endangered rangewide or in a significant portion of their ranges is erroneous. While the directed fishery that originally drastically reduced the numbers of Atlantic sturgeon has been closed, recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon, and they continue to face a variety of other threats that contribute to their risk of extinction. Their late age at maturity (5 to 19 years in the Southeast) 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 increases the timeframe over which exposure to the multitude of threats facing the Carolina and South Atlantic DPS can occur.

Based on available information, we determined that to be viable, the Carolina and South Atlantic DPSs require multiple stable riverine populations, and we have added discussion to the final determination to better explain our reasoning. The importance of having multiple stable riverine spawning populations within each DPS and the need to maintain suitable habitat to support the various life functions (spawning, feeding, growth) of Atlantic sturgeon is best understood by looking at the concept of metapopulations. Each DPS, made up of multiple river populations, is analogous to a metapopulation, which is a ''population of populations'' (Levins, 1969), a group of spatially separated populations of the same species which interact at some level. Separation into metapopulations is expected by sturgeon and other anadromous fishes. While recolonization of northern rivers following post-Pleistocene deglaciation likely occurred following a stepping-stone sequential model (Waldman *et al.,* 2002), genetic analyses reveal that currently, there are very low rates of exchange between river populations. The amount and effectiveness of movement separates a metapopulation from a single large, patchy population. Low rates of connectivity through dispersal, with little to no effective movement, allow individual populations to remain distinct as the rate of migration between local populations is low enough not to have an impact on local dynamics or evolutionary lineages and distinguishes a metapopulation from a patchy population (Harrison 1994).

Metapopulation persistence depends on the balance of extinction and colonization in a static environment (Hanski 1996). If habitat remains suitable following local extirpation, recolonization via immigrants into now-empty habitat may replace at least some of those losses (Thomas, 1994). However, if the cause of extinction is a deterministic population response to unsuitable conditions (*e.g.,* lack of suitable spawning habitat, poor water quality, or disturbance of substrates through repeated dredging), the local habitat is likely to remain unsuitable after extinction and be unavailable for effective recolonization (Thomas, 1994). Therefore, recolonization is dependent upon both immigration from adjacent, healthy populations and habitat suitability. Because the DPSs are groups of populations, the stability, viability, and persistence of individual populations affects the persistence and viability of the larger DPS. The loss of any population within a DPS will result in: (1) A long-term gap in the range of the DPS that is unlikely to be recolonized, or recolonized only very slowly; (2) loss of reproducing individuals; (3) loss of genetic biodiversity; (4) potential loss of unique haplotypes; (5) potential loss of adaptive traits; and (6) reduction in total number. The loss of a population will negatively impact the persistence and viability of the DPS as a whole as fewer than two individuals per generation currently spawn outside their natal rivers (Wirgin *et al.,* 2000; King *et al.,* 2001; Waldman *et al.,* 2002).

The persistence of individual populations, and in turn the DPS, depends on successful spawning and rearing within the freshwater habitat, the immigration into marine habitats to grow, and then the return of adults to natal rivers to spawn. Information on Atlantic sturgeon spawning within the Carolina and South Carolina DPSs is limited. In the proposed listing rule, we presumed spawning was occurring if young-of-the-year (YOY) were observed or mature adults were present in freshwater portions of the system.

Within the Carolina DPS, we concluded that spawning is occurring, or occurred in the recent past, in the following rivers based on these data:

1. Roanoke River—collection of 15 YOY (1997–1998); single YOY (2005).
2. Tar and Neuse Rivers—one YOY (2005).
3. Cape Fear—upstream migration of adults in the fall, carcass of ripe female upstream in mid-September.
4. Winyah Bay—running ripe male in Great Pee Dee River (2003).

Within the South Atlantic DPS, we concluded that spawning is occurring, or has occurred in the recent past, in the following rivers based on these data:

1. ACE Basin—1,331 YOY (1994–2001); gravid female and running ripe male in the Edisto (1997); 39 spawning adults (1998).
2. Savannah River—22 YOY (1999–2006); running ripe male (1997).
3. Ogeechee River—age-1 captures, but high inter-annual variability (1991–1998); 17 YOY (2003); 9 YOY (2004).
4. Altamaha River—74 captured/308 estimated spawning adults (2004); 139 captured/378 estimated spawning adults (2005).
5. Satilla River—4 YOY and spawning adults (1995–1996).

These data indicate that spawning occurs within the Carolina and South Atlantic DPSs; they do not indicate the frequency of annual spawning events or the degree to which spawning in these systems leads to population growth, persistence, or viability. The extent and effectiveness of spawning events is unknown and likely precarious in many rivers, given ongoing threats that limit population size and spawning success, such as water quality and restricted access to upstream spawning areas (75 FR 61904). Peer reviewer 1 stated that data from the proposed listing rule indicate the spawning populations in the Santee-Cooper system appear to remain functional and not particularly vulnerable to extinction; however, in the proposed listing rule, we noted our determination that spawning may occur in the Santee and/or the Cooper Rivers, but it may not result in successful recruitment. Lack of access to historical spawning habitat due to dams restricts spawning to areas just below the dam. The proximity of these spawning areas to salt water may result in very high mortality to any larvae spawned in those systems.

In addition to spawning success, it is difficult to quantify spawning potential within the two DPSs, given the lack of population estimates. Currently, the number of Atlantic sturgeon in the Carolina DPS is estimated to be 3 percent of historical population size and the South Atlantic DPS is estimated to be 1 percent of historical population size, with the exception of the Altamaha River population, estimated to be at 6 percent of historical population size. Although the largest impact that caused the precipitous decline of the species has been curtailed (directed fishing), the population size has remained relatively constant at these greatly reduced levels for approximately 100 years.

In response to comments about divergence from the status review report's listing conclusions for the Carolina and South Atlantic DPSs, NMFS' Protected Resources Divisions have the responsibility to make listing recommendations to the Assistant Administrator. Status review reports are an important part of the information base for such recommendations, but NMFS must independently review the information in status review reports and apply the ESA's listing determination requirements in accordance with regulations, case law, and agency guidance. The Atlantic Sturgeon Status Review Report states that ''risks of extinction assessments are performed to help summarize the status of the species, and do not represent a decision by the Status Review Team on whether the species should be proposed for listing as endangered or threatened under the ESA'' (page 106; ASSRT, 2007). Subsequent to the status review report, we conducted a comprehensive assessment of the combined impact of the five ESA section 4(a)(1) factors across the Carolina and South Atlantic DPSs in classifying extinction risk for each DPS. We focused on evaluating whether the DPSs are presently in danger of extinction or the danger of extinction is likely to develop in the future. In our proposed rules to list 5 DPSs of Atlantic sturgeon, we determined that each DPS was at greater risk of extinction than determined by the 2007 ASSRT. While the ASSRT did discuss and consider how multiple threats might act in concert on a given subpopulation, they ultimately classified extinction risk using the highest single threat score on an individual population within a DPS, or within what they considered to be a significant portion of a DPS's range (pages 108–109; ASSRT, 2007). We evaluated the overall stability and viability of the DPSs as a whole based on the combined statuses of the component river populations and the impacts of threats and impacts across the DPS, when determining extinction risk of each DPS, because, as discussed above, the Carolina and South Atlantic DPSs require multiple stable river populations. In addition, because of the lapse in time between the development of the status review report (ASSRT, 2007) and the publication of the proposed listing rule (75 FR 61904, October 6, 2010), new information on bycatch (ASMFC, 2007) and water quality (USEPA, 2008), as well as climate change (IPCC, 2008) and drought (*e.g.,* USGS, 2007), became available to us, and we incorporated this information into our listing determinations.

Since publication of the proposed rules, a Federal District Court has thoroughly reviewed and considered the distinction between the definitions of threatened and endangered species in the ESA, explained by the USFWS in litigation challenging their determination to list the polar bear as threatened and not endangered, as discussed above (*In re. Polar Bear Endangered Species Act Litigation*). Prompted by this decision and the comments received by the Services requesting further explanation of the divergence of our proposed listing statuses and the conclusions of the ASSRT, we have reviewed our determinations and concluded that all the proposed listings of specific DPSs as ''threatened species'' or ''endangered species,'' respectively, satisfy the requirements of the relevant ESA definition. Thus, we have not changed these classifications in the final rules. We found that the Carolina and South Atlantic DPSs are presently in danger of extinction, and thus, listing them as endangered is warranted.

As discussed above, because a DPS is a group of populations (a metapopulation), the stability, viability, and persistence of individual populations affects the persistence and viability of the larger DPS. The persistence of individual populations, and in turn the DPS, depends on successful spawning and rearing within the freshwater habitat, the immigration into marine habitats to grow, and then the return of adults to natal rivers to spawn. While the directed fishery that originally drastically reduced the numbers of Atlantic sturgeon has been closed, modification and curtailment of Atlantic sturgeon habitat resulting from dams, dredging, and degraded water quality are inhibiting spawning and population rebounding throughout both DPSs, and contributing to their endangered statuses. Existing water allocation issues will likely be compounded by human population growth and potentially by climate change as well. Climate change is predicted to elevate water temperatures and exacerbate nutrient-loading,

pollution inputs, and lower dissolved oxygen (DO), all of which are currently negatively impacting the Carolina and South Atlantic DPSs. Continued overutilization of Atlantic sturgeon from bycatch in multiple commercial fisheries in both their marine and freshwater habitats is another ongoing impact to the Carolina and South Atlantic DPSs that is contributing to their endangered status. Atlantic sturgeon taken as bycatch may suffer immediate mortality. In addition, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (*e.g.,* exposure to toxins and low DO). This may result in reduced ability to perform major life functions, such as foraging and spawning, or may even result in post-capture mortality. Several of the river populations in the South Atlantic DPS (*e.g.,* the Ogeechee and the Satilla) are stressed to the degree that any level of bycatch could have an adverse impact on the status of the DPS (ASSRT, 2007).

The Carolina and South Atlantic DPSs are in danger of extinction now, due to precipitous declines from historical abundances to population sizes that are low and potentially unstable throughout the DPSs. As discussed above, both DPSs exhibit sporadic spawning with uncertain effectiveness. Population rebuilding and recovery in both DPSs is being inhibited by impacts due to habitat curtailment and degradation, and due to capture as bycatch in commercial fisheries. The current low levels of abundance noted previously in combination with the high degree of threat to the two Southeast DPSs put them in danger of extinction throughout their ranges; none of the populations making up the DPSs are large or stable enough to provide any level of certainty for continued existence of either DPS.

Regarding the conclusion that the Carolina and South Atlantic DPSs should be listed as threatened, peer reviewer 1 incorrectly stated that listing as threatened provides protection from direct take of any kind. The ESA's prohibition against take contained in section 9 only applies to endangered species, unless a section 4(d) rule is in place to extend the take prohibition to a threatened species. If we determine that the Carolina and South Carolina DPSs meet the ESA's definition of endangered, then we cannot list the species as threatened for the purposes of providing flexibility for scientific sampling, tissue analyses, and experimental manipulation. We also cannot list the DPSs as endangered to obtain legal leverage relative to the larger industrial impacts, *e.g.,* dams and bycatch, as suggested by the reviewer. Rather, we must make our listing determination based on application of the statutory factors.

Comment 2 (new information on Altamaha River population): Peer reviewer 2 presented data on the estimated abundance of age-1, river resident Atlantic sturgeon in the Altamaha River from 2004 to 2010, which showed large estimated increases in this age group in 2009 and 2010. The peer reviewer also stated that he and other researchers are beginning to detect slower growth in age-1 Atlantic sturgeon in the Altamaha and he attributed this to density-dependent factors that are beginning to limit available resources. The reviewer stated that a few more years of data are needed to determine if the increasing trend is real, but none of the other variables tested (*e.g.,* river flows or temperature) explain the trend. The peer reviewer attributed the apparent increases in juveniles in the Altamaha to the moratorium on the harvest of adults. The peer reviewer stated that data are not available to determine whether this trend is occurring in other spawning populations. The reviewer stated that catch per unit effort (CPUE) data are worthless without calibration or validation and we do not have historical abundance data to know what abundance should be on any of the river systems, though there is general agreement that populations are a fraction (less than 1 to 10 percent) of historical abundance. The reviewer recommended that long-term monitoring of recruitment using mark-recapture of age-1 juveniles be implemented on key river systems.

Response: We are encouraged by the apparent increases in juvenile Atlantic sturgeon estimated by the peer reviewer's research in the Altamaha River and appreciate the contribution of this information for our consideration in our listing determination. We revised the relevant discussion in the text from the proposed listing rule to include this information. We agree that additional years of data are necessary to confirm this trend in the Altamaha and that we cannot determine whether similar trends may be occurring in other river populations. This information is consistent with information we provided in the proposed listing rule, which refers to the Altamaha River as having a larger and healthier Atlantic sturgeon population than any other river in the Southeast. The proposed listing rule also stated that juvenile Atlantic sturgeon from the Altamaha are relatively more abundant in comparison to other rivers in the region.

Peer reviewer 2 noted that density-dependent factors may be starting to limit available resources. We are interested in working with the reviewer and other researchers to determine whether habitat modification, which we describe in detail in the proposed listing rule, is a contributing factor to the limitation of resources in addition to the increase in numbers of juvenile Atlantic sturgeon utilizing the resources. While water quality in the Altamaha River is good at this time, the drainage basin is dominated by silviculture and agriculture, with two paper mills and over two dozen other industries or municipalities discharging effluent into the river. Nitrogen and phosphorus concentrations are increasing, and eutrophication and loss of thermal refugia are growing concerns for this and other rivers in the South Atlantic DPS. The Altamaha is one of the rivers with current and pending water allocation issues. We are currently funding a project through the ESA section 6 program to map habitats in four Georgia rivers, including the Altamaha, and this may be a valuable step in answering this question.

We agree that CPUE data should be used in the proper context and that historical abundance data, other than data from commercial fisheries in the late 19th century, are not available. However, as required by section 4(b)(1)(A) of the ESA, we must make our listing determination based on the best scientific and commercial data available. When only CPUE and other fishery-dependent data were available to us, we clarified and acknowledged the constraints of the data, and we conclude that we used them in a valid manner. This is further addressed in our responses to several public comments on specific sections of the proposed listing rule (*e.g.,* comments 19, 23, 24, 25, and 29).

Comment 3 (import of the 2003 workshop): Peer reviewer 1 stated the proposed listing rule appeared to dismiss any evidence of an increase in Carolina DPS populations of Atlantic sturgeon, citing a statement in the proposed listing rule (page 61904–61905) that ''the [NMFS-sponsored 2003] workshop revealed mixed results in regards to the status of Atlantic sturgeon populations, despite the coast-wide fishing moratorium. Some populations seemed to be recovering while others were declining.'' The reviewer stated that at the time of the 2003 workshop, the moratorium on direct harvest and possession of Atlantic sturgeon had only been in effect for 4 years and this was not sufficient time for populations to increase in response

to the protective measures. The reviewer concluded the observations available at the time of the 2003 workshop do not provide a scientific basis for listing the Carolina DPS as endangered.

Response: The information we evaluated in making our proposed listing determination of endangered for the Carolina and South Atlantic DPSs of Atlantic sturgeon was not confined to the results of the 2003 workshop. As stated in the proposed listing rule, the information gathered at the 2003 workshop, including the equivocal evidence that some populations appeared to be recovering while others were declining, prompted us to complete a new review of Atlantic sturgeon status, which was published in 2007. Since the ASSRT's completion of its status review, we obtained and evaluated additional information on threats to Atlantic sturgeon (see our response to comment 1). Our evaluation of this information indicates that the moratorium on directed fisheries has not and will not be sufficient to address the impacts that are preventing sturgeon populations from recovering (including lack of access to required habitat, and habitat quality issues). Section 4(b)(1)(A) of the ESA stipulates that listing decisions be made using the best available scientific and commercial information, therefore we used information from the 2007 status review report (which incorporated information from the 2003 workshop) and new information in forming our determination. Our responses to comments from the public further detail our use of information available at the time of the proposed listing rule, as well as our consideration of new information submitted during the public comment period.

Comment 4 (viability of small Atlantic sturgeon populations): The estimated 343 spawning adult Atlantic sturgeon in the Altamaha River exceeds the number of spawning adults in the ''very viable'' Yellow River Gulf sturgeon population, according to peer reviewer 1. Peer reviewer 1 stated that information presented in Schueller and Peterson (2010) suggests a very robust reproductive response to protection of adult spawners under the Atlantic sturgeon moratorium. From these data, the reviewer stated that it seems highly improbable that the Altamaha River population is at risk of extinction and a listing of endangered does not seem applicable to the Altamaha population within the South Atlantic DPS. The reviewer stated that if the Altamaha population follows the model of the Suwannee River Gulf sturgeon population after harvest was banned, then overall population growth in the next decade will be exponential until density-dependent population controls come into play. Peer reviewer 1 also stated that the ''less than 300 spawning adults'' criterion in the proposed listing rule for classifying a river population as vulnerable to extinction sets a ''very high, probably unrealistic, bar,'' and one not conforming to scientific literature documenting sturgeon population recovery from much smaller effective breeding population sizes (20–80 spawning females, based on examples provided by the reviewer). Peer reviewer 1 stated that sturgeon species have the documented ability to establish/re-establish viable populations over a short timeframe (10 to 20 years), starting from ''a few tens'' of spawning adults without negative fitness impacts from low genetic diversity.

Response: As explained above, NMFS does not agree with peer reviewer 1's premise that an endangered listing would only be appropriate if no single historical spawning river within that DPS appeared to sustain both a relatively abundant and simultaneously regularly-reproducing Atlantic sturgeon population. We note that the Yellow River population of Gulf sturgeon referred to as ''very viable'' by the reviewer is listed as threatened under the ESA. While the number of spawning adult Atlantic sturgeon in the Altamaha River may be larger than that of Gulf sturgeon in the Yellow River, the peer reviewer noted that the Yellow River population is one that has rebounded since it was listed. The Altamaha River population of Atlantic sturgeon is estimated to be at only 6 percent of its historical abundance. While there is a moratorium on harvest and possession of Atlantic sturgeon, the species is not currently afforded the protections of section 9 of the ESA, nor do they benefit from the consultation and permitting responsibilities of ESA sections 7 and 10, that apply to the listed Gulf sturgeon. Information provided by peer reviewers 1 and 2 indicated recent (2009–2010) increases in the estimated number of juveniles in the Altamaha River. We are encouraged by this and hope that the Altamaha River population does exhibit exponential growth, as the Suwannee River Gulf sturgeon population did following listing. However, our listing determination is based on the best information currently available to us, and we do not feel that the information provided on increases in juvenile Atlantic sturgeon in the Altamaha River or the comparison to Gulf sturgeon populations in the Suwannee and Yellow Rivers provides a basis for revising our proposed determination that the South Atlantic DPS be listed as endangered.

In response to the reviewer's comment that the ''less than 300 spawning adults criterion'' sets a ''very high, probably unrealistic, bar'', we clarify that the 300 spawning adults per year was an estimate of the relative sizes of Atlantic sturgeon river spawning populations, based on the available information on the annual spawning adult abundance measured in the Altamaha River (343 spawning adults) and the fact that it is the largest population in the Southeast, combined with qualitative and quantitative anecdotal information from the other river systems. The 300 spawning adults per year estimate does not constitute a criterion or a bar for listing and/or recovery as a general matter. Rather, the estimate is evaluated in the specific context of the Atlantic sturgeon river populations and the impacts and threats they face. These populations likely have the capacity to recover, as the reviewer suggested, if existing and future impacts and threats are alleviated. The low estimated population numbers in each of the river systems within the DPSs (1–6 percent of historical abundance), combined with the ongoing impacts and threats from habitat modification and bycatch, indicate that the populations are small and vulnerable, and the DPSs they comprise are in danger of extinction.

Comment 5 (sturgeon ability to recolonize systems; genetic exchange): Peer reviewer 1 stated that sturgeon species are resilient and capable of repopulating an extirpated river, or colonizing a new river, if habitat remains available, dams do not block spawning ground access, water quality is satisfactory, and a competing sturgeon population is not already established. A natal river population, well-established over a long span of geological time and highly adapted to its respective natal river, would not realize success in colonizing another river already populated by a second population better adapted to its respective natal river than a potential colonist. The reviewer stated that the low rate of genetic exchange displayed among adjacent sturgeon populations does not reflect the incapacity of the species to colonize, but the competitive advantage held by a pre-established natal river population facing migrant individuals. The reviewer provided examples of recolonization by Atlantic sturgeon in bays and rivers from New England to Labrador and Newfoundland within a span of 10,000 years following deglaciation. The

reviewer stated the northernmost and most genetically conservative Atlantic sturgeon population re-colonized over 1,500 miles of coastline within 40 generations (and probably much fewer) in addition to undertaking a successful, essentially instantaneous, 3,300 mile migration to colonize the Baltic Sea 1,200 years ago. The reviewer also provided an example of Gulf sturgeon rebounding in Gulf Coast river systems. Peer reviewer 1 stated that following state harvest prohibitions on the Gulf sturgeon and its listing as threatened under the ESA, some river populations have rebounded (the Yellow, Choctawhatchee, and Suwannee river populations). The reviewer concluded the logic in the proposed listing rule is not compelling that if one of the DPSs were to be completely extirpated, it would remain so over a long span of time. Peer reviewer 3 stated, in reference to the genetic analyses showing fewer than two individuals per generation spawn outside their natal rivers, that this reflects the average number of individuals and noted it would be useful to compare this to straying determined from tagging data.

Response: We agree with the peer reviewer's comment that the low rate of genetic exchange displayed between Atlantic sturgeon river populations may reflect the competitive advantage held by pre-established natal river populations facing migrant individuals. We revised the relevant discussion in the text from the proposed listing rule to include this information. However, as stated in the proposed listing rule, we do not expect Atlantic sturgeon that originate from other river systems to recolonize extirpated systems and establish new spawning populations, except perhaps over a long time frame (*i.e.,* many Atlantic sturgeon generations). Though the reviewer provided an example of Atlantic sturgeon colonizing the Baltic Sea 1,200 years ago after a single migration, other examples of recolonization provided took 40 generations (approximately 1,000 years, based on a 25-year generation period) to 10,000 years, which is consistent with our statement in the proposed listing rule. Further, recolonization occurred in the absence of present-day human impacts, such as habitat modifications and mechanized fishing.

We noted the reviewer's comment that sturgeon species are resilient and capable of repopulating an extirpated river or colonizing a new river if habitat remains available, dams do not block spawning ground access, and water quality is satisfactory. As discussed extensively in the proposed listing rule and in our responses to comments in this document, Atlantic sturgeon in the Carolina and South Atlantic DPSs and the rivers within their ranges are affected by habitat modification and destruction, blocked access to spawning grounds, downstream habitat impacts caused by dams, and water quality (and quantity) issues. Thus, the commenter's stated conditions for expecting recolonization by Atlantic sturgeon are not met. Atlantic sturgeon from the Carolina and South Atlantic DPSs are also taken as bycatch in fisheries. Regarding the statement that following state harvest prohibitions on the Gulf sturgeon and its listing as threatened under the ESA, some river populations have rebounded (the Yellow, Choctawhatchee, and Suwannee river populations), the rivers that have rebounded have two factors in common versus those which have not rebounded (*e.g.,* the Apalachicola, Pascagoula, and Pearl river populations): (1) No mainstem dam on the natal river limiting Gulf sturgeon access to upriver spawning grounds or YOY access to riverine feeding habitat; and, (2) no major commercial fishery causing Gulf sturgeon bycatch mortality in the natal river, natal river estuary, or adjacent marine waters. Assessing the impacts of these two factors may be equally as important to sturgeon population recovery as is protection from all other impacts, now that direct harvest has been stopped. We agree with these comments by the peer reviewer and also believe that these threats associated with dams, habitat, water quality, and bycatch would hamper and slow recolonization of extirpated river systems. One reviewer acknowledged that rivers, watersheds, and coastal habitats inhabited by Atlantic sturgeon have been drastically modified and impacted by human activities (dammed, channelized, de-watered, diverted, dredged, mined, sedimented, polluted, deforested, developed, populated by introduced species, *etc.*) and that it would be remarkable to achieve recovery to even 10–30 percent of the 1890 carrying capacity of individual sturgeon rivers.

In reference to peer reviewer 3's suggestion about comparing the degree of straying from tagging studies to the estimate of straying from the genetic studies, we agree this could be a valuable exercise in the future when we have the necessary information on river of origin (based on genetic analyses) and the degree of straying (from tagging and relocation studies). While the estimate of less than 2 individuals spawning in rivers outside their natal system is a measure of successful transfer of genetic information from a fish originating from another system, the analysis suggested by the peer reviewer would provide us with knowledge of how many fish actually stray into another system and potentially attempt to spawn. This could also provide insight into the comments by the first peer reviewer that lack of gene flow between river populations is due to reduced success from competition and not from lack of attempts at migrant spawning.

Comment 6 (issues with estimating sturgeon abundance): According to one peer reviewer, targeted Atlantic sturgeon population studies in the Roanoke River and Santee-Cooper system, as well as most other river systems, have been limited in duration, intensity, and continuity such that population estimates may be substantially underestimated. Peer reviewer 1 noted that sturgeon species are cryptic fish found in deep, mainstem rivers. They are rarely observed visually, not typically sampled in many commercial river fisheries targeting other fish species (with the exception of the shad gill net fishery), and are rarely caught by recreational anglers. The reviewer stated that this illustrates that presence and abundance of sturgeon cannot be based on incidental catches from commercial fisheries or scientific sampling not specifically targeting sturgeon. The reviewer stated that in the past, sturgeon abundance has often been vastly underestimated until an appropriate and dedicated reporting or sampling program was undertaken. The reviewer recommended that only continuous, standardized mark-recapture efforts spanning sufficient time (a minimum of 3 years, but realistically greater than 5 years) can provide reliable preliminary abundance estimates.

Response: The majority of the data presented in the proposed listing rule came from studies targeting Atlantic sturgeon or from fisheries that are known to have a high incidence of interaction with Atlantic sturgeon (*i.e.,* gillnet fisheries). As much as possible, we clarified the data collection methods and constraints, and any assumptions we made. This is also discussed in our response to comment 2. We have used the best available commercial and scientific information to evaluate the status of the Carolina and South Atlantic DPSs, but we agree with the reviewer that long-term, continuous, standardized studies of Atlantic sturgeon abundance are needed.

Comment 7 (viable population sizes and sturgeon genetics): Peer reviewer 1 stated the minimum viable population

sizes of several hundreds to several thousands of individuals advanced in the literature are not particularly instructive with respect to sturgeon species based on new genetic information (Kreiger *et al.,* 2006). The reviewer commented that sturgeon are polyploid and the significance of polyploidy upon genetic diversity has just emerged. Most fishes are diploid with 40–50 chromosomes, a number similar to most vertebrates. However, all sturgeons are polyploid, having approximately 120 chromosomes (tetraploid, 4N), 240 chromosomes (octoploid, 8N) or more, including species with 12N or 16N ploidy. Polyploidy allows for multiple alleles (not just two as in diploid species) at a given gene locus, allowing for intra-individual genetic variation (Kreiger *et al.* 2006). The reviewer suggested that this might explain the high degree of plasticity displayed by sturgeon populations and the documented ability of sturgeons to repopulate from very few spawning adults without apparent inbreeding depression. He concluded that until we gain a deeper understanding of the genetics of polyploidy and the implications regarding sturgeon population dynamics, any discussion of minimum viable population size for sturgeon populations cannot be phrased in terms of what we know about inbreeding depression in diploid mammal populations. Thus, the 50/500 rule of thumb cited in the proposed listing rule may be an inappropriate criterion by which to assess viability of sturgeon populations, and we do not know how few polyploid sturgeons are too few to sustain a viable population.

Response: We appreciate the peer reviewer's input on the polyploid nature of Atlantic sturgeon and how this genetic characteristic may affect our evaluation of minimum viable population sizes in our listing determination. We revised the relevant discussion in the text from the proposed listing rule to include this information. As noted by the reviewer, we need a deeper understanding of the genetics of polyploidy and the implications regarding sturgeon population dynamics. We are not sure how polyploidy in Atlantic sturgeon will affect their recovery, but even if it allows the species to repopulate from relatively fewer individuals without inbreeding depression, there is no assurance that this will occur. Other polyploid Acipenser species have required listing under the ESA, such as shortnose sturgeon (listed as endangered in 1967), Gulf sturgeon (listed as threatened in 1991), and green sturgeon (listed as threatened in 2006). In the case of the shortnose sturgeon, recovery has not been achieved even though it has been protected for almost 45 years. Further, the polyploid nature of Atlantic sturgeon may further support the need for protection under the ESA. Southern populations of Atlantic sturgeon exhibit high diversity and many low frequency (and sometimes private) haplotypes (Grunwald *et al.,* 2008). Allendorf and Leary (1988) noted that in polyploid cutthroat trout, alleles constituting the majority of the variation in the species are found in only one or two local populations, but they often occur at high frequencies in those populations. They concluded preserving the genetic variation in cutthroat trout entails preserving as many local populations as possible. Finally, a polyploid nature may not be sufficient to promote recovery in Atlantic sturgeon populations, even if it is indicative of smaller viable population sizes, given the nature and number of ongoing impacts and threats to sturgeon and their habitats.

Comment 8 (ACE Basin populations): Peer reviewer 1 commented that the statement in the proposed listing rule that ''the low population numbers of every river population in the Carolina and South Atlantic DPSs put them in danger of extinction throughout their ranges; none of the populations are large or stable enough to provide with any level of certainty for continued existence of Atlantic sturgeon in this part of its range,'' seems contrary to the data from recent Atlantic sturgeon sampling results for the Altamaha, Savannah, and ACE Basin. This reviewer asserts that collection of 3,000 juvenile Atlantic sturgeon from the ACE Basin in seven years of sampling is not a low number.

Response: The proposed listing rule stated that 3,000 juvenile Atlantic sturgeon were collected in the ACE Basin (consisting of the Ashepoo, Combahee, and Edisto Rivers) between 1994 and 2001. While the reviewer did not believe this is a low number, we disagree. The ACE Basin and every system in the South Atlantic DPS, with the exception of the Altamaha River, is estimated to be at 1 percent of its historical abundance and to have less than 300 adult Atlantic sturgeon spawning per year (the Altamaha is estimated to be at 6 percent of its historical abundance and have 343 spawning adults per year). However, the statement from the proposed listing rule referred to by the peer reviewer was not referring strictly to population size, but rather to the restrictive effects of low population numbers in all component river populations on the DPSs' ability to respond to threats. This statement was taken from a section of the proposed listing rule addressing viable population size, and the statement was meant to be taken in the context of the statements that preceded it: ''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 and South Atlantic DPSs put them in danger of extinction throughout their ranges.'' Low population numbers hamper recovery by making the populations less resilient to the dangers they continue to face from being taken as bycatch and from the loss, reduction, and degradation of habitat resulting from dams, dredging, and changes in water quality parameters (such as depth, temperature, velocity, and dissolved oxygen). Because these DPSs are groups of populations, the stability, viability, and persistence of individual populations affects the persistence and viability of the larger DPS. In the example of the ACE Basin, the capture of 3,000 juvenile Atlantic sturgeon between 1994 and 2001 (an average of 375 Atlantic sturgeon juveniles per year) alone is not sufficient to indicate that the DPS can persist, given the low population numbers in each of the river systems in the DPS and the existing threats to the species (*e.g.,* bycatch, habitat degradation), some of which may worsen as a result of water allocation issues and climate change.

Comment 9 (relevance of historical abundance estimates): Peer reviewer 1 commented on the statements in the proposed listing rule that the Carolina DPS is estimated to number less than 3 percent of its historical population size; the Altamaha River is suspected to be less than 6 percent of its historical abundance; and the abundances of the remaining river populations within the South Atlantic DPS are estimated to be less than 1 percent of what they were historically. This describes the depleted status of these populations, and provides a reference point from which to gauge re-population. Peer reviewer 1 commented that caution should be exercised in using 1890s fisheries abundance as the recovery target, and similarly as a metric against which population recovery can be measured. Rivers, watersheds, and coastal habitats inhabited by Atlantic sturgeon have been drastically modified and impacted by human activities (dammed, channelized, de-watered, diverted, dredged, mined, sedimented, polluted,

deforested, developed, populated by introduced species, *etc.*) and it would be remarkable to achieve recovery to even 10–30 percent of the 1890 carrying capacity of individual sturgeon rivers. The reviewer believed the remaining 1–6 percent of the historical population numbers represents a good foundation for population recovery at the beginning of an unprecedented era of harvest prohibition, habitat restoration, and conservation awareness.

Response: The discussion in the proposed listing rule of current population size relative to historical levels was not meant to imply those levels would be recovery targets. Relative population size was intended as a metric of the depth of the DPS' decline over time. The reviewer's observation that permanent habitat modifications have reduced potential population levels by 70–90 percent underscores the significance of the multiple habitat threats facing Atlantic sturgeon.

Comment 10: Peer reviewer 1 took issue with the statement in the proposed listing rule that ''recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon.'' This reviewer stated this thesis is fundamentally faulty for sturgeon and other species. Late maturity in a species has little to do with speed of population increase beyond the initial lag period of one generation span or less, after which reproduction is continuous. As per the theory of Malthus, the reviewer stated that any population of any species in nature, whether of mice or elephants, will increase geometrically, as long as resources are not limiting. For a sturgeon population depleted by overfishing, once subadults are permitted to mature and spawn without being harvested first, recovery can be quite rapid if other human impacts have not removed or severely restricted essential resources.

Response: We have considered the peer reviewer's comment. However, we continue to find that the Atlantic sturgeon's life history traits are hindering its recovery in several ways, as supported by scientific literature. For example, Meyers and Worm (2005) state, ''from the land it is well known that large species with high ages at maturity are particularly vulnerable to extinction (Purvis *et al.,* 2000). There is no reason to believe that this may be different in the ocean (Myers & Mertz, 1998; Hutchings, 2001; Dulvy and Reynolds, 2002; Dulvy *et al.,* 2003).'' Specifically regarding the Atlantic sturgeon, Balazik *et al.* (2010) state that ''the Atlantic sturgeon's life history (high age of maturation and 2–5 years between female broods) probably inhibits population recovery (Boreman, 1997; Smith and Clugston, 1997).'' Gardmark *et al.* (2003) states that ''small populations are sensitive to stochastic effects, especially so if not all mature individuals reproduce,'' and as noted in the proposed listing rule (as well as Balazik *et al.,* 2010, above), adult Atlantic sturgeon do not reproduce every year.

There are several ways the Atlantic sturgeon's life history traits may be hampering recovery. The species' late age at maturity provides more opportunities for individuals to be removed from the population before reproducing. The limited ability of small populations with non-annual spawning adults to respond to stochastic effects could greatly affect Atlantic sturgeon recovery, and human population increases and climate change are likely to exacerbate existing water quality and quantity problems. Based on their life history, Atlantic sturgeon populations are more sensitive to fishing (bycatch) mortality than other coastal fish species. Like other K-selected species (which have large body size, long *life expectancy*, and produce fewer offspring, versus r-selected species, which are characterized as having high fecundity, small body size, early maturity onset, short generation time, and the ability to disperse offspring widely), Atlantic sturgeon are long-lived, have an older age at maturity, and have lower maximum fecundity values, with 50 percent of the lifetime egg production for Atlantic sturgeon occurring later in life (Boreman, 1997). That species with K-selected life history traits, such as Atlantic sturgeon, exhibit greater sensitivity to bycatch mortality is also supported by Baskett *et al.* (2006): ''fisheries have a greater long-term negative impact on species with lower population growth rates, later maturation, larger organism size, and greater longevity than on species with faster production (Jennings *et al.,* 1998; Heino and Godø, 2002).''

We agree with the peer reviewer's comments that any species with discrete generations or distinct breeding seasons will increase geometrically, ''as long as resources are not limiting.'' We also agree that Atlantic sturgeon can recover if fisheries mortality is reduced, allowing sub-adults to recruit to the spawning population, and ''if other human impacts have not removed or severely restricted essential resources.'' We stated in the proposed listing rule that the species' ''long life-span also allows multiple opportunities to contribute to future generations provided the appropriate spawning habitat and conditions are available.'' However, we believe that even though prohibitions on direct harvest and possession of Atlantic sturgeon have been in place for years, their life history characteristics, small population sizes, and the continued threats associated with bycatch and habitat modification are hampering the recovery of Atlantic sturgeon.

Comment 11: Peer reviewer 3 questioned why the use of samples from YOY and mature adult Atlantic sturgeon in the genetic analysis by Wirgin and King (2006) ensured that the samples came from fish originating in the sampled river system. The reviewer stated this implies that intermediate size fish stray more than adults. The reviewer also asked if the adults sampled were running ripe adults.

Response: Whether all of the adults utilized in the study were running ripe (*i.e.,* were making a spawning run) is unclear. However, adults generally only enter freshwater to spawn and the vast majority of Atlantic sturgeon spawn in their natal river (with estimates of less than 2 individuals per generation spawning outside their natal system). Therefore, the use of genetic samples in this study from adults captured in the freshwater portion of a river would indicate that the fish originated from that river and had returned to spawn. Similarly, Atlantic sturgeon spend the first year of their life in their natal river. Therefore, using genetic samples from YOY in a river system ensures that the fish originated in that river. Subadult (fish older than 1 to 2 years old) Atlantic sturgeon, as well as non-spawning adults, are known to make extensive coastal migrations. Subadults may use multiple estuarine or riverine areas for refuge, foraging, and nursery habitat, while non-spawning adults make extensive marine migrations. These life stages were excluded from the study because the river of origin cannot be determined from the location the fish are captured.

Comment 12: Peer reviewer 3 noted that 88 percent average accuracy in determining a sturgeon's natal river of origin was high and questioned whether the 94 percent average accuracy in assigning a sturgeon to one of the 5 DPSs was significantly better. The reviewer asked if the variance around the 88 and 94 percent figures is known. The proposed listing rule stated that the loss of either the Carolina or the South Atlantic DPS would constitute an important loss of genetic diversity for the Atlantic sturgeon. The reviewer commented that additional context on

the amount of genetic diversity within river populations, among river populations within a DPS, and between the 5 DPSs would better support that the loss of a DPS would represent a significant loss of diversity.

Response: The overall accuracy in assigning an Atlantic sturgeon to its natal river ranged from 60 to 94.8 percent (60 to 91.7 percent for southeastern rivers), while the overall accuracy in identifying a sturgeon to one of the 5 DPSs ranged between 88.1 and 95.9 percent (91.7 to 95.9 percent for the two southeastern DPSs). The peer reviewer's point is well-taken that, while there is higher accuracy in identifying a sturgeon to its DPS because of clearer genetic differences between the DPSs, the accuracy in identifying a sturgeon to its natal river is also quite high. We also agree with the peer reviewer that the broader context of the amount of genetic diversity exhibited by Atlantic sturgeon, within a DPS as well as among DPSs, provides additional support for our conclusion that the loss of a DPS would constitute a significant loss of genetic diversity. The high accuracy (60 to 92 percent) in utilizing genetic differences to assign Atlantic sturgeon in the Southeast to their natal rivers indicates that there is a significant amount of genetic diversity among rivers within a DPS, as well as between the two Southeast DPSs. Grunwald *et al.* (2008) reports that southern Atlantic sturgeon river populations have high diversity and many low frequency (and sometimes private) haplotypes. The information from Grunwald *et al.* (2008) indicates that each river population within a DPS makes unique contributions to the genetic diversity of the DPS as a whole and lends greater support to our determination that the loss of a DPS represents a significant loss of genetic diversity.

Comment 13: Peer reviewer 3 asked if the statement in the proposed listing rule that ''with the exception of the Waccamaw River population, all river populations sampled within each population segment along the entire East Coast were geographically adjacent'' was intended to mean that, with one exception, the genetic results are consistent with geography. In reference to the statement that the sample size from the Waccamaw River population was small (21 fish), the reviewer asked what the sample size was for the remaining river populations utilized in the genetic analysis.

Response: The peer reviewer interpreted the statement in the proposed listing rule correctly. In reference to the genetic sample sizes for rivers other than the Waccamaw, they ranged from 35 to 115. However, it is also important to note that genetic samples used in the analysis for the other river populations were taken from YOY and adult Atlantic sturgeon only to ensure that the fish were spawned in the river they were captured in. The genetic samples from Atlantic sturgeon captured in the Waccamaw River, in addition to being small in number, were taken from only juvenile Atlantic sturgeon, as those were the only samples available. As stated previously, juveniles may utilize multiple systems for foraging and nursery habitat, therefore the fish captured in the Waccamaw River and used in the genetic analysis were not necessarily spawned in that system. We are revising information in this final rule to indicate that the genetic samples from the Waccamaw River all came from juvenile Atlantic sturgeon.

Public Comments

Comments on the Delineation of the DPSs

Comment 14: Multiple comments were received either disagreeing with the listing of DPSs or disagreeing with the way populations were grouped into DPSs. One commenter stated that DPS is not a scientific term and that the DPS policy is arbitrary. The commenter also stated that the decision to list five DPSs results from the lack of NMFS' scientific ability to support the listing of the species as a whole. Several comments were received, some citing Grunwald *et al.* (2008), that all riverine populations of Atlantic sturgeon are genetically distinct. Another commenter stated that populations should either be evaluated on a drainage-specific basis or as a single unit south of Cape Hatteras because current DPS delineations combine high abundance rivers with rivers that have low abundance or unknown population status, are extirpated, or exist at the margins of the historical range. Comments were received that the entire Carolina DPS does not warrant listing as a unit and that only populations from river systems that would be afforded further protection by an ESA listing should be listed. Multiple commenters were concerned that incorrect delineation of DPSs could result in negative impacts to Atlantic sturgeon.

Response: The ESA, as amended in 1978, included in the definition of ''species'' ''any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.'' On February 7, 1996, the USFWS and NMFS adopted a joint policy (61 FR 4722) regarding the recognition of distinct population segments (DPSs) under the ESA. We agree with the commenter that this is not a scientific term, which is acknowledged in the policy itself: ''the authority to list a 'species' as endangered or threatened is thus not restricted to species recognized in formal taxonomic terms, but extends to subspecies, and for vertebrate taxa, to distinct population segments (DPSs)'' and ''the term is not commonly used in scientific discourse, although 'population' is an important term in a variety of contexts.'' The DPS policy is not arbitrary, and has been upheld by numerous courts as a rational and permissible interpretation of the statute by the Services. The policy formalizes the criteria that must be met in order to consider a subset of a species a DPS, and those criteria are based on scientific principles. The Services determined that the listing, delisting, and reclassification of DPSs of vertebrate species would consider the discreteness and significance of the population segment in relation to the remainder of the species to which it belongs.

We did not delineate the DPSs based on population abundance information and lumping high and low abundance rivers. We do not agree that the best available scientific information supports listing other population segments in the Southeast, such as on a drainage-specific basis or as a single DPS south of Cape Hatteras. In accordance with the DPS policy, we determined that two DPSs of Atlantic sturgeon exist in the Southeast based on genetic information that indicates the DPSs as delineated constitute cohesive ecological and evolutionary units, on each DPS' persistence in unique ecological settings, and on the conclusion that the loss of either population segment would result in a significant gap in the range of the species as a whole. In the proposed rule, we stated that Atlantic sturgeon studies consistently demonstrated the species to be genetically diverse and that between seven and ten Atlantic sturgeon population groupings can be statistically differentiated range-wide (*e.g.,* King *et al.,* 2001; Waldman *et al.,* 2002; Wirgin *et al.,* 2002; Wirgin *et al.,* 2005; Grunwald *et al.,* 2008).

Given a number of key differences among the studies (*e.g.,* the analytical and/or statistical methods used, the number of rivers sampled, and whether samples from subadults were included), it is not unexpected that each reached a somewhat different conclusion. In the proposed listing rule, we specifically evaluated and discussed the information

presented by Grunwald *et al.* (2008) and concluded that, though they used additional samples, some from fish in the size range (less than 130 cm) excluded in the analysis we relied on because they were smaller than fish considered to be mature adults, the results of the genetic analyses in Grunwald *et al.* (2008) and in the proposed listing were qualitatively the same and did not invalidate our DPS structure. We agree that Atlantic sturgeon from different riverine spawning populations can be distinguished genetically. However, genetic distances and statistical analyses (bootstrap values and assignment test values) used to investigate significant relationships among, and differences between, Atlantic sturgeon river populations, formed the basis of our judgment that the DPSs as proposed constitute cohesive ecological and evolutionary units that are appropriate for listing under the ESA and the DPS policy. In our judgment, the groupings of river populations into the DPSs as proposed, incorporates likely patterns of Atlantic sturgeon dispersal between drainages.

We believe all river populations within the DPSs will be afforded greater protection by an ESA listing, and listing the DPSs as proposed will not result in negative impacts to Atlantic sturgeon. Any action funded, authorized, or undertaken by a Federal agency that may affect Atlantic sturgeon from either DPS would require consultation with NMFS under section 7 of the ESA. Those analyses will focus initially on the impact of an action on the spawning population(s) to which affected sturgeon belong and then consider the significance of those impacts to the DPS(s).

Comment 15: Several commenters said use of the genetic data that are available for the designation of DPSs may be unreliable due to limited sample sizes, spatial, temporal, and ontogenetic differences in collection, and lack of samples from all river systems. Commenters also said our review of the literature was based on techniques used rather than the samples used to derive the conclusions. A commenter stated (citing Grunwald *et al.,* 2008) that genetic analyses should have been restricted to samples from spawning adults. The commenter cited several studies (Grunwald *et al.,* 2008; Wirgin and King, 2006; Wirgin *et al.,* 2005; Wirgin *et al.,* 2000) as indicating that the north-to-south clustering of Atlantic sturgeon river populations into DPSs is not valid. The commenter believed NMFS relied on genetic studies to say that there are genetic differences among populations but then ignored the actual results of the studies. The commenter stated that the Wirgin and King data were not peer reviewed and should be given less consideration. The commenter also stated that genetic information needs to be integrated with ecological and behavioral data in order to draw appropriate conclusions. Commenters stated that more data are needed to list DPSs and that although the peer reviewed studies have described a high degree of genetic separation with good classification success, there are problems when the papers are reviewed and considered for management. Several commenters noted that genetic samples for adult sturgeon will be collected in upcoming years through federally funded projects along the Atlantic Coast.

Response: We agree with commenters that sample sizes, spatial, temporal, and ontogenetic differences in collection, and lack of samples from all river systems create uncertainty in the Atlantic sturgeon genetic data. However, in our judgment the available data show genetic separation of the Carolina and South Atlantic DPSs from northern populations and from each other. Results showed 92 and 96 percent accuracy in correctly classifying a sturgeon from four sampled river populations (the Albemarle Sound, Savannah, Ogeechee, and Altamaha River populations) to two groupings of river populations (Albemarle Sound and Savannah/Ogeechee/Altamaha Rivers). Contrary to the commenters' assertion, in reviewing the literature and evaluating the available genetics data in our consideration of DPSs we looked at both technique and the samples used. As stated in Grunwald *et al.* (2008), due to the potential for subadult and adult Atlantic sturgeon to undertake extensive migration between systems, specimens certain to be spawned within a system (and candidates for use in genetic studies of spawning populations) include spawning adults or juveniles less than two-years-of-age. When possible, the genetic analyses we relied on in the 2007 status review report and in the proposed listing rule limited the samples utilized to those collected from spawning adults and YOY, which is consistent with (and more restrictive than) what Grunwald *et al* (2008) described. Where genetic samples from adult and YOY were missing, we reported the results of other analyses utilizing juvenile Atlantic sturgeon and clarified this in the proposed listing rule.

The commenter presented a comparison of river groupings (UPGMA trees) derived from genetic cluster analyses from the cited studies and asserted that the various groupings conflicted with the DPS structure proposed in the listing, stating that a north-to-south clustering of river populations is not valid. However, there is no difference in the river groupings resulting from the genetic analyses presented in Grunwald *et al.* (2008; Figure 3) and the river groupings resulting from genetic analyses presented in the 2007 status review report (Wirgin and King, 2006; Figure 16) for the southern populations. The river groupings presented in Wirgin *et al.* (2000) differ from our results, likely due to the inclusion of samples from subadults which may have originated from a system other than where they were collected. Wirgin *et al.* (2000) did find a pronounced latitudinal cline in the number of composite mtDNA haplotypes and in haplotypic diversity, which increased from north to south. The researchers ascribed the greater genetic diversity within and among southern populations to the persistence of these populations through the Pleistocene and to the faster mutation rates associated with their shorter generation times. The genetic results referred to by the commenter in Wirgin *et al.* (2005) were for shortnose sturgeon, not Atlantic sturgeon.

While the genetic analysis by Wirgin and King presented in the 2007 status review report was not previously published, it was peer reviewed as part of the status review and as part of the proposed rule. The status review report was peer reviewed by six experts from academia, and the proposed listing rule was peer reviewed by three experts, two from academia (including an Atlantic sturgeon genetics expert) and one from a Federal resource agency.

We agree with the comment that genetic information needs to be integrated with ecological and behavioral data in order to draw appropriate conclusions. We relied on behavioral information (*i.e.,* the migratory nature of subadults and non-spawning adults) to determine the appropriate life stages (*i.e.,* YOY and spawning adults) to use for the genetic analysis. We also used behavioral and ecological information in conducting our DPS analysis per the Services' joint DPS policy. We considered the species' behavior in that the majority of Atlantic sturgeon return to their natal rivers to spawn. We also considered ecological issues, such as the fact that the DPSs persist in unique ecological settings and that the loss of a DPS would represent a significant gap in the range of the species.

Additional genetic analyses will improve our understanding of Atlantic sturgeon and their population structure, and we eagerly await the results of upcoming and ongoing genetic analyses, some of which we are funding through our Species Recovery Grant Program under section 6 of the ESA. However, we believe that the currently available data support the discreteness and significance of the Carolina and South Atlantic DPSs. Because we have integrated the genetic data with other sources of Atlantic sturgeon information, such as the behavioral and ecological information noted above, we do not believe listing DPSs will create management problems.

Comment 16: One commenter disagreed that the DPSs persist in unique ecological settings, citing a study by the Institute for Ocean Conservation (2010) that Atlantic sturgeon tagged in the Hudson traveled from Nova Scotia to Georgia. The commenter also disagreed that the loss of a DPS would result in the loss of important genetic diversity, citing Quattro *et al.* (2002) that dispersal is sufficient to prevent deep divergence over long evolutionary scales and Peterson *et al.* (2008) that Atlantic sturgeon are resilient to genetic bottlenecks.

Response: The proposed listing rule states multiple times that Atlantic sturgeon mix extensively in the marine environment, which is consistent with the citation provided by the commenter. However, we disagree with the commenter that the Carolina and South Atlantic DPSs do not persist in unique ecological settings. The vast majority of Atlantic sturgeon return to their natal river to spawn, and the spawning habitat of each DPS is found in a separate and distinct ecoregion as identified by The Nature Conservancy (TNC) based on the habitat, climate, geology, and physiographic differences for terrestrial and marine ecosystems throughout the range of the Atlantic sturgeon.. The unique ecological characteristics of the ecoregions the Carolina and South Atlantic DPSs originate from are described in detail in the proposed listing rule.

We disagree with the comment that the loss of a DPS would not result in the loss of important genetic diversity. Grunwald *et al.* (2008) note that, while northern populations of Atlantic sturgeon have low genetic diversity, southern populations exhibit high genetic diversity with many low frequency haplotypes. The loss of genetic diversity associated with the loss of either the Carolina or South Atlantic DPS would reduce the ability of Atlantic sturgeon as a subspecies to adapt to new selective pressures, such as climate change or shifts in available resources. We also disagree with the commenter's assertion that Peterson *et al.* (2008) supports a conclusion that Atlantic sturgeon populations are resilient to bottlenecks. Peterson *et al.* (2008) reported ''pronounced cropping'' of genetic diversity in the Altamaha River Atlantic sturgeon population. The researchers expressed surprise over this result ''given the resiliency to genetic bottlenecks previously reported in other studies of remnant Atlantic and shortnose sturgeon populations (Quattro *et al.,* 2002; Waldman *et al.,* 2002).'' Grunwald *et al.* (2008) also stated that ''current populations from the Hudson River northward represent step-wise recolonizations with a bottlenecking effect.''

Comment 17: One commenter stated that the proposed listing rule suggested the number of Atlantic sturgeon spawning in locations other than their natal rivers (''outmigrants'') is not dependent on population size. The commenter believed the rate of outmigration is much higher than stated and should be presented as a percentage, but that some level of mixing should be considered. Another commenter stated that recolonization of a basin would be slow regardless of whether adjacent populations are low or robust due to the low rate of outmigration and genetic transfer between basins. The commenter noted that there are greater distances between rivers within the Carolina DPS than between the Carolina and South Atlantic DPSs. This commenter stated that if outmigration is limited and most likely occurs between adjacent populations, this refutes the DPS structure.

Response: The number of Atlantic sturgeon outmigrants (less than 2 per generation) included in the proposed listing rule was estimated from genetic analyses by the studies we cited. We did not relate outmigration of Atlantic sturgeon to population size in the proposed listing rule, and we do not have available data to present outmigration as a percentage of population size; however, we agree with the commenter that rates of outmigration may increase with increasing population size. We agree that recolonization of a system from adjacent populations would be slow, which is consistent with statements in the 2007 status review report (page 97) and in the proposed listing rule (page 61912). The distances separating rivers within and between the Carolina and South Atlantic DPSs do not account for the extremely low level of outmigration in Atlantic sturgeon spawning populations. Adult (and subadult) Atlantic sturgeon are known to make extensive movements between systems along the East Coast range of the species. Though the exact cues are not known, it is a life history characteristic of Atlantic sturgeon that the vast majority spawn in their natal river system. The low level of outmigration does not refute the DPS structure; as we stated above, the groupings of river populations into the DPSs as proposed, incorporates patterns of Atlantic sturgeon dispersal among drainages. The evidence supporting the structure of the Carolina and South Atlantic DPSs is presented in the proposed listing rule and in our responses to comments 14–16 above.

Comment 18: Several commenters stated that there were no specific geographic boundaries or coordinates listed to delineate the five DPSs and believed this should be addressed in the final rule, since conservation and other management measures will likely be implemented based on the delineation of the DPSs. The commenters also had concerns that the rivers and tributaries listed in each DPS are not all-inclusive and could potentially create loopholes for management and conservation measures. Another commenter stated that the extensive mixing of Atlantic sturgeon in the marine environment will make conservation and management of the DPSs difficult to impossible.

Response: We do not believe additional geographic boundaries or coordinates delineating the DPSs are necessary or that there are any loopholes for management or conservation. As stated in the proposed rule text, each of the DPSs is defined to include fish that spawn in the range of watersheds encompassed by the DPS. Our intent was that all fish spawned in such watersheds would also be included in the listing throughout their life cycles. Thus, fish spawned in one river, but using an adjacent river as nursery or subadult feeding habitat, are included in the listing. We have refined the text descriptions of the Carolina and South Atlantic DPSs in the final listing rule to more clearly reflect this issue. The modifications to the text clarify the riverine ranges of the DPSs but do not change the populations making up each of the Southeast DPSs.

As noted by commenters, Atlantic sturgeon from each riverine watershed and DPS may be found in multiple riverine, estuarine, and marine environments at various life stages. We agree that the extensive mixing of Atlantic sturgeon will make conservation and management of the

DPSs challenging. As we stated in the proposed listing rule, this extensive mixing of Atlantic sturgeon in the marine environment, as well as in multiple riverine and estuarine systems, can expose Atlantic sturgeon of a given DPS to a variety of threats at various life stages and in multiple locations. We discuss management challenges and potential strategies for dealing with them in the sections of the proposed and final listing rules entitled ''Identifying the DPS(s) Potentially Affected by an Action During Section 7 Consultation.''

Species Data and Information Supplied by Commenters

Comment 19: Commenters from North and South Carolina state agencies and other commenters supplied data and information for the Carolina DPS. One comment stated that there was an observed increase in abundance of Atlantic sturgeon in Albemarle Sound between 2005 and 2008. The commenter also stated there was a slight increase in abundance of juveniles and subadults in Pamlico Sound, while river surveys showed a slight decrease in abundance. Commenters also included data from late 2010 indicating there is a fall spawning run in the Roanoke River. Based on anecdotal angler reports from North Carolina, some commenters asserted that Atlantic sturgeon are persisting, though there has been little improvement in the size and age distributions of the Carolina DPS relative to historical levels. They also noted sampling efforts directed toward sturgeon have been sparse and limit ability to accurately characterize existing populations. Comments from South Carolina noted that Atlantic sturgeon were captured in most nets set in Winyah Bay from April to July in 2007 to 2009, including sites far upriver, and that sonar sampling indicated several hundred Atlantic sturgeon at the confluence of the Sampit River and Winyah Bay in 2009. A commenter stated that fishery surveys conducted as a requirement of the Federal Energy Regulatory Commission (FERC) license for the Yadkin-Pee Dee Hydroelectric Project resulted in the capture of a running ripe male in the Pee Dee River in October of 2003, indicating spawning activity. Large fish believed to be Atlantic sturgeon were sighted during electrofishing from 2002 to 2003. The commenter stated that this and other research (Collins and Smith, 1997; Collins *et al.,* 2003; Gibbons and Post, 2009) suggest that there may be a sizeable Atlantic sturgeon population present in the Pee Dee River and the Winyah Bay system. State agency comments noted that there have been few encounters with Atlantic sturgeon in the Santee River and there are anecdotal reports of breaching sturgeon in the Cooper River.

Response: We reviewed the specific information supplied for Atlantic sturgeon from the Carolina DPS and have added it to the ''Distribution and Abundance'' section of the final listing rule; however, this information does not require a change in our listing determination. The Independent Gill Net Survey (IGNS) data supplied by the North Carolina Department of Environment and Natural Resources (NCDENR) does show an increase in CPUE between 2005 and 2008 in Albemarle Sound. Based on Table 1 and Figure 2 included in NCDENR's comments, the CPUE in 2005 was 0.012, and increased in each successive year until 2008, when it reached 0.031. However, the data supplied by NCDENR for Albemarle Sound dates back to 1990 and continues to 2009. The 1990–2009 CPUE data as a whole shows a great deal of fluctuation, with no increasing trend, but rather periodic increases and decreases. In 2009, the CPUE dropped back down to 0.015, the level recorded in 2006. While 2008 was the highest CPUE observed since 2002, the CPUEs recorded for 1990 (0.081), as well as for 2000 and 2001 (0.032 both years), were actually the highest recorded in the 1990–2009 dataset for Albemarle Sound provided by NCDENR. The lowest CPUE levels recorded in the 1990s (0.005 to 0.010 in 1992, 1993, 1995, and 1996) were observed again in 2002, 2003, and 2004 (0.005 to 0.007). The commenter stated that there has been an increase in juveniles and subadults in Pamlico Sound since 2001. Based on IGNS data provided by NCDENR (Table 4, Figure 8), the CPUE for Pamlico Sound was 0 in 2001, and greater than 0 for 2002 through 2009. While all CPUEs for Pamlico Sound are greater than that recorded in 2001, there is no apparent increasing trend in the data. While the highest CPUEs were observed between 2004 and 2007 (0.016 to 0.066), the highest being recorded in 2005, the CPUE has decreased since 2005. The level observed in 2009 (0.003), the lowest CPUE in this dataset, was also observed in 2002 and 2003. Similarly, the river surveys of the Pamlico, Pungo, and Neuse Rivers showed a peak CPUE in 2005, with very low numbers observed in the other years within the survey period of 2000 to 2009. The information provided by the commenter on spawning in the Roanoke River supports information included in the proposed listing rule. While the Roanoke was determined to be an active spawning river within the Carolina DPS in the proposed listing rule, information supporting that a fall spawning run occurs there will greatly aid in the conservation and management of the species. We agree with the commenters' statement that Atlantic sturgeon are persisting, though there has been little improvement in the size and age distributions of the Carolina DPS relative to historical levels. The failure of Atlantic sturgeon populations to rebound, even with the moratorium on harvest and possession and other efforts to recover the species, is the primary reason we are proposing to list the species as endangered. In 1901, the Atlantic sturgeon fishery collapsed when less than 10 percent of the U.S. 1890 peak landings were reported. The landings continued to decline coastwide, reaching about 5 percent of the peak in 1920. Coastwide landings remained between 1 and 5 percent of the 1890 peak levels until the Atlantic sturgeon fishery was closed by ASMFC in 1998. Atlantic sturgeon populations, estimated to be 1 to 6 percent of their historical levels, have remained relatively unchanged since the initial collapse caused by the Atlantic sturgeon fishery of the late 19th century. We agree that sampling efforts need to be increased to effectively characterize populations and we are making efforts to see that it happens.

The South Carolina Department of Natural Resources provided information (SCDNR) for Winyah Bay that Atlantic sturgeon were encountered in most nets set from April to July (2007 to 2009) and that a researcher using sonar observed several hundred Atlantic sturgeon in Winyah Bay near the confluence of the Sampit River in 2009. We contacted Dr. Hightower, the researcher conducting the sonar work in Winyah Bay, to get further information on his observations. Dr. Hightower provided additional information via email on July 7, 2011, that he and fellow researchers were conducting ''pilot trials without a specific survey protocol, so we have not tried to generate density estimates. One of the issues that must be resolved before using the side-scan files in a quantitative way is to estimate the probability of identifying (detecting) a sturgeon, given that it is present in the area surveyed by the side-scan sonar. We are still working on that question, but results to date suggest that the detection probability depends on fish size, position in the water column, and possibly orientation relative to the sonar. Thus, we could come up with a density estimate for fish above some

size threshold, but we would not be able to reliably estimate how many of those were Atlantic sturgeon. Some of the large fish on those images are clearly Atlantic sturgeon and many others are likely to be sturgeon. The statement that several hundred were in that area is a reasonable description of what the side-scan data show but we are not at the point of being able to estimate the density with confidence.'' Dr. Hightower also remarked that ''we have done pilot survey work in the Roanoke, Neuse, Cape Fear, and Pee Dee river systems. The side-scan images from the Pee Dee (Winyah Bay) suggest markedly higher densities than in the other rivers.'' If all fish detected by Dr. Hightower were Atlantic sturgeon, the possibility that there were hundreds in Winyah Bay does not conflict with our estimate of less than 300 spawning adults per year in each spawning river. The sonar study was conducted in August 2009. Due to the time of year and location, it is unlikely this was a spawning aggregation and there is no way of knowing what age classes were present. It is possible that some of these fish were juvenile Atlantic sturgeon, which are known to utilize multiple riverine and estuarine systems other than their natal system. The information provided regarding the surveys conducted on the Yadkin-Pee Dee as a requirement of a FERC license is not new information, as it was included in the proposed listing rule. The information on the Santee-Cooper system is noted, and it is consistent with the proposed listing rule. The information for Atlantic sturgeon in the Carolina DPS presented by commenters, when considered as part of our listing determination, does not change our determination that the Carolina DPS warrants listing as endangered. In our judgment, none of the river populations in the DPS are large or stable enough to provide with any level of certainty for the continued existence of the DPS in the face of threats currently acting on the species. In our judgment, the Carolina and South Atlantic DPSs require multiple stable spawning populations.

Comment 20: Commenters from state agencies supplied data and information for the South Atlantic DPS. South Carolina Department of Natural Resources (SCDNR) supplied data from the Edisto, where 3,661 Atlantic sturgeon were captured between 1994 and the present; their population models estimate between 20,000 to 70,000 sturgeon. Between 1997 and 1999, SCDNR captured 118 adults in the Edisto River during spring and fall spawning runs, but netting ceased once that number was reached. They believed if they had continued netting activities, they would have captured more than 300 spawning adults. SCDNR also noted approximately 20 adults were captured in one to two months during surveys targeting other species. In 2010, four adults tagged in the 1990's as age 0+ were recaptured, which they believe indicates the moratorium is having the desired effect of allowing fish to recruit to the broodstock population. In the Savannah River, the SCDNR captured 369 Atlantic sturgeon between 1997 and 2010. SCDNR commented that there is not enough data to support the contention that the Altamaha has the largest population in the southeast and that other rivers have less than 300 spawning adults per year. The Georgia Department of Natural Resources (GADNR) commented that there is new information on the potential increase of Atlantic sturgeon in the Altamaha, and additionally, the Satilla River has been found to contain a substantial number of fish, where few to none were thought to exist in the past. Citing Peterson *et al.* (2008), GADNR stated the Altamaha may be recovering, though absence of adults older than age 17 suggests the effects of overfishing are still evident. According to Georgia's recent compliance reports to the ASMFC, the 2009 and 2010 estimates of age-1 Atlantic sturgeon in the Altamaha River were two and five times the estimates from the 2004–2008 period, respectively. In the most recent compliance report to ASMFC, University of Georgia (UGA) researchers collected more than 200 Atlantic sturgeon in the Satilla River in less than 2 years of sampling. They concluded that the presence of juvenile fish measuring less than 50 cm indicates this is likely a self-sustaining, spawning population.

Response: We reviewed the specific information supplied by the states for Atlantic sturgeon from the South Atlantic DPS and have added it to the ''Distribution and Abundance'' section of the final listing rule. However, the additional information does not require a change in our listing determination. SCDNR stated that in the 16-year period since 1994, they captured 3,661 juvenile (one- to three-year-old) Atlantic sturgeon in the Edisto River. This updates information we included in the proposed listing rule that over 3,000 juvenile Atlantic sturgeon were collected in the ACE Basin between 1994 and 2001, including 1,331 YOY. SCDNR used Lincoln-Peterson and Schnabel models to derive Atlantic sturgeon population estimates from these data, which resulted in estimates of 70,000 and 20,000 Atlantic sturgeon in the Edisto River, respectively. SCDNR commented that the models' results suggest increasing trends in abundance. Both models rely on mark-recapture data and assume a closed population (there are no births, deaths, or immigration/emigration between the initial capture and the recapture period) and that all individuals have an equal chance of being captured (Nichols, 1992; Lindeman, 1990; Chao, 1987). We note that there is great uncertainty in the population estimates resulting from the two models, as evident in the great disparity between the two results (20,000 versus 70,000). The reliability of the population models used depends on the validity of the assumptions of those models. The primary assumption of these two models, that each individual has an equal probability of capture, is likely unattainable in natural populations (Chao, 1987; Carothers, 1973). The assumption of a closed population is probably violated for any estimate calculated using the Schnabel or Lincoln-Petersen method on data collected over several weeks or months, and it is surely violated when data from one or more active seasons are used (Lindeman, 1990). SCDNR indicated they are currently completing an open system model (which is based on survival probabilities, as well as capture probabilities) to better assess the Atlantic sturgeon population in the Edisto River. Because the closed system models used by SCDNR provide estimates of juvenile abundance only and do not account for other population dynamics (birth, mortality, immigration/emigration), the estimates provided by the models likely represent an overestimate of juvenile abundance, do not provide an estimate of how many juveniles likely mature into spawning adults, and do not provide any information that undermines our use of the estimate of less than 300 spawning adults per year in the system. Atlantic sturgeon do not reproduce every year; females reproduce on the order of once every 2 to 5 years, males every 1 to 5 years. Small numbers of fish spawning can reduce the likelihood of successful spawning and the amount of genetic variation introduced into the next generation.

SCDNR commented that we do not have enough data to support the belief that the Altamaha River has the largest spawning population in the Southeast and that all other rivers have less than that. However, we relied on the best available information in arriving at the

estimate, and the information supplied by commenters, including the data provided by SCDNR, actually supports the estimate. The Altamaha is believed to have the largest Atlantic sturgeon spawning population in the Southeast, based on the absence of dams impeding access to appropriate spawning habitat, the lack of heavy development in the watershed, and relatively good water quality. The information supplied by GADNR showed an increase in age-1 Atlantic sturgeon from the Altamaha River in 2009 and 2010 over 2004 to 2008 levels. This was also reported by peer reviewer 2 and discussed in our response to comment 2. The information provided for the Satilla River is consistent with information in the proposed listing rule that the Satilla River has a resident spawning population of Atlantic sturgeon. The information for Atlantic sturgeon in the South Atlantic DPS presented by commenters, when considered as part of our listing determination, does not change our determination that the South Atlantic DPS warrants listing as endangered. In our judgment all river populations in the DPS are too small to be stable and self-sustaining.

Comment 21: In response to our request in the proposed listing rule for information on the mixing of Atlantic sturgeon populations, the petitioner cited Erickson *et al.* (2011) stating that out of 15 Atlantic sturgeon tagged in the Hudson River, one was relocated in Georgia, which supports extensive, long range mixing of sturgeon. The petitioner also cited Laney *et al.* (2007) that Atlantic sturgeon from the Hudson River represent approximately 44 percent of those in North Carolina overwintering habitat.

Response: We appreciate the information provided by the petitioner. These studies support our assertion in the proposed listing rule that extensive mixing of the DPSs outside their natal rivers occurs during non-spawning phases. We are continuing to seek information on the degree of mixing of the different river populations, including through our funding of the project to determine seasonal and spawning migration patterns and incidences of inter-basin transfer for adult Atlantic (and shortnose) sturgeon in southeastern rivers in North Carolina, South Carolina, and Georgia.

Comments on Abundance and Trends

Comment 22: Many comments were received stating that the abundance estimate of 300 spawning adults per year is not supported by data. Many of these comments stated that the proposed listing rule is not valid without stock assessments of Atlantic sturgeon populations. One commenter stated that the estimate of 300 spawning adults per year is misleading in regards to total population abundance since Atlantic sturgeon do not spawn every year and the total population abundance is likely much higher. Another commenter, citing Schueller and Peterson (2010), stated that we should consider juveniles rather than spawning adults. A comment was received that the statements on page 61920 of the proposed listing rule about spawning populations being less than the 500 recommended by Thompson (1991) conflict with the statement that total population abundances for the Carolina and South Atlantic DPSs are not available. Additionally, a comment was received that based on modeling, populations in the Winyah Bay system and the ACE Basin have more individuals than Thompson (1991) recommended as minimum viable population sizes for short-term and long-term population fitness.

Response: In response to comments on lack of stock assessments being a bar to listing determinations, we note that section 4(b)(1)(A) of the ESA provides that the Secretary shall make required listing determinations solely on the basis of the best scientific and commercial data available to him at the time of the determination, after conducting a review of the status of the species and taking into account efforts to protect the species. Even if a formal stock assessment of the species has not been conducted, if the best available information indicates the species warrants listing, as it does for Atlantic sturgeon, then we are required to list the species. Lack of formal stock assessments is not an unusual circumstance for species that have drastically declined, are at very low population numbers, or whose ranges have constricted, such that they are the subject of petitions to list them as threatened or endangered. Though we do not have stock assessments, we believe the current body of information on the declines of Atlantic sturgeon, the failure of their population numbers to rebound despite harvest prohibitions, the small relative magnitude of riverine spawning populations, and the ongoing impacts and threats from bycatch and habitat modification, warrant listing the Carolina and South Atlantic DPSs as endangered.

In the Southeast, the Altamaha is the only river where abundance has been directly surveyed. While traditional stock assessments from other Southeast rivers in the species' U.S. range are not available, we nevertheless relied on the best available data to produce a relative estimate of the number of Atlantic sturgeon in the remaining spawning populations. Based on a comprehensive review of the available data, the literature, and information provided by local, state, and Federal fishery management personnel (both documented in the 2007 status review report and in comments received on this rule), it is our judgment that the Altamaha River has the largest Atlantic sturgeon spawning population in the Southeast. The larger size of this population relative to the other river populations in the Southeast is likely due to the absence of dams that impede access to appropriate spawning habitat, the lack of heavy development in the watershed, and relatively good water quality, as Atlantic sturgeon populations in the other rivers in the Southeast have been affected by one or more of these factors. Though abundance estimates from stock assessments are not available for the other river populations, because the Altamaha spawning population is the largest, we believe it is reliable to estimate the size of other spawning populations in the Southeast Region as no more than 300 adults spawning per year. Further, data supplied by managers and researchers (and discussed in the previous section of responses to comments), support an estimate of less than 300 spawning adults per year in the other Southeast rivers.

The use of annually spawning adults is not intended to be misleading. We agree with the commenter that total riverine population numbers of Atlantic sturgeon are higher than the number of annually spawning adults. However, the only quantitative abundance estimate available to us when the proposed rule published was the number of annually spawning adults in the Altamaha River, not total population numbers or the total number of juveniles, as suggested by another commenter citing Schueller and Peterson (2010).

Schueller and Peterson (2010) stated that quantified methods of assessing sturgeon recruitment are essential for evaluating population trends, but that early life stages of most sturgeon species are notoriously difficult to sample, and their study on the Altamaha River provides the first quantified recruitment data describing a juvenile Atlantic sturgeon population in a southern river. They conducted their research during the summers of 2004 to 2007 and estimated that juvenile abundance ranges from 1,072 to 2,033 individuals in the Altamaha River, with age-1 and age-2 individuals comprising greater

than 87 percent of the population. Based on modeling, estimated apparent survival and per capita recruitment indicate that the juvenile population experiences high annual turnover: Apparent survival rates are low (less than 33 percent), and per capita recruitment is high (0.82–1.38). However, the authors noted that their mark–recapture methods were not capable of providing separate estimates of annual survival and out-migration, yet these rates are critical in understanding recruitment processes for the species. They noted future studies are needed to obtain quantified recruitment data using alternative methods, such as biotelemetry and known-fates modeling approaches. Schueller and Peterson (2010) concluded that future studies of subadult and adult life stages are needed, but quantified assessment of river resident juveniles can provide fisheries managers with the data necessary for evaluating population trends.

The statement in the proposed listing rule that spawning populations are less than the 500 recommended by Thompson (1991) as a minimum viable population size for long-term population fitness does not conflict with the statement that total population abundances for the Carolina and South Atlantic DPSs are not available. As we stated in this response, we do not have direct estimates of total population numbers for any of the Southeast spawning populations. Based on data from Schueller and Peterson (2006), we were able to present an estimate of the number of annually spawning adults in the Altamaha River. Although survey/stock assessment data on total population numbers or annually spawning adults are not available for the remaining Southeast river populations, based on information that the Altamaha is the largest population in the Southeast and data from the remaining rivers, we estimate in comparison that the other spawning populations have no more than 300 spawning adults per year.

In response to the comment that based on observations and modeling, the Winyah Bay system and ACE Basin have more individuals than Thomas (1990) recommended as minimum viable population sizes for short-term and long-term population fitness, we note that Thomas (1990) offered a population size of 5,500 as ''a useful goal,'' but suggested that where uncertainty regarding a species' population dynamics, changing environmental conditions, and the species' reaction to the changing environmental conditions is extreme (as it is for Atlantic sturgeon) ''we should usually aim for population sizes from several thousand to ten thousand.'' Information provided for the Winyah Bay and ACE Basin does not provide an estimate of total population size in either system. Because annual spawning adults was the only quantitative population metric we had for any southern river population at the time of the proposed listing, we looked at estimated annual spawning adult population sizes in comparison to various viable population sizes suggested in the literature. We now have additional information on juvenile abundance in the Altamaha River and some preliminary modeling of juvenile abundance in the Edisto River; however, this information is lacking for most river systems, and the population trends are not certain from the data we have. Although the Carolina and South Atlantic DPSs, made up of multiple river populations of Atlantic sturgeon, were determined to be interbreeding population units, the vast majority of Atlantic sturgeon return to their natal rivers to spawn, with fewer than two migrants per generation spawning outside their natal system. We looked at the number and size of each riverine spawning population within each DPS when considering the effects of a small population size on the extinction risk for the DPS as a whole. We do not believe that information presented by the commenters provides a basis to revise our evaluation of the status of the Carolina and South Atlantic DPSs of Atlantic sturgeon.

Comment 23: Several commenters stated that historical commercial landings do not accurately reflect abundance and are not a good indicator of status. One commenter stated that Secor (2002) should not be used as the basis for estimating historical abundances of Atlantic sturgeon. The commenter stated that due to the nearshore location of the fisheries in the latter part of the 19th century, the data would include Atlantic sturgeon from multiple populations and represent a gross overestimate of historical abundance. A comment was received that population modeling should have been used to analyze the trajectory of the species.

Response: Section 4(b)(1)(A) of the ESA states that the Secretary shall make listing determinations solely on the basis of the best scientific and commercial data available. Historical abundance data is not available. However, we believe that the historical landings data and the sharp downward decline observed in landings throughout the 20th century are a valid indicator of the declines in abundance experienced by Atlantic sturgeon. Secor (2002) represents the best available data on the estimated historical abundances of Atlantic sturgeon, as does the U.S. Fish Commission data on historical landings, which the Secor (2002) publication was based on and which we reviewed ourselves for clarification in preparing the making our listing determinations. We agree that it is impossible to conclusively determine whether historical landings data potentially represents Atlantic sturgeon from multiple river systems and multiple DPSs. In the proposed listing rule, we reported historical abundances of Atlantic sturgeon from Secor (2002) as state-wide estimates of spawning females for North Carolina, South Carolina, and Georgia. Though not stated directly in the proposed listing rule, this infers that multiple river populations and DPSs are represented in these estimates, since each state contains multiple river systems, both of the DPSs in the Southeast encompass multiple states, and in the case of South Carolina, both DPSs include river populations originating in that state. Therefore, our use and presentation of the data in the proposed listing rule was appropriate and not inconsistent with the commenter's statement. Due to the lack of data (*e.g.,* abundance, recruitment, natural mortality, bycatch mortality) on Atlantic sturgeon throughout most of the species' range, reliable population modeling at the species/DPS level is not possible. However, as detailed in the proposed listing rule, we believe that the trajectory observed in the commercial landings from the late 19th century through the 20th century, combined with information from recent and ongoing surveys of Atlantic sturgeon populations and information on threats to the species from habitat modification (*e.g.,* dams, dredging, water quality and quantity) and bycatch clearly demonstrates that Atlantic sturgeon population abundances have shown little improvement since their initial declines and continue to face a degree of threat that warrants listing the Carolina and South Atlantic DPSs of Atlantic sturgeon as endangered.

Comment 24: A commenter stated that the 1990–2003 increasing trend in Atlantic sturgeon abundance in the Cape Fear River should not have been discounted in the status review.

Response: We did not discount information in the proposed listing rule on trends in Atlantic sturgeon abundance in the Cape Fear River between 1990 and 2003, as reported by Moser *et al.* (1998) and Williams and

Lankford (2003). We presented different interpretations of the data that the researchers noted themselves in their research publications. In the proposed listing rule, we stated ''abundance of Atlantic sturgeon below Lock and Dam #1 in the Cape Fear River seemed to have increased dramatically during the 1990–1997 surveys (Moser *et al.,* 1998), as the CPUE of Atlantic sturgeon was up to eight times greater during 1997 than in the earlier survey years. Since 1997, Atlantic sturgeon CPUE doubled between the years of 1997 and 2003 (Williams and Lankford, 2003). However, it is unknown whether this is an actual population increase reflecting the effects of North Carolina's ban on Atlantic sturgeon fishing that began in 1991, or whether the results were skewed by one outlier year. There was a large increase observed in 2002, though the estimates were similar among all other years of the 1997 to 2003 study.'' The commenter stated that the 2007 status review report should not have discounted the increase in sturgeon abundance in 2002 as an outlier year for the reason that it was a flood year. Williams and Lankford (2003) stated that CPUE is used to indicate a population size, but if environmental conditions affect the susceptibility of fish to being captured in gillnets, then the data may show a change in population size when environmental conditions actually caused the change in CPUE. Williams and Lankford (2003) further stated that, ''although previous years have documented relatively similar catch-per-unit-efforts, the summer of 2002 yielded twice the CPUE of any season since 1997. This also happens to be the lowest flow conditions experienced during this survey. Although catch-per-unit-effort increased greatly during these low flow conditions, previous years with low flow summers did not have the same resulting increases in CPUE. Future surveys should investigate river flow and other environmental conditions that may impact the Atlantic sturgeon's use of the Lower Cape Fear River.'' The researchers acknowledged ambiguity in whether these results represent increases in Atlantic sturgeon abundance or whether environmental conditions affected CPUE. Therefore, the information we presented in the proposed listing rule on trends in the Cape Fear River is consistent with what the researchers presented. Further, even if the data in the Cape Fear River do represent an actual increase in Atlantic sturgeon, data provided by NCDENR during the public comment period on the proposed listing rule did not show increasing trends in Atlantic sturgeon populations in other North Carolina rivers.

Comment 25: A commenter asked if the historical data on pounds of Atlantic sturgeon landed in South Carolina (page 61907 of the proposed listing rule) can be converted to CPUE.

Response: The majority of the landings data for South Carolina referred to by the commenter cannot be converted into CPUE. However, the data were taken from Smith *et al.* (1984), which did provide CPUE for the time period 1973 to 1982, and provided anecdotal data about the level of fishing effort for earlier time periods. The objective of the research conducted by Smith *et al.* (1984) was to obtain baseline information on the Atlantic sturgeon fishery in South Carolina. At the time their research commenced, South Carolina accounted for 55 percent of the total U.S. landings of Atlantic sturgeon, but little information on the characteristics of the fishery was available. Figure 2 in Smith *et al.* (1984) shows license data for the Atlantic sturgeon fishery in South Carolina. From 1960 to 1982, the number of fishermen licensed for sturgeon remained relatively constant, averaging 21 individuals (ranging between 15 and 30) per year. Smith *et al.* (1984) noted that fishermen possessing certain other types of fishing licenses (*e.g.,* a shrimp fishing license) were permitted to fish for Atlantic sturgeon without having a specific sturgeon license. Based on field observations, they estimated that there were two to three times the number of recorded licensed sturgeon fishermen active in these fisheries. No data on the amount of gear fished were available for the period of most active exploitation of the fishery (pre 1910), but from 1925 to 1970, the number of licensed units of fishing gear was also relatively constant and averaged 17.8 (ranging between 11 and 26). This suggests that landings data are representative of relative abundance, since fishing pressure remained constant.

There was a dramatic increase in fishing effort in the 1970 to 1982 time period, with the number of licensed nets at record levels for the time. The number of licensed nets in 1970 was less than 30, but by 1982, it was around 140. Smith *et al.* (1984) calculated CPUE data for 1973 to 1982 based on reported total landings and number of net licenses, as well as field observations and verbal information provided by fisherman. They noted several limitations of the license and landings data for calculating CPUE: (1) Though individual gear were required to be licensed, the license was not based on type or length; (2) the license data included gear fished in the northern (Winyah Bay) and southern (Edisto, Coosawhatchie, and Combahee Rivers) fisheries, whereas the landings data only included fish from the northern fisheries; (3) field observations indicated that not all nets were licensed, nor landings reported; and, (4) pre-1973 data included landings of shortnose sturgeon in addition to Atlantic sturgeon. Figures 6 and 7 in Smith *et al.* (1984) show landings, effort, and CPUE. Landings rose from about 20,000 to 42,000 kilograms (kg) between 1973 and 1982, while the number of licensed nets increased from 36 to 133 during the same time period, resulting in a slight declining trend in CPUE (Figure 6). Observations of fishermen on the Winyah Bay jetties between 1978 and 1982 (Figure 7) also showed a decline in CPUE during the time period, with Atlantic sturgeon landings declining even with effort increasing. Smith *et al.* (1984) concluded that a definitive analysis of the fishery was not possible because of the limitations of the data, but they stated that ''fishing effort has substantially increased without a concomitant increase in landings'', and though ''the fate of this fishery in South Carolina is not clear, it appears likely that intensive fishing effort will adversely affect local populations of these long-lived fish.''

Comments on the 2007 Status Review, the 1998 Status Review, and Difference Between the Status Reviews and the Proposed Listing Rule

Comment 26: Commenters disagreed with NMFS' proposal to list both of the DPSs in the Southeast as endangered, when the 2007 status review report concluded that the Carolina DPS should be listed as threatened and did not make a listing conclusion for the South Atlantic DPS due to lack of information to allow a full assessment of subpopulations within the DPS. Several of these commenters stated that there was no new scientific information presented justifying the proposed listing of the Carolina and South Atlantic DPSs differently from the conclusions reached in the 2007 status review report. Similar comments were received that no new data has been collected, and no changes in the level of threats have been documented, since the 1998 status review, which concluded that listing was not warranted at that time. One commenter said the proposed listing rule does not sufficiently explain why the conclusion in the 1998 status review report that the existing moratorium on fishing for Atlantic sturgeon and the

listing of the shortnose sturgeon was adequate to protect Atlantic sturgeon is no longer valid.

Response: Regarding comments about divergence from the 2007 status review report's listing conclusions for the Carolina and South Atlantic DPSs, see our response to peer reviewer comment 1 above.

In 1998, NMFS and USFWS (Services) determined that an ESA listing of Atlantic sturgeon throughout its range was not warranted at that time (63 FR 50187, September 21, 1998). The Services cited eight reasons for the negative determination: (1) Evidence that the historical range of the species has not been substantially reduced and that its current range is not likely to be significantly reduced in the foreseeable future; (2) persistence of at least 14 spawning populations; (3) the expected efficacy of existing prohibitions on harvest and possession in all 15 states comprising the species' U.S. range; (4) detailed evaluation of current habitat conditions and threats to habitat showing that conditions are adequate to sustain the species and are likely to remain so in the foreseeable future; (5) lack of substantial information indicating that overutilization for commercial, recreational, scientific or educational purposes is currently significantly affecting the species; (6) lack of information indicating that disease or predation are causing significant losses of individuals of the species; (7) existing regulatory mechanisms which provide adequate protection and further the conservation of the species; and, (8) lack of information indicating that artificial propagation is currently posing a threat to the species.

Section 4(b)(1)(A) of the ESA requires that listing decisions be made using the best available scientific and commercial information at the time of the decision, after conducting a review of the status of the species and considering the conservation efforts of states and foreign nations.

Information provided in the 2007 status review report and the 2010 proposed listing rule explain why we no longer believe all of the eight conclusions in the 1998 status review report are valid, particularly as applied to DPSs of Atlantic sturgeon. Specifically: (1) Reductions in the historical range of Atlantic sturgeon have occurred, as evidenced by extirpations of several spawning populations in both Southeast DPSs and limited access to historical river reaches and habitats above dams (detailed in the ''Distribution and Abundance'' and ''Conservation Status'' sections of the proposed and final listing rules); (2) no spawning populations in the DPSs are large or stable enough to provide with any level of certainty for the continued existence of the DPS in the face of threats currently acting on the species; (3) existing prohibitions on harvest and possession of Atlantic sturgeon in all East Coast states do not alleviate other significant threats to Atlantic sturgeon (*i.e.,* bycatch and habitat destruction/modification, a point discussed in further detail in the discussion on those threats); (4) habitat destruction and modification (from dams, dredging, degraded water quality and quantity, *etc.*) is a significant threat to Atlantic sturgeon river populations and DPSs, as discussed below and in our responses to comments 39–45; (5) information on overutilization of Atlantic sturgeon as bycatch suggests that this is also a significant threat to Atlantic sturgeon populations, as discussed below and in our responses to comments 46 and 47; and, (7) existing regulatory mechanisms have proven inadequate at controlling the threats to Atlantic sturgeon from habitat modification/destruction and bycatch, as discussed in our responses to comments 49 and 50. Evidence for these conclusions and detailed responses to the comments received on these conclusions is presented in the following text.

Comments stated that no new data has been collected and no changes in the level of threats have been documented since the 1998 status review. However, studies not available at the time of the 1998 status review report on bycatch (discussed here) and habitat quality (discussed later in this section) have been reviewed by NMFS as part of our current listing determination. The 1998 status review report determined that estimated levels of mortality associated with bycatch on the Delaware and Hudson Rivers indicated that bycatch was not a significant threat to the species survival but could impede recovery, and recommended that efforts be made to better quantify data on bycatch levels, fishing effort, and river population levels to ensure that assumptions made using Hudson and Delaware River information are valid for other river populations. Since 1998, the ASMFC (2007) produced a bycatch report providing estimates of Atlantic sturgeon bycatch, as did Stein *et al.* (2004), a bycatch report used by the 2007 ASSRT. The reports documented mean bycatch mortality rates of 13.8 percent and 22 percent, respectively. However, the ASMFC (2007) report noted that the estimates of bycatch utilized in the analysis are likely to be underestimates of true bycatch and mortality levels, since they rely only on reported bycatch from the observer program (there is limited observer coverage in fisheries potentially capturing Atlantic sturgeon in Federal waters from North Carolina to Florida), and delayed mortality is not accounted for in their estimates. Further, the 1998 status review report did not consider the effects of bycatch and degraded habitat working in combination on greatly reduced Atlantic sturgeon populations, which are at 1 to 6 percent of historical levels.

In response to the comments that the proposed listing rule does not sufficiently explain why the conclusion in the 1998 status review report that the existing moratorium on fishing was adequate to protect Atlantic sturgeon is no longer valid, at the time of the 1998 determination, we note that the ASMFC moratorium on retention of Atlantic sturgeon had recently gone into effect. Because this eliminated directed fishing for Atlantic sturgeon (NMFS followed this with a 1999 closure of the EEZ to fishing for Atlantic sturgeon), which was considered the primary threat to the continued existence of the species at the time, the moratorium factored heavily in the Services' decision not to list the species at the time. However, since implementation of the moratorium, additional bycatch information (Stein *et al.,* 2004; ASMFC, 2007) has become available and indicates that Atlantic sturgeon are vulnerable to bycatch in commercial fisheries, and that the current rate of bycatch is unsustainable in the long term (ASMFC, 2007). Further, the proposed listing rule described in detail why the existing moratorium on directed capture of Atlantic sturgeon has not eliminated the incidence of sturgeon bycatch in other fisheries and also does not address threats associated with the destruction and modification of their habitat. Comments were also received that the proposed listing rule does not sufficiently explain why the conclusion in the 1998 status review report that the listing of the shortnose sturgeon was adequate to protect Atlantic sturgeon is no longer valid. While Atlantic sturgeon have benefited from some of the protections afforded the endangered shortnose sturgeon due to their shared presence in some rivers, shortnose sturgeon do not coexist in all rivers within the Atlantic sturgeon's range and shortnose sturgeon do not use the coastal and marine environments used extensively by Atlantic sturgeon. Additionally, there is often spatial and temporal separation of riverine habitat

use by the Atlantic and shortnose sturgeon. Adults of both species use similar habitats for spawning in the riverine environment, but they are known to use them at slightly different times of the year. As stated in the 1998 recovery plan for the shortnose sturgeon, spawning begins in freshwater from late winter/early spring in southern rivers. The 2007 Atlantic sturgeon status review report stated that spawning adults generally migrate upriver in the spring/early summer (February to March in southern systems). Further, the 2007 Atlantic sturgeon status review report noted that other life stages of Atlantic and shortnose sturgeon may use different sections and/or different depths within the same river system. Therefore, the threats facing each species are not identical and protections for shortnose sturgeon cannot be expected to fully alleviate threats to Atlantic sturgeon.

Comment 27: Several comments were received on differences in the 1998 and 2007 status reviews in the evaluations of the threat to Atlantic sturgeon from habitat modification. A commenter noted that the 1998 status review report denied the petitioner's claims that dam blockages, degraded water quality, and dredging significantly contributed to low Atlantic sturgeon abundances, but NMFS has not provided any evidence supporting a reversal of this conclusion. Another commenter specifically asked what changed between the 1998 and 2007 status reviews to warrant the ''moderately high (4)'' ranking of threats from dams on the Cape Fear River in the 2007 status review. The commenter also asked if the recommendations on page 91 of the 1998 status review report have been followed. The commenter requested we provide the baseline data on spawning and nursery habitat, including locations, depths, flows, substrates, carrying capacity or optimal population, that was recommended as ''contributing to and accelerating the ongoing recovery or enhancement of Atlantic sturgeon'' in the 1998 status review. Several commenters also cited the 1998 status review's statements that water quality has been improving since the 1970s, dredging activities are increasingly rare and have minimal effects on sturgeon, and successful shortnose restoration is indicative of future rebounding of Atlantic sturgeon stocks. One of the commenters referenced Table 9 in the 2007 Status Review, which shows a 2004 U.S. Environmental Protection Agency (USEPA) water quality grade in the Southeast as ''B'', then questioned the extinction risk ratings in Table 13 of the 2007 Status Review, which rates water quality in most of the Southeast rivers as having a moderate risk of causing extinction.

Response: In reaching our 1998 not warranted determination, we did not consider the loss of habitat due to dams to be a significant threat. Page 31 of the status review report states, ''In the southern region of the U.S. Atlantic coast, the fall line is commonly much farther inland (322 river kilometers or rkm on the Savannah River, South Carolina-Georgia border) or almost nonexistent (St. Johns River, Florida). This potentially provided more freshwater (spawning) habitat than in many northern rivers. However, historical records of the amount of habitat actually used by Atlantic sturgeon are lacking. Thus, for most rivers, it is not possible to determine how much habitat was lost due to dam construction for southern rivers.'' As stated above, the 1998 analysis included the amount of spawning habitat available to the species across its range. Since that time, we have determined the amount of habitat lost on each of the rivers due to dams (see Table 7 of the 2007 status review). We also have additional information on spawning locations for some rivers. The 1998 status review report cited the Savannah River as an example of a river with a fall line far inland and the 2007 status review report also stated that 92 percent of the habitat on the Savannah is unimpeded by dams. While both of these facts are true, the historical primary spawning habitat for Atlantic sturgeon (and only shoal habitat on the Savannah River), the Augusta Shoals, is not accessible to Atlantic sturgeon because it lies above the New Savannah Bluff Lock and Dam (Wrona *et al.,* 2007; Marcy *et al.,* 2005; Duncan *et al.,* 2003; USFWS, 2003). Regarding the comment on the ranking for the Cape Fear River, the 1998 status review report did not have an estimate for how much spawning habitat was blocked by Lock and Dam #1. The 2007 status review report included the following information and provides insight into the ''moderately high'' ranking for the threat of dams on that river (page 51): ''Historical spawning locations are unknown in the Cape Fear River; therefore, it is assumed that the fall line is the upper limit of spawning habitat. Using the fall line as guide, only 33 percent of the historical habitat is available to Atlantic sturgeon (96 km of 292 km). In some years, the salt water interface reaches the first lock and dam; therefore, spawning adults in the Cape Fear River either do not spawn in such years or spawn in the major tributaries of the Cape Fear River (*i.e.,* Black River or Northeast Cape Fear rivers) that are not obstructed by dams.''

Dredging activities are far from rare. NMFS routinely conducts section 7 consultations on listed species for dredging projects within the range of Atlantic sturgeon. Statistics on hopper dredging, the form of dredging most likely to take aquatic species (such as sea turtles and Atlantic sturgeon), can be found on the U.S. Army Corps of Engineers' (USACE) ''Sea Turtle Data Warehouse'' Web site (*http://el.erdc.usace.army.mil/seaturtles/index.cfm*). The Charleston, Jacksonville, Savannah, and Wilmington Districts have completed 307 hopper dredging projects, removing over 220 million cubic yards of material from federally maintained navigation channels in 307 projects since 1991. The number of private dredging projects permitted by USACE would increase that number considerably. Further, these numbers do not include other dredging methods (*e.g.,* cutterhead and mechanical) used by Federal and private entities that are less likely to directly interact with sturgeon species, but can modify and degrade sturgeon habitat.

While water quality has generally improved since the 1970s due to numerous Federal, state, and local laws, including the Clean Water Act of 1972, water quality continues to be an issue for Atlantic sturgeon due to human population expansion and a variety of agricultural, industrial, and commercial activities in the coastal zone. Table 9 in the 2007 status review report cites the USEPA's National Coastal Condition Report (NCCR) II (2005) in grading the Southeast water quality as a B. The NCCR II also assigned water quality a numerical score of 4 (where 1 is poor and 5 is good), ranking it as ''good to fair.'' It is important to note that the water quality index in the NCCR II was based on a combination of several parameters, the most important of which to Atlantic sturgeon is dissolved oxygen (DO). The DO range considered ''good'' in the NCCR II was greater than 5 mg/L while a DO range of 2 to 5 mg/L was considered ''fair.'' As stated in the proposed listing rule, sturgeon are more highly sensitive to low DO than other fish species and ''low'' DO was defined as less than 5 mg/L (Niklitschek and Secor, 2009a, 2009b). A DO of 2 mg/L (the lower end of the ''fair'' scale in the NCCR II report) would be considered very poor for an Atlantic sturgeon, likely lethal to early life stages (Niklitschek and Secor, 2009a, 2009b; Niklitschek and Secor, 2005; Secor and Gunderson, 1998). The USEPA

published the NCCR III in 2008 and downgraded water quality in the Southeast from a 4 to a 3, ranking it as ''fair'' rather than ''good to fair.'' It also showed that the portion of the Southeast that had a ''poor'' water quality index ranking increased slightly from 5 percent to 6 percent. While other condition indicators for the Southeast in the NCCR III showed improvement over the NCCR II levels (the benthic index was upgraded from a 3 to a 5 in the Southeast) or remained the same (the coastal habitat index remained a 3), the sediment quality index was downgraded from a 4 to a 3, and the fish tissue contaminant index was downgraded from a 5 to a 4. This resulted in a decrease from 3.8 to 3.6 in the overall condition of the Southeast. The results of the NCCR III report do not support the commenters' assertion that water quality has continually improved since the 1970's. Water quality was downgraded to ''fair'', and DO levels included under a ''fair'' rating may be less than adequate for Atlantic sturgeon, particularly early life stages. Further, the percentage of geographic areas in the Southeast with ''poor'' water quality increased between NCCR II and III.

NMFS and other partners involved in the conservation of Atlantic sturgeon (such as the ASMFC, USFWS, and state agencies) continue to work on monitoring, research, and other activities, including those outlined in the 1998 status review, to recover Atlantic sturgeon. However, these are long-term, ongoing efforts, and the objectives outlined in the 1998 status review report are not complete. We do not have all of the data requested by the commenter, but what is available is included in the 2007 status review, the proposed listing rule, and the references cited therein. Once Atlantic sturgeon are listed, NMFS will have a greater opportunity to prioritize and standardize Atlantic sturgeon research, as recommended for recovery and conservation of Atlantic sturgeon in the 1998 status review.

Comment 28: Several comments stated that the 2007 status review report was developed with little or no input from state agency experts and that state agency comments should be weighed heavily. One commenter stated that the results of the 2003 workshop that preceded the 2007 status review report were not publicly available.

Response: Eight state and regional experts from six state agencies provided their individual expert opinions on the information contained in the 2007 status review report and provided additional data to ensure the status review report included the best available. Many of the comments, data, and information presented in this document originated from state agencies. As stated in the status review report and the proposed listing rule, information obtained at the 2003 workshop prompted the initiation of the status review. Information from the workshop was incorporated into the 2007 status review. In addition, the 2003 workshop was held in conjunction with a meeting of the ASMFC Atlantic Sturgeon Technical Committee and some of the proceedings of the workshop are published in various meeting summaries, reports, and documents on the ASMFC's Atlantic sturgeon Web site (*http://www.asmfc.org*).

Comments on the Need To List Atlantic Sturgeon Under the ESA

Comment 29: Comments were received stating that Atlantic sturgeon should not be listed because their populations are stable, sufficiently large, and/or increasing. Commenters cited to Grunwald *et al.* (2008) for statements that the Altamaha and Edisto appear to have large, multiple year class populations that exhibit high annual reproductive success. The State of Georgia commented that, in order to list as threatened or endangered under the ESA, the condition must exist in ''all or a significant portion of its range.'' The commenter stated the Altamaha River represents a significant portion of the South Atlantic DPS's range due to the large population of Atlantic sturgeon in that river and the area of the watershed. They also stated populations are persisting in other systems, and therefore, they do not believe Atlantic sturgeon are threatened or endangered throughout a significant portion of their range. Other commenters stated that Atlantic sturgeon have been observed in most South Carolina coastal rivers during the last two decades, although it is not known if all rivers support a spawning population. Currently, the only long term data set available for Atlantic sturgeon in South Carolina is on the Edisto River, where the Atlantic sturgeon population seem to be relatively stable based on fishery independent sampling efforts by the South Carolina Department of Natural Resources. A commenter stated that abundance and distribution presented in the proposed listing rule is inconclusive, citing increasing incidental take in Albemarle Sound gill nets, increases in average length of Atlantic sturgeon captured off North Carolina between 1986 and 2003, suspected spawning activity on the Pee Dee River during the Fall of 2003, and the doubling of CPUE of Atlantic sturgeon from annual surveys conducted in the Cape Fear River between 1997 and 2003. One commenter stated that for the Savannah River, conclusions were incorrectly drawn in the proposed listing rule that the greater catch of shortnose sturgeon than Atlantic sturgeon, as cited in Collins *et al.* (1996), was not a reflection of lower than expected catch of Atlantic sturgeon, but rather that they were fishing in areas/habitat not preferred by juvenile Atlantic sturgeon.

Response: The information presented by commenters stating that Atlantic sturgeon should not be listed does not provide a basis for revising our proposed listing rule determination of endangered for the Carolina and South Atlantic DPSs of Atlantic sturgeon. Grunwald *et al.* (2008) stated that ''among southeastern populations, those in the Altamaha (Peterson *et al.* in press) and Edisto appear to be large, with multiple year classes and high annual reproductive success.'' Grunwald *et al.* (2008) continued that ''others range from small (Ogeechee and Savannah) to possibly extirpated (Satilla).'' This is consistent with information we presented in the proposed listing rule that, at the 2003 workshop, we determined some populations seemed to be recovering while others were declining, prompting our initiation of the 2007 status review. This comment is also consistent with our description in proposed listing rule of the Altamaha population as larger and more robust than other populations in the Southeast. We received information from SCDNR (presented in the previous section of comments) that they have captured 3,661 Atlantic sturgeon in the Edisto since 1994. If all of these were spawning adults, then this represents an average of approximately 230 spawning adults per year since 1994, which is consistent with our estimate of less than 300 spawning adults per year for this system. The low number of annually spawning adults estimated for Atlantic sturgeon in the Southeast (343 for the Altamaha River and less than 300 for the remaining spawning populations) factored heavily in our determination that the Carolina and South Atlantic DPSs warranted listing as endangered. In the proposed listing rule, we did not define which rivers constitute a significant portion of the species' range because we concluded that the Carolina and South Atlantic DPSs are endangered throughout their entire ranges. The presence of multiple spawning populations does not negate the need for listing. As discussed above, we do not believe that any of the riverine

populations within either DPS, alone or in combination, are viable and stable enough to constitute a significant portion of either DPS's range.

We acknowledged uncertainty in the abundance and distribution information we presented. However, we believe that a conservative evaluation of the information the commenter referred to as ''inconclusive'' supports our endangered listing determination. As the commenter noted, we stated that catch records for Albemarle Sound, as well as the Roanoke River, indicate that this population seemed to be increasing until 2000, when recruitment began to decline. We also indicated the existence of catch records and observations from other river systems in North Carolina (*e.g.,* the Tar, Neuse, and Cape Fear Rivers), but, based on the relatively low numbers of fish caught, we stated it was difficult to determine whether the populations in those systems are declining, rebounding, or remaining static. However, the fact alone that low numbers of fish were caught does not logically lead to a conclusion that populations are increasing. The commenter's interpretation of data on increases in average length of Atlantic sturgeon caught off North Carolina between 1986 and 2003 (from Laney *et al.,* 2007) is incorrect. While Figure 5 in Laney *et al.* (2007) showed an increase in average length of fish caught from 1988 to 2006, the commenter suggested this is due to a reduction in commercial harvest of larger sturgeon. Commercial harvest of Atlantic sturgeon was completely prohibited in 1999. The trend of increasing size was linear over the full time period and the rate of increase showed no association with the time period during which the moratorium was active. Laney *et al.* (2007) did not draw any conclusions about the increase in average size over the study period. However, they did conclude from the length data that all but five of the Atlantic sturgeon captured were juveniles. They attributed the low numbers of adults to either the age distribution of the population (*i.e.,* low numbers of adults in the population because of pre-moratorium fishing) or the ability of adults to more successfully evade capture in nets. As we discussed in our response to a previous comment, it is possible that the increases in Atlantic sturgeon observed in the Cape Fear River surveys were due to environmental conditions rather than actual population increases. As we also stated above, the same data the commenter states shows an increased population in the Cape Fear River would have to be interpreted to show no increase in Atlantic sturgeon in other North Carolina Rivers, and as previously stated, neither DPS can be judged not in danger of extinction based on any single river population within the DPS.

We do not agree that we incorrectly interpreted the lower catch of Atlantic versus shortnose sturgeon in the Savannah River, as reported in Collins *et al.* (1996). Researchers conducted surveys in both the lower river (rkm 45–75) and upper river (rkm 160–299). No Atlantic sturgeon were captured in the upper river, while 14 Atlantic sturgeon (and 189 shortnose) were captured in the lower Savannah River. As stated in Collins *et al.* (1996), juvenile Atlantic sturgeon in the size range likely to be captured in the shad fishery (and the size range observed in this study) occur in estuarine and tidally influenced portions of the river. According to the New Georgia Encyclopedia, the Savannah River is tidally influenced up to Clyo, Georgia, 61 miles (98 rkm) upriver. Therefore, the lower river study area was within the area Collins *et al.* (1996) expects juvenile Atlantic sturgeon to occur.

Comment 30: Several commenters recommended that NMFS implement alternative actions instead of listing Atlantic sturgeon. One commenter suggested that NMFS designate Atlantic sturgeon as a Species of Concern and conduct another status review in 2017. Some commenters believed that, in lieu of listing Atlantic sturgeon, NMFS should enter into multi-state, multi-agency partnerships to obtain the information they believe is necessary to support management actions. A commenter specifically requested that we provide information on any cooperative efforts NMFS is engaged in. One commenter suggested that increased fishing regulations, including the development of habitat reserves, as well as area and seasonal closures, are warranted instead of listing. Another commenter stated that NMFS should expand the 1965 Anadromous Fish Conservation Act in order to protect Atlantic sturgeon and said that imposing a listing is a poor substitute for restoring habitat and water quality.

Response: We made our proposed listing determinations for the Carolina and South Atlantic DPSs of Atlantic sturgeon by carefully analyzing the declines in population abundance, available information on the current status of riverine spawning populations, and the threats facing the species, and whether their status or the threats are adequately addressed by existing regulatory mechanisms or protective or conservation mechanisms. Though moratoria on harvest and possession of Atlantic sturgeon were enacted by the ASMFC, NMFS, and several states, populations have not rebounded and the moratoria do not control bycatch. We believe continued overutilization of Atlantic sturgeon from bycatch in commercial fisheries is an ongoing impact to the Carolina and South Atlantic DPSs that is contributing to their endangered status. 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. While some of the threats to the Carolina and South Atlantic DPSs have been reduced through the existing regulatory mechanisms, such as the moratoria on directed fisheries for Atlantic sturgeon, bycatch is currently not being addressed through existing mechanisms. Further, water quality continues to be a problem even with existing controls on some pollution sources and water withdrawal, and dams continue to curtail and modify habitat, even with the Federal Power Act. Since our evaluation of the Carolina and South Atlantic DPSs resulted in our determining that both DPSs are in danger of extinction throughout their ranges (*i.e.,* meet the definition of endangered), we cannot list the DPSs as threatened or continue to designate Atlantic sturgeon as a species of concern.

Section 4(b)(3)(B) of the ESA requires us to make a finding within 12 months of receiving a petition as to whether the petitioned action is warranted. Section 4(b)(6)(A) of the ESA requires that a final listing determination be made within 12 months of publication of the proposed listing rule. Because we received a petition to list Atlantic sturgeon from the Natural Resources Defense Council (NRDC) on October 6, 2009, that established mandatory deadlines under the ESA for determining whether listing of the species is warranted, and for associated rules. As described above, the best available scientific and commercial information on the status of, and threats to, Atlantic sturgeon is sufficient to warrant listing of the Carolina and South Atlantic DPSs of Atlantic sturgeon as endangered under the ESA. Therefore, listing cannot be postponed, and we cannot enter into multi-state, multi-agency partnerships or increase fishery regulations to address Atlantic sturgeon conservation issues in lieu of listing. However, once listed, fishery regulations, such as the development of habitat reserves or seasonal/area closures, could be considered as a means to reduce threats to Atlantic

sturgeon from being taken as bycatch. If this was determined to be necessary for the conservation of Atlantic sturgeon, it would be done in collaboration with all the stakeholders, including the affected fishing community.

We currently work with multiple agencies in multiple states to improve our knowledge of the species and to enhance conservation efforts. In fact, our efforts and exchange of knowledge with our multi-agency, multi-state partners factored into our decision that listing the Carolina and South Atlantic DPSs of Atlantic sturgeon as endangered is warranted. In 1999, pursuant to section 804(b) of the Atlantic Coastal Fisheries Cooperative Management Act (16 U.S.C. 5101 *et seq.*), we supported the ASMFC's moratorium on Atlantic sturgeon by closing the Exclusive Economic Zone (EEZ) to Atlantic sturgeon retention. In 2003, we sponsored a workshop with the USFWS and ASMFC to discuss the status of sturgeon along the Atlantic Coast and determine what obstacles, if any, were impeding their recovery. Based on the information gathered from the 2003 workshop, we decided that a new review of Atlantic sturgeon status was needed to determine if listing as threatened or endangered under the ESA was warranted. The ASSRT was a multi-agency team consisting of NMFS, USFWS, and USGS biologists. Also, as described in the example given in the response above, we have entered into multi-state, multi-agency partnerships to conduct research.

The projects described in the previous response to document seasonal and spawning migrations of sturgeon, identify interbasin migrations, develop genetic aging techniques, and map habitat were all funded through the Species Recovery Grants Program (''section 6 program'') in 2010. Section 6 of the ESA provides a mechanism for cooperation between NMFS and states in the conservation of threatened, endangered, and candidate species. Under section 6, NMFS is authorized to enter into agreements with any state that establishes and maintains an ''adequate and active'' program for the conservation of endangered and threatened species. Once a state enters into such an agreement, NMFS is authorized to assist in, and provide Federal funding for, implementation of the state's conservation program. Federal funding, provided in the form of grants, can be used to support management, outreach, research, and monitoring projects that have direct conservation benefits for listed species, recently delisted species, and candidate species that reside within that State. Each of the states occupied by the Carolina and South Atlantic DPSs has a section 6 agreement with NMFS. In addition to the multi-year, multi-state, multi-agency projects funded in 2010, various research projects by multiple agencies involving the Carolina and South Atlantic DPSs were funded through the section 6 program in prior years (NMFS, 2009), including evaluations by GADNR of Atlantic sturgeon populations and habitat in the Altamaha River (2003, 2004, and 2006) and the St. Mary's and Satilla Rivers (2008), and studies by SCDNR of Atlantic sturgeon growth, diet, and genetics (2003, 2005).

The Anadromous Fish Conservation Act (AFCA) of 1965 is another source of collaboration between Federal and state partners. Projects funded under this act are conducted for the conservation, development, and enhancement of anadromous fishery resources and must be cleared with the fishery agency of the state that the work is carried out in. Many projects funded under AFCA are critical elements of larger programs to manage, restore, or enhance anadromous resources. In 1998, SCDNR was awarded $176,837 for a 3-year project to collect life history data on juvenile Atlantic sturgeon and determine seasonal habitat utilization, movements, and growth. SCDNR was also awarded $116,926 in 2001 for a 3-year period to continue work on the previous project funded through the AFCA, as well as look at the effects of fisheries, such as shad gillnet fisheries, on sturgeon. Research publications resulting from these projects were evaluated in the proposed listing. AFCA funding for research in the Southeast Region is generally around $104,000 per year, though the program has not received funding for the past 3 years.

We do not believe the listing of the Carolina and South Atlantic DPSs is a substitute for restoring habitat and water quality. Rather, the need to list the two DPSs of Atlantic sturgeon in the Southeast as endangered highlights the need to restore water quality and their habitat, because as we outlined in the proposed listing, habitat modification and poor water quality are significantly contributing to the endangered status of Atlantic sturgeon.

Comment 31: Commenters both supporting and opposed to the proposed listing believed that additional information on Atlantic sturgeon, such as abundance, movement, life history information, habitat usage, response to threats, *etc.,* is necessary. Commenters supporting the proposed listing believed this information is important to address threats to the species and determine recovery actions. Fisheries and Oceans Canada provided information on current Atlantic sturgeon studies planned or underway and expressed their interest in exploring potential areas of collaboration to enhance our mutual understanding of Atlantic sturgeon. Commenters opposed to the proposed listing believed that NMFS should not pursue listing before more information on abundance, movement, genetics, threats, *etc.,* is obtained. A comment was received that NMFS is proposing listing the Atlantic sturgeon without dedicating funding to collecting necessary information on the species. Some commenters believed that a final listing determination should be postponed until the results of recently commenced studies on Atlantic sturgeon are available. Several commenters also stated that NMFS should implement the measures listed in the 1998 amendment to the ASMFC's FMP for Atlantic sturgeon and address the monitoring and data needs in it before making a listing determination.

Response: As described in the proposed listing rule and in the previous response, section 4(b)(3)(B) of the ESA requires us to make a finding within 12 months of receiving a petition as to whether the petitioned action is warranted, on the basis of the best data available at the time of the determination. Because we determined the Carolina and South Atlantic DPSs of Atlantic sturgeon warranted listing as ''endangered,'' we published a proposed listing rule in the **Federal Register**. The ESA requires that we publish final listing rules within one year from the date that we publish proposed rules to list species. The best available scientific and commercial data on the historical declines of Atlantic sturgeon, the species' failure to rebound even with the prohibition on directed captured and possession, the information on the status of current spawning populations, the information on the level of threats to the species from bycatch, habitat modification and curtailment, and the failure of existing regulatory mechanisms to protect the species indicate that listing of the Carolina and South Atlantic DPSs of Atlantic sturgeon as endangered under the ESA is warranted. Therefore, we cannot postpone a listing determination until the results of recently commenced studies are available. However, we agree with commenters that additional information on Atlantic sturgeon concerning abundance, movement, life history information, habitat usage, and response to threats is critical to fully recovering the species.

Section 4(b)(1)(A) of the ESA requires us to make listing determinations solely on the basis of the best scientific and commercial data available, whether research funding for the species is available or not. However, while Atlantic sturgeon were considered a ''species of concern'' and a candidate species, NMFS dedicated funding to Atlantic sturgeon in order to gain knowledge necessary for conservation and recovery of the species. NMFS is currently funding a multi-year, multi-state, multi-agency project to document, through telemetry, seasonal and spawning migration patterns and incidences of inter-basin transfer for adult Atlantic (and shortnose) sturgeon in southeastern rivers in North Carolina, South Carolina, and Georgia, as well as develop, test, and implement a genetic aging technique. We are also funding research to map habitat in four Georgia rivers that will complement this study, as it overlaps with the area where the telemetry work is being conducted. These studies also address components of the monitoring and data needs outlined in the ASMFC's Atlantic sturgeon FMP. We will continue to conduct and fund Atlantic sturgeon research as funds become available in the future. We look forward to working with the ASMFC, Fisheries and Oceans Canada, our state partners, and other stakeholders in the conservation and recovery of Atlantic sturgeon, including obtaining the necessary research to fill in the gaps in our knowledge.

Comment 32: One commenter stated that NMFS relied on non-peer reviewed, agency-based opinion rather than scientific fact and stated that future management steps would also be driven by conjecture rather than science. Another commenter stated that the proposed listing rule was politically motivated instead of scientifically warranted. A comment was received that NMFS is rushing to list Atlantic sturgeon to gain leverage in FERC relicensing activities underway, such as the Santee-Cooper Hydroelectric Project.

Response: Section 4(b)(1)(A) of the ESA requires us to make listing determinations solely on the basis of the best scientific and commercial data available, not conjecture or political motivation. However, the ESA's best available data standard does not require us to limit the information we consider to published, peer-reviewed scientific literature. Our listing determination is consistent with the Services' Interagency Cooperative Policy on Information Standards (59 FR 24271; July 1, 1994). The majority of the literature cited in the status reviews and the proposed listing rule consists of peer-reviewed publications. As required by the regulations and agency policy for implementing the ESA and by the Information Quality Act, status reviews and listing decisions themselves are peer reviewed. The proposed listing rule for the Carolina and South Atlantic DPS was peer reviewed by three experts. The list of peer reviewers, with their affiliations, and the peer review comments in their entirety, are posted at *www.regulations.gov* and *http://www.cio.noaa.gov/Policy_Programs/prplans/ID184.html.* Our responses to the peer review comments are stated in this document. NMFS is not rushing to list Atlantic sturgeon to gain leverage in FERC relicensing activities; as discussed previously, section 4(b) of the ESA dictates strict timelines for making determinations and publishing rules in response to a petition to list a species as threatened or endangered.

Comments on the Consequences of the Proposed Listing Rule

Comment 33: Several comments were received stating that listing will not eliminate the impacts to Atlantic sturgeon (*e.g.,* it will not result in the removal of locks and dams).

Response: The commenters are correct that listing will not eliminate all impacts to Atlantic sturgeon. However, section 4(b)(1)(A) of the ESA states that the Secretary shall make listing determinations solely on the basis of the best scientific and commercial data available to him after conducting a review of the status of the species and taking into account efforts to protect the species. Based on our review of the best available information on the status of the Carolina and South Atlantic DPSs of Atlantic sturgeon and the efforts currently in place to protect the DPSs, we concluded that both DPSs should be listed as endangered. Our reasoning is outlined in the proposed listing rule and supplemented by our responses to the public comments in this document.

While listing a species does not automatically remove all threats, the ESA does provide tools for greater protection of listed species. When this final rule takes effect, the prohibition on ''take'' in section 9 of the ESA will apply. Also, any action funded, authorized, or undertaken by a Federal agency that may affect Atlantic sturgeon from either DPS will require consultation between that Federal agency and NMFS under section 7 of the ESA. Once listed, section 4 of the ESA also requires that we develop and implement a recovery plan that must, in part, identify objective, measurable criteria which, when met, would result in a determination that the species may be removed from the list; this standard inherently requires that recovery plans propose methods to address impacts and threats to the species. In the example given by the commenter for locks and dams, during section 7 consultation, NMFS would work with the operating and/or authorizing agency (*e.g.,* USACE or FERC) to minimize the effects on Atlantic sturgeon and their habitat. This could result in a variety of conservation measures to allow passage of Atlantic sturgeon upstream of the lock or dam and to control any downstream effects from the structures. The installation of fish passage, dam breaching, and even lock/dam removal have been undertaken in the past to restore natural flows and allow access to habitat for anadromous species.

Comment 34: Comments were received stating there will be negative consequences to various stakeholders associated with the listing. One commenter stated the Federal listing would increase regulations and potentially affect parties that do not have significant impacts on Atlantic sturgeon survival. Several commenters stated that there will be impacts to fisheries if additional restrictions are placed on them due to the listing, even if the interactions with Atlantic sturgeon do not cause significant mortality. Several comments were received that the listing process will hold up the issuance of new FERC licenses in the range of the two DPSs, which contain measures that they believe would benefit sturgeon. Commenters were concerned that there will be impacts to commerce if ship strikes result in speed restrictions and could be more far-reaching than the right whale protection zone. Commenters also believed there will be further restrictions on dredging, such as at large ports, that could have economic consequences for ports and commercial shipping interests. Commenters suggested that the cost to Federal and state entities associated with increased permitting needs should be considered in the listing. Another commenter stated that NMFS is using the listing to force regulators to impose requirements on third parties (*e.g.,* hydropower licensees) through the ESA consultation process, and the impact will affect society for decades. The commenter said that the costs of recovery should be leveled equitably among all parties, including NMFS, by allocating funding to collecting data needed for management. One commenter stated that economics should not be considered in the listing.

Response: As explained in the response above, section 4(b)(1)(A) of the

ESA states that the Secretary shall make listing determinations based solely on the best scientific and commercial data available to him after conducting a review of the status of the species and taking into account efforts to protect the species. The regulations implementing the ESA at 50 CFR 424.11(b), consistent with case law interpreting the ESA and its legislative history, state that the listing determination will be made without reference to possible economic or other impacts of such determination. We cannot consider the potential consequences (*e.g.,* increased economic costs or regulatory responsibilities) to the various stakeholders in our listing determination. Through the ESA section 7 consultation process, measures to reduce the effect of impacts on Atlantic sturgeon may be required for federally funded or permitted projects that adversely affect fish from the Carolina or South Atlantic DPS, but the listing will not affect entities or activities that do not affect Atlantic sturgeon. NMFS is not using the listing to force regulators to impose requirements on third parties (*e.g.,* hydropower facility licensees) and we are working with FERC to ensure that the listing of Atlantic sturgeon does not hold up the issuance of new licenses. For example, where we had already been engaged in section 7 consultation regarding a proposed relicensing's effects on the endangered shortnose sturgeon, we began ''conference consultations'' on the effects of such projects on Atlantic sturgeon once the species was proposed to be listed. Such ''conference opinions'' can be promptly adopted without reinitiating consultation on a project, if a species' listing is finalized as proposed. The listing determination, prompted by the 2007 status review report and the 2010 NRDC petition, is based solely on the status of the species and its current level of protection from impacts and threats.

NMFS currently dedicates funding to the recovery of listed species (and species of concern) through a variety of channels; we provide funds to the NMFS Science Centers, to academic institutions, and our state partners doing research. We currently have a multi-state effort to tag and track Atlantic sturgeon, and a simultaneous habitat mapping project in a portion of the area where the tagging/tracking is occurring, funded through our ESA section 6 grant program (Species Recovery Grants). However, successful recovery of the species will require the actions of entities other than NMFS. Section 4(f)(2) of the ESA states that the Secretary, in developing and implementing recovery plans, may procure the services of appropriate public and private agencies and institutions, and other qualified persons. Section 7(a)(1) of the ESA charges all Federal agencies to utilize their authorities in furthering the purposes of the ESA by carrying out programs for the conservation of threatened and endangered species. Recovery may also be facilitated through incorporating conservation measures into activities that potentially affect Atlantic sturgeon, for example, through section 7(a)(2) consultation and section 10(a)(1)(B) permitting. Those processes provide a means to tailor the required conservation measures to the severity of an activity's impacts.

Comment 35: Many commenters had concerns over the time lag in getting research permits to study Atlantic sturgeon if they are listed as endangered. Other commenters said that in addition to creating a lengthy research permitting process, listing will lead to sampling constraints that would invalidate long established sampling protocols and will terminate long-term indices of abundance, as a change in the survey protocol is essentially the initiation of a new survey. Several commenters stated that the listing will abolish all efforts presently being undertaken to study the Atlantic sturgeon, including research on captive Atlantic sturgeon and studies conducted by other Federal agencies, such as USACE. One commenter suggested that these issues be taken into account in deciding whether to proceed with listing as endangered versus threatened. In addition to concerns over Atlantic sturgeon research, commenters also expressed concerns over impacts to other fishery survey and sampling programs that may encounter Atlantic sturgeon, as these would also require permitting. Commenters also expressed concern over the ability to opportunistically collect data from incidental captures of Atlantic sturgeon if they are listed as endangered. Several commenters expressed concern that the increased permitting workload associated with an Atlantic sturgeon listing would also cause a greater delay in obtaining permits to conduct research on other species, such as the shortnose sturgeon.

Response: As explained in the responses above, we cannot consider the potential consequences to stakeholders, including those conducting research on Atlantic sturgeon that aids in the management and conservation of the species, in making listing determinations. However, NMFS is making every effort to ensure that Atlantic sturgeon research, including ongoing care and study of captive fish, can continue uninterrupted once they are listed. Section 10(a)(1)(A) of the ESA allows NMFS to issue permits authorizing activities otherwise prohibited by section 9 of the ESA for the purpose of scientific research on listed species. The NMFS Office of Protected Resources, Permits Division contacted known Atlantic sturgeon researchers, at the time the proposed listing rule published in the **Federal Register**, requesting information on planned research activities so that an expedited permitting process could be put in place. Twelve applications for research permits for Atlantic sturgeon have been received and are undergoing review, and the steps necessary to comply with the National Environmental Policy Act and section 7(a)(2) of the ESA are already underway. Section 10(a)(1)(B) of the ESA allows NMFS to issue permits authorizing incidental take of listed species during the course of otherwise legal activities, such as fishery survey and sampling programs targeting species other than Atlantic sturgeon. If the activities are Federal actions, section 7 consultations can also provide incidental take authorization.

In March 2010, NMFS published ''A Protocol for Use of Shortnose, Atlantic, Gulf, and Green Sturgeons'' (Kahn and Mohead, 2010; available at *http://www.nmfs.noaa.gov/pr/pdfs/species/kahn_mohead_2010.pdf*). Section 10 permits will likely require that the protocol be followed during Atlantic sturgeon research. The goal of the protocol is standardization of research practices to benefit the recovery of sturgeon species, including the Atlantic sturgeon, while also minimizing potentially negative impacts of research.

These protocols were developed from a comprehensive review of the best available scientific information at the time of publication, including peer reviewed journals, technical memoranda, interviews with researchers, and empirical evidence provided by researchers. Some researchers expressed concern that sampling constraints associated with such a protocol would invalidate long-established sampling protocols and will terminate long-term indices of abundance. However, the protocol was developed with input from researchers and will serve to standardize research in the future. Any variation from previous research methods can likely be accounted for when comparing results. It is common in research, including Atlantic sturgeon research, for methods and equipment to evolve as experience

and technology in the field of research grows. Further, there is flexibility built into the protocol. For example, the introduction to the document states, ''When researchers or managers have reason to exceed recommendations in this document using less known or riskier techniques, NMFS recommends first using surrogate Acipenserids or hatchery-reared sturgeon. When researchers or managers feel non-recommended methods must be conducted on wild listed or candidate species, the researchers should consult with the appropriate permitting agency in order to justify why their methodology is necessary to provide information for the recovery of these species.''

Comment 36: Flagler County, Florida, commented that they do not believe Atlantic sturgeon or habitat supporting sturgeon exists in their county and requested that they be excluded from regulatory jurisdiction. Oconee County, Georgia, requested an exemption for previously permitted public water supply projects.

Response: Section 4(b)(5)(a)(ii) of the ESA requires that we notify each county where Atlantic sturgeon are believed to occur and invite their comment. Because we do not know all of the exact locations where Atlantic sturgeon may occur, and to ensure all counties potentially affected by the proposed listing were contacted, we used a GIS database to generate a list of all counties within the watersheds of rivers with current or historical spawning populations of Atlantic sturgeon. This resulted in over 200 counties for the Carolina and South Atlantic DPSs. Flagler County, Florida, is part of the St. Johns River watershed. The St. Johns River is used by Atlantic sturgeon as nursery habitat. We realize that not all of the counties we contacted have Atlantic sturgeon present; however, upstream projects can have effects on Atlantic sturgeon downstream, and we chose to be more inclusive to give adequate opportunity for communication between NMFS and potentially affected counties. Moreover, Atlantic sturgeon may reoccupy areas of their former ranges once their populations begin to recover, or when impediments to their migration are removed. Areas where Atlantic sturgeon do not exist and where activities that could potentially affect Atlantic sturgeon, directly or indirectly, are not occurring, will not be affected by the listing of Atlantic sturgeon. We cannot grant exemptions for projects that may affect Atlantic sturgeon once they are listed as endangered. Oconee County did not state whether they believe their permitted water supply projects will have effects on Atlantic sturgeon. Once listed as endangered, we will work with such entities to protect Atlantic sturgeon while still carrying out the purpose of their projects, such as providing water to the public.

Comments on Our Analysis of Threats

Comment 37: One commenter stated that the extinction risk analysis assigns arbitrary risk values to the level of threat an activity poses for Atlantic sturgeon populations in each river on a scale of 1 to 5. The commenter believed statistically sound information would be difficult to derive from this analysis when used to determine the status of a species under the ESA.

Response: We believe this comment misinterprets the purpose and utility of the extinction risk analysis contained in the Atlantic sturgeon status review. However, that risk analysis was not determinative to our proposed listing because we did our own independent extinction risk analysis, which we determined was required to be consistent with the ESA. The ASSRT characterized their extinction risk analysis as a ''semi-quantitative'' approach. It is not possible, nor did the ASSRT or NMFS ever intend, to conduct statistical analyses on the results of the extinction risk analysis contained in the status review. Further, the status review report clarifies that the intent of the extinction risk assessment was to help summarize the status of the species, and did not represent a decision by the ASSRT on whether the species should be proposed for listing as endangered or threatened under the ESA. In our proposed listing rule, we considered the information contained in the ASSRT's extinction risk analysis as part of our listing determination. However, we also considered additional threats (*e.g.,* drought, water allocation issues, and climate change) not considered by the ASSRT. In addition to evaluating the threats to the species, we considered the effects of small population size on the risk of extinction of Atlantic sturgeon DPSs. We compared estimated Atlantic sturgeon abundances with minimum viable population sizes discussed in relevant literature (see ''Conservation Status'' section in the proposed listing rule).

Comments on Habitat Threats

Comment 38: Commenters supporting the proposed listing rule emphasized that Atlantic sturgeon are vulnerable to habitat destruction, noting sensitivity to low DO, pollution, and river-specific threats from dams, dredging, and development, and a summary of their comments are included here. Several commenters noted that the Cape Fear River is above permissible mercury limits and all 13,123 waters in North Carolina are in Category 5 (waters impaired for one or more designated uses by a pollutant(s)) on the state's 2010 303(d) list (the list of impaired and threatened waters that section 303(d) of the Clean Water Act requires all states to submit to the USEPA) for mercury due to statewide fish consumption advisories. Several commenters also provided NMFS with information that a proposed cement plant on the Cape Fear River is requesting authorization to emit 263 pounds (119 kg) per year of mercury and discharge 10–15 million gallons of water a day (mgd). One commenter cited an analysis by a marine chemist that conditions are favorable in the Cape Fear estuary to convert the mercury to more dangerous forms. The chairman of the North Carolina Marine Fisheries Commission identified the proposed site of the plant as a spawning area for Atlantic sturgeon and five other diadromous species. Commenters also provided information on habitat threats from other proposed projects, such as the Cape Fear Skyway and the North Carolina International Container Terminal. A commenter encouraged further studies on the effect of toxins on all Atlantic sturgeon life stages. Comments were also received supplementing information in the proposed listing rule on concentrated animal feeding operations (CAFOs). While there is a moratorium in North Carolina limiting hog operations, a commenter noted this does not apply to the poultry industry, which is greatly expanding in the state and poses a significant water quality threat. The commenter listed two processing plants, one in the Neuse River basin and one undergoing permitting in the Tar-Pamlico basin, that are driving the establishment of poultry CAFOs and will result in increased nitrogen and phosphorus loading in coastal waters. Another commenter, citing NCDENR Department of Water Quality (DWQ) as the source of information, reported the decline of 1,600 freshwater miles (50 percent of the total freshwater miles) in the Neuse River basin and indicated that runoff is a contributing factor. They further cited NCDENR DWQ that this is likely an underestimate of the true number of miles affected by nonpoint-source runoff. The commenter also noted the ecological and water quality benefits from undisturbed riparian buffers and noted many instances in the coastal counties where construction of bulkheads and other shoreline

stabilization activities has resulted in the partial or complete loss of riparian buffers. Comments were received that in 1999, 60 percent of surface water tested in Georgia was too polluted for fishing, swimming, or drinking compared to national average of 40 percent. The Savannah River was reported to be the fourth most toxic river in the U.S., with 48 industrial outfalls over a 200 mile stretch from Augusta to Savannah. Comments included that the river has high levels of mercury, low DO is likely to worsen if the harbor deepening project is approved, and temperature is also a challenge, as cold water from the J. Strom Thurmond Dam is discharged 75 feet below the lake surface, disrupting the natural temperature regime. Though the proposed listing rule noted that water quality in the Altamaha is relatively good, a commenter provided information that 19 rivers and streams making up 192 miles of the Altamaha basin were on the 2002 303(d) list as not meeting their designated uses. This is an area dominated by silviculture and agriculture, two paper mills, and numerous other dischargers. Information provided included that a Federal Superfund site is contributing chemicals (including mercury). A May 2009 report noted lesions on fish in the river, linked to poor water quality and bacteria present in floodwaters. A commenter also noted the St. Mary's River is much warmer than the 70–75 degrees Fahrenheit ideal for sturgeon (it reaches the 90s), DO levels drop to less than 2 parts per million at times, and of the coal power plants on the river, half report releasing water in the summer months (when high temperature and low DO already a problem) at peak temperatures of 100 degrees Fahrenheit or more. The commenter concluded thermal pollution can stress or kill any fish present, and will be exacerbated by poor water quality conditions in these rivers.

Response: Additional information provided by commenters on the threats posed by the destruction, modification, or curtailment of Atlantic sturgeon habitat is consistent with our finding that it poses a significant threat to the Carolina and South Atlantic DPSs. We will continue to work with our partners and stakeholders through our existing authorities to reduce or eliminate the adverse effects of anthropogenic activities on sturgeon and their habitat.

Comment 39: Comments stated that water quality information presented in the proposed listing rule was overly generalized and should receive a more comprehensive review. Some commenters stated that water quality is good and/or improving, and disagreed that water quality is affecting Atlantic sturgeon. A commenter stated that after more than 30 years of water quality improvements associated with the Clean Water Act, it is unreasonable to think habitat is not of good quality. Another commenter stated that water quality has been improved through existing Federal and state regulations and programs, such as the mandate to implement water quality improvement programs that are consistent with Total Maximum Daily Load (TMDL) plans. The Cape Fear River was used as an example; the comments maintained that while certain areas are impaired, other areas used by Atlantic sturgeon are in excellent condition and fully support sturgeon life functions, and the NCDENR DWQ's water quality data should be used. NCDENR DWQ also submitted comments on the proposed listing rule, providing benthic macroinvertebrate data for 1983 to 2010 and stated that data from 12 river segments are fair to excellent. Commenters also said fish kills are not a good indicator of water quality, as reporting varies by year and location. One commenter stated that NMFS failed to identify water quality issues in the Cooper River, the Santee River meets state DO standards greater than 96 percent of the time, and NMFS did not acknowledge increased minimum flows associated with the new Santee-Cooper license. One commenter stated that NMFS did not present a substantive analysis concerning the sensitivity of sturgeon to water quality parameters relative to water quality conditions that currently exist in ''critical habitat areas.'' The commenter provided a literature summary on Atlantic sturgeon sensitivity to DO, temperature, and salinity in the Cape Fear River and a water quality database from the Cape Fear River Estuary Program and stated that an assessment of these data would provide information on the spatial and temporal distribution of various sturgeon life stages, sensitivities, and the likelihood of exposure to potentially adverse water quality conditions.

Response: As stated in our response to comment 27 on the 1998 and 2007 status reviews, while water quality has generally improved since the 1970s due to numerous Federal, state, and local laws, including the Clean Water Act of 1972, water quality continues to be an issue for Atlantic sturgeon due to human population expansion and a variety of agricultural, industrial, and commercial activities in the coastal zone. The USEPA publishes the National Coastal Condition Report and the NCCR II, published in 2005, graded the Southeast's water quality as a B. The NCCR II also assigned water quality a numerical score of 4 (where 1 is poor and 5 is good), ranking it as ''good to fair.'' The USEPA published the NCCR III in 2008. It downgraded water quality in the Southeast from a 4 to a 3, ranking it as ''fair'' rather than ''good to fair.'' It also showed that the portion of the Southeast that had a ''poor'' water quality index ranking increased slightly from 5 percent to 6 percent. While other condition indicators for the Southeast in the NCCR III showed improvement over the NCCR II levels (the benthic index was upgraded from a 3 to a 5 in the Southeast) or remained the same (the coastal habitat index remained a 3), the sediment quality index was downgraded from a 4 to a 3, and the fish tissue contaminant index was downgraded from a 5 to a 4. This resulted in a decrease from 3.8 to 3.6 in the overall condition of the Southeast. It is also important to note that the water quality index in the NCCR is based on several parameters, the most important of which to Atlantic sturgeon is DO. The DO level included within the ''good'' rating in the NCCR II was greater than 5 mg/L, while a DO range of 2 to 5 mg/L is included in the ''fair'' rating. As stated in the proposed listing rule, sturgeon are more highly sensitive to low DO than other fish species and ''low'' DO for sturgeon has been defined as less than 5 mg/L (Niklitschek and Secor, 2009a, 2009b). A DO of 2 mg/L (the lower end of the ''fair'' scale in the NCCR II report) would be considered very poor for an Atlantic sturgeon and is likely lethal to early life stages. The USEPA also monitors TMDLs, a calculation of the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards. Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes. Based on 2006 to 2010 data, each of the states in the range of the Carolina and South Atlantic DPSs had impaired waters under section 303(d) of the Clean Water Act: Florida (828 waterbodies), Georgia (215 waterbodies), South Carolina (1,060 waterbodies), North Carolina (902 waterbodies), and Virginia (2,534 waterbodies). Of the rivers and streams assessed, 51 to 66 percent of these waters were impaired in each of the southeastern states. Between 24 and 84 percent of the lakes, reservoirs, and

ponds assessed in each southeastern state were listed as impaired, as were 22 to 95 percent of bays and estuaries assessed. In the Cape Fear River basin, the example used by the commenter, 205 sections of the river are listed as impaired on the 303(d) list. As suggested by the commenter, we reviewed water quality information from NCDENR DWQ. We reviewed the most recent Water Quality Plan (October 2005) available for the Cape Fear River basin (publicly available at *http://h2o.enr.state.nc.us/basinwide/draftCPFApril2005.htm*), which supplements the TMDL data provided by the USEPA. The plan (Chapter 27, Figure 31) indicates ''habitat degradation'' and low DO occur in over 140 miles of impaired streams. Low DO is also estimated to occur in approximately 6,500 acres of impaired estuarine waters (Chapter 27, Figure 32). Figures 37 and 38 note various sources of stressors to streams and estuarine waters, respectively. While wastewater treatment, municipal stormwater, agriculture, land clearing, development, and impervious surfaces are listed as potential sources, the largest source affecting water quality in impaired streams and estuarine waters in the Cape Fear River basin is ''unknown.''

NCDENR DWQ commented on the proposed listing rule, as well. They stated that a review of benthic macroinvertebrate data from the Cape Fear mainstem demonstrates that the river is supporting robust benthic invertebrate communities. Benthic invertebrate communities serve as prey for foraging Atlantic sturgeon. NCDENR DWQ stated that 6.2 percent of the samples received ''excellent'' bioclassifications, and 31.2 percent each received ''good'', ''good to fair'', and ''fair'' bioclassifications. There were no samples receiving ''poor'' bioclassifications. However, with the exception of one sample collected in 2003, the remaining samples were collected in the 1980's and 1990's. Also, benthic invertebrate communities are only one of the many factors affecting the quality and suitability of habitat for Atlantic sturgeon. Regarding NCDENR DWQ's comment that fish kills were not a good indicator of water quality and that some of the fish kills on the Cape Fear River are likely due to naturally occurring low DO from blackwater swamps, we also reported this in the proposed listing rule. The comment that fish kill reporting varies by year and location, and is not a good indicator of water quality, is also consistent with our treatment of fish kill information in the proposed listing rule. We did not compare fish kill information across river systems with varying degrees of monitoring and reporting effort, rather we only included fish kill data as anecdotal evidence of naturally occurring low DO in the lower Cape Fear River.

With regard to habitat modification and curtailment in the Santee-Cooper system, the majority of the discussion in the proposed rule focused on the threats to Atlantic sturgeon from dams. The Clean Water Act 303(d) list of impaired waters includes 21 waterbodies within the Santee River basin and 34 waterbodies within the Cooper River basin. The commenter stated that the Santee River meets state DO standards greater than 96 percent of the time but did not provide data or a reference we could evaluate. The list of 303(d) waters in the Santee River basin lists 19 waterbodies that are listed as a result of low DO. We also reviewed the South Carolina State Water Assessment of the Santee River Basin, prepared by SCDNR (2009), which lists 9 waterbodies that are partially supporting of aquatic life and 19 waterbodies that are non-supporting of aquatic life, based on DO. The new license for the Santee-Cooper Hydroelectric project has not yet been issued, therefore the magnitude and timing of implementation of required increased minimum flows is unknown at this time. Significant concerns still exist over the inability of Atlantic sturgeon to access over 60 percent of historical habitat in the Santee-Cooper system due to the presence of the dams, though this would be partially ameliorated by fish passage for sturgeon that was prescribed in 2007 by NMFS for the Santee and Cooper Rivers pursuant to the Federal Power Act, if these prescriptions are implemented.

A commenter stated that we did not present an analysis of water quality in critical habitat areas. NMFS has not designated critical habitat, but the proposed listing rule and responses supplied in this document detail water quality conditions and potential effects of reduced water quality in habitat used by the Carolina and South Atlantic DPSs of Atlantic sturgeon. The literature summary on Atlantic sturgeon sensitivity to DO, temperature, and salinity in the Cape Fear River and a water quality database from the Cape Fear River Estuary Program is consistent with information in the proposed listing rule. The literature reviewed by the commenter was also cited in the 2007 status review report and/or the proposed listing rule.

Comment 40: A commenter stated that silviculture and forest manufacturing facilities do not appear to have significant implications for sturgeon or their habitat, particularly when compared to other land uses like agriculture or development. The commenter supplied information on forestry best management practices, sedimentation, the use of herbicides, and urged NMFS to reconsider its assertion that forest management practices pose a significant threat to biological diversity or to habitat for the Atlantic sturgeon. The commenter asserted that water quality has improved and will continue to improve through existing Federal and state regulations and program. The commenter also stated that implementation rates for forestry best management practices (BMPs) are high nationally, and there is an extensive body of scientific literature that confirms that forestry BMPs are effective. The commenter also indicated that state agencies and sustainable forestry certification programs are effective at educating the forest management community about forestry BMPs and encouraging their implementation, and providing reasonable assurance that forestry BMPs are being implemented effectively. The commenter concluded that sustainable forest management that adheres to BMPs does not pose a threat to terrestrial or aquatic organisms, including Atlantic sturgeon.

Response: The proposed listing rule included silviculture and forestry practices as potential threats to Atlantic sturgeon. The proposed listing rule stated that the spawning habitat of the Carolina DPS occurs within the Mid-Atlantic Coastal Plain ecoregion. The Nature Conservancy lists land conversion (*e.g.,* forests converted to timber plantations) as one of several significant threats in the ecoregion. The South Atlantic DPS occurs within the South Atlantic Coastal Plain ecoregion. The Nature Conservancy described the primary threats to biological diversity in this ecoregion as silvicultural practices, including conversion of natural forests to highly managed pine monocultures and the clear-cutting of bottomland hardwood forests. The proposed listing rule also noted that in the Altamaha River, which has the largest spawning population of Atlantic sturgeon in the Southeast, water quality is good at this time, but the drainage basin is dominated by silviculture and agriculture, with two paper mills and over two dozen other industries or municipalities discharging effluent into the river. While we agree that some existing programs are effective, degraded water quality continues to pose a threat to Atlantic sturgeon in

many systems despite existing regulatory mechanisms.

We appreciate the information provided by the commenter on the degree of threat to Atlantic sturgeon from forestry activities, as well as forestry BMPs and the efforts of the industry to ensure successful BMP implementation, including education and monitoring. However, we do not believe that our characterization of the potential threat of forestry practices to Atlantic sturgeon was overemphasized or overstated in the proposed listing rule, or was inconsistent with information provided by the commenter. While we do not disagree with the comments regarding the effective implementation of forestry BMPs, we note that implementation of the BMPs is voluntary in some cases, and that while BMP implementation nationally is high (89 percent), it is not 100 percent. The commenter also stated that implementation rates for BMPs can be used to understand trends and identify areas where improvement is necessary; however, BMP evaluations are detailed reports of many on-site practices, are designed to highlight potential problems for post-harvest monitoring, and are not a direct measure of water quality impact. We look forward to working with the commenter and other industry representatives to proactively evaluate and address forestry impacts on Atlantic sturgeon.

Comment 41: We received multiple comments supporting our evaluation of the effects of dams on Atlantic sturgeon and their habitat; some commenters provided additional information on the nature of the threat of dams to Atlantic sturgeon. A commenter concerned about the effects of dams on Atlantic sturgeon recommended continued investigation into ways to provide fish passage in areas where barriers obstruct access to essential habitat or where passage is otherwise obstructed in a manner that can injure and/or kill Atlantic sturgeon and noted that effective sturgeon passage does not exist. Another commenter provided NMFS with additional information on threats from dams. For example, the commenter detailed the effects of bed coarsening, which can reduce the ability of Atlantic sturgeon to forage for food, impair nutrient and waste assimilation through altered flow regimes and greater evaporation from the presence of reservoirs, and effect biodiversity as a result of habitat loss. The commenter also provided data on the presence of dams in Georgia, which has the highest density of dams in the Southeast. The commenter provided information that the number of dams listed in the National Dam Inventory (NDI) shows 4,423 reservoirs in Georgia but the actual number is believed to be higher based on studies conducted by UGA, which estimates 68,000 reservoirs in Georgia. The commenter stated that American Rivers named the Altamaha the 7th most endangered river in the country based on its importance to fisheries and multiple threats from five proposed dams that would have severe effects on fish species, including loss of habitat and increased pollutant concentrations, and noted that the governor of Georgia urged legislative action to build new reservoirs. The commenter also noted that the Savannah River is impacted by New Savannah Bluff Lock and Dam and J. Strom Thurmond Dam. The latter is the largest reservoir east of the Mississippi and Atlantic sturgeon are blocked from habitat above Augusta where data shows they previously occurred. The commenter also noted loss of habitat from dams in the St. Johns.

Response: Additional information provided by commenters on the threats posed by dams to Atlantic sturgeon and their habitat is consistent with our finding that dams pose a significant threat to the Carolina and South Atlantic DPSs.

Comment 42: We received multiple comments disagreeing with our evaluation of the effects of dams on Atlantic sturgeon and their habitat. A commenter stated that the proposed listing rule failed to indicate the extent to which Atlantic sturgeon access to habitat has been lost on the Roanoke, Tar-Pamlico, and Neuse River systems, all of which have dams. Other commenters disagreed with the evaluation of dams in the proposed listing rule. One stated that the majority of Atlantic sturgeon habitat is available, as 91 percent of historical spawning habitat is unimpeded by dams, 27 of 35 rivers contain 100 percent of their historical habitat (*e.g.,* Pee Dee River), and 32 have over 75 percent of the historical range available. Another commenter stated that NMFS has not evaluated the quality of the remaining 91 percent of habitat available to Atlantic sturgeon. One commenter questioned whether the estimated 64 percent of historical habitat impeded by Lock and Dam #1 on the Cape Fear was accurate and provided his own estimate of 30 percent. A comment was received that the use of watershed miles as the measure of habitat loss due to dams suggests that the entire river system is critical habitat and any reduction is a reduction in sturgeon habitat. The commenter contended that since critical habitat has not been determined or designated, it is presumptuous to assume every portion of the river is appropriate habitat without an analysis or evaluation. The commenter also believed that the proposed listing rule gave undue weight to restoration of these habitats rather than prioritizing actions that would have significant and immediate benefits to Atlantic sturgeon (*e.g.* reducing bycatch). A similar comment was received that NMFS has placed too much emphasis on restoring historical habitat, which is poorly defined and may be of questionable importance to Atlantic sturgeon. The commenter believed that there are lower costs and larger near-term gains in protecting, mitigating, and enhancing currently accessible habitat than trying to reconnect historical habitat in highly developed and substantially modified watersheds. Another commenter said future habitat availability will increase through fish passage efforts on the lower Cape Fear River and through hydropower flow enhancements on the Pee Dee River, and similar flow enhancements will occur on other rivers through FERC relicensing projects. A commenter stated that there is a lack of knowledge about the exact location of historical spawning habitat on the Roanoke River. A commenter stated that both the Gaston and Roanoke Rapids hydroelectric facilities are located above the fall line. Given that the Carolina DPS is estimated to be less than 3 percent of the historical abundance and lack of documentation of significant spawning historically occurring upstream of the fall line, it seemed unlikely to this commenter that restricted spawning habitat is limiting restoration efforts. The commenter stated that these hydroelectric facilities have been modified to simulate more natural flow during spawning season and during the FERC relicensing, measures to limit peaking operations and enhance flows were put in place. The commenter also said the facilities adhere to North Carolina state water quality standards for temperature and DO except when flood control flows from upstream at the Kerr Dam overwhelm their ability to maintain the water quality standards. A commenter stated that the Cape Fear Lock and Dam #1 has been in place since 1915 and Atlantic sturgeon have obviously adapted to it since they are still spawning.

Response: In regard to the comment that the proposed listing rule failed to indicate the extent to which Atlantic sturgeon access to habitat has been lost on the Roanoke, Tar-Pamlico, and Neuse River systems, Table 7 of the 2007 status

review report estimates the percentage of riverine habitat, in river kilometers, available to Atlantic sturgeon in each river system shows that access to 18 percent of the habitat on the Roanoke River is blocked by the Roanoke Rapids Dam. Table 7 shows no loss on the other two rivers. The percentages of historical habitat unimpeded by dams presented by another commenter are mostly consistent with Table 7 of the status review. As documented in Table 7, the 91 percent of historical habitat available to Atlantic sturgeon includes 36 rivers (not 35), 2 of which are in Canada and not included in the proposed U.S. listings. Coast-wide, 25 U.S. rivers, plus the 2 Canadian rivers, are listed as having 100 percent of their historical habitat accessible. As noted by the commenter, an additional 5 rivers have greater than 75 percent of their river miles unimpeded by dams. However, three rivers in the Southeast have 62 to 64 percent of their length inaccessible to sturgeon due to the presence of dams. Moreover, rivers without dams but without spawning populations present, may not provide habitat to sturgeon for decades; because the vast majority of Atlantic sturgeon spawn in their natal river, they are not likely to seek out spawning habitat in other rivers and reduced spawning success due to lack of appropriate habitat can greatly affect the recovery potential of a spawning population. In addition to preventing or reducing the ability to spawn, dams can have effects far downstream that reduce the suitability of river habitat for other sturgeon life functions. As identified in the 2007 status review report and the proposed listing rule, in addition to blocking habitat upstream, dams also degrade habitat downstream by altering DO concentrations and temperature; artificially destratifying the water column; changing sediment load and channel morphology; accelerating eutrophication and changing nutrient cycling; and contaminating water and sediment. The suitability of riverine habitat for Atlantic sturgeon spawning and rearing also likely depends on annual fluctuations in flow, which can be greatly altered or reduced by the presence of dams, as has been shown for sturgeon species (Richter and Thomas, 2007; Pringle *et al.,* 2000; Beamesderfer and Farr, 1997). Activities associated with dam maintenance, such as dredging and minor excavations along the shore, can release silt and other fine river sediments that can be deposited in nearby spawning habitat.

The estimate of 64 percent of historical habitat on the Cape Fear River blocked by Lock and Dam #1 was questioned by a commenter, who provided his own estimate of 30 percent of historical habitat blocked on the Cape Fear River. The estimate for the Cape Fear River included in Table 7 of the status review report is accurate, and potentially even an underestimate of the amount of habitat blocked to Atlantic sturgeon by Lock and Dam #1. The estimate came from thesis research (Oakley, 2003) that used regression models based on river characteristics, including total river length and distance to the first dam, to help predict presence of shortnose sturgeon within a river system. BASINS 3.0, a GIS-based program developed by the USEPA, was used to estimate these physical characteristics for each river modeled in the study, including the Cape Fear. Information from the thesis, presented in Table 7, lists rkm 95 as the location of Lock and Dam #1 and rkm 267 as the fall line, which indicates 172 rkm (or 64.4 percent of the Cape Fear River) are inaccessible to Atlantic sturgeon. However, in ''Rivers of North America'' (Benke and Cushing, 2005) it is stated that the fall line on the Cape Fear is located at the confluence of the Deep and Haw Rivers at rkm 313, which would indicate 218 rkm (or 69.7 percent of the Cape Fear River) are inaccessible to Atlantic sturgeon due to Lock and Dam #1. In addition, NCDENR's Office of Environmental and Public Affairs notes that access to 160 miles (257 rkm) of habitat has been blocked to anadromous species on the Cape Fear River (*http://www.eenorthcarolina.org/public/ecoaddress/riverbasins/capefear2.pdf*).

In response to comments about the use of river miles/kilometers as a measure of habitat loss and availability rather than habitat quality, we note that Table 7 of the status review report states ''river kilometers is only an estimate of habitat availability and should not be confused as a reference to habitat suitability, as many factors can reduce the quality of this available habitat (*e.g.,* impeded by water flow, dredging, water quality and other similar factors).'' The commenter is correct that we have not designated critical habitat, and we are not suggesting that the entire river is necessary for spawning or other life functions. Because we have little historical or current information about the exact locations of Atlantic sturgeon habitat, the best available information was the amount of habitat inaccessible to sturgeon above dams. We agree that habitat quality and its suitability for different sturgeon life functions is a necessary consideration in evaluating the extent of accessible habitat. In fact, the use of river kilometers below dams as a measure of habitat availability is potentially an overestimate of the amount of spawning habitat available to Atlantic sturgeon. For instance, Table 7 indicates that only 8 percent of historical habitat on the Savannah River is impeded by dams, based on the location of the New Savannah Bluff Lock and Dam (NSBL&D) at rkm 317 and the fall line at rkm 343. However, the Augusta Shoals, the only rocky shoal habitat on the Savannah River and the former primary spawning habitat for Atlantic sturgeon in the river (Wrona *et al.,* 2007; Marcy *et al.,* 2005; Duncan *et al.,* 2003; USFWS, 2003), is located above NSBL&D, and is inaccessible to Atlantic sturgeon. While the status review report states that 92 percent of the historical habitat on the Savannah River is still accessible (based on river kilometers below NSBL&D), in actuality, the remaining available spawning habitat is likely far less. Additionally, while spawning habitat may exist downstream of many dams, the quality of that habitat is often degraded, due to fluctuations in water level, velocity, and DO resulting from discharges from the dam, as well as upstream migration of the salt wedge, resulting from reduced freshwater discharge from upstream and/or channel modifications downstream. Because Atlantic sturgeon must spawn in freshwater and the resulting offspring must have adequate freshwater exposure for growth before entering saltwater, the encroachment of the salt wedge can reduce the availability of spawning habitat and even reduce the survival of YOY even if spawning is successful.

One commenter felt that we did not evaluate the quality of the 91 percent of total undammed habitat available to Atlantic sturgeon; however, the proposed rule went into great detail about dredging and water quality and quantity issues existing below dams that affect the suitability of spawning habitat for the Carolina and South Atlantic DPSs. While we have little historical or current information about the exact locations of Atlantic sturgeon habitat, we are currently funding research to document habitat utilization of Atlantic sturgeon. We do not believe the proposed listing rule gave undue weight to the loss of access to habitat due to dams or underestimated other threats, such as Atlantic sturgeon bycatch. We did not do a cost-benefit analysis on potential conservation and recovery efforts, as the ESA and its implementing regulations prohibit this type of consideration in listing determinations. We are hopeful about pending efforts on

the Cape Fear and Pee Dee Rivers, and we will continue to work with FERC and other stakeholders to improve habitat quality and access during relicensing activities. However, in our listing determinations, we had to evaluate the current status of, and threats to, Atlantic sturgeon, and how those are affected by existing regulatory mechanisms and protective efforts.

Contrary to comments about the Roanoke River, we do have information suggesting spawning historically occurred above the fall line in that system (Kahnle *et al.,* 1998; Armstrong and Hightower, 2002). However, in the proposed listing rule, we focused primarily on downstream effects associated with flow, water temperature, and DO levels in the Roanoke River from the Kerr Dam and the Gaston Dam/Roanoke Rapids facilities. Consistent with the comments received, we acknowledged in the proposed listing rule that there have been modifications to facilities operations on the river to simulate natural flows and that this has likely benefited Atlantic sturgeon. However, we also detailed the continuing threat to Atlantic sturgeon from hypoxic waters released from the Kerr Dam on the Roanoke in the summer, and the sensitivity of Atlantic sturgeon to hypoxia coupled with high temperature. Consistent with the comments, the proposed listing rule states that spawning populations occur in the Roanoke and Cape Fear Rivers. However, the failure of populations to rebound does not signify their adaptation to these conditions, but rather suggests the threat posed by dams to the Carolina and South Atlantic DPSs is contributing to their status.

Comment 43: Several comments were received on the effects of water withdrawals on Atlantic sturgeon habitat. A commenter supplemented information included in the proposed listing rule that demand for water for consumption purposes in the Southeast is not only going to increase with increasing population, but also due to increasing energy demands. The commenter stated that power plants withdraw an average of 40 billion gallons of water every day, representing 65 percent of total water withdrawals. The commenter also noted that there are currently 25 interbasin transfers in Georgia, involving 6 out of 14 of the state's river basins. One commenter noted that there is substantial information for water withdrawals in North Carolina and permits are required to some extent for agricultural withdrawals. Another commenter stated that the proposed listing rule discussed permitted water quantities but did not provide data on the available volume of water at each source or cite studies that link permitted interbasin transfers to the degradation of surface waters. A commenter stated that conservation and recovery decisions should not be based on the assumption that most, possibly all, subpopulations of Atlantic sturgeon are at risk of entrainment and impingement and that the impact from water intakes should be further evaluated according to the relationship between the activity, river, and sturgeon population.

Response: Additional information provided by commenters on the threats posed by water withdrawals to Atlantic sturgeon and their habitat is consistent with our finding that these activities pose a significant threat to the Carolina and South Atlantic DPSs. A commenter noted that there is substantial information on water withdrawals in North Carolina and permits are required to some extent for agricultural withdrawals. This is consistent with information we presented in the proposed listing rule on permitted water withdrawals. A commenter stated that we did not provide data on the available volume of water at each source or cite studies linking permitted interbasin transfers to the degradation of surface waters. Real-time water data for the United States is publicly available on the USGS Web site (*http://waterdata.usgs.gov/usa/nwis/rt*). However, as we stated in the proposed listing rule, categories of potentially large water withdrawals in several states do not require permits and are therefore not easily quantifiable. While river and stream flow data is monitored and recorded, we do not know how much non-permitted water withdrawals account for reductions in flow, and often we do not have data on the historical (*i.e.,* unimpaired) flow regimes in most rivers to quantify the degree to which flow volumes are currently reduced (Fisher *et al.,* 2003). The proposed listing rule included citations from studies describing the impacts of water withdrawals, permitted and non-permitted, on water quantity and quality parameters important to Atlantic sturgeon (*e.g.,* UGA, 2002; CBO, 2006; Georgia Water Coalition, 2006). The Congressional Budget Office (CBO, 2006) directly quantified the effects of water withdrawal on other ESA-listed species. CBO stated that among the 663 species listed as ''threatened'' or ''endangered'' in 1995, 141 were affected by the diversion or drawdown of surface water, 82 by water-level fluctuation, 26 by water-level stabilization, 61 by water temperature alteration, 103 by reservoirs, 71 by the drawdown of groundwater, and 14 by alteration of water's salinity. In addition to the citations included in the section on water allocation, many of the citations in the remainder of the ''Water Quality'' section of the proposed listing rule specifically address the effects of alteration of DO, temperature, and pollutant assimilation (potential effects associated with water withdrawals) on Atlantic sturgeon (*e.g.,* Niklitschek and Secor, 2005, 2009a, 2009b; Secor and Gunderson, 1998; Secor, 1995).

The proposed listing rule stated that the withdrawal of water from rivers that support Atlantic sturgeon populations was considered to pose a threat as a result of impingement and entrainment of eggs, larvae, and small juvenile sturgeon; however, data are lacking to determine the overall impact of this threat on sturgeon populations, as impacts are dependent on a variety of factors (*e.g.,* the species, time of year, location of the intake structure, and strength of the intake current). Of the three extant studies on direct impacts to Atlantic sturgeon from water withdrawals, only one was conducted in the Southeast at the Edwin I. Hatch Nuclear power plant, which withdraws from, and discharges to, the Altamaha River. Pre-operational drift surveys were conducted and only two Acipenser larvae were collected. Entrainment samples were collected for the years 1975, 1976, and 1980, and no Acipenser species were observed in the samples (Sumner, 2004). As stated in the proposed listing rule, the migratory behavior of larval sturgeon may allow them to avoid intake structures, since migration is active and occurs in deep water (Kynard and Horgan, 2002). The 2007 status review report ranked the threats from impingement and entrainment as low for both DPSs, and we concurred. If additional information becomes available on impingement and entrainment of Atlantic sturgeon, that information will be evaluated on a level appropriate to the activity, the river, and the sturgeon population.

Comment 44: Comments were received about the effects of dredging on Atlantic sturgeon and their habitat. One commenter pointed to a 2007 study that Atlantic sturgeon in the St. Lawrence River avoided areas created by displaced sediments from dredging activities and that those sites have lower value as juvenile benthic feeding habitat as compared to control sites. In contrast, USACE commented that a 2009 study showed dredging operations did not impede movement or utilization of habitat by Atlantic sturgeon, and that direct take of sturgeon by hopper

dredging between 1990 and 2005 was observed to be 0.6 fish per year. A commenter noted the 1998 status review report listed dredging on spawning grounds as a stressor, but that all dredging in the Cape Fear River occurs in saltwater, so the commenter believed the only habitat being affected is nursery habitat. The commenter requested NMFS provide information on dredging in the freshwater portion of the Cape Fear River and whether there are any known effects to shortnose sturgeon from dredging by the Corps in the past 10 years. Another commenter noted frequent maintenance dredging occurs in the Savannah and St. Johns Rivers. One commenter was concerned that different types of dredging (new, maintenance, marine mining, *etc.*) in different environments (small portion of river versus entire navigation channel; narrow, shallow sections versus wide, deep sections) were treated the same in the proposed rule and that a listing could inappropriately curtail or eliminate all maintenance dredging. Several commenters believed that additional research on the effects of dredging on Atlantic sturgeon habitat should be undertaken. One commenter recommended that the identification of spawning, nursery, foraging, and overwintering habitats be given top priority in rivers with existing Atlantic sturgeon populations where there is significant current or proposed dredging or port expansion activity.

Response: Additional information provided by commenters on the threats posed by dredging to Atlantic sturgeon and their habitat is consistent with our finding that these activities pose a significant threat to the Carolina and South Atlantic DPSs. A commenter questioned the level of threat to sturgeon from dredging in the Cape Fear River, and requested information on effects to shortnose sturgeon from dredging. As cited in the 2007 status review, Dickerson (2005) reported observed takings of sturgeon from dredging activities conducted by USACE between 1990 and 2005. Overall, 24 sturgeon (2 Gulf, 11 shortnose, and 11 Atlantic sturgeon) were taken by dredges during those years. Of the 24 sturgeon captured, 15 (62.5%) were reported as dead. In 2006–2008, the South Atlantic Division (North Carolina to Florida) of USACE reported a single take of a 125 cm Atlantic sturgeon (categorized in the incidental take report as ''fresh dead'') during dredging of the Savannah Harbor entrance channel. Relocation trawling for the same project captured and moved eight Atlantic sturgeon. Though dredging is a source of mortality, and therefore a concern to NMFS, we believe the most significant potential threats to Atlantic sturgeon from dredging are associated with effects to their habitat. In response to the commenter requesting information on dredging in freshwater on the Cape Fear River, we do not know of specific examples. However, we have significant concerns over dredging in the portions of the river Atlantic sturgeon can access (*i.e.,* habitat below Lock and Dam #1), which includes both spawning and nursery habitat. As noted in the proposed listing rule, dredging operations (including the blasting of rock) on the lower Cape Fear River, Brunswick River, and port facilities at the U.S. Army's Sunny Point Military Ocean Terminal and Port of Wilmington are extensive. Moser and Ross (1995) found that some of the winter holding sites favored by sturgeon in the lower Cape Fear River estuary also support very high levels of benthic infauna and may be important feeding stations. The Shortnose Sturgeon Recovery Plan also notes that, in addition to direct effects, dredging operations may also impact shortnose sturgeon by destroying benthic feeding areas, disrupting spawning migrations, and filling spawning habitat with resuspended fine sediments. A commenter noted that frequent maintenance dredging occurs in the Savannah and St. Johns River, which was also noted in the proposed listing rule.

The proposed listing rule did not include a detailed evaluation of the different forms and locations of dredging. Rather, we focused on the effects of dredging that pose the greatest threat to Atlantic sturgeon and their habitat, including the disturbance or removal of benthic fauna, elimination of deep holes, and alteration of rock substrates, as well as the creation of turbidity/siltation, contaminant resuspension, noise/disturbance, and alterations to hydrodynamic regime and physical habitat. We have a large body of knowledge on potential effects to habitat from our ESA section 7 consultations with USACE on dredging in Gulf sturgeon habitat, as well as in habitat on the East Coast for shortnose sturgeon. It is unlikely that listing Atlantic sturgeon would inappropriately curtail or eliminate all maintenance dredging, as maintenance dredging is a common occurrence in areas inhabited by ESA-listed Gulf and shortnose sturgeon. However, through our ESA consultations with USACE and other action agencies, we may recommend or require conservation measures that reduce or eliminate potential impacts to Atlantic sturgeon and their habitat. We agree that additional research on the effects of dredging on Atlantic sturgeon habitat and on the locations of spawning, nursery, foraging, and overwintering habitat in relation to potential dredging activities would be useful. We are constantly working to expand our knowledge on the effects of dredging on ESA-listed (and candidate) species and their habitat, which includes Atlantic sturgeon.

Comment 45: A commenter concerned about the effects of climate change recommended additional research and monitoring with respect to the impacts and synergistic effects of climate change on Atlantic sturgeon subpopulations. Another commenter stated that climate change will be the single largest driver of changes in biodiversity by the end of the 21st century and that disproportionate effects will be experienced in the Southeast, which is the most vulnerable region due to its long low-lying coastline and high biodiversity. The commenter noted that the South will be drier, with climate models predicting decreases in precipitation in the summer combined with higher temperatures, resulting in increased evaporation. The commenter also noted the Carolinas and Georgia have already shown significant trends of increasing drought from 1958 to 2007. A commenter noted that drought occurred in North Carolina during the same time frame drought occurred in South Carolina and Georgia, which further supports the threat to Atlantic sturgeon from such occurrences. In addition to habitat threats from climate change outlined in the proposed listing rule, a commenter provided information and a presentation from a NCDENR climate change symposium that included potential effects to the North Carolina coast and noted that habitat for the Carolina DPS is almost exclusively in this area. The presentation discussed threats of sea level rise, increasing storms, and resultant property protection activities, such as beach renourishment and installation of hard structures. The presentation stated there will be detrimental effects to sounds, rivers, and estuaries utilized by the Carolina DPS. In contrast, a commenter stated that even with gradual climate change and warming, it is likely that Atlantic sturgeon populations will continue to increase over most of their range, as the species has survived more significant climate and temperature regimes in its evolutionary past. However, the commenter acknowledged that genetic diversity of the species may be important to assure its survival.

Several commenters cautioned that climate change models do not provide information appropriate for making management decisions regarding Atlantic sturgeon. One commenter cautioned against using the most extreme scenarios modeled by the International Panel on Climate Change (IPCC) and also noted that climate change may negatively impact species in one area, but benefit the species in others, and both positive and negative impacts should be considered. Two commenters noted that the proposed listing rule incorrectly stated the two Southeast DPSs are in a region the IPCC predicts will experience decreases in precipitation, which could exacerbate low oxygen, and that increases in precipitation are actually predicted.

Response: Additional information provided by commenters on the threats posed by climate change to Atlantic sturgeon and their habitat is consistent with our finding that it poses a significant threat to the Carolina and South Atlantic DPSs. We agree that additional research and monitoring of impacts and synergistic effects on Atlantic sturgeon are necessary. As we noted in the proposed listing rule, we are particularly concerned about the exacerbation through climate change of existing water quality issues and increasing water demands due to human population increases in the Southeast. While Atlantic sturgeon may have experienced different climate and temperature regimes over their evolutionary history, they have not had to persist with the combination of threats they face now, and we do not agree with the commenter that Atlantic sturgeon populations will increase without addressing these threats. Their populations were rapidly depleted by 1901 as a result of fishing. Even though directed fishing was abolished, Atlantic sturgeon continue to be taken as bycatch in various fisheries. Dams block access to habitat and affect downstream habitat quality, as does dredging. Water quantity and quality is affected by a variety of watershed activities. These threats are predicted to increase as population in the Southeast increases, and climate change is expected to further exacerbate water quality and quantity issues. We agree with the commenter that genetic diversity (and larger population sizes) will be necessary for Atlantic sturgeon to recover in the face of these increasing threats.

We agree with the comment that the most extreme scenarios modeled by the IPCC are not appropriate for making management decisions associated with our listing of the Carolina and South Atlantic DPSs. While the IPCC modeled many scenarios and reported results with varying degrees of certainty, we only reported the most conservative results, the scenarios that were ''very likely'' to occur and which the IPCC projected with ''high confidence.'' In addition, our discussion of climate change focused on the ways in which it was likely to exacerbate existing threats, which we do feel warranted consideration in our listing determination. We did not use the IPCC's most extreme climate change model scenarios to make predictions about potential future threats to Atlantic sturgeon or factor those scenarios into our proposed listing determination. While we agree in theory that climate change could have both positive and negative effects, our review of the IPCC information did not reveal any aspects of climate change that would have positive effects on the Carolina and South Atlantic DPSs in the Southeast and the comment did not include specific examples of positive effects for our consideration.

We appreciate the commenters noting that we incorrectly stated the two Southeast DPSs are in a region that the IPCC predicts will experience decreases in precipitation, exacerbating low DO. Overall, the Southeast is predicted to experience increases in precipitation. However, evaporation is also predicted to increase with increasing temperatures and the net effect for the Southeast is predicted to be overall drying. Further, conservative seasonal predictions for the summer show either a slight increase in precipitation or a slight decrease. Decreased precipitation or even a slight increase, offset by increased summer temperatures and evaporation, would exacerbate low DO when temperatures are highest. As discussed in the proposed listing rule, Atlantic sturgeon are particularly vulnerable to low DO when combined with high temperatures. Also, overall decreased water availability due to increased temperature and longer periods of time between rainfall events is predicted for the Southeast, even though individual rainfall events are predicted to be more extreme, leading to the increased precipitation estimates. We have corrected this information in the section of the final rule that addresses climate change.

Comments on Bycatch

Comment 46: Many comments were received from parties concerned about the impacts of Atlantic sturgeon bycatch in both commercial fisheries and scientific surveys, and several commenters provided suggested solutions. One commenter stated that over 1,000 Atlantic sturgeon are taken annually as bycatch. Another commenter cited Munro *et al.* (2007) that bycatch likely has more detrimental effects in habitats that are limited in area and where certain life stages of Atlantic sturgeon tend to congregate, such as early juvenile habitats in the estuarine transition zone and the subadult/adult habitat in the nearshore oceanic zone. The commenter also stated that protecting juvenile marine stage Atlantic sturgeon from bycatch mortality in aggregation areas is likely the key to restoring Atlantic sturgeon populations given that the intrinsic rate of population increase for long-lived species like Atlantic sturgeon is most sensitive to changes in juvenile survival. The commenter noted that while little direct mortality is reported for trawl fisheries, within aggregation areas it is not uncommon to catch ten or more Atlantic sturgeon in a single 20 minute tow, and that with longer trawl times in commercial fisheries, fish released alive may die days after. A commenter was concerned that bycatch of Atlantic and shortnose sturgeon has been occurring, citing data from the Santee River. A comment was received recommending research to determine the impacts of bycatch and bycatch mortality on Atlantic sturgeon populations, identification of the spatial and temporal distribution of bycatch throughout the species range, and development of measures that could be implemented to reduce bycatch and/or bycatch mortality. Several commenters stated that NMFS has not taken adequate steps to reduce or stop the use of gillnets and other gears to protect sturgeon. Comments were received that the moratorium has not prevented bycatch, and gill nets should be banned in order to recover Atlantic sturgeon. One commenter asked if NMFS had solicited or received advice from commercial fishermen on limiting bycatch mortality in gillnets. Citing Dunton *et al.* (2010), a commenter stated that because previous Atlantic sturgeon management has not resulted in significant improvements to populations, recovery efforts should now focus on establishing marine reserves or implementing area closures to protect essential habitat and to reduce fishing mortality on juveniles (Collins *et al.,* 2000). The commenter stated that the primary juvenile habitat and juvenile migrations are limited to narrow corridors in waters less than 20 meters deep and this is conducive to a seasonal or permanent closure to gillnet and trawl fisheries. The commenter

believed that by focusing immediate efforts on the protection of these hotspots and corridor pathways, bycatch mortality will be reduced effectively through protection of habitat. One commenter was concerned about mortality levels in scientific surveys and recommended that scientific sampling be banned in the Cape Fear River.

Response: Additional information provided by commenters on the impacts of Atlantic sturgeon bycatch is consistent with our finding that it poses a significant threat to the Carolina and South Atlantic DPSs. As we continue to work to reduce Atlantic sturgeon bycatch, we will consider suggestions provided by commenters, such as the importance of protecting juvenile marine stage Atlantic sturgeon, identifying hotspots and migratory corridors, investigating the establishment of marine reserves or closed areas, and working with gillnet fisheries to reduce the level of Atlantic sturgeon bycatch. We do not feel that banning scientific sampling in the Cape Fear River would benefit Atlantic sturgeon, and we recently published ''A Protocol for Use of Shortnose, Atlantic, Gulf, and Green Sturgeons'' (Kahn and Mohead, 2010; available at *http://www.nmfs.noaa.gov/pr/pdfs/species/kahn_mohead_2010.pdf*) that can be followed to better ensure the safety of sturgeon during research, including during capture using gillnets. We will continue to work with our partners and stakeholders through our existing authorities to reduce or eliminate the effects of bycatch on Atlantic sturgeon.

Comment 47: Several commenters questioned how listing Atlantic sturgeon will result in a greater reduction in bycatch than is already being realized by closing the commercial fishery for Atlantic sturgeon. A commenter stated that there has been a significant reduction in vessels and effort in the shad gillnet and shrimp trawling fisheries over the last 10 years. Other commenters listed a number of commercial fishery regulations (*i.e.,* harvest seasons, gill net mesh size, and quantity restrictions), some associated with other fisheries (*e.g.,* striped bass, American shad) that also reduce the potential for gill net interactions with Atlantic sturgeon. Commenters also noted significant reductions in pound net and haul seine use have occurred during recent decades in the Albemarle Sound area, further reducing potential interactions between sturgeon and commercial fisheries. Two North Carolina state agencies reported that out of more than 3,000,000 yards of large and small mesh gill nets observed since 2001, overall bycatch mortality was 6 percent (with an annual range of 0 to 12 percent), which is lower than the 13.8 percent estimated by the ASMFC and cited in the proposed listing rule. The agencies also reported that mortality in the Albemarle and Pamlico Sound IGNS had overall Atlantic sturgeon mortalities of 3 and 10 percent, respectively, and mortality in the Pamlico, Pungo, and Neuse Rivers IGNS was 12 percent. The agencies commented that mortalities were high in the Cape Fear River IGNS (35 percent), and that mortality was less than 13.8 percent in Cape Fear River and near shore Atlantic Ocean Fishery Independent Assessment Program. In reference to the 35 percent mortality in the Cape Fear IGNS, commenters (including NCDENR) said that these results cannot be extrapolated to commercial fisheries because of gear and seasonal restrictions in place for those fisheries that do not allow them to be operated in the same time, place, or with the same gear. These agencies also noted that bycatch has been documented for over 958 tows conducted by commercial shrimp trawlers working in North Carolina with no Atlantic sturgeon reported and that no Atlantic sturgeon have been captured in the 528 blue crab trawl tows examined since 1990. They also stated that the White and Armstrong Fishery Resource Grant study (2000) conducted in the Albemarle Sound was used in the listing documents because of a high collection rate; however, targeting of Atlantic sturgeon may have occurred since the design of the study was to estimate survival of sturgeon captured in commercial flounder nets. White and Armstrong (2000) also noted no mortality of Atlantic sturgeon collected. GADNR commented that less than 10 fish per year were estimated to have been captured in the Altamaha River anchored gillnet fishery during a 3-year study. All fish were juveniles and no injury or mortality was documented. Georgia also noted the season for gillnetting shad occurs while adults are at sea and juveniles are in the lower parts of the estuary. Since the 2007 status review, which ranked bycatch as a moderate threat in the Altamaha, the State of Georgia commented that recent action by the Board of Natural Resources has prohibited the use of gillnets for shad fishing in a large portion of the Altamaha. Two commenters disagreed with the use of Stein *et al.* (2004) in relation to bycatch in the Southeast, stating that offshore fisheries with long soak times should not be used as a proxy for inshore fisheries, and though mixing of sturgeon populations occurs in marine areas, most of the fish captured as bycatch would be fish from northern DPSs. A comment was received that listing Atlantic sturgeon could require changes to gear design or fishery regulations for fisheries that encounter Atlantic sturgeon as bycatch, and that while bycatch mortality estimates are unknown for many species, they are believed to be low with the exception of sink gillnet fisheries with long soak times. One commenter suggested that the South Atlantic DPS was not subject to the same level of bycatch as the Carolina DPS.

Response: Listing the Carolina and South Atlantic DPSs as endangered could result in a further reduction in fishing mortality, beyond the commercial harvest moratoria, if conservation measures implemented pursuant to the ESA lead to reductions in bycatch, for example through section 10 permits or section 7 biological opinions. While the moratoria on harvest and possession have greatly reduced the effects of fisheries on Atlantic sturgeon, fish from these DPSs are still being taken as bycatch in many fisheries. Once listed as endangered, bycatch of Atlantic sturgeon would be considered ''take'', defined in section 3 of the ESA as ''to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct.'' Section 7 consultation would be required for federally authorized fisheries that take Atlantic sturgeon as bycatch. During consultation, NMFS would evaluate the anticipated level of take associated with the fishery, evaluate whether it would jeopardize the continued existence of the species, and determine reasonable and prudent measures that would reduce the anticipated effects of the incidental take on the species. A section 10(a)(1)(B) permit would be required for fisheries authorized by states that result in Atlantic sturgeon bycatch. A section 10(a)(1)(B) would require the development of a conservation plan that details the impact to the species, the steps that will be taken to minimize and mitigate the impacts, alternative actions considered and why they were not implemented, and any other measures required by NMFS to benefit the species.

Even with reductions in gillnet and trawl vessels and fishing effort, and the implementation of other seasonal and gear restrictions, there are still large numbers of participants in fisheries using these gears. Every year, NMFS publishes a list of commercial fisheries and classifies them into categories according to the level of interactions

with marine mammals. Based on the latest list, published on November 8, 2010 (75 FR 68468), fisheries using gillnet and trawl gear and the number of participants in those fisheries in the range of the Carolina and South Atlantic DPSs include the following: Mid-Atlantic gillnet fishery, 5,495 participants; the North Carolina inshore gillnet fishery, 2,250 participants; the Southeast Atlantic gillnet fishery, 779 participants; the Southeastern U.S. Atlantic shark gillnet fishery, 30 participants; the Mid-Atlantic bottom trawl fishery, 1,182 participants; and, the Southeast U.S. Atlantic, Gulf of Mexico shrimp trawl fishery, 4,950 participants (though this includes Gulf of Mexico participants). However, we note that the number of participants listed here is potentially an overestimate of the number of participants interacting with Atlantic sturgeon. For example, in the gillnet fisheries, the number of participants includes fishermen using non-sink gillnets, which have fewer interactions with Atlantic sturgeon. In addition, all fishery participants may not be operating at times or in areas where they are likely to encounter Atlantic sturgeon. Further, based on available bycatch data, which suggests sturgeon are primarily caught in waters less than 50 meters deep, commercial and recreational fisheries using trawl and gillnet gear in waters greater than 50 meters deep may not have Atlantic sturgeon bycatch. Estimates for Atlantic sturgeon bycatch in these fisheries is largely unavailable, as bycatch is underreported in state waters and there is limited observer coverage in fisheries potentially capturing Atlantic sturgeon in the South Atlantic (North Carolina to Florida) Federal waters.

We have added information on bycatch provided by North Carolina and Georgia to section ''B. Overtutilization for Commercial, Recreational, Scientific, or Educational Purposes'' of the final listing determination. Regarding bycatch data supplied by the State of North Carolina, the lack of recorded Atlantic sturgeon bycatch in commercial shrimp trawls and blue crab trawls in North Carolina is consistent with information presented in the proposed listing rule that trawl gear is not believed to be a significant threat to Atlantic sturgeon. Data reported for the Albemarle and Pamlico Sound IGNS, as well as IGNS in the Pamlico, Pungo, Neuse, and Cape Fear Rivers, show overall (*i.e.,* mortality over all survey years combined) Atlantic sturgeon capture mortality in gillnets ranging from 3 to 35 percent. With the exception of the highest morality rate, which was observed in the Cape Fear River IGNS, North Carolina commented that all of the observed mortality rates were less than the 13.8 mortality cited in the proposed listing rule, but that the majority of the results cannot be extrapolated to commercial fisheries due to gear and seasonal harvest restrictions under which they operate. Based on the data supplied by the state, capture mortality of Atlantic sturgeon varied greatly by year, by month, and by the gillnet mesh size used during the survey. For instance, mortality during individual survey years in the Albemarle Sound IGNS ranged from 0 to 19 percent during 1990 to 2009. Mortality by month ranged from 0 to 7 percent, with the highest mortalities recorded in April (3 percent), May (7 percent), and November (5 percent). Mortality ranged from 0 to 100 percent in mesh sizes ranging from 2.5- to 10-inch stretched mesh (ISM), with fairly consistent levels: 2 to 4 percent for mesh sizes 2.5 to 5.5 ISM, 9 percent for 6.5 ISM, and 100 for 10 ISM (representing 1 Atlantic sturgeon). Similar variability was seen in the Pamlico Sound IGNS data. During 2001 to 2008, 0 to 17 percent mortality was observed in the Pamlico Sound IGNS, with 100 percent in 2009, based on 1 Atlantic sturgeon. Mortality ranged from 0 to 25 percent by month, with peak mortalities occurring in June (25 percent), August (17 percent), and November (17 percent). The Pamlico Sound IGNS used mesh sizes ranging from 3 to 6.5 ISM. Mortality by mesh size ranged from 0 to 25 percent, with the highest mortalities observed in the 3 ISM (25 percent), 3.5 ISM (20 percent), and 6.5 ISM (20 percent). While the State of North Carolina commented that the IGNS data should not be extrapolated to estimate a mortality rate for commercial fisheries, it does show that time of year and gear type factor heavily into Atlantic sturgeon bycatch mortality. As stated by North Carolina, as well as in the proposed listing rule, other factors, such as gillnet soak time, affect mortality rates. Overall mortality rates in all North Carolina surveys (with the exception of the Cape Fear River IGNS) may be below the 13.8 percent estimate reported in the proposed listing rule; however, mortality rates during individual survey years, during certain survey months, and for specific gillnet mesh sizes used often exceeded 13.8 percent. While North Carolina provided fishery-dependent survey data from their observer program, observer coverage in fisheries potentially capturing Atlantic sturgeon is very limited for the remainder of the Southeast range occupied by the Carolina and South Atlantic DPSs. High levels of bycatch underreporting are suspected. Further, even if bycatch mortality is lower than the 13.8 percent estimate reported in the proposed listing rule, total population abundances for the Carolina and South Atlantic DPSs are not available and we do not know what portion of the Carolina and South Atlantic DPSs are subject to being taken as bycatch. As cited in the proposed listing rule, Boreman (1997) calculated a sustainable fishing (bycatch) mortality rate of 5 percent per year for adult Atlantic sturgeon, indicating they can only tolerate relatively low levels of bycatch mortality.

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. Atlantic sturgeon taken as bycatch may suffer immediate mortality. In addition, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (*e.g.,* exposure to toxins and low DO). This may result in reduced ability to perform major life functions, such as foraging and spawning, or may even result in post-capture mortality. Several of the river populations in the South Atlantic DPS (*e.g.,* the Ogeechee and the Satilla) are stressed to the degree that any level of bycatch could have an adverse impact on the status of the DPS (ASSRT, 2007). Therefore, the information supplied by the State of North Carolina does not provide a basis for revising our evaluation of the threat of bycatch to Atlantic sturgeon populations or our determination that the Carolina and South Atlantic DPSs warrant listing as endangered. For the same reasons, the information supplied by the State of Georgia does not provide a basis for revising our evaluation of the threat of bycatch to Atlantic sturgeon. The state documented less than 10 fish per year taken as bycatch in the Altamaha River gillnet fishery, with no observed mortality during a 3-year study. Georgia also commented that the shad gillnet season occurs while adults are at sea and juveniles are in the lower part of the estuary and that the state now prohibits shad gillnetting in a large portion of the Altamaha. However, the Altamaha River has the largest and healthiest population of Atlantic sturgeon in the Southeast and bycatch occurring in systems with smaller, more greatly stressed

populations (such as the Ogeechee and Satilla; ASSRT, 2007) may have adverse impacts. We commend the state for their efforts in reducing the threat of bycatch in the Altamaha River, but we believe bycatch still represents a significant threat to the Carolina and South Atlantic DPSs of Atlantic sturgeon. The bycatch information for Atlantic sturgeon in the Carolina and South Atlantic DPSs provided by North Carolina and Georgia, when considered as part of our listing determination, does not change our determination that the two DPSs warrant listing as endangered.

The White and Armstrong (2000) study was not considered in the proposed listing rule for the reason suggested by the commenter, *i.e.,* due to the high collection rate of Atlantic sturgeon. We cited this study as one of the only fishery-dependent bycatch surveys of Atlantic sturgeon from either the Carolina or South Atlantic DPSs available to us. Contrary to the commenters' assertion that targeting of Atlantic sturgeon may have occurred, the research publication states in the ''Methods'' section that ''southern flounder (not Atlantic sturgeon) were the target species, and the incidence of Atlantic sturgeon captures in the catch was expected to be representative of normal bycatch rates.'' The publication also stated that ''survival rates were inestimable, the apparently healthy condition of incidentally captured Atlantic sturgeon is consistent with low release mortality.''

While commenters disagreed with our use of offshore fisheries data in relation to bycatch in the Southeast (*e.g.,* Stein *et al.,* 2004; ASMFC, 2007), we used the best data available to us in the proposed listing rule and clarified its utility. We noted in the proposed listing rule that any estimate of bycatch from the NMFS ocean observer dataset will be an underestimate, because bycatch is underreported in state waters and there is no observer coverage in the South Atlantic (North Carolina to Florida) Federal waters. We are updating information in this section of the final rule to reflect that there is limited observer coverage in Federal waters in the Southeast for gear types that potentially capture Atlantic sturgeon. The shark drift gillnet program, which operates primarily off the southern Atlantic Coast of Florida and North Carolina, observes a relatively small fishery (25–30 vessels) targeting coastal shark species, as well as king and Spanish mackerel, little tunny, bluefish, and Atlantic croaker. There is also an observer program for the Southeastern shrimp trawl fishery, which covers approximately 1 percent of the fishery in the South Atlantic. This information does not change our conclusion that bycatch is underreported in state and Federal waters. In addition to immediate mortality, bycatch mortality estimates do not account for post-capture mortality and may further underestimate the mortality rate in sink gillnets in the Carolina and South Atlantic DPSs because bycatch survival is greater in colder water temperatures of the north compared to warmer southern waters occupied by these DPSs.

Comments on Disease and Predation

Comment 48: One commenter stated that the need and ability to regulate the aquarium trade should not have been discounted in the proposed listing rule. The commenter believed importation of non-native sturgeon is a greater threat to native sturgeon than any other factor because non-natives potentially out-compete native fish and introduce disease.

Response: We agree that the ability to regulate the aquarium trade should not have been discounted in the proposed listing rule, and we are removing that text in the final rule. However, we do not have information that suggests the aquarium trade is a current threat to Atlantic sturgeon. We disagree that the importation of non-native sturgeon is a greater threat to native sturgeon than any other threat. We included information in the proposed listing rule that there were only five known Atlantic sturgeon commercial aquaculture operations in the Southeast, one in North Carolina and four in Florida. These operations all cultured Atlantic sturgeon originating from Canadian stock, with the exception of the North Carolina operation that acquired Siberian sturgeon (*A. baerii*) in 2006 after obtaining an addendum to their permit from the ASMFC. Additionally, we obtained information on the culture of other sturgeon species. Commercial U.S. culture of meat and caviar is currently taking place in three states: California, Idaho, and Florida (Monterey Bay Aquarium, 2007). Four facilities (Evans Farm, Mote Marine Laboratory, Rokaviar, and Sturgeon AquaFarms, LLC) in Florida, the only state in the range of Atlantic sturgeon culturing non-native species, conduct tank culture of the following species: Siberian sturgeon (*A. baerii*), Russian sturgeon (*A. gueldenstaedti*), Stellate sturgeon (*A. stellatus*), Sterlet sturgeon (*A. ruthenus*), Adriatic sturgeon (*A. naccarii*), beluga sturgeon (*Huso huso*), and the hybrid Bester sturgeon (*H. huso* x *A. rutheni*)(M. Berrigan, FDACS, pers. comm.). The nature of current containment practices and the reported record of total escape prevention for the Florida facilities that presently culture non-native sturgeons suggest currently low exposure for wild sturgeon stocks to the ecological risks of farmed fish escapes (Monterey Bay Aquarium, 2007). We acknowledged in the proposed listing rule that introduction of non-native species could impact native sturgeon populations. However, we did not believe that this was a significant threat based on the very low occurrence of non-native Atlantic sturgeon culture operations and the fact that stock enhancement programs follow culture and stocking protocols approved by the ASMFC, which includes, ''if non-native or hybrid sturgeon are permitted within a state, they should be restricted to culture operations where escapement and reproduction can and will be controlled.'' We also noted that mechanisms are in place at all facilities to prevent escapement of sturgeon; facilities are all land based, and most are not located in close proximity to any Atlantic sturgeon rivers. All of the facilities in Florida are periodically screened for disease by University of Florida Institute for Food and Agricultural Science (IFAS) veterinarian. None have reported diseases. All facilities are above the 100-year flood plain and have zero discharge.

We received information during the public comment period that indicates a further reduction in the potential threat of non-native sturgeon to the Carolina and South Atlantic DPSs. The Florida Department of Agriculture and Commerce (FDACS), which certifies aquaculture facilities and inspects those facilities twice a year for compliance, informed us that only one commercial facility with Atlantic sturgeon is currently operating in Florida, and they only have one surviving fish. All other Atlantic sturgeon held in Florida aquaculture facilities died in captivity. Additional information supplied by FDACS on Florida aquaculture facilities is included in our response to comment 53.

Comments on the Inadequacy of Existing Regulatory Mechanisms

Comment 49: Several commenters provided us with additional examples of the inadequacy of regulatory mechanisms. One commenter believed the ASMFC's failure to end the harvest of overfished stocks (*e.g.,* winter flounder and weakfish) and North Carolina's request for an exemption to the law that fishery management plans have a 50 percent probability of recovering depleted stocks exemplify

inadequacies of existing regulatory mechanisms to protect species and highlight the need for ESA listing. Several commenters noted the lack of permitting programs in southeastern states for water withdrawals, including interbasin transfers, and the lack of regulation of instream flows. One commenter noted that while there is a blanket prohibition against water transfers into metro Atlanta, adjacent counties are joining the district where Atlanta is incorporated in order to avoid the prohibition. Another commenter stated that North Carolina coastal counties currently seeking interbasin transfers have been exempted from 2007 amendments regulating interbasin transfer and the North Carolina Department of Water Quality is seeking to create regulatory changes to the current buffer rules. The commenter also stated that, for the second year in a row, North Carolina passed legislation allowing any existing permit or finding to extend until after 2011 without having to reapply or renew as a way to mitigate the economic downturn. The extension is applicable to several types of permits and applications that could affect the Carolina DPS, including: Findings of no significant impact; approvals of an erosion and sedimentation control plan; permits for major developments or minor developments under the State's Coastal Area Management Act; water or wastewater permits; building permits; stream origination certifications; water quality certifications; air quality permits; and city and county site specific development plans. A comment was also received regarding Senate Bill 778, which became law in North Carolina in August of 2010. The bill was drafted as a response to litigation regarding the proposed Titan Cement plant and created a loophole that any project such as Titan, which may have a significant environmental impact, can bypass the State Environmental Policy Act (SEPA) by structuring a contract on the basis of incentives. While the legislation does not retroactively exempt Titan Cement from SEPA, it ensures that a roadmap exists for any similar projects in the future to avoid the environmental review process established in SEPA.

Response: In the proposed listing rule, we concluded that the inadequacy of regulatory mechanisms to fully address the threats of bycatch and habitat modification are contributing to the endangered status of the Carolina and South Atlantic DPSs of Atlantic sturgeon. The information provided by these commenters supports this conclusion. We will continue to investigate these issues and ways to ameliorate any effects they are having on Atlantic sturgeon.

Comment 50: Several commenters disagreed with NMFS' finding in the proposed listing rule that existing regulatory mechanisms protecting Atlantic sturgeon and their habitat are inadequate. Numerous commenters believed the proposed listing rule is unnecessary because directed fishing and retention of Atlantic sturgeon has been prohibited by the moratoria implemented by the ASMFC and NMFS, as well as various prohibitions enacted by individual states. A commenter noted that South Carolina and North Carolina initiated moratoria on harvest and possession of Atlantic sturgeon in 1985 and 1991, respectively. Another commenter noted that special concern designations have been given to Atlantic sturgeon by the states of Virginia and Florida. Many commenters believe the prohibitions are working and that no listing action should be taken until the moratoria have had sufficient time to work. A commenter stated that protections already in place for co-occurring endangered species are sufficient to protect Atlantic sturgeon and their habitat. Comments were received that NMFS did not thoroughly consider the benefits of existing regulatory mechanisms addressing bycatch and activities affecting Atlantic sturgeon habitat (*e.g.,* regulations associated with construction, demolition, and dredging), and that existing regulations should be used to protect Atlantic sturgeon populations. The State of North Carolina commented that the North Carolina Coastal Habitat Protection Plan (NCCHPP) and moratoria on construction, dredging, and other habitat altering activities are already managing habitat issues, observer programs are expanding to include more fisheries, gear configurations and regulations have been updated to reduce bycatch and limit interactions with protected species, and research is being funded that will allow North Carolina and other states to gain a better understanding of the migratory patterns, spawning areas, and distribution of Atlantic sturgeon within the next few years. The NCCHPP was adopted in 2005 and its stated goals are: (1) Improving effectiveness of existing rules and programs protecting coastal fish habitats; (2) identifying, designating, and protecting strategic habitat areas (SHAs); (3) enhancing habitat and protecting it from physical impacts; and, (4) enhancing and protecting water quality. The North Carolina Marine Fisheries Commission (NCMFC) approved SHAs for Region 1 in North Carolina in January 2009, and is currently evaluating SHAs for other regions in North Carolina. According to the commenter, SHAs represent priority habitat areas for protection due to their exceptional condition or imminent threat to their ecological functions supporting estuarine and coastal fish and shellfish species and will be incorporated into conservation and restoration efforts. One SHA (Bellows Bay to Knotts Island Bay) was identified in part due to the nearshore ocean areas that are important for Atlantic sturgeon and striped bass and another SHA (Chowan and Roanoke Rivers and western Albemarle Sound) may include one of the few Atlantic sturgeon spawning habitats in North Carolina. The State also commented that the North Carolina Department of Marine Fisheries (NCDMF) provides input to federal and state regulatory agencies of the location of habitats used by Atlantic sturgeon. NCDMF and the North Carolina Wildlife Resources Commission have designated Anadromous Fish Spawning Areas (AFSA) through rules for their respective jurisdictions.

Response: Though moratoria on harvest and possession of Atlantic sturgeon were enacted by the ASMFC, NMFS, and several states, populations have not rebounded and the moratoria do not control bycatch. We believe continued bycatch of Atlantic sturgeon in commercial fisheries has an ongoing impact upon the Carolina and South Atlantic DPSs that is not adequately addressed through existing regulatory mechanisms and is contributing to their endangered status. 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. Poor water quality also continues to result in adverse effects to Atlantic sturgeon even with existing controls on some pollution sources and water withdrawal, and dams continue to curtail and modify habitat, even given the provisions for establishing fishways under the Federal Power Act.

As noted in the comments, Florida has designated the Atlantic sturgeon as a species of special concern. This designation stipulates that no person shall take, possess, transport, or sell any species of special concern without a permit. The comments also noted Atlantic sturgeon was designated as a species of special concern by Virginia, which is described as a ''watchlist'' of wildlife species with no other regulatory or statutory requirements. Currently, the state's Wildlife Action Plan identifies

Virginia's Species of Greatest Conservation Need (SGCN) and has made the ''special concern'' designation obsolete. The SGCN also has no regulatory requirements, but requires that Comprehensive Wildlife Conservation Strategies be developed that include 8 essential elements, including key information on distribution, abundance, threats, descriptions of conservation actions, and plans for species monitoring. While states should be commended for recognizing the need for conservation of Atlantic sturgeon, these designations are not enough to alleviate the threats to the Carolina and South Atlantic DPSs of Atlantic sturgeon or change our evaluation of the species as meeting the definition of endangered from section 3 of the ESA.

While there are a variety of other Federal, state, and local laws and programs (*e.g.,* regulations governing construction activities and gear configurations that reduce bycatch) that benefit Atlantic sturgeon, we believe that threats from habitat modification and bycatch are not sufficiently managed through current regulatory mechanisms in place. For instance, seasonal restrictions governing construction and dredging in North Carolina may benefit Atlantic sturgeon during critical time periods, as stated by the commenter, but construction and dredging during other times of the year can still impact Atlantic sturgeon and their habitat. Required gear configurations may reduce Atlantic sturgeon bycatch, but bycatch still occurs. Further, the lack of bycatch data does not allow us to evaluate the degree to which bycatch is potentially reduced by these measures. We reviewed the information provided by the State of North Carolina on the NCCHPP, SHAs, and AFSAs, as well as additional information on these programs on NCDENR's Web sites. While these programs have excellent goals of increasing enforcement of existing regulations, identifying and protecting habitat important to the species, and monitoring these habitats, many of these actions are still in the early stages and it is not clear exactly what protections will be given to areas designated as SHAs or AFSAs. We are also including an evaluation of these programs in the section of the final listing rule evaluating current protective efforts.

Comments on Other Natural and Manmade Factors

Comment 51: The ASMFC commented that states and jurisdictions where ship strikes are an issue are currently monitoring and working to minimize these impacts. Another commenter was concerned that if ship strikes increase, regulation may be required, and the commenter requested clarification on the ''large number of mortalities'' cited in the proposed listing rule. The commenter suggested that if ship strikes have increased over time, it could indicate the population of Atlantic sturgeon in these areas has increased.

Response: The ASMFC's comment on monitoring of ship strikes on Atlantic sturgeon is noted. In response to the commenter requesting clarification on ''a large number of mortalities'' cited in the proposed listing rule, the full statement on page 61924 is ''a large number of mortalities observed in these rivers from potential ship strikes have been of large adult Atlantic sturgeon.'' The sentence is not indicating that there are a large number of ship strike mortalities, but rather a large percentage of the mortalities resulting from ship strikes are large adult fish. On the following page (61925), we quantified ship strikes in the one river in the Southeast where they have been documented (''one ship strike per 5 years is reported for the Cape Fear River within the Carolina DPS.''). This section of the proposed listing rule further noted that, while it is possible that ship strikes may have occurred and have gone unreported or unobserved, the lack of large ship traffic on narrow waterways within the range of the DPS may limit potential interactions. We concurred with the ASSRT's assessment of the threat from ship strikes as low for both the Carolina and South Atlantic DPS and concluded that it was not contributing to the endangered status of the DPSs. An increase in ship strikes on Atlantic sturgeon could result from a variety of factors, including an increase in Atlantic sturgeon populations, an increase in shipping traffic, changes to shipping channel characteristics (*e.g.,* channel shallowing or narrowing), and transit of larger vessels. If NMFS receives new data showing that ship strikes pose a significant threat to the Carolina or South Atlantic DPS, we will work with stakeholders, including the shipping industry, to evaluate the best options for minimizing impacts to Atlantic sturgeon without unduly hampering shipping activities.

Comment 52: A commenter agreed with concerns expressed in the proposed listing rule about the effects of aquaculture and stock enhancement on Atlantic sturgeon populations from disease, escape, and out-breeding depression, but believes these can be minimized and that a responsible stocking program using native broodstock is the best option for reestablishing a population in extirpated systems. The commenter stated that there is evident disdain by the ASSRT for stocking and enhancement activities based on the discussion of the dangers of stocking and categorizing the release of cultured fish as a section 9 violation. The commenter believed listing would result in currently captive fish being destroyed rather than used for commercial or stocking purposes and would provide no incentive for the private sector to maintain the fish they currently have. The commenter also believed aquaculture and stock enhancement afford research opportunities and would afford a level of protection for wild stocks from poaching by providing a legal product to the market. FDACS, which certifies aquaculture facilities and inspects those facilities twice a year for compliance, commented on the proposed listing rule. They stated that NOAA participated in a cultured sturgeon risk analysis in 2000 that governs Florida sturgeon farming and that the disposition of the Atlantic sturgeon in aquaculture facilities is known, contrary to information reported in the proposed listing rule. FDACS indicated that captive Atlantic sturgeon in Florida are from a genetically distinct population that is not being considered for listing and were cultured in waters outside those being defined as within the South Atlantic DPS. The commenter stated that sturgeon products sold by Florida farms possess an Aquaculture Certificate of Registration and are exempt from the provisions of the ESA.

Response: Both the proposed listing rule and the 2007 status review report presented an objective discussion of stocking and enhancement and did not reflect disdain on the part of the agency or the ASSRT for those activities. Both documents state that artificial propagation has the potential to be a tool for recovery of the species, as well as a threat. While collecting, handling, releasing, and harming captive Atlantic sturgeon were identified in the proposed listing rule as potential violations of the take prohibitions in section 9 of the ESA, we also stated that permits are available to lawfully conduct these activities for purposes of scientific research or to enhance the propagation of the or survival of Atlantic sturgeon DPSs. As stated in our response to other comments above, we must base listing determinations solely on the best scientific and commercial data available on the status of and threats to the species. We cannot consider the potential economic consequences (or lack of economic

incentives) to entities currently in possession of captive Atlantic sturgeon. However, in our response to comment 35, we describe the types of authorizations available to conduct activities such as artificial propagation in full compliance with the ESA and we encourage the affected parties to utilize this option.

In response to comments from FDACS that the disposition of all Atlantic sturgeon acquired by Florida aquaculture facilities is known, we contacted FDACS to confirm current holdings. FDACS informed us that Evan's Fish Farm is currently the only facility in Florida with Atlantic sturgeon, and they only have one surviving fish. All other Atlantic sturgeon held in Florida aquaculture facilities died in captivity. We are updating the final listing rule with this information. As stated in the proposed listing rule and confirmed by the commenter, Atlantic sturgeon in possession of Florida aquaculture facilities originated from Canadian populations and not from any of the U.S. DPSs currently being proposed for listing under the ESA. Therefore, the remaining Atlantic sturgeon held by Evan's Fish Farm is not affected by the listing.

Comment 53: A commenter provided information on impingement of juvenile Atlantic sturgeon at the Brunswick Nuclear Power Plant on the lower Cape Fear River. Plant modifications were implemented in the early 1980s as part of the NPDES permit. An average of 55 juvenile Atlantic sturgeon were impinged per year from 1975 to 1981. A fish diversion was installed in 1981 and a fish return system was installed in 1983. Only 2 impinged juveniles were observed between 1982 and 2010 and were returned alive to the river.

Response: We appreciate the information provided by the commenter and we added this information to the section of the final listing rule on impingement and entrainment. As we noted in the proposed listing rule, the withdrawal of water from rivers that support Atlantic sturgeon populations was considered to pose a potential threat of impingement and entrainment; however, data are lacking to determine the overall impact of this threat on sturgeon populations, as impacts are dependent on a variety of factors (*e.g.,* the species, time of year, location of the intake structure, and strength of the intake current). Prior to receiving the above information, we only had one survey showing the direct impact of water withdrawal on Atlantic sturgeon in the Southeast. As stated in the proposed listing rule, the Edwin I. Hatch Nuclear power plant, located 11 miles north of Baxley, Georgia, withdraws water from, and discharges to, the Altamaha River. Pre-operational drift surveys were conducted and only two *Acipenser* larvae were collected. Entrainment samples at the plant were collected for the years 1975, 1976, and 1980, and no *Acipenser* species were observed in the samples (Sumner, 2004). We concurred with the ASSRT's assessment of the threat from impingement and entrainment as low for both the Carolina and South Atlantic DPS and concluded that it was not contributing to the endangered status of the DPSs. The information provided by the commenter that two juvenile Atlantic sturgeon were impinged at the Brunswick Nuclear Power Plant between 1982 and 2010, and both were returned to the Cape Fear River alive, does not change our conclusion.

Comment on Recovery

Comment 54: A comment was received that a recovery plan for Atlantic sturgeon should place a high priority on research and gathering sufficient information to define what it means to both jeopardize and recover Atlantic sturgeon and define the allowable take authorized by the ESA. Ecosystem dynamics and level of anthropogenic activity vary in each river, and recovery tasks should be prioritized based on research into potential impacts of the activities on Atlantic sturgeon. The commenter recommended an accelerated and concentrated research effort prior to development of a targeted restoration strategy.

Response: Section 4(f) of the ESA directs NMFS to develop and implement recovery plans for threatened and endangered species, unless such a plan would not promote conservation of the species. According to the statute, these plans must incorporate, at a minimum: (1) A description of site-specific management actions necessary to achieve recovery of the species, (2) objective, measurable criteria which, when met, would result in a determination that the species be removed from the list; and (3) estimates of the time and costs required to achieve the plan's goal. NMFS agrees with the commenter that research to fill knowledge gaps in areas important to recovery should be a priority. NMFS is currently undertaking and funding a variety of projects, including research on abundance and to determine movement and habitat utilization by Atlantic sturgeon. In addition, through years of section 7 consultations on shortnose sturgeon, which share many of the same rivers as Atlantic sturgeon, we have much information on anthropogenic activities occurring in those rivers. We will continue to seek information on Atlantic sturgeon, their habitat, and the threats they are facing and use this information to prioritize recovery actions. Once a draft recovery plan is developed, we will submit it for public review and comment before finalizing it.

Comments on Critical Habitat

Comment 55: A commenter recommended that confirmed and potential nursery and spawning locations in each river should be designated as critical habitat for Atlantic sturgeon, as well as known marine migration corridors and aggregation areas. The commenter provided information and literature citations identifying some of these areas and the habitat characteristics potentially preferred by Atlantic sturgeon.

Response: We appreciate the information provided by the commenter. Section 4(a)(3)(A) of the ESA requires that critical habitat be designated, to the maximum extent prudent and determinable, concurrently with a determination that a species is endangered or threatened. When such a designation is not determinable at the time of final listing of a species, section 4(b)(6)(C)(ii) of the ESA provides for an additional year to promulgate a critical habitat designation. We have concluded that critical habitat for the Carolina and South Atlantic DPSs is not determinable at this time. Through the status review and public comment process on the proposed listing rule, we have begun to collect information on the location of biological and physical and biological features essential to the conservation of the two DPSs. Throughout the next year, we intend to gather and review current and ongoing studies on the habitat use and requirements of Atlantic sturgeon from the two DPSs in the Southeast, including an ongoing study with USGS to compare sturgeon location data with a variety of habitat parameters and a study to map riverine habitat in four Georgia rivers known to support the South Atlantic DPS funded through NMFS Section 6 program. We will also gather and analyze information on the benefits and impacts of a critical habitat designation.

Comment 56: A comment stated that critical habitat for the South Atlantic DPS should be accurately defined. The commenter noted that Figure 2 in the proposed listing rule depicts habitat well above the fall line and stated that accurate delineation of critical habitat is necessary so undue compliance costs

are not placed on communities outside the actual habitat utilized by the DPS.

Response: NMFS has not yet designated critical habitat for the Carolina and South Atlantic DPSs. The shaded areas in Figure 2 in the proposed listing rule encompass the rivers where Atlantic sturgeon belonging to the Carolina and South Atlantic DPSs may occur. The shaded areas were made sufficiently large so that no rivers or tributaries potentially inhabited by fish from the Carolina and South Atlantic DPSs were excluded. The shaded areas were meant to be a visual reference, rather than a definitive indication of the presence of Atlantic sturgeon, though any sturgeon encountered in a location within a shaded area would be from a DPS being listed through this final rule (as all Atlantic sturgeon on the East Coast of the U.S. are from a DPS currently proposed for listing as threatened or endangered). We have modified Figure 2, now Figures 2 and 3, to more accurately reflect the text descriptions of the Carolina and South Atlantic DPSs. Because Atlantic sturgeon are included in a DPS based on the watershed in which they spawn or were spawned, we have redrawn Figures 2 and 3 using HUC 8 watershed boundaries obtained from USGS. Because this is only a visual representation of where fish from the Carolina and South Atlantic DPSs may be encountered, it does not change the entities being listed and does not indicate that critical habitat may be designated in a certain location. We agree that critical habitat for the Carolina and South Atlantic DPSs should be accurately defined at the time of designation to ensure compliance with the ESA's mandate at section 7(a)(2) that any activity authorized, funded, or carried out by a Federal agency is not likely to result in the destruction or adverse modification of critical habitat. Though activities occurring outside designated critical habitat can still affect critical habitat in some instances, NMFS does not have the authority or the intent to place compliance burdens on entities engaged in activities that would not adversely affect Atlantic sturgeon or their designated critical habitat.

Comment 57: A commenter stated that NMFS has not designated critical habitat for the endangered shortnose sturgeon, which would improve habitat protection for the Atlantic sturgeon due to the substantial overlap in habitat utilization between the two species. The commenter stated NMFS should meet the management objectives of the ESA for shortnose sturgeon before taking on the substantial administrative burden of a listing for Atlantic sturgeon and said that species with critical habitat designated are twice as likely to be recovered as species without critical habitat. Another commenter questioned why NOAA failed to identify Essential Fish Habitat (EFH) for Atlantic sturgeon to support the proposed listing rule and noted that EFH and Habitat Areas of Particular Concern (HAPCs) have not been designated for shortnose sturgeon either.

Response: The shortnose sturgeon was listed as endangered on March 11, 1967, under the Endangered Species Preservation Act of 1966, a predecessor to the Endangered Species Act of 1973. Shortnose sturgeon continued to meet the listing criteria for endangered under subsequent definitions specified in the 1969 Endangered Species Conservation Act and remained on the list with the inauguration of the ESA in 1973. NMFS later assumed jurisdiction for shortnose sturgeon under a 1974 government reorganization plan (38 FR 41370). Because the shortnose sturgeon was listed prior to the amendments to the ESA that made critical habitat designations mandatory for newly listed species, NMFS is not required to designate critical habitat for the species (designation is discretionary). However, NMFS has undertaken a number of activities to protect shortnose sturgeon and their habitat, including publishing a recovery plan for the species (63 FR 69613; December 17, 1998), funding research on the species, and consulting with Federal agencies under section 7 of the ESA to ensure shortnose sturgeon are not jeopardized by activities that may harm the fish or their habitat. Some of these efforts also benefit Atlantic sturgeon, as noted in the proposed listing rule. However, NMFS cannot delay a listing determination or a critical habitat designation for Atlantic sturgeon until the recovery objectives for shortnose sturgeon are met. Because NMFS was petitioned to list the Atlantic sturgeon, we were required to evaluate the status of the species and the threats it is facing and make a finding on whether the petitioned action was warranted within 12 months, which resulted in our proposed listing rule determination of endangered for the Carolina and South Atlantic DPSs of Atlantic sturgeon. NMFS works with the regional fishery management councils to identify EFH and HAPCs for federally managed fishery species. Atlantic and shortnose sturgeon are not federally managed fishery species, therefore NMFS did not identify EFH or HAPCs for either species.

Comments on the Public Hearings

Comment 58: A commenter asked if the ''limited advertising'' and one public hearing met the minimum statutory requirements for receiving public comments on the proposed listing rule, since it affects a large geographic area, numerous counties, cities, states, industries, *etc.* The commenter stated the meeting was not on the Southeast Region's or the Office of Protected Resources' Web site. The commenter noted that a legal notice was placed in the local newspaper, but he asked the paper to enlarge the notice and to also include a separate article about the public hearing.

Response: The notice and public comment period on the proposed listing rule for the Carolina and South Atlantic DPSs of Atlantic sturgeon exceeded the requirements established in section 4(b)(5) of the ESA. The proposed listing rule established a 90-day comment period (October 6, 2010, through January 4, 2011), during which comments were accepted electronically via the Federal eRulemaking Portal (*http://www.regulations.gov*), as well as by mail, hand delivery, and facsimile. We extended the comment period an additional 30 days at the request of the public and accepted comments through February 4, 2011. In compliance with section 4(b)(5)(A)(ii), we sent over 200 letters with a complete copy of the proposed rule to each relevant state and county agency where the Carolina and South Atlantic DPS potentially occur, inviting them to comment on the proposed listing rule. Section 4(b)(5)(E) of the ESA only requires that one public hearing be held on a proposed listing rule if it is requested by the public within 45 days after the date of the publication of the proposed listing rule in the **Federal Register**. Though the Southeast Region did not receive any requests for a public hearing, we elected to hold two public hearings, one each in the areas occupied by the Carolina and South Atlantic DPSs of Atlantic sturgeon. Hearings were held in Wilmington, North Carolina, on December 6, 2010, and Atlanta, Georgia, on December 7, 2010, to accept public comments. In addition to publishing a notice in the **Federal Register** (75 FR 69049; November, 10, 2010) announcing the hearings, a notice was placed in the legal section of a major newspaper in each of the five states occupied by the Carolina and South Atlantic DPSs on November 15, 2010: the Florida Times-Union (Florida), the Atlanta Journal Constitution (Georgia), The State (South Carolina), The Charlotte Observer (North Carolina), and the Richmond

Times-Dispatch (Virginia). As the commenter noted, we also placed a notice in the local paper, The Star-News, for Wilmington, North Carolina, where the first hearing was held. An announcement with a link to the **Federal Register** notice for the hearings was placed on the Southeast Regional Office's Web site on December 2, 2010.

Summary of Changes From the Proposed Listing Rule

Based on the comments received and our review of the proposed rule, we made the changes listed below.

1. We refined the text descriptions of the watersheds making up the ranges of the Carolina and South Atlantic DPSs and the individual fish that are included in the DPSs. The modifications to the text only clarify the riverine ranges of the DPSs and do not change the spawning populations making up each of the Southeast DPSs.

2. We slightly extended the marine range of the DPSs based on recent tagging data. We also provided refined maps showing the riverine ranges of the Carolina and South Atlantic DPSs using HUC 8 watershed boundaries.

3. We added information on metapopulations and the importance of multiple viable riverine populations to the ''Conservation Status'' section, per our response to comment 1 from peer reviewers 1 and 2.

4. We added information on the role of adaptation and competition in the observed low rate of genetic exchange between Atlantic sturgeon river populations, per comment 5 submitted by peer reviewer 1.

5. We added information on polyploidy in Atlantic sturgeon and potential effects on the evaluation of minimum viable population size, per comment 7 submitted by a peer reviewer 1.

6. We added information on recent estimated increases in juvenile Atlantic sturgeon abundance in the Altamaha River, Georgia, per comment 2 submitted by peer reviewer 2.

7. We added information about the nature of the samples used in the genetic analysis for the Waccamaw River population, per comment 13 submitted by peer reviewer 3.

8. We added Atlantic sturgeon location and abundance data provided by the states (North Carolina, South Carolina, and Georgia) for the Carolina and South DPS to the ''Distribution and Abundance'' section, per comments 19 and 20.

9. We revised the erroneous statement in the section on climate change that the Carolina and South Atlantic DPSs are within a region the IPCC predicts will experience decreases in precipitation. As noted in our response to comment 45, the Southeast is predicted to experience increases in precipitation; however, evaporation is also predicted to increase with increasing temperatures and the net effect for the Southeast is predicted to be overall drying.

10. We added and updated Atlantic sturgeon bycatch information in Section B ''Overutilization for Commercial, Recreational, Scientific, or Educational Purposes'' with information provided by the states of North Carolina and Georgia, per comment 47.

11. We removed the statement that it is unlikely the aquarium industry could ever be effectively regulated, per comment 48.

12. We updated information on the current holdings of Atlantic sturgeon in Florida aquaculture facilities.

13. We corrected the location of the Bears Bluff National Fish Hatchery.

14. We added information on impingement and entrainment of juvenile Atlantic sturgeon at the Brunswick Nuclear Power Plant on the lower Cape Fear River.

15. We added an evaluation of North Carolina's NCCHPP and designation of AFSAs to our evaluation of current protective efforts.

16. We made minor corrections and updates to information in the listing rule based on recommendations from peer reviewers, commenters, and our own review of the proposed listing rule.

Our listing determination and summary of the data on which it is based, with the incorporated changes, are presented in the remainder of this document.

Taxonomy and Life History

There are two subspecies of Atlantic sturgeon—the Gulf sturgeon *(Acipenser oxyrinchus desotoi*) and the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Historically, the Gulf sturgeon occurred from the Mississippi River east to Tampa Bay. Its present range extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi east to the Suwannee River in Florida. The Gulf sturgeon was listed as threatened under the ESA in 1991. The finding in this final rule addresses the subspecies *Acipenser oxyrinchus oxyrinchus* (referred to as Atlantic sturgeon), which is distributed along the eastern coast of North America. Historically, sightings have been reported from Hamilton Inlet, Labrador, south to the St. Johns River, Florida. Recently, a tagged Atlantic sturgeon was tracked off Cape Canaveral, Florida. Occurrences south of the St. Johns River, Florida, and in Labrador may have always been rare.

Atlantic sturgeon is a long-lived, late-maturing, estuarine-dependent, anadromous species. Atlantic sturgeon may live up to 60 years, reach lengths up to 14 feet (ft; 4.27 meters (m)), and weigh over 800 pounds (lbs; 363 kg). They are distinguished by armor-like plates and a long protruding snout that is ventrally located, with four barbels crossing in front. Sturgeon are omnivorous benthic (bottom) feeders and filter quantities of mud along with their food. Adult sturgeon diets include mollusks, gastropods, amphipods, isopods, and fish. Juvenile sturgeon feed on aquatic insects and other invertebrates (ASSRT, 2007).

Vital parameters of Atlantic sturgeon populations show clinal variation with faster growth and earlier age at maturation in more southern systems, though not all data sets conform to this trend. Atlantic sturgeon mature between the ages of 5 and 19 years in South Carolina (Smith *et al.,* 1982), between 11 and 21 years in the Hudson River (Young *et al.,* 1988), and between 22 and 34 years in the St. Lawrence River (Scott and Crossman, 1973). Atlantic sturgeon likely do not spawn every year. Multiple studies have shown that spawning intervals range from 1 to 5 years for males (Smith, 1985; Collins *et al.,* 2000; Caron *et al.* 2002) and 2 to 5 years for females (Vladykov and Greeley, 1963; Van Eenennaam *et al.,* 1996; Stevenson and Secor, 1999). Fecundity of Atlantic sturgeon has been correlated with age and body size, with egg production ranging from 400,000 to 8 million eggs per year (Smith *et al.,* 1982; Van Eenennaam and Doroshov, 1998; Dadswell, 2006). The average age at which 50 percent of maximum lifetime egg production is achieved is estimated to be 29 years, approximately 3 to 10 times longer than for other bony fish species examined (Boreman, 1997).

Spawning adults migrate upriver in the spring, which occurs during February and March in southern systems, April and May in mid-Atlantic systems, and May and July in Canadian systems (Murawski and Pacheco, 1977; Smith, 1985; Bain, 1997; Smith and Clugston, 1997; Caron *et al.,* 2002). In some southern rivers, a fall spawning migration may also occur (Rogers and Weber, 1995; Weber and Jennings, 1996; Moser *et al.,* 1998). Spawning typically occurs in flowing water between the salt front and fall line of large rivers, where optimal flows are 18 to 30 inches (in) per second (46 to 76 centimeters (cm) per second) and depths are 36 to 89 ft (11 to 27 m) (Borodin, 1925; Leland, 1968; Scott and Crossman, 1973; Crance,

1987; Bain *et al.,* 2000). The fall line is the boundary between an upland region of continental bedrock and an alluvial coastal plain, sometimes characterized by waterfalls or rapids. Sturgeon eggs are highly adhesive and are deposited on the bottom substrate, usually on hard surfaces (*e.g.,* cobble) (Gilbert, 1989; Smith and Clugston, 1997). Hatching occurs approximately 94 to 140 hours after egg deposition at corresponding temperatures of 68.0 to 64.4 degrees Fahrenheit (20 to 18 degrees Celsius). The newly emerged larvae assume a demersal existence (Smith *et al.,* 1980). The yolksac larval stage is completed in about 8 to 12 days, during which time the larvae move downstream to rearing grounds (Kynard and Horgan, 2002). During the first half of their migration downstream, movement is limited to night. During the day, larvae use benthic structure (*e.g.,* gravel matrix) as refugia (Kynard and Horgan, 2002). During the latter half of migration, when larvae are more fully developed, movement to rearing grounds occurs both day and night. Juvenile sturgeon continue to move further downstream into brackish waters and eventually become residents in estuarine waters for months to years.

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. However, a long life-span also allows multiple opportunities to contribute to future generations provided the appropriate spawning habitat and conditions are available.

Distribution and Abundance

Historically, Atlantic sturgeon were present in approximately 38 river systems throughout their range, of which 35 systems have been confirmed to have had a historical spawning population. More recently, presence has been documented in 35 river systems with spawning taking place in at least 18 rivers. Spawning has been confirmed in the St. Lawrence, Annapolis, St. John, Kennebec, Hudson, Delaware, James, Roanoke, Tar-Pamlico, Cape Fear, Waccamaw, Great Pee Dee, Combahee, Edisto, Savannah, Ogeechee, Altamaha, and Satilla rivers. Rivers with possible, but unconfirmed, spawning populations include the St. Croix, Penobscot, Androscoggin, Sheepscot, York, Neuse, Santee and Cooper Rivers.

Historical records from the 1700s and 1800s document large numbers of sturgeon in many rivers along the Atlantic Coast. Atlantic sturgeon underwent significant range-wide declines from historical abundance levels due to overfishing in the late 1800s, as discussed more fully below. Sturgeon stocks were further impacted through environmental degradation, especially due to loss of access to habitat and reduced water quality from the construction of dams in the early to mid-1900s. The species persisted in many rivers, though at greatly reduced levels (1 to 5 percent of their earliest recorded numbers), and commercial fisheries were active in many rivers during all or some of the years 1962 to 1997 (Waldman and Wirgin, 1998; Smith and Clugston, 1997). Many of these contemporary fisheries resulted in continued overfishing, which prompted ASMFC to impose the Atlantic sturgeon fishing moratorium in 1998 and NMFS to close the EEZ to Atlantic sturgeon retention in 1999.

Quantified abundance estimates of Atlantic sturgeon obtained through sampling surveys are currently only available for the Hudson (NY) and Altamaha (GA) rivers, where adult spawning populations are estimated to be approximately 870 and 343 fish per year, respectively (Kahnle *et al.,* 2007; Schueller and Peterson, 2006). Surveys from other rivers in the species' U.S. range are more qualitative, primarily focusing on documentation of multiple year classes and reproduction, as well as the presence of very large adults and gravid females, in the river systems. In the Southeast Region, spawning has been confirmed in 11 rivers (Roanoke, Tar-Pamlico, Cape Fear, Waccamaw, Great Pee Dee, Combahee, Edisto, Savannah, Ogeechee, Altamaha, and Satilla rivers), with possible spawning occurring in 3 additional rivers (the Neuse, Santee and Cooper Rivers). Based on a comprehensive review of the available data, the literature, and information provided by local, state, and Federal fishery management personnel, the Altamaha River is believed to have the largest population in the Southeast (ASSRT, 2007). The larger size of this population relative to the other river populations in the Southeast is likely due to the absence of dams, the lack of heavy development in the watershed, and relatively good water quality, as Atlantic sturgeon populations in the other rivers in the Southeast have been affected by one or more of these factors. Trammel net surveys, as well as independent monitoring of incidental take in the American shad fishery, suggested that the Altamaha population was neither increasing nor decreasing. However, recent studies by Schueller and Peterson (2010) and Peterson (2011; UGA, pers. comm.) estimated large increases in abundance of Atlantic sturgeon juveniles from 2004–2010, particularly during the 2009–2010 period. Schueller and Peterson (2010) conducted their research during the summers of 2004 to 2007 and estimated that juvenile abundance ranged from 1,072 to 2,033 individuals in the Altamaha River, with age-1 and age-2 individuals comprising greater than 87 percent of the population. Based on modeling, estimated apparent survival and per capita recruitment indicated that the juvenile population experienced high annual turnover: apparent survival rates were low (less than 33 percent), and per capita recruitment was high (0.82–1.38). The numbers of juvenile Atlantic sturgeon in the Altamaha River in 2009 and 2010 were between approximately 3,500 and 6,500. However, the authors noted that their mark–recapture methods were not capable of providing separate estimates of annual survival and out-migration, yet these rates are critical in understanding recruitment processes for the species. Though quantitative abundance estimates obtained through sampling surveys are not available for the other river populations, because the Altamaha spawning population is the largest, we believe a conservative estimate of the other spawning populations in the Southeast Region is no more than 300 adults spawning per year.

Historically, Atlantic sturgeon were abundant in most North Carolina coastal rivers and estuaries, with the largest fisheries occurring in the Roanoke River/Albemarle Sound system and in the Cape Fear River (Kahnle *et al.,* 1998). Historical landings records from the late 1800s indicated that Atlantic sturgeon were very abundant within Albemarle Sound (approximately 135,600 lbs or 61,500 kg landed per year). Abundance estimates derived from these historical landings records indicated that between 7,200 and 10,500 adult females were present within North Carolina prior to 1890 (Armstrong and Hightower, 2002; Secor 2002). NCDMF has conducted the Albemarle Sound IGNS, initially designed to target striped bass, since 1990. During that time, 842 YOY and subadult sturgeon have been captured. Incidental take of Atlantic sturgeon in the IGNS, as well as multiple observations of YOY from the Albemarle Sound and Roanoke River, provide evidence that spawning continues. Three adult Atlantic sturgeon (2 males, 1 unknown) were tagged in the Roanoke River during September 2010 and the fish were tracked out of the river several weeks later, potentially

suggesting a fall spawning run of Atlantic sturgeon in the Roanoke River. Catch records indicate that the Roanoke River Atlantic sturgeon population seemed to be increasing until 2000, when recruitment began to decline. The Albemarle IGNS data for 2006–2009 showed higher Atlantic sturgeon CPUEs (0.015 to 0.031) than the 2002–2005 period, though they were still lower than the 2000–2001 level (0.032) and there is no overall trend in the overall 1990–2009 CPUE dataset. Catch records and observations from other river systems in North Carolina exist (*e.g.,* Hoff, 1980, Oakley, 2003, in the Tar and Neuse rivers; Moser *et al.,* 1998, and Williams and Lankford, 2003, in the Cape Fear River) and provide evidence for spawning, but based on the relatively low numbers of fish caught, it is difficult to determine whether the populations in those systems are declining, rebounding, or remaining static. The Pamlico IGNS survey data from 2001–2009 shows peak CPUE of Atlantic sturgeon in 2005 (0.095), but no decreasing or increasing trends are apparent. River surveys in the Pamlico, Pungo, and Neuse Rivers since 2000 have shown a slight decrease in Atlantic sturgeon abundance. Also, large survey captures during a single year are difficult to interpret. For instance, abundance of Atlantic sturgeon below Lock and Dam #1 in the Cape Fear River seemed to have increased dramatically during the 1990–1997 surveys (Moser *et al.,* 1998) as the CPUE of Atlantic sturgeon was up to eight times greater during 1997 than in the earlier survey years. Since 1997, Atlantic sturgeon CPUE doubled between the years of 1997 and 2003 (Williams and Lankford, 2003). However, it is unknown whether this is an actual population increase reflecting the effects of North Carolina's ban on Atlantic sturgeon fishing that began in 1991, or whether the results were skewed by one outlier year. There was a large increase observed in 2002, though the estimates were similar among all other years of the 1997 to 2003 study.

Atlantic sturgeon were likely present in many South Carolina river/estuary systems historically, but it is not known where spawning occurred. Secor (2002) estimated that 8,000 spawning females were likely present prior to 1890, based on U.S. Fish Commission landing records. Since the 1800s, however, populations have declined dramatically (Collins and Smith, 1997). Recorded landings of Atlantic sturgeon in South Carolina peaked at 481,050 lbs (218,200 kg) in 1897, but 5 years later, only 93,920 lbs (42,600 kg) were reported landed (Smith *et al.,* 1984). Landings remained depressed throughout the 1900s, with between 4,410 and 99,210 lbs (2,000 and 45,000 kg) of Atlantic sturgeon reported annually between 1958 and 1982 (Smith *et al.,* 1984). During the last two decades, Atlantic sturgeon have been observed in most South Carolina coastal rivers, although it is not known if all rivers support a spawning population (Collins and Smith, 1997). Sampling for shortnose sturgeon (*Acipenser brevirostrum*) conducted in Winyah Bay captured two subadult Atlantic sturgeon in 2004. SCDNR noted in comments on the proposed listing rule that Atlantic sturgeon were captured in most nets set in Winyah Bay from April to July in 2007 to 2009, including sites far upriver. Further, a researcher conducting pilot sonar survey trials in Winyah Bay potentially detected several hundred fish, many of which could be Atlantic sturgeon. The researcher has conducted pilot sonar trials in the Roanoke, Neuse, Cape Fear, and Pee Dee River systems and believes the initial results suggest Atlantic sturgeon densities in the Pee Dee River (Winyah Bay) system are higher than the other systems surveyed (J. Hightower, pers. comm.) Captures of age-1 juveniles from the Waccamaw River during the early 1980s suggest that a reproducing population of Atlantic sturgeon may persist in that river, although the fish could have been from the nearby Great Pee Dee River (Collins and Smith, 1997). Until recently, there was no evidence that Atlantic sturgeon spawned in the Great Pee Dee River, although subadults were frequently captured and large adults were often observed by fishers. However, a fishery survey conducted by Progress Energy Carolinas Incorporated captured a running ripe male in October 2003 and observed other large sturgeon, perhaps revealing a fall spawning run (ASSRT, 2007). There are no data available regarding the presence of YOY or spawning adult Atlantic sturgeon in the Sampit River, although it did historically support a population and is thought to serve as a nursery ground for local stocks (ASMFC, 2009).

The Santee-Cooper system had some of the highest historical landings of Atlantic sturgeon in the Southeast. Data from the U.S. Fish Commission shows that greater than 220,460 lbs (100,000 kg) of Atlantic sturgeon were landed in 1890 (Secor, 2002). The capture of 151 subadults, including age-1 juveniles, in the Santee River in 1997 suggests that an Atlantic sturgeon population still exists in this river (Collins and Smith, 1997). The status review report documents that three adult Atlantic sturgeon carcasses were found above the Wilson and Pinopolis dams in Lake Moultrie (a Santee-Cooper reservoir) during the 1990s, and also states that there is little information regarding a land-locked population existing above the dams. There is no effective fish passage for sturgeon on the Santee and Cooper Rivers, and the lowest dams on these rivers are well below the fall line, thus limiting the amount of freshwater spawning and developmental habitat for fish below the dams. In 2007, an Atlantic sturgeon entered the fish lift (a lock designed specifically for fish passage) at the St. Stephen dam; it was physically removed and translocated downstream into the Santee River (A. Crosby, SCDNR, pers. comm.) In 2004, 15 subadult Atlantic sturgeon were captured in shortnose sturgeon surveys in the Santee River estuary. The previous winter, four juvenile (YOY and subadults) Atlantic sturgeon were captured from the Santee (one fish) and Cooper (three fish) rivers. These data support previous hypotheses that a fall spawning run occurs within this system, similar to that observed in other southern river systems. However, the status review report notes that SCDNR biologists have some doubt whether smaller sturgeon from the Santee-Cooper are resident YOY, as flood waters from the Pee-Dee or Waccamaw Rivers could have transported these YOY to the Santee-Cooper system via Winyah Bay and the Intracoastal Waterway (McCord, 2004). Resident YOY could, however, be evidence of a spawning population above the dams, as is the case with shortnose sturgeon (Collins *et al.,* 2003)

From 1994 to 2001, over 3,000 juveniles have been collected in the Ashepoo-Combahee-Edisto Rivers (ACE) Basin, including 1,331 YOY sturgeon (Collins and Smith, 1997; ASSRT, 2007). Specifically, SCDNR reports that 3,661 juvenile (one- to three-year-old) Atlantic sturgeon were collected in the Edisto River during the 16-year period since 1994. Utilizing this data, SCDNR used Lincoln-Peterson and Schnabel models to derive Atlantic sturgeon population estimates, which resulted in estimates of 70,000 and 20,000 juvenile Atlantic sturgeon in the Edisto River, respectively. SCDNR commented that the model results suggest increasing trends in abundance. Both models rely on mark-recapture data and assume a closed population (there are no births, deaths, or immigration/emigration between the initial capture and the recapture period) and that all individuals have an equal chance of

being captured (Nichols, 1992; Lindeman, 1990; Chao, 1987). We note that there is great uncertainty in the population estimates resulting from the two models, as evident in the great disparity between the two numbers. The reliability of the population models depends on the validity of the assumptions, and the primary assumption of equal capture probability is likely unattainable in natural populations (Chao, 1987; Carothers, 1973). SCDNR indicated they are currently completing an open system model (which is based on survival probabilities, as well as capture probabilities) to better assess the Atlantic sturgeon population in the Edisto River. Sampling for adults began in 1997, with two adult sturgeon captured in the first year of the survey, including one gravid female captured in the Edisto River and one running ripe male captured in the Combahee River. The running ripe male in the Combahee River was recaptured one week later in the Edisto River, which suggests that the three rivers that make up the ACE Basin may support a single population that spawns in at least two of the rivers. Between 1997 and 1999, SCDNR captured 118 adults in the Edisto River during spring and fall spawning runs, but netting ceased once that number was reached, so the entire spawning run was not sampled and more Atlantic sturgeon may have been captured if netting continued. SCDNR also noted approximately 20 adults were captured in the Edisto River over one to two months during surveys targeting other species. In 2010, four adults tagged in the 1990's as age 0+ were recaptured. These captures show that a current spawning population exists in the ACE Basin, as both YOY and spawning adults are regularly captured.

The Ashley River, along with the Cooper River, drains into Charleston Bay; only shortnose sturgeon have been studied in these rivers. While the Ashley River historically supported an Atlantic sturgeon spawning population, it is unknown whether the population still exists. There has been little or no scientific sampling for Atlantic sturgeon in the Broad/Coosawatchie River. One fish of unknown size was reported from a small directed fishery during 1981 to 1982 (Smith and Dingley, 1984).

Prior to the collapse of the fishery in the late 1800s, the sturgeon fishery was the third largest fishery in Georgia. Secor (2002) estimated from U.S. Fish Commission landing reports that approximately 11,000 spawning females were likely present prior to 1890. The sturgeon fishery was mainly centered on the Altamaha River, and in more recent years, peak landings were recorded in 1982 (13,000 lbs, 5,900 kg). In Georgia, Atlantic sturgeon are believed to spawn in the Savannah, Ogeechee, Altamaha, and Satilla rivers. Based on juvenile presence and abundance, the Altamaha River currently supports one of the healthier Atlantic sturgeon populations in the southeast (ASSRT, 2007). Atlantic sturgeon are also present in the Ogeechee River; however, the absence of age-1 fish during some years and the unbalanced age structure suggests that the population is highly stressed (Rogers and Weber, 1995). Sampling results from the mid-1990s indicated that the Atlantic sturgeon population in the Satilla River was also highly stressed (Rogers and Weber, 1995). Only four spawning adults or YOY, which were used for genetic analysis (Ong *et al.,* 1996), had been collected from this river since 1995. In the most recent compliance report to ASMFC, University of Georgia (UGA) researchers collected more than 200 Atlantic sturgeon in the Satilla River in less than 2 years of sampling. The presence of juvenile fish measuring less than 50 cm supports this is likely a self-sustaining, spawning population. The Savannah River supports a reproducing population of Atlantic sturgeon (Collins and Smith, 1997). According to NOAA's National Ocean Service, 70 Atlantic sturgeon have been captured since 1999 (ASSRT, 2007). Twenty-two of these fish have been YOY. A running ripe male was captured at the base of the dam at Augusta during the late summer of 1997, which supports the hypothesis that spawning occurs there in the fall. In the Savannah River, the SCDNR captured 369 Atlantic sturgeon between 1997 and 2010.

Reproducing Atlantic sturgeon populations are no longer believed to exist south of the Satilla River in Georgia. Sampling of the St. Marys River in the early 1990s failed to locate any sturgeon, which suggests that the spawning population may be extirpated (Rogers *et al.,* 1994). In January 2010, 12 sturgeon, believed to be Atlantic sturgeon, were captured at the mouth of the St. Marys during relocation trawling associated with a dredging project (J. Wilcox, Florida Fish and Wildlife Conservation Commission, pers. comm.), the first capture of Atlantic sturgeon in the St. Marys in decades. However, because they were not YOY or adults captured upstream, these trawl-captured sturgeon do not provide new evidence of a spawning population in the St. Marys. Researchers captured a total of 9 Atlantic sturgeon in the St. Marys River in March and June of 2010, based on a final report submitted to NMFS on a project funded through our Species Recovery Grant Program under section 6 of the ESA. The report stated that, based on the sizes of these individuals, the researchers concluded that none of these individuals were ''river-residents''. Though there was no definitive proof that these individuals had immigrated from other rivers, the report stated that the absence of small, river-resident juveniles suggests that Atlantic sturgeon in the St. Marys experienced complete recruitment failure from 2007–2010. There have been reports of Atlantic sturgeon tagged in the Edisto River (South Carolina) being recaptured in the St. Johns River, indicating this river may serve as a nursery ground; however, there are no data to support the existence of a current spawning population (*i.e.,* YOY or running ripe adults) in the St. Johns (Rogers and Weber, 1995; Kahnle *et al.,* 1998). In response to the proposed listing rule, Florida Fish and Wildlife Commission reported that 30 subadults (1 meter in length) were captured in the St. Marys River in 20 months and two juveniles (approximately 50 centimeters, age-1 or 2) were captured in the St. Johns River in February 2011, though these captures do not provide new evidence of spawning based on the size/age classes of sturgeon caught.

Identification of Distinct Population Segments

The ESA's definition of ''species'' includes ''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.'' The high degree of reproductive isolation of Atlantic sturgeon (*i.e.,* homing to their natal rivers for spawning; ASSRT, 2007; Wirgin *et al.,* 2000; King *et al.,* 2001; Waldman *et al.,* 2002), as well as the ecological uniqueness of those riverine spawning habitats, the genetic differentiation amongst subpopulations, and the differences in life history characteristics, provide evidence that discrete reproducing populations of Atlantic sturgeon exist, which led the Services to evaluate application of the DPS policy in its 2007 status review. To determine whether any populations qualify as DPSs, we evaluated populations pursuant to the joint DPS policy, and considered: (1) The discreteness of any Atlantic sturgeon population segment in relation to the remainder of the subspecies to which it belongs; and (2) the significance of any Atlantic sturgeon population segment to the remainder of the subspecies to which it belongs.

Discreteness

The joint DPS policy states that a population of a vertebrate species may be considered discrete if it satisfies either one of the following conditions: (1) It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors (quantitative measures of genetic or morphological discontinuity may provide evidence of this separation) or (2) it is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of Section 4(a)(1)(D) of the ESA.

Atlantic sturgeon throughout their range exhibit ecological separation during spawning that has resulted in multiple, genetically distinct, interbreeding population segments. Tagging studies and genetic analyses provide the evidence of this ecological separation (Wirgin *et al.,* 2000; King *et al.,* 2001; Waldman *et al.,* 2002; ASSRT, 2007; Grunwald *et al.,* 2008). As previously discussed, though adult and subadult Atlantic sturgeon originating from different rivers mix in the marine environment (Stein *et al.,* 2004a), the vast majority of Atlantic sturgeon return to their natal rivers to spawn, with some studies showing only one or two individuals per generation spawning outside their natal river system (Wirgin *et al.,* 2000; King *et al.,* 2001; Waldman *et al.,* 2002). In addition, spawning in the various river systems occurs at different times, with spawning occurring earliest in southern systems and occurring as much as 5 months later in the northernmost river systems (Murawski and Pacheco, 1977; Smith, 1985; Rogers and Weber, 1995; Weber and Jennings, 1996; Bain, 1997; Smith and Clugston, 1997; Moser *et al.,* 1998; Caron *et al.,* 2002). Therefore, the ecological separation of the interbreeding units of Atlantic sturgeon results primarily from spatial separation (*i.e.,* very few fish spawning outside their natal river systems), as well as temporal separation (spawning populations becoming active at different times along a continuum from north to south).

Genetic analyses of mitochondrial DNA (mtDNA), which is maternally inherited, and nuclear DNA (nDNA), which reflects the genetics of both parents, provides evidence of the separation among Atlantic sturgeon populations in different rivers (Bowen and Avise, 1990; Ong *et al.,* 1996; Waldman *et al.,* 1996a; Waldman *et al.,* 1996b; Waldman and Wirgin, 1998; Waldman *et al.,* 2002; King *et al.,* 2001; Wirgin *et al.,* 2002; Wirgin *et al.,* 2005; Wirgin and King, 2006; Grunwald *et al.,* 2008). Overall, these studies consistently found Atlantic sturgeon to be genetically diverse, and offered that between seven and ten Atlantic sturgeon population groupings can be statistically differentiated range-wide (King *et al.,* 2001; Waldman *et al.,* 2002; Wirgin *et al.,* 2002; Wirgin *et al.,* 2005; ASSRT, 2007 (Tables 4 and 5); Grunwald *et al.,* 2008).

Given a number of key differences among the studies (*e.g.,* the analytical and/or statistical methods used, the number of rivers sampled, and whether samples from subadults were included), it is not unexpected that each reached a different conclusion regarding the number of Atlantic sturgeon population groupings. Wirgin and King (2006) refined the genetic analyses for Atlantic sturgeon to address such differences in prior studies. Most notably, they increased sample sizes from multiple rivers and limited the samples analyzed to those collected from YOY and mature adults (greater than 130 cm total length) to ensure that the fish originated from the river in which it was sampled. The results of the refined analysis by Wirgin and King (2006) are presented in the status review report (ASSRT, 2007; *e.g.,* Table 6 and Figure 17); both the mtDNA haplotype and nDNA allelic frequencies analyzed by Wirgin and King (2006) indicated that Atlantic sturgeon river populations are genetically differentiated. The results of the mtDNA analysis used for the status review report were also subsequently published by Grunwald *et al.* (2008). In comparison to the mtDNA analyses of the status review report, Grunwald *et al.* (2008) used additional samples, some from fish in the size range (less than 130 cm) excluded by Wirgin and King because they were smaller than those considered to be mature adults. Nevertheless, the results were qualitatively the same and demonstrated that each of the 12 sampled Atlantic sturgeon populations could be genetically differentiated (Grunwald *et al.,* 2008).

Genetic distances and statistical analyses (bootstrap values and assignment test values) were used to investigate significant relationships among, and differences between, Atlantic sturgeon river populations (ASSRT, 2007; Table 6 and Figures 16–18). Overall, the genetic markers used in this analysis resulted in an average accuracy of 88 percent for determining a sturgeon's natal river origin, but an average accuracy of 94 percent for correctly classifying it to one of five groups of populations (Kennebec River, Hudson River, James River, Albemarle Sound, and Savannah/Ogeechee/Altamaha Rivers) when using microsatellite data collected only from YOY and adults (ASSRT, 2007; Table 6). The overall accuracy in assigning an Atlantic sturgeon to its natal river ranged from 60 to 94.8 percent (60 to 91.7 percent for southeastern rivers), while the overall accuracy in identifying a sturgeon to one of the 5 DPSs ranged between 88.1 and 95.9 percent (91.7 to 95.9 percent for the two southeastern DPSs). A phylogenetic tree (a neighbor joining tree) was produced from only YOY and adult samples (to reduce the likelihood of including strays from other populations) using the microsatellite analysis (ASSRT, 2007; Figure 17). Bootstrap values (which measure how consistently the data support the tree structure) for this tree were high (the lowest was 87 percent, and all others were over 90 percent) (ASSRT, 2007). Regarding sturgeon from southeast rivers, this analysis resulted in a range of 60 to 92 percent accuracy in determining a sturgeon's natal river origin, but 92 and 96 percent accuracy in correctly classifying a sturgeon from four sampled river populations (the Albemarle Sound, Savannah, Ogeechee, and Altamaha River populations) to two groupings of river populations (Albemarle Sound and Savannah/Ogeechee/Altamaha Rivers). These two groupings exhibited clear separation from northern populations and from each other.

Genetic samples for YOY and spawning adults were not available for river populations originating between the Albemarle Sound and the other three rivers. However, nDNA from an expanded dataset that included juvenile Atlantic sturgeon was used to produce a neighbor-joining tree with bootstrap values (ASSRT, 2007; Figure 18). This dataset included additional samples from the Santee-Cooper, Waccamaw, and Edisto populations in the Southeast. Atlantic sturgeon river populations also grouped into five population segments along the U.S. East Coast in this analysis. In the Southeast, Atlantic sturgeon from the Santee-Cooper system grouped with the Albemarle Sound population, while the other two river populations grouped with the Savannah/Ogeechee/Altamaha River population segment. With the exception of the Waccamaw River population, all river populations sampled within each population segment along the entire East Coast were geographically adjacent. The Waccamaw River population

grouped with the Edisto/Savannah/Ogeechee/Altamaha River population segment, even though it is geographically located between Albemarle Sound and the Santee and Cooper Rivers. However, we attributed this to the small sample size (21 fish) from the Waccamaw River and the fact that all samples came from juveniles, which may be migrants from other systems. From the seven Southeast river populations included in the analysis, we determined based on genetic information that river populations from the ACE Basin southward are a genetically distinct, interbreeding population segment and that river populations between the Santee-Cooper system and Albemarle Sound (Roanoke River) are a genetically distinct, interbreeding population segment.

The higher accuracy in identifying Atlantic sturgeon to one of two population groupings (Albemarle Sound/Santee-Cooper Rivers and Ogeechee/Savannah/Altamaha/Edisto Rivers) compared to their natal rivers supports the fact that these multiple-river population segments are discrete from each other.

We have considered the information on Atlantic sturgeon population structuring provided in the status review report and Grunwald *et al.* (2008). The nDNA analyses described in the status review report provide additional genetic information and include chord distances and bootstrap values to support the findings for population structuring of Atlantic sturgeon within the United States. Therefore, based on genetic differences observed among certain river populations and the assumption that adjacent river populations are more likely to breed with one another than river populations from rivers that are not adjacent to each other, five discrete Atlantic sturgeon population segments in the United States meet the DPS Policy's discreteness criterion, with two located in the Southeast: (1) The ''Carolina'' population segment, which includes Atlantic sturgeon originating from the Roanoke, Tar/Pamlico, Cape Fear, Waccamaw, Pee Dee, and Santee-Cooper Rivers, and (2) the ''South Atlantic'' population segment, which includes Atlantic sturgeon originating from the ACE Basin (Ashepoo, Combahee, and Edisto rivers), Savannah, Ogeechee, Altamaha, and Satilla Rivers.

Significance

When the discreteness criterion is met for a potential DPS, as it is for the Carolina and South Atlantic population segments in the Southeast identified above, the second element that must be considered under the DPS policy is significance of each DPS to the taxon as a whole. The DPS policy cites examples of potential considerations indicating significance, including: (1) Persistence of the discrete population segment in an ecological setting unusual or unique for the taxon; (2) evidence that loss of the discrete population segment would result in a significant gap in the range of the taxon; (3) evidence that the DPS represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historical range; or, (4) evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics.

We believe that the Carolina and South Atlantic population segments persist in ecological settings unique for the taxon. This is evidenced by the fact that spawning habitat of each population grouping is found in separate and distinct ecoregions that were identified by TNC based on the habitat, climate, geology, and physiographic differences for both terrestrial and marine ecosystems throughout the range of the Atlantic sturgeon along the Atlantic coast (Figure 1). TNC descriptions do not include detailed information on the chemical properties of the rivers within each ecoregion, but include an analysis of bedrock and surficial geology type because it relates to water chemistry, hydrologic regime, and substrate. It is well established that waters have different chemical properties (*i.e.,* identities) depending on the geology of where the waters originate.

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

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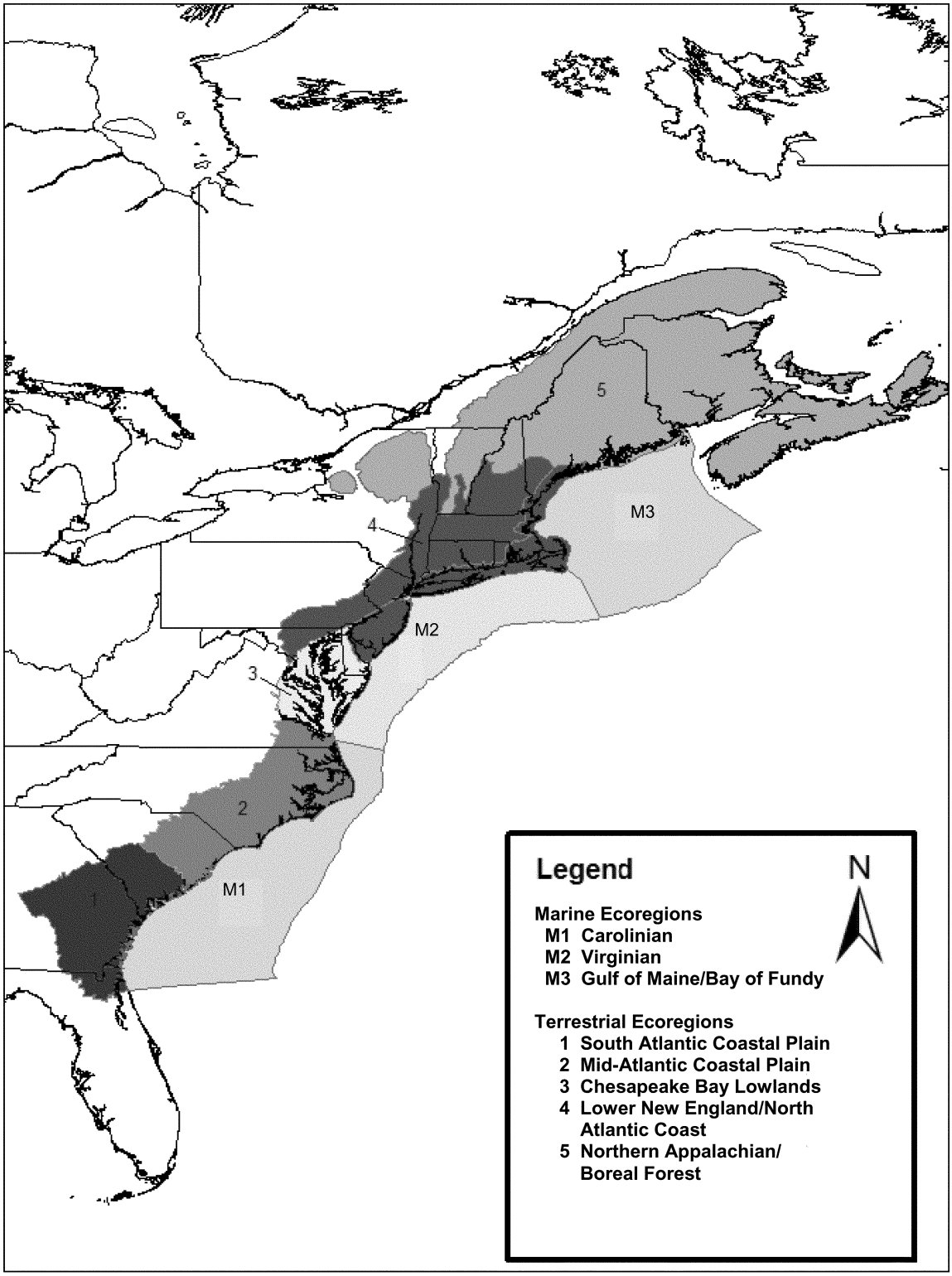

Figure 1: Map of TNC Marine and Terrestrial Ecoregions

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

Therefore, the ecoregion delineations support that the physical and chemical properties of the Atlantic sturgeon spawning rivers utilized by the Carolina and South Atlantic DPSs are unique to each population segment. Since reproductive isolation accounts for the discreteness of each population segment, the Carolina and South Atlantic population segments of Atlantic sturgeon are ''significant'' as defined in the DPS policy given that the spawning rivers for each population segment occur in a unique ecological setting.

The loss of either the Carolina or the South Atlantic population segments of Atlantic sturgeon would create a significant gap in the range of the taxon. The loss of the Carolina population segment would result in a 475-mile (764-kilometer (km)) gap between the northern population segments and the South Atlantic population segment. The loss of the South Atlantic population segment would truncate the southern range of Atlantic sturgeon by greater than 150 miles (241 km). Though Atlantic sturgeon travel great distances in the marine environment and may use multiple river systems for foraging and nursery habitat, the range occupied by the Carolina and South Atlantic population segments would likely not be recolonized by a new, viable spawning population if either population segment was lost, except over a long time frame. Genetic analyses show that fewer than two individuals per generation spawn outside their natal rivers (Wirgin *et al.,* 2000; King *et al.,* 2001; Waldman *et al.,* 2002). However, a caveat to this information is that a natal river population, well-established over a long span of geological time and highly adapted to its respective natal river, may not realize success in colonizing another river already populated by a second population better adapted to its respective natal river than a potential colonist. The low rate of genetic exchange displayed among adjacent sturgeon populations may not reflect the incapacity of the species to colonize, but the competitive advantage held by a pre-established natal river population facing migrant individuals. However, we do not expect Atlantic sturgeon that originate from other population segments to re-colonize extirpated systems and establish new spawning populations, except perhaps over a long time frame (*i.e.,* many Atlantic sturgeon generations). Therefore, the loss of either the Carolina or South Atlantic population segments would result in a significant gap in the range of Atlantic sturgeon over a long time frame, and negatively impact the species as a whole because the loss of either population segment would constitute an important loss of genetic diversity for the Atlantic sturgeon.

The information presented above describes: (1) Persistence of the Carolina and South Atlantic population segments in ecological settings that are unique for the Atlantic sturgeon as a whole; and (2) evidence that loss of either population segment would result in a significant gap in the range of the taxon. Based on this information, we conclude that the Carolina and South Atlantic population segments meet the discreteness and significance criteria outlined in the DPS policy. We hereafter refer to these DPSs as the Carolina and South Atlantic DPSs. Figures 2 and 3 show the Carolina and South Atlantic DPSs. While the entire marine range of both the Carolina and South Atlantic DPSs extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida, figures 2 and 3 only depict the portion of the marine range directly adjacent to the riverine portions of each DPS.

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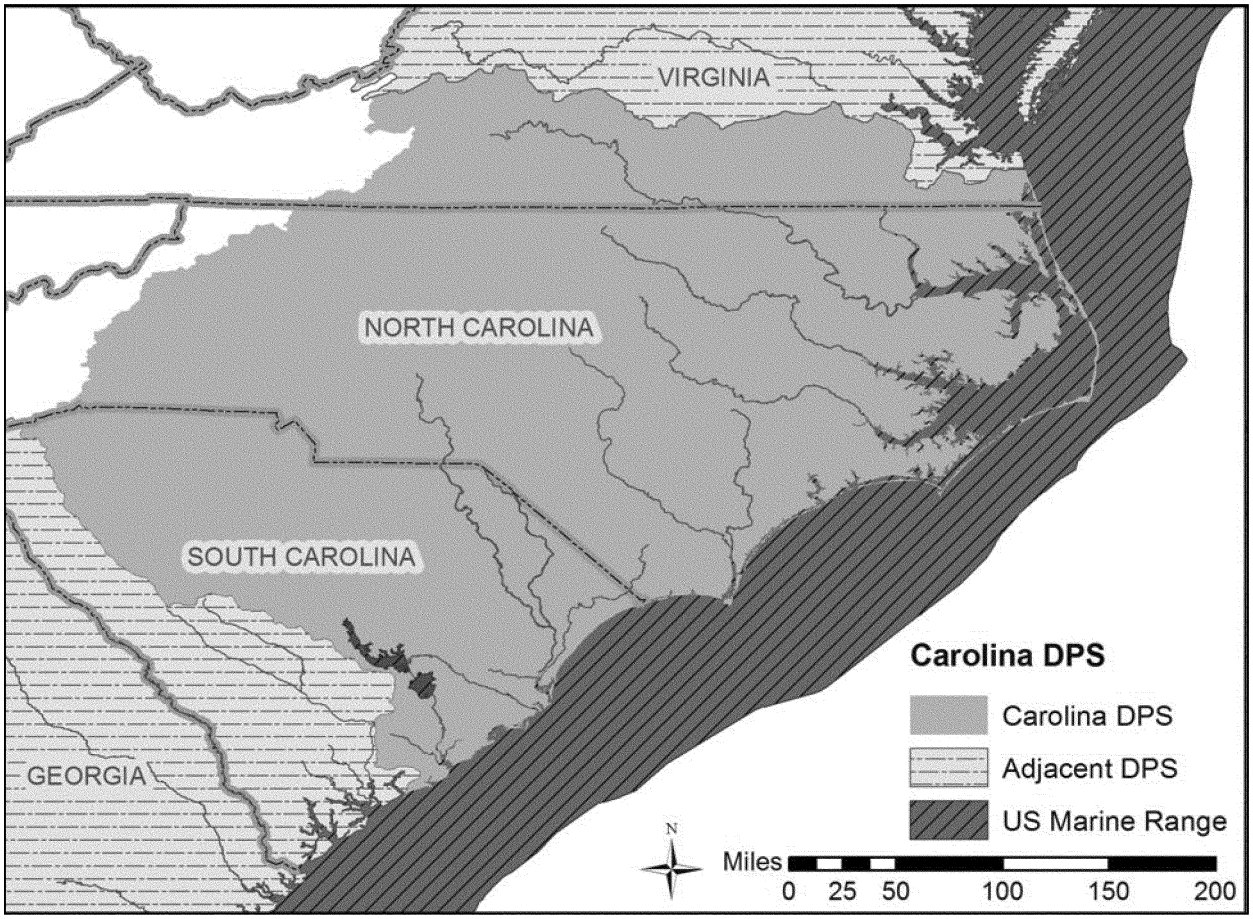

Figure 2: The Carolina DPS, including the adjacent portion of the marine range.

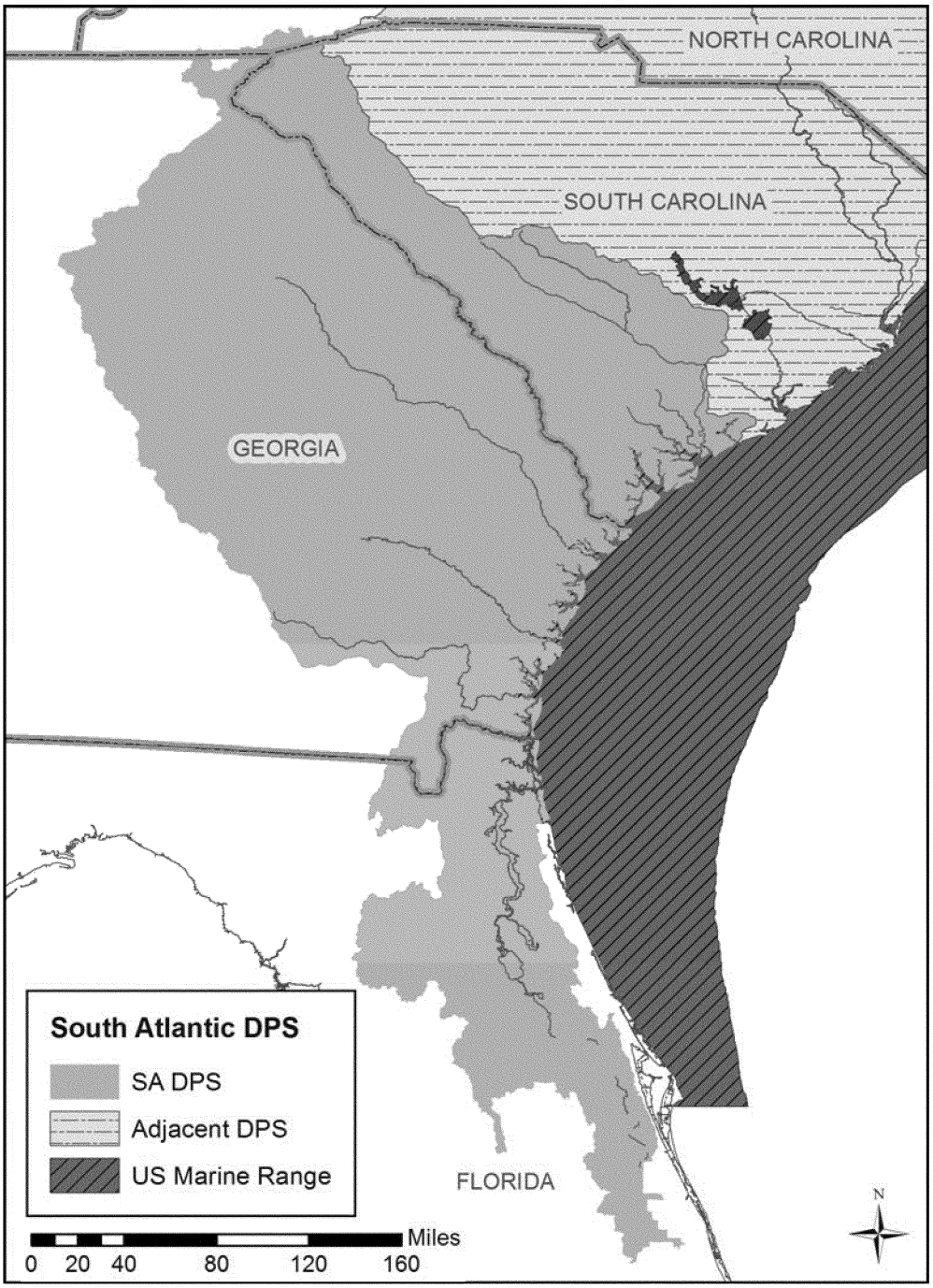

Figure 3: The South Atlantic DPS, including the adjacent portion of the marine range.

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Conservation Status

To determine the conservation status of the two DPSs in the Southeast Region's jurisdiction, the Carolina and South Atlantic DPSs, in relation to the ESA's standards for listing, we evaluated whether each DPS meets the definition of ''endangered'' or ''threatened'' as defined in section 3 of the ESA, and whether that status is a result of one or a combination of the factors listed under section 4(a)(1) of the ESA. An endangered species is ''any species which is in danger of extinction throughout all or a significant portion of its range'' and a threatened species is one ''which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.''

The abundance of Atlantic sturgeon has decreased dramatically within the last 150 years. A major fishery for Atlantic sturgeon developed in 1870 when a caviar market was established (Smith and Clugston, 1997). Record landings in the United States were reported in 1890, with over 7,385,000

lbs (3,350,000 kg) of Atlantic sturgeon landed from coastal rivers along the entire Atlantic Coast (Smith and Clugston, 1997; Secor and Waldman, 1999). Ten years after peak landings, the fishery collapsed in 1901, when less than 10 percent (650,365 lbs, 295,000 kg) of the U.S. 1890 peak landings were reported. The landings continued to decline coastwide, reaching about 5 percent of the peak in 1920. During the 1950s, the remaining U.S. fishery switched to targeting sturgeon for flesh, rather than caviar, and coastwide landings remained between 1 and 5 percent of the 1890 peak levels until the Atlantic sturgeon fishery was closed by ASMFC in 1998. None of the riverine spawning populations in either DPS have rebounded from the population crashes to be large or stable enough to provide with any level of certainty for continued existence of Atlantic sturgeon in this part of its range. All of the spawning populations in each DPS are subjected to threats and impacts that have and will continue to prevent population increases and recovery. We must look at the status of river populations across the whole of the DPSs in making our listing determinations.

The importance of having multiple self-sustaining riverine spawning populations within each DPS and the need to maintain suitable habitat to support the various life functions (spawning, feeding, growth) of Atlantic sturgeon is further highlighted by looking at the concept of metapopulations. Each DPS, made up of multiple river populations, is analogous to a metapopulation, which is a ''population of populations'' (Levins, 1969), a group of spatially separated populations of the same species that interact at some level. The metapopulation concept is closely linked with the processes of population turnover, extinction, and establishment of new populations, and the study of metapopulation dynamics is essentially the study of the conditions under which these two processes are in balance and the consequences of that balance to associated processes (Hanski and Gilpin, 1991). Separation into metapopulations is expected by sturgeon and other anadromous fishes, given their likely stepping-stone sequential model of recolonization of northern rivers following post-Pleistocene deglaciation (Waldman *et al.* 2002).

Metapopulation persistence depends on the balance of extinction and colonization in a static environment (Hanski 1996). Models and empirical observations suggest that very small populations are relatively likely to become extinct (Soulé, 1986; Lande, 1988; Simberloff, 1988; Thomas, 1990; Kindvall and Alhlen, 1992), and many local populations in remnant habitat fragments will remain small. Under the assumption that the environment does not change greatly, many empirical studies have shown that the expected lifetime of a population increases with its current size (Williamson 1981, Diamond 1984, Schoener and Spiller 1987). However, for rare and declining species, Thomas (1994) argues that: (1) Extinction is usually the deterministic consequence of the local environment becoming unsuitable (through habitat loss or modification, introduction of a predator, *etc.*); (2) that the local environment usually remains unsuitable following local extinction, so extinctions only rarely generate empty patches of suitable habitat; and 3) that colonization usually follows improvement of the local environment for a particular species. Therefore, if habitat remains suitable following local extirpation, recolonization via immigrants into now-empty habitat may replace at least some of those losses (Thomas 1994). However, if the cause of extinction is a deterministic population response to unsuitable conditions (*e.g.,* lack of suitable spawning habitat, poor water quality, or disturbance of substrates through repeated dredging), the local habitat is likely to remain unsuitable after extinction and be unavailable for recolonization (Thomas 1994). Therefore, recolonization is dependent upon both immigration from adjacent, healthy populations and habitat suitability. Because a DPS is a group of populations, the stability, viability, and persistence of individual populations affects the persistence and viability of the larger DPS. The loss of any population within a DPS will result in: (1) A long-term gap in the range of the DPS that is unlikely to be recolonized, or recolonized only very slowly; (2) loss of reproducing individuals; (3) loss of genetic biodiversity; (4) potential loss of unique haplotypes; (5) potential loss of adaptive traits; and (6) reduction in total number. The loss of a population will negatively impact the persistence and viability of the DPS as a whole as fewer than two individuals per generation currently spawn outside their natal rivers.

The persistence of individual populations, and in turn the DPS, depends on successful spawning and rearing within the freshwater habitat, the immigration into marine habitats to grow, and then the return of adults to natal rivers to spawn. Information on Atlantic sturgeon spawning within the Carolina and South Carolina DPSs is extremely limited. In the proposed listing rule, we presumed spawning was occurring if young-of-the-year (YOY) were observed or mature adults were present in freshwater portions of the system. Within the Carolina DPS, we concluded that spawning is occurring in the following rivers based on these data:

1. Roanoke River—collection of 15 YOY (1997–1998); single YOY (2005).
2. Tar and Neuse Rivers—one YOY (2005).
3. Cape Fear—upstream migration of adults in the fall, carcass of ripe female upstream in mid-September.
4. Winyah Bay—running ripe male in Great Pee De River (2003).

Within the South Atlantic DPS, we concluded that spawning is occurring in the following rivers based on these data:

1. ACE (Ashepoo, Combahee, and Edisto Rivers) Basin—1,331 YOY (1994–2001); gravid female and running ripe male in the Edisto (1997); 39 spawning adults (1998).
2. Savannah River—22 YOY (1999–2006); running ripe male (1997).
3. Ogeechee River—age-1 captures, but high inter-annual variability (1991–1998); 17 YOY (2003); 9 YOY (2004).
4. Altamaha River—74 captured/308 estimated spawning adults (2004); 139 captured/378 estimated spawning adults (2005).
5. Satilla River—4 YOY and spawning adults (1995–1996).

These data indicate that spawning occurs within the Carolina and South Atlantic DPSs; they do not indicate the frequency of annual spawning events or the degree to which spawning in these systems leads to population growth, persistence, or viability. The extent and effectiveness of spawning events is unknown and likely precarious in many rivers given ongoing threats such as water quality and restricted access to upstream spawning areas (75 FR 61904). In addition to spawning success, it is difficult to quantify spawning potential within the two DPSs given the lack of population estimates. Currently, the number of Atlantic sturgeon in the Carolina DPS is estimated as at 3 percent of historical population size and the South Atlantic DPS is estimated to be at 1 percent of historical population size, with the exception of the Altamaha River population, estimated to be at 6 percent of historical population size. Although the largest impact that caused the precipitous decline of the species has been curtailed (directed fishing), the population size has remained relatively constant at these greatly reduced levels for approximately 100 years.

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. While Atlantic sturgeon exhibit a high degree of spawning fidelity to their natal rivers, multiple riverine, estuarine, and marine habitats may serve various life (*e.g.,* nursery, foraging, and migration) functions. Rivers known to have current spawning populations within the range of this DPS include the Roanoke, Tar-Pamlico, Cape Fear, Waccamaw, and Pee Dee Rivers. However, in some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and other stressors on juvenile survival and development. There may also be spawning populations in the Neuse, Santee and Cooper Rivers, though it is uncertain. Historically, both the Sampit and Ashley Rivers were documented to have spawning populations at one time. However, the spawning population in the Sampit River is believed to be extirpated and the current status of the spawning population in the Ashley River is unknown. Both rivers may be used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. This represents our current knowledge of the river systems utilized by the Carolina DPS for specific life functions, such as spawning, nursery habitat, and foraging. However, fish from the Carolina DPS likely use other river systems than those listed here for their specific life functions. The Carolina DPS also includes Atlantic sturgeon held in captivity (*e.g.,* aquaria, hatcheries, and scientific institutions) and which are identified as fish belonging to the Carolina DPS based on genetics analyses, previously applied tags, previously applied marks, or documentation to verify that the fish originated from (hatched in) a river within the range of the Carolina DPS, or is the progeny of any fish that originated from a river within the range of the Carolina DPS. NMFS has no records of Atlantic sturgeon from the Carolina DPS being held in captivity.

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 timeframe. Prior reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the Carolina DPS. Currently, the Atlantic sturgeon spawning population in at least one river system within the Carolina DPS has been extirpated, with a potential extirpation in an additional system. The abundance of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, is estimated to be less than 3 percent of what it was historically (ASSRT, 2007). Though directed fishing and possession of Atlantic sturgeon is no longer legal, the Carolina DPS continues to face threats such as habitat alteration and bycatch. The presence of dams has resulted in the loss of access to over 60 percent of the historical sturgeon habitat on the Cape Fear River and in the Santee-Cooper system. This has resulted in the loss of important spawning and juvenile developmental habitat and has reduced the quality of the remaining habitat by affecting water quality parameters (such as depth, temperature, velocity, and DO) that are important to sturgeon.

The South Atlantic DPS includes all Atlantic sturgeon that spawn or are spawned 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. The marine range of Atlantic sturgeon from the South Atlantic DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. While Atlantic sturgeon exhibit a high degree of spawning fidelity to their natal rivers, multiple riverine, estuarine, and marine habitats may serve various life (*e.g.,* nursery, foraging, and migration) functions. Rivers known to have current spawning populations within this DPS include the Combahee, Edisto, Savannah, Ogeechee, Altamaha, and Satilla Rivers. However, in some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and other stressors on juvenile survival and development. Historically, both the Broad-Coosawatchie and St. Marys Rivers were documented to have spawning populations at one time; there is also evidence that spawning may have occurred in the St. Johns River or one of its tributaries. However, the spawning population in the St. Marys River, as well as any historical spawning population present in the St. Johns, is believed to be extirpated, and the status of the spawning population in the Broad-Coosawatchie is unknown. Both the St. Marys and St. Johns Rivers are used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. The use of the Broad-Coosawatchie by sturgeon from other spawning populations is unknown at this time. The presence of historical and current spawning populations in the Ashepoo River has not been documented; however, this river may currently be used for nursery habitat by young Atlantic sturgeon originating from other spawning populations. This represents our current knowledge of the river systems utilized by the South Atlantic DPS for specific life functions, such as spawning, nursery habitat, and foraging. However, fish from the South Atlantic DPS likely use other river systems than those listed here for their specific life functions. The South Atlantic DPS also includes Atlantic sturgeon held in captivity (*e.g.,* aquaria, hatcheries, and scientific institutions) and which are identified as fish belonging to the South Atlantic DPS based on genetics analyses, previously applied tags, previously applied marks, or documentation to verify that the fish originated from (hatched in) a river within the range of the South Atlantic DPS, or is the progeny of any fish that originated from a river within the range of the South Atlantic DPS. Ten Atlantic sturgeon taken from the Altamaha River are currently being held at the Bears Bluff National Fish Hatchery on Wadmalaw Island, South Carolina, though it is not certain whether those fish were spawned in the Altamaha or were migrants from another river system. NMFS has no other records of Atlantic sturgeon from the South Atlantic DPS being held in captivity.

Secor (2002) estimated that 8,000 spawning female Atlantic sturgeon were present in South Carolina. Historically, the population of spawning female Atlantic sturgeon in Georgia was estimated at 11,000 fish per year prior to 1890 (Secor, 2002). Prior reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the South Atlantic DPS. Currently, the Atlantic sturgeon spawning population in one (possibly two) river systems within the South Atlantic DPS have been extirpated. The Altamaha River, with an estimated 343 spawning adults per year, is suspected to be less than 6 percent of its historical abundance, extrapolated from the 1890s commercial landings; the abundance of the remaining river populations within the

DPS, each estimated to have fewer than 300 spawning adults, is estimated to be less than 1 percent of what it was historically (ASSRT, 2007). While the directed fishery that originally drastically reduced the numbers of Atlantic sturgeon has been closed, other impacts have contributed to their low population numbers, may have contributed to the extirpation of some spawning populations, and are likely inhibiting recovery of extant river populations. Historically, Atlantic sturgeon likely accessed all parts of the St. Johns River, as American shad were reported as far upstream as Lake Poinsett (reviewed in McBride, 2000). However, the construction of Kirkpatrick Dam (originally Rodman Dam) at river mile (rm) 95 (rkm 153) restricted migration to potential spawning and juvenile developmental habitat upstream. Approximately 63 percent of historical sturgeon habitat is believed to be blocked due to the dam (ASSRT, 2007), and there is no longer a spawning population in the St. Johns River.

Small numbers of individuals resulting from drastic reductions in populations, such as occurred with Atlantic sturgeon due to the commercial fishery, can remove the buffer against natural demographic and environmental variability provided by large populations (Berry, 1971; Shaffer, 1981; Soulé, 1980). Though the Carolina and South Atlantic DPSs, made up of multiple river populations of Atlantic sturgeon, were determined to be genetically discrete, interbreeding population units, the vast majority of Atlantic sturgeon return to their natal rivers to spawn, with fewer than two migrants per generation spawning outside their natal system (Wirgin *et al.,* 2000; King *et al.,* 2001; Waldman *et al.,* 2002). Therefore, it is important to look at each riverine spawning population within each DPS when considering the effects of a small population size on the extinction risk for the DPS. Though there is no absolute population size above which populations are ''safe'' and below which they face an unacceptable risk of extinction (Gilpin and Soulé, 1986; Soulé and Simberloff, 1986; Ewens *et al.,* 1987; Goodman, 1987; Simberloff, 1988; Thomas, 1990), some have argued that ''rules of thumb'' can and should be applied (Soulé, 1987; Thompson, 1991). Salwasser *et al.* (1984) prescribe a minimum viable population size of at least 1,000 reproducing adults. Belovsky (1987) indicates that a minimum viable population in the range of 1,000 to 10,000 reproducing adults should be sufficient for a mid-sized vertebrate species. Soulé (1987) suggests that minimum viable population sizes for vertebrate species should be in the ''low thousands'' or higher. Thomas (1990) offers a population size of 5,500 as ''a useful goal,'' but suggests that where uncertainty regarding a species' population dynamics, changing environmental conditions, and the species' reaction to the changing environmental conditions is extreme ''we should usually aim for population sizes from several thousand to ten thousand.'' In a NOAA Technical Memorandum entitled ''Determining Minimum Viable Populations under the ESA,'' Thompson (1991) states the ''50/500'' rule of thumb initially advanced by Franklin (1980) and Soulé (1980) comes the closest of any to attaining ''magic number'' status. Franklin (1980) has suggested that, simply to maintain short-term fitness (*i.e.,* prevent serious inbreeding and its deleterious effects), the minimum effective population size should be around 50. He further recommended that, to maintain sufficient genetic variability for adaptation to changing environmental conditions, the minimum effective population size should be around 500. Soulé (1980) has pointed out that, above and beyond preserving short-term fitness and genetic adaptability, long-term evolutionary potential (at the species level) may well require a number of substantially larger populations. It is important to note that the 50/500 rule is cast in terms of effective population size, a concept introduced by Wright (1931). The effective population size refers to an ideal population of breeding individuals produced each generation by random union of an equal number of male and female gametes randomly drawn from the previous generation. To the extent that this ideal is violated in nature, the effective population size is generally smaller than the overall number of mature individuals in the population. Multiple studies have shown that Atlantic sturgeon do not spawn every year, with spawning intervals ranging from 1 to 5 years for males (Smith, 1985; Collins *et al.,* 2000; Caron *et al.* 2002) and 2 to 5 years for females (Vladykov and Greeley, 1963; Van Eenennaam *et al.,* 1996; Stevenson and Secor, 1999). Therefore, the effective population size (the number of adults in a population that contribute offspring to the next generation) for Atlantic sturgeon is more closely related to the number of annually spawning adults, rather than total number of reproductively mature adults. In the Southeast, even the spawning population in the Altamaha River, believed to be the largest spawning population of either the Carolina or South Atlantic DPS, is estimated to be smaller than the 500 recommended by Thompson (1991) to maintain sufficient genetic variability for adaptation to changing environmental conditions. Total adult population sizes are not known for any of the rivers in the Carolina or South Atlantic DPS. However, using the upper end of our estimated range of abundance (*i.e.,* no more than 300 spawning adults per year per river) and the fact that Atlantic sturgeon only spawn every 1 to 5 years (*i.e.,* 20 to 100 percent of the total adult population is spawning every year), then a conservative estimate of the total reproductively mature adult population in Southeastern rivers is 300 to 1,500. The Altamaha River would be slightly higher than this, and many rivers may be much lower, since we don't know how many fewer annual adult spawners than the estimated 300 are in each river. But these ranges are either below or on the lower end of the 1,000 to 10,000 individuals recommended by other authors. It is not known if certain riverine populations are at abundances smaller than the minimum effective population size of 50 that would prevent serious inbreeding (Thompson, 1991). Moreover, in some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and other stressors on juvenile survival and development.

Another factor potentially affecting the size of a viable population of Atlantic sturgeon is that they are polyploid. Polyploid is a term used to describe cells and organisms containing more than two paired (homologous) sets of chromosomes. The polyploidy of Atlantic sturgeon might explain the high degree of plasticity displayed by sturgeon populations and may provide them with the ability to repopulate from very few spawning adults without apparent inbreeding depression. However, we have no certainty at this time that this genetic characteristic will allow the Atlantic sturgeon to recover from such low population numbers, as other listed polyploid Acipenser species, such as the Gulf and shortnose sturgeon, have not recovered sufficiently to be delisted even after being protected for 20 to 45 years.

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 and South Atlantic DPSs put them in danger of extinction throughout

their ranges; none of the populations are large or stable enough to provide with any level of certainty for continued existence of Atlantic sturgeon in this part of its range. While the directed fishery that originally drastically reduced the numbers of Atlantic sturgeon has been closed, recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon, and they continue to face a variety of other threats that contribute to their risk of extinction. Their late age at maturity provides more opportunities for individual Atlantic sturgeon to be removed from the population before reproducing. While a long life-span also allows multiple opportunities to contribute to future generations, it also results increases the timeframe over which exposure to the multitude of threats facing the Carolina and South Atlantic DPS can occur. These threats include the loss, reduction, and degradation of habitat resulting from dams, dredging, and changes in water quality parameters (such as depth, temperature, velocity, and DO). Even with a moratorium on directed fisheries, bycatch is a threat to both the Carolina and South Atlantic DPSs. 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 spawning, foraging, and other life functions, 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 may even result in post-capture mortality. While some of the threats to the Carolina and South Atlantic DPS have been ameliorated or reduced due to the existing regulatory mechanisms, such as the moratorium on directed fisheries for Atlantic sturgeon, bycatch is currently not being addressed through existing mechanisms. Further, water quality continues to be a problem even with existing controls on some pollution sources and water withdrawal, and dams continue to curtail and modify habitat, even with the Federal Power Act's provisions regarding anadromous fish passage.

We have reviewed the status review report, as well as other available literature and information, and have consulted with scientists and fishery resource managers familiar with Atlantic sturgeon in the Carolina and South Atlantic DPSs. After reviewing the best scientific and commercial information available, we find that both the Carolina and South Atlantic DPSs are in danger of extinction throughout their ranges and thus meet the ESA's definition of an endangered species. Atlantic sturgeon populations declined precipitously decades ago due to directed commercial fishing. The failure of Atlantic sturgeon numbers within the Carolina and South Atlantic DPSs to rebound even after the moratorium on directed fishing was established in 1998 indicates that impacts and threats from limits on habitat for spawning and development, habitat alteration, and bycatch are responsible for the risk of extinction faced by both DPSs. In addition, the persistence of these impacts and threats points to the inadequacy of existing regulatory mechanisms to address and reduce habitat alterations and bycatch. We will address the threats of habitat alteration, bycatch, and the inadequacy of regulatory mechanisms and their contributions to the endangered statuses of the Carolina and South Atlantic DPSs in detail in the following sections of this final rule.

Analysis of Section 4(a)(1) Factors' Effects on the Species

The ESA requires us to determine whether any species is endangered or threatened because of any of the following factors: (A) Present or threatened destruction, modification, or curtailment of habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. Listing determinations are made solely on the best scientific and commercial data available and after taking into account any efforts being made by any state or foreign nation to protect the species. The ASSRT examined each of the aforementioned five factors for their impacts on the Atlantic sturgeon: DPSs. The following is a summary of its relevant findings, any additional information that has become available since the status review report was published, and the conclusions that we have made based on the available information.

A. Present or Threatened Destruction, Modification, or Curtailment of the Species' Habitat or Range

Habitat alterations considered by the ASSRT that affect the status of sturgeon populations include: Dam and tidal turbine construction and operation; dredging, disposal, and blasting; and water quality modifications, such as changes in levels of DO, water temperature, and contaminants. Atlantic sturgeon, like all anadromous fish, are vulnerable to a host of habitat impacts because they use rivers, estuaries, bays, and the ocean at various points of their life. In addition to the habitat alterations considered by the ASSRT, other emerging threats to habitat considered in this section are drought, intra- and inter-state water allocation issues, and climate change. These threats have the potential to further exacerbate habitat modifications evaluated by the ASSRT. Because they were not evaluated in the status review report, they are considered in more detail in this section. In this section, we summarize the threats for each DPS that we believe represent a present or threatened destruction, modification or curtailment of the DPS's habitat or range and are contributing to the endangered status of both DPSs.

Dams

Dams are a threat to the Carolina and South Atlantic DPS that contributes to their endangered status by the curtailment of the extent of available habitat, as well as modifying sturgeon habitat downstream through a reduction in water quality. As noted in the status review report, dams for hydropower generation, flood control, and navigation adversely affect Atlantic sturgeon habitat by impeding access to spawning, developmental and foraging habitat, modifying free-flowing rivers to reservoirs, physically damaging fish on upstream and downstream migrations, and altering water quality in the remaining downstream portions of spawning and nursery habitat. Attempts to minimize the impacts of dams using measures such as fish passage have not proven beneficial to Atlantic sturgeon, as they do not regularly use existing fish passage devices, which are generally designed to pass pelagic fish. To date, only four Atlantic sturgeon have been documented to have passed via a fish lift (three at the St. Stephens fish lift in South Carolina and one at the Holyoke Dam in Massachusetts), as these passage facilities are not designed to accommodate adult-sized sturgeon. While there has not been a large loss of Atlantic sturgeon habitat throughout the entire species' range due to the presence

of dams, individual riverine systems have been severely impacted by dams, as access to large portions of historical sturgeon spawning and juvenile developmental habitat has been eliminated or restricted. The ASSRT used GIS tools and dam location data collected by Oakley (2003) as reference points for river kilometer measurements to map historical rivers in which Atlantic sturgeon spawned. This information was then used to determine the number of kilometers of available habitat. Within the Carolina and South Atlantic DPSs, the Cape Fear, Santee-Cooper, and St. Johns River systems have lost greater than 60 percent of the habitat historically used for spawning and juvenile development.

The Cape Fear River has three locks and dams (constructed from 1915 to 1935) between Wilmington and Fayetteville that are located below the fall line; two additional dams, Buckhorn and B. Everette Jordan, are located above the fall line. Atlantic sturgeon movement is blocked at the first lock and dam located in Riegelwood, North Carolina, which was constructed in 1915. Pelagic species can pass over the three locks and dams during high water, but the benthic Atlantic sturgeon is not known to pass over these three locks/dams. No Atlantic sturgeon have been captured upstream of Lock and Dam #1 despite extensive sampling efforts (Moser *et al.,* 1998). Exact historical spawning locations are unknown in the Cape Fear River, but Atlantic sturgeon spawning is generally believed to occur in flowing water between the salt front and fall line of large rivers (Borodin, 1925; Leland, 1968; Scott and Crossman, 1973; Crance, 1987; Bain *et al.,* 2000). Therefore, sturgeon researchers judge the fall line to be the likely upper limit of spawning habitat. Using the fall line as a guide, only 36 percent of the historical habitat is available to Atlantic sturgeon. In some years, the salt water interface reaches the first lock and dam; therefore, spawning adults in the Cape Fear River either do not spawn in such years or spawn in the major tributaries of the Cape Fear River (*i.e.,* Black River or Northeast Cape Fear Rivers) that are not obstructed by dams.

The Santee-Cooper Hydroelectric Project is located in the coastal plain of the Santee Basin on the Santee and Cooper Rivers, South Carolina. The project was finished in 1942 and includes Lake Marion, which is impounded by the Santee Dam (Wilson Dam) on the Santee River at rm 87 (rkm 140), and Lake Moultrie, which is impounded by the Pinopolis Dam on the Cooper River at rm 48 (rkm 77). Using the fall line as the upper region of spawning habitat, it is estimated that only 38 percent of the historical habitat is available to Atlantic sturgeon today. Although a lock and a fish lift operate during the spring at the Pinopolis and St. Stephen Dams, respectively, observations of sturgeon in the lock and lift are extremely rare (traditional fish passage designs are not typically successful for sturgeon). There is no record of an adult Atlantic sturgeon being lifted, although three dead Atlantic sturgeon were observed in Lake Marion between 1995 and 1997, and in 2007, an Atlantic sturgeon entered the St. Stephen fish lift and was physically removed and translocated downstream into the Santee River (A. Crosby, SCDNR, pers. comm.)

In addition to blocking access to habitat, dams can degrade spawning, nursery, and foraging habitat downstream by reducing water quality. Flow, water temperature, and oxygen levels in the Roanoke River are affected by the Kerr Dam and the Gaston Dam/Roanoke Rapids facilities, which engage in peaking operations. Riverine water flow has already been modified by the dam operators during the striped bass spawning season to simulate natural flow patterns; these modifications undoubtedly benefit Atlantic sturgeon. Regardless of the temporary modifications, lower water temperatures resulting from the hypolimnetic discharge from Kerr Dam have caused temporal shifts in the spawning peaks for both American shad and striped bass and likely have had the same impact for other diadromous species, including Atlantic sturgeon (ASSRT, 2007). High flows from Kerr Dam during the summer are coupled with high ambient temperatures and an influx of swamp water with low DO, creating a large, hypoxic plume within the river. Fish kills have been documented to occur during this time (ASSRT, 2007), and sturgeon are more highly sensitive to low DO (less than 5 milligrams per liter (mg/L)) than other fish species (Niklitschek and Secor, 2009a, 2009b). Low DO in combination with high temperature is particularly problematic for Atlantic sturgeon, and studies have shown that juvenile Atlantic sturgeon experience lethal and sublethal (metabolic, growth, feeding) effects as DO drops and temperatures rise (Niklitschek and Secor, 2009a, 2009b; Niklitschek and Secor, 2005; Secor and Gunderson, 1998). Therefore, it is likely that dam operations are negatively affecting Atlantic sturgeon nursery habitat in the lower Roanoke River.

Dredging

Dredging is a present threat to both the Carolina and South Atlantic DPSs and is contributing to their endangered status by modifying the quality and availability of Atlantic sturgeon habitat. Riverine, nearshore, and offshore areas are often dredged to support commercial shipping and recreational boating, construction of infrastructure, and marine mining. Environmental impacts of dredging include the direct removal/burial of organisms; turbidity/siltation effects; contaminant resuspension; noise/disturbance; alterations to hydrodynamic regime and physical habitat; and actual loss of riparian habitat (Chytalo, 1996; Winger *et al.,* 2000). According to Smith and Clugston (1997), dredging and filling impact important habitat features of Atlantic sturgeon as they disturb benthic fauna, eliminate deep holes, and alter rock substrates. To reduce the impacts of dredging on anadromous fish species, most of the Atlantic states impose work restrictions during sensitive time periods (spawning, migration, feeding) when anadromous fish are present. NMFS also imposes seasonal restrictions to protect shortnose sturgeon populations (where present) through Section 7 consultations that may have the added benefit of protecting Atlantic sturgeon where the two species co-occur. Within the Carolina DPS, dredging operations (including the blasting of rock) on the lower Cape Fear River, Brunswick River, and port facilities at the U.S. Army's Sunny Point Military Ocean Terminal and Port of Wilmington are extensive. To protect diadromous fish, restrictions are placed on dredging to avoid sensitive seasons and locations, such as potential spawning habitat (February 1 through June 30) and suspected nursery grounds (April 1 through September 30). However, while the restrictions prevent dredging from occurring when Atlantic sturgeon are expected to be present, the effects of dredging on Atlantic sturgeon habitat remain long after the dredging has been completed. Moser and Ross (1995) found that some of the winter holding sites favored by sturgeon in the lower Cape Fear River estuary also support very high levels of benthic infauna and may be important feeding stations. Repeated dredging in the Cape Fear River can modify sturgeon habitat through the removal or burial of benthic infauna in feeding grounds and creation of unsuitable substrate in spawning grounds (ASSRT, 2007). Similar habitat modifications are occurring in the Cooper River, which flows into Charleston Harbor, one of the busiest

ports on the Atlantic Coast, and is dredged regularly. The river channel is maintained by dredging all the way to the Pinopolis Dam. No seasonal restrictions are placed on dredging in the Cooper River, potentially interrupting spawning activities (ASSRT, 2007). In August 2011, the USACE published a notice of intent to prepare an EIS to study the impacts of potential deepening of Charleston Harbor to accommodate much larger container vessels; the project would entail extensive dredging (76 FR 50187).

In the South Atlantic DPS, maintenance dredging in Atlantic sturgeon nursery habitat in the Savannah River is frequent, and substantial channel deepening took place in 1994. The Georgia Ports Authority is seeking to expand its port facility on the Savannah River. Within the 1999 Water Resources Development Act, Congress authorized the deepening of the Savannah Navigation Channel from the current depth of −42 to −48 ft (−12.8 to −14.6 m) mean low water. Hydrodynamic and water quality models have been developed to predict changes in water quality across depth and throughout the channel. The channel deepening is predicted to alter overall water quality (*e.g.,* salinity and DO), creating inhospitable foraging/resting habitat in the lower Savannah River for sturgeon. The lower Savannah River is heavily industrialized and serves as a major shipping port. Nursery habitat in the lower river has been heavily impacted by diminished water quality and channelization. Reduced DO levels and upriver movement of the salt wedge are predicted to result from channel deepening. Currently, USACE has entered into formal consultation with NMFS regarding the Savannah Harbor Expansion Project, which includes a conference consultation on Atlantic sturgeon. Though not yet finalized, the conference consultation on Atlantic sturgeon will evaluate whether the adverse effects on sturgeon from the expansion will result in jeopardy, and consider potential benefits to Atlantic sturgeon from the proposed fish passage at NSBL&D that could provide access to 20 miles of potential spawning habitat. Sturgeon are highly sensitive to low DO, more so than other fish species (Niklitschek and Secor, 2009a, 2009b). Because Atlantic sturgeon spawn above the interface between fresh water and salt water, the upriver movement of the salt wedge will curtail the extent of Atlantic sturgeon habitat in the Savannah River. Dredging also commonly occurs within the St. Johns River and has been linked to the reduction in submerged aquatic vegetation where Atlantic sturgeon likely forage (Jordan, 2002). Though there is currently no resident spawning population in the St. Johns, it still provides nursery habitat for juvenile Atlantic sturgeon in the South Atlantic DPS (NMFS and USFWS, 1998). Access to over 60 percent of the historical sturgeon habitat in the St. Johns River has already been curtailed by the presence of a dam, and dredging modifies the quality of the remaining nursery habitat in the river.

Water Quality

Degraded water quality is a present threat to the Carolina and South Atlantic DPSs and is contributing to their endangered status by modifying and curtailing the extent of available habitat for spawning and nursery areas. Atlantic sturgeon rely on a variety of water quality parameters to successfully carry out their life functions. Low DO and the presence of contaminants modify the quality of Atlantic sturgeon habitat and in some cases, curtail the extent of suitable habitat for life functions. Secor (1995) noted a correlation between low abundances of sturgeon during this century and decreasing water quality caused by increased nutrient loading and increased spatial and temporal frequency of hypoxic conditions. Of particular concern is the high occurrence of low DO coupled with high temperatures in the river systems throughout the range of the Carolina and South Atlantic DPSs. Sturgeon are more highly sensitive to low DO than other fish species (Niklitschek and Secor, 2009a, 2009b) and low DO in combination with high temperature is particularly problematic for Atlantic sturgeon. Studies have shown that juvenile Atlantic sturgeon experience lethal and sublethal (metabolic, growth, feeding) effects as DO drops and temperatures rise (Niklitschek and Secor, 2009a, 2009b; Niklitschek and Secor, 2005; Secor and Gunderson, 1998). Water quality within the river systems in the range of the Carolina and South Atlantic DPSs is also negatively impacted by contaminants and large water withdrawals.

For the Carolina DPS, water quality in the Pamlico system, especially in the lower Neuse River, is highly degraded (Paerl *et al.,* 1998; Qian *et al.,* 2000; Glasgow *et al.,* 2001). The entire basin has been designated as nutrient-sensitive, and additional regulatory controls are being implemented to improve water quality. Both the Neuse and Pamlico portions of the estuary have been subject to seasonal episodes of anoxia that significantly affect the quality of Atlantic sturgeon nursery habitat. CAFOs cause at least some portion of the current water quality problems in the Pamlico watershed (Mallin and Cahoon, 2003). Farms that produce hogs, turkeys, and chickens have proliferated throughout the coastal portion of the basin in the last decade, with increases in both aquatic and atmospheric deposition of nitrogenous waste products. North Carolina passed a moratorium in 1997 limiting additional hog operations and is conducting a study of measures to address the problem; the moratorium was renewed in 1999 and 2003. Water quality in the Cape Fear River is poor for aquatic life, due largely to industrial development and use, including the Port of Wilmington and numerous industrial point-source discharges. Development of CAFOs in the coastal portion of the Cape Fear River basin has been especially heavy (most concentrated operations of CAFOs occur in the Cape Fear River drainage within North Carolina) and contributes to both atmospheric and aquatic inputs of nitrogenous contamination, possibly causing DO levels to regularly fall below the 5 mg/L state standard (Mallin and Cahoon, 2003). In recent years, fish kills have been observed, usually as a result of blackwater swamps (with low DO) being flushed after heavy rainfall.

Industrialization also threatens the habitat of the Carolina DPS. Paper and steel mills in the Winyah Bay system, which includes the Waccamaw, Pee Dee, and Sampit rivers, have impacted water quality. Riverine sediment samples contain high levels of various toxins including dioxins (NMFS and USFWS, 1998). Though the effects of these contaminants on Atlantic sturgeon are unknown, Atlantic sturgeon are particularly susceptible to impacts from contaminated sediments due to their benthic foraging behavior and long-life span, and effects from these compounds on fish include production of acute lesions, growth retardation, and reproductive impairment (Cooper, 1989; Sinderman, 1994). It should be noted that the effect of multiple contaminants or mixtures of compounds at sub-lethal levels on fish has not been adequately studied. Atlantic sturgeon use marine, estuarine, and freshwater habitats and are in direct contact through water, diet, or dermal exposure with multiple contaminants throughout their range.

Habitat used by the South Atlantic DPS in the Savannah River has also been modified by mercury contamination (ASSRT, 2007). While water quality in the Altamaha River is good at this time, the drainage basin is

dominated by silviculture and agriculture, with two paper mills and over two dozen other industries or municipalities discharging effluent into the river. Nitrogen and phosphorus concentrations are increasing, and eutrophication and loss of thermal refugia are growing concerns for the South Atlantic DPS. In the Ogeechee River, the primary source of pollution results from non-point sources, which results in nutrient-loading and decreases in DO. These problems result from the cumulative effect of activities of many individual landowners or managers. The Ogeechee River Basin Watershed Protection Plan developed by the Georgia Environmental Protection Division (GAEPD, 2001b) states that because there are so many small sources of non-point loading spread throughout the watershed, non-point sources of pollution cannot effectively be controlled by state agency permitting and enforcement, even where regulatory authority exists. The increases in nutrients and resulting decreases in DO are coupled with increases in water temperature resulting from clearing of the riparian canopy and increased paved surface areas. Downstream sturgeon nursery habitat is compromised during hot, dry summers when water flow is minimal, and non-point sources of hypoxic waters have a greater impact on the system as potential thermal refugia are lost when the aquifer is lowered. Since 1986, average summer DO levels in the Ogeechee have dropped to approximately 4 mg/L (GAEPD, 2001b). Low DO (less than 5 mg/L), most likely due to non-point sources, was a common occurrence observed during 1998 and 1999 water quality surveys (GAEPD, 2002) in the Satilla River, which serves as both spawning and nursery habitat for sturgeon in the South Atlantic DPS. The extirpation of the Atlantic sturgeon spawning population in the St. Marys River is believed to have been caused by reduced DO levels during the summer in the nursery habitat, probably due to eutrophication from non-point source pollution (ASSRT, 2007). Both the St. Marys and St. Johns Rivers continue to be used as nursery habitat by Atlantic sturgeon in the South Atlantic DPS; however, low DO is a common occurrence during the summer months when water temperatures rise. At times, it is so severe in the St. Marys that it completely eliminates juvenile nursery habitat during the summer (D. Peterson, UGA, pers. comm.)

Water allocation issues are a growing threat in the Southeast and exacerbate existing water quality problems. Taking water from one basin and transferring it to another fundamentally and irreversibly alters natural water flows in both the originating and receiving basins, which can affect DO levels, temperature, and the ability of the basin of origin to assimilate pollutants (Georgia Water Coalition, 2006). Water allocation issues increasingly threaten to exacerbate the present threat of degraded water quality on the endangered status of the Carolina DPS. North Carolina is experiencing problems where somewhat limited natural availability of water is coupled with high demand or competition among water users. Some of the areas in North Carolina where this is an emerging issue are the Central Coastal Plain, where the Cretaceous aquifers have a relatively slow recharge rate; the headwater areas of the Piedmont river basins, where streamflows are greatly reduced during dry weather; and some areas near the coast and on the Outer Banks, where the natural availability of fresh water is limited (NCDENR, 2001a). Interbasin water transfers are increasingly being looked at to deal with the inadequate water availability. In 1993, the North Carolina Legislature adopted the Regulation of Surface Water Transfers Act (G.S. § 143–215.22I). This law regulates large surface water transfers between river basins by requiring a certificate from the North Carolina Environmental Management Commission. The act has been modified several times since it was first adopted, most recently in 2007 when G.S. § 143–215.22I was repealed and replaced with G.S. § 143–215.22L. A transfer certificate is required for a new transfer of 2 mgd (7,600 m^3pd) or more and for an increase in an existing transfer by 25 percent or more (if the total including the increase is more than 2 mgd). Certificates are not required for facilities that existed or were under construction prior to July 1, 1993, up to the full capacity of that facility to transfer water, regardless of the transfer amount.

The North Carolina Department of Environment and Natural Resources reports that 20 facilities, with a combined average (not maximum) daily transfer of 66.5 mgd (252,000 m^3pd), were grandfathered in when G.S. § 143–215.22I was enacted (NCDENR, 2009). Since then, five additional facilities have received certificates to withdraw up to a combined maximum total of 167.5 mgd (634,000 m^3pd). The most significant certified interbasin transfer in this group is the withdrawal of 60 mgd (227,000 m^3pd) of water from Lake Gaston (part of the Roanoke River Basin) by Virginia Beach, Virginia. Virginia Beach began pumping in 1998 following a very lengthy and contested FERC approval process, during which North Carolina opposed the withdrawals (NCDENR, 2001b). Certificates are pending for three facilities, totaling almost 60 mgd (227,000 m^3pd). This includes the Kerr Lake Regional Water System (KLRWS), a regional provider of drinking water. The KLRWS has an existing, grandfathered, surface water transfer capacity of 10 mgd (38,000 m^3pd). The grandfathered capacity allows the system to move water from the Roanoke River Basin (Kerr Lake) to sub-basins of the Tar-Pamlico River Basin. On February 18, 2009, KLRWS submitted a Notice of Intent to Request an Interbasin Transfer Certificate to the Environmental Management Commission. In that notice, KLRWS requested to increase the authorized transfer from 10 mgd to 24 mgd (38,000 m^3pd to 91,000 m^3pd), and to transfer 2.4 mgd (9,100 m^3pd) from the Roanoke River Basin to the Neuse River Basin. These transfer amounts are based on water use projections to the year 2040.

Water allocation issues also increasingly threaten to exacerbate the present threat of degraded water quality on the endangered status of the South Atlantic DPS. Water allocation issues are occurring on the Atlantic Coast of South Carolina and Georgia (Ruhl, 2003). This area is served by five major rivers—the Savannah, Altamaha (including its two major tributaries, the Oconee and Ocmulgee rivers), Ogeechee, Satilla, and St. Marys Rivers. A 2006 study by the Congressional Budget Office (CBO) reported that Georgia had the sixth highest population growth (26.4 percent) in the nation, followed by Florida (23.5 percent) (CBO, 2006). A report from UGA states that the per capita water use in Georgia has been estimated to be 8 to 10 percent greater than the national average, and 17 percent higher than per capita use in neighboring states (UGA, 2002). Water shortages have already occurred and are expected to continue due to increasing periods of drought coupled with the rapid population growth expected in the region over the next 50 years (Cummings *et al.,* 2003). Two of the largest and most rapidly expanding urban areas in the Savannah River basin, Augusta-Richmond County and Savannah, currently utilize both ground water and surface water for drinking water uses (GAEPD, 2001a). Surface water use in the Savannah River basin is expected to increase in the near future, due to a population increase in the basin. Predictions for 2050 estimate

the population will increase to nearly 900,000 (GAEPD, 2001a). It is important to note that the two water supply sources are not independent, because ground water discharge to streams is important in maintaining dry-weather flow. Thus, withdrawal of ground water also results in reduction in surface water flow.

The Vogtle Electric Generating Plant consists of two nuclear reactors and currently uses up to 64 mgd of water from the Savannah River to generate power. In March 2008, the Southern Nuclear Operating Company applied to the Nuclear Regulatory Commission for a license to build two additional nuclear reactors at the plant, increasing the potential water usage to 80 mgd. Up to 100 mgd (379,000 m^3pd) of Savannah River water may be withdrawn to support the growth of South Carolina communities located outside of the Savannah River basin, such as Greenville and Beaufort County (Spencer and Muzekari, 2002). While Georgia has laws restricting interbasin transfers of water, South Carolina has yet to adopt stream flow protections and does not regulate surface water withdrawals (Rusert and Cummings, 2004). Savannah has been withdrawing water from its coastal aquifer since the city became established. However, Savannah has grown to the point that the aquifer has been depleted over 100 ft (31 m) beneath the city due to growth and increased water usage. This decrease in aquifer storage water has resulted in salt water intrusion into the water wells used by Hilton Head, just north of Savannah. Currently, five of Hilton Head's 12 wells are unusable and the problem is expected to escalate if no action is taken to prevent further salt water intrusion. The South Carolina team on the Savannah River Basin Advisory Group has begun looking at withdrawing surface water from the Savannah River to ease the aquifer problem (Massey, 2007; Spencer and Muzekari, 2002).

New surface water withdrawal permits in the Savannah, Ogeechee, and Altamaha Rivers pose potential threats to water quality in those rivers (Alber and Smith, 2001). Approximately 126,500 people depend on the Altamaha basin for water. The Ocmulgee River, a tributary of the Altamaha, is located in North Georgia and passes through Atlanta and Macon before joining the Altamaha River. Of the seven river basins in Georgia, the Ocmulgee River Basin has the highest population of 1,714,722 people. The Ocmulgee River Basin is home to a diverse industrial and attraction base, from agriculture to defense. It has the highest agriculture production and the most agricultural water withdrawal permits in Georgia (Fisher *et al.,* 2003).

It is not known how much water is already being removed from rivers utilized by the South Atlantic DPS for spawning and nursery habitat because there is little information concerning actual withdrawals and virtually no information concerning water discharges. This is particularly the case for municipal and industrial uses because water use permits are not required for withdrawals less than 100,000 gpd (379 m^3pd) (Cummings *et al.,* 2003) and discharge permits are not required unless discharge contains selected toxic materials. Agricultural water use permits are not quantified in any meaningful way, thus neither water withdrawals nor return flows are measured (Fisher *et al.,* 2003). Large withdrawals of water (such as those for municipal use) result in reduced water quality (altered flows, higher temperatures, and lowered DO), and reduced water quality is already contributing to the endangered status of the South Atlantic DPS. Therefore, water withdrawals from the rivers in the range of the South Atlantic DPS, which are highly likely to occur based on current water shortages and increasing demand, threaten to exacerbate water quality problems that are currently modifying and curtailing Atlantic sturgeon habitat in the South Atlantic DPS.

Climate Change

Climate change threatens to exacerbate the effects of modification and curtailment of Atlantic sturgeon habitat caused by dams, dredging, and reduced water quality on the endangered status of the Carolina and South Atlantic DPSs. A major advance in climate change projections is the large number of simulations available from a broader range of climate models, run for various emissions scenarios. The IPCC reports in its technical paper ''Climate Change and Water'' that best-estimate projections from models indicate that decadal average warming over each inhabited continent by 2030 (*i.e.,* over the next 20-year period) is insensitive to the choice of emissions scenarios and is ''very likely'' to be at least twice as large (around 0.36 degrees Fahrenheit or 0.2 degrees Celsius per decade) as the corresponding model-estimated natural variability during the 20th century (IPCC, 2008). Continued greenhouse gas emissions at or above current rates under non-mitigation emissions scenarios would cause further warming and induce many changes in the global climate system during the 21st century, with these changes ''very likely'' to be larger than those observed during the 20th century. In addition, the IPCC expects the rate of warming to accelerate in the coming decades. Because 20 years is equal to at least one generation of Atlantic sturgeon (ASSRT, 2007), and possibly multiple generations in the Southeast where Atlantic sturgeon may mature as early as 5 years (Smith *et al.,* 1982), the modifying effects of climate change over the next 20 years on vital parameters of the Carolina and South Atlantic DPS's habitat will occur on a scale relevant to their endangered status. Researchers anticipate that the frequency and intensity of droughts and floods will change across the nation (CBO, 2006). The IPCC report states that the most important societal and ecological impacts of climate change in North America stem from changes in surface and groundwater hydrology (IPCC, 2008).

Both the Carolina and South Atlantic DPSs are within a region the IPCC predicts will experience overall climatic drying. Since the status review report was completed, the Southeast experienced approximately 3 years of drought. During this time, South Carolina experienced drought conditions that ranged from moderate to extreme (South Carolina State Climatology Office, 2008). From 2006 until mid-2009, Georgia experienced the worst drought in its history. In September 2007, many of Georgia's rivers and streams were at their lowest levels ever recorded for the month, and new record low daily streamflows were recorded at 15 rivers with 20 or more years of data in Georgia (USGS, 2007). The drought worsened in September 2008. All streams in Georgia except those originating in the extreme southern counties were extremely low. While Georgia has periodically undergone periods of drought—there have been 6 periods of drought lasting from 2 to 7 years since 1903 (USGS, 2000)—drought frequency appears to be increasing (Ruhl, 2003). Abnormally low stream flows restrict access to habitat areas, reduce thermal refugia, and exacerbate water quality issues, such as water temperature, reduced DO, nutrient levels, and contaminants.

The Carolina and South Atlantic DPSs are already threatened by reduced water quality resulting from dams, inputs of nutrients, contaminants from CAFOs, industrial activities, and non-point sources, and interbasin transfers of water. The IPCC report projects with high confidence that higher water temperatures and changes in extremes in this region, including floods and

droughts, will affect water quality and exacerbate many forms of water pollution—from sediments, nutrients, dissolved organic carbon, pathogens, pesticides, and salt, as well as thermal pollution, with possible negative impacts on ecosystems. In addition, sea-level rise is projected to extend areas of salinization of groundwater and estuaries, resulting in a decrease of freshwater availability for humans and ecosystems in coastal areas. Some of the most populated areas of this region are low-lying, and the threat of salt water entering into its aquifers with projected sea-level rise is a concern (U.S. Global Research Group, 2004). Existing water allocation issues would be exacerbated, leading to an increase in reliance on interbasin water transfers to meet municipal water needs, further stressing water quality. Dams, dredging, and poor water quality have already modified and curtailed the extent of suitable habitat for Atlantic sturgeon spawning and nursery habitat. Changes in water availability (depth and velocities) and water quality (temperature, salinity, DO, contaminants, *etc.*) in rivers and coastal waters inhabited by Atlantic sturgeon resulting from climate change will further modify and curtail the extent of suitable habitat for the Carolina DPS. Effects could be especially harmful since these populations have already been reduced to low numbers. The spawning populations within the Carolina DPS are all estimated to number fewer than the 500 recommended by Thompson (1991) to maintain sufficient genetic variability for adaptation to changing environmental conditions, and certainly smaller than the 1,000 to 10,000 recommended by other authors (Salwasser *et al.,* 1984; Belovsky, 1987; Soulé, 1987; Thomas, 1990).

The ASSRT concluded that habitat modifications due to the placement of dams, dredging, and degraded water quality present a moderate to moderately high threat to all river populations within the Carolina DPS, with the exception of the Roanoke River. For the South Atlantic DPS, the ASSRT concluded that dredging and water quality issues are having a moderately low to moderate impact on the river populations. We believe that the modification and curtailment of Atlantic sturgeon habitat resulting from dams, dredging, and degraded water quality is contributing to the endangered status of both the Carolina and South Atlantic DPSs. Further, additional threats arising from water allocation and climate change threaten to exacerbate water quality problems already present throughout the range of both DPSs. Existing water allocation issues will likely be compounded by population growth and potentially climate change. Climate change is also predicted to elevate water temperatures and exacerbate nutrient-loading, pollution inputs, and lower DO, all of which are current threats to the Carolina and South Atlantic DPSs.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization for commercial purposes is a factor that contributed to the historical drastic decline in Atlantic sturgeon populations throughout the species' range. Data on the total weight of Atlantic and shortnose sturgeon harvested were collected by each state starting in 1880, and in the late 1800s commercial fisheries were landing upwards of 6,800,000 lbs (3,084 kg) of sturgeon annually (Murawski and Pacheco, 1977). By 1905, only 15 years later, this number had dropped to 20,000 lbs (9,071 kg). The population sizes were then further reduced by overfishing in the 1900s, when the landings drastically fell to a total of 215 lbs (98 kg) in 1990 (Stein *et al.,* 2004b). The total landings recorded include shortnose sturgeon as well as Atlantic sturgeon; however, the harvest is thought to have been primarily Atlantic sturgeon due to the large mesh-size nets commonly used at that time. A complete moratorium on possession of Atlantic sturgeon has been implemented in both state and Federal waters since 1998 to eliminate the threat of directed catch and incentives to retain Atlantic sturgeon bycatch. However, Atlantic sturgeon are taken as bycatch in various commercial fisheries along the entire U.S. Atlantic Coast within inland, coastal, and Federal waters. While Atlantic sturgeon caught incidentally can no longer be legally landed, bycatch may still be a threat if fish are injured or killed in the act of being caught.

Based on their life history, Atlantic sturgeon are more sensitive to fishing mortality than other coastal fish species. They are a long-lived species, have an older age at full maturity, have lower maximum fecundity values, with 50 percent of the lifetime egg production for Atlantic sturgeon occurring later in life (Boreman, 1997). Boreman (1997) looked at the relationship between fishing mortality (F) and the corresponding percentage of the maximum lifetime egg production of an age 1 female. The F_{50} is the fishing rate at which a cohort produces 50 percent of the eggs that it would produce with no fishing effort. Boreman calculated a sustainable fishing (bycatch) mortality rate of 5 percent per year for adult Atlantic sturgeon based on the F_{50}. While many fishery models use a less conservative target fishing level of F_{30} or F_{20}, the more conservative choice of F_{50} for Atlantic sturgeon is justified by their late age at maturity and because they are periodic spawners (Boreman, 1997).

We currently do not have all the data necessary to determine whether the percentage of Atlantic sturgeon populations lost annually due to bycatch mortality exceeds a sustainable rate of 5 percent per year suggested by Boreman (1997), because we do not have abundance estimates for the Carolina and South Atlantic DPSs and bycatch remains highly underreported. However, bycatch is occurring throughout the range of the Carolina and South Atlantic DPSs of Atlantic sturgeon, and the bycatch mortality associated with the dominant fishing gear in the Southeast is relatively high. All the spawning populations in the Southeast Region are quite small, which means that the loss of a small number of fish to bycatch mortality could exceed the sustainable rate of 5 percent per year. Bycatch of Atlantic sturgeon in commercial fisheries is presently a threat to the Carolina and South Atlantic DPSs, and we believe it is contributing to their endangered status.

Mortality rates of Atlantic sturgeon taken as bycatch in various types of fishing gear range between 0 and 51 percent, with the greatest mortality occurring in sturgeon caught by sink gillnets (Stein *et al.,* 2004b; ASMFC, 2007). The ASMFC Sturgeon Technical Committee (TC) determined that bycatch losses principally occur in sink gillnet fisheries, though there may be losses in the trawl fisheries, as well. Atlantic sturgeon are particularly vulnerable to sink gillnets due to their demersal nature (tendency to be at the bottom of the water column). If the nets are not tended often enough, it can be detrimental to the sturgeon, resulting in suffocation because their operculum or gills can be held closed by the net. Using the NMFS ocean observer dataset, the NMFS Northeast Fisheries Science Center (NEFSC) estimated that bycatch mortality of sturgeon captured in sink gillnets between 2001 and 2006 was 13.8 percent (ASMFC, 2007). The ASMFC Sturgeon TC notes that any estimate of bycatch from the NMFS ocean observer dataset will be an underestimate because bycatch is under-reported in state waters and there is limited observer coverage in fisheries potentially affecting Atlantic sturgeon in the South Atlantic (North Carolina to Florida) Federal waters. In addition,

bycatch mortality estimates do not account for post-capture mortality. The 13.8 percent mortality rate for sink gillnets estimated by the NEFSC may further underestimate the mortality rate in sink gillnets in the Carolina and South Atlantic DPSs because bycatch survival is greater in colder water temperatures of the north compared to warmer southern waters occupied by these DPSs (ASSRT, 2007). Mortality of Atlantic sturgeon captured by trawls seems to be low, with most surveys reporting 0 percent mortality. The State of North Carolina has documented bycatch in over 958 tows conducted by commercial shrimp trawlers working in North Carolina with no Atlantic sturgeon reported; there have also been no Atlantic sturgeon captured in the 528 blue crab trawl tows examined since 1990. However, these studies do not include post-capture mortality, and studies of mortality from trawl fisheries conducted in the south, where tow times are longer and water temperatures are higher, are very limited.

Sink gillnets and trawls are used throughout riverine, estuarine, and marine waters in the range of the Carolina DPS to target a wide array of finfish and shellfish. Data on Atlantic sturgeon bycatch in Albemarle and Pamlico Sound commercial fisheries come from three sources: (1) NCDMF IGNS that were initially designed to monitor striped bass; (2) NCDMF Observer Program; and (3) NC Sea Grant Fishery Resource Grant project that examined sturgeon bycatch in the flounder fishery (White and Armstrong, 2000). The Albemarle and Pamlico IGNS used sink and drift gillnets, similar to those used by the shad/herring and the flounder fisheries. Overall bycatch mortality in the Albemarle Sound IGNS from 1990–2009 was 3 percent. Mortality rates in Albemarle Sound varied annually from 0–19 percent, and also varied by month (0–7 percent) and by mesh size (0–100 percent). Overall bycatch mortality in the Pamlico Sound IGNS from 2001–2009 was 10 percent, and ranged from 0–100 percent annually, 0–25 percent by month, and 0–25 percent by mesh size. In the Pamlico, Pungo, and Neuse Rivers IGNS, overall bycatch mortality between 2000 and 2009 was 12 percent, ranging annually from 0–50 percent. Bycatch mortality rate also varied by month (0–67 percent) and by mesh size (0–33 percent). Since 2001, the NCDMF Observer Program has observed approximately 3,031,356 yards of large and small mesh gill nets and collected 110 Atlantic sturgeon with an overall bycatch mortality of 6 percent (7 fish). Mortalities ranged from 0 percent in 2008 to a high of 12 percent in 2004. Overall bycatch mortality in large mesh nets was 5 percent and ranged between 0 and 8 percent. Overall bycatch mortality in small mesh nets was 17 percent, ranging from 0–100 percent. Commercial fishermen in Albemarle and Pamlico Sound and Cape Fear River reported catches of zero to two sturgeon per fishery per year. However, White and Armstrong (2000) reported that sturgeon bycatch in flounder gillnets fished from 1998 to 2000 by a single fishermen in the Albemarle Sound flounder fishery included the capture of 131 Atlantic sturgeon. Of the 131 Atlantic sturgeon captured, no mortalities were reported, although four individuals were noted as having minor injuries. These data indicate that underreporting of sturgeon bycatch is occurring in this area.

A sink gillnet survey conducted in the Cape Fear River by University of North Carolina at Wilmington personnel noted that 25 percent of sturgeon intercepted (22 of 88 caught) were killed. The gillnets were set one day, checked the second, and retrieved on the third. The greatest mortality occurred during periods of highest water temperature (Moser *et al.,* 1998). This survey was continued by the NCDMF, and it has reported mortality rates of 37 percent overall. Similar to earlier findings, mortality was greatest during the summer months (June through August), averaging 49 percent (34 of 69 sturgeon died) (ASSRT, 2007). This study has been discontinued due to lack of funding. There are no estimates of bycatch in fishery dependent surveys.

Winyah Bay is currently fished for American shad using both sink and drift gillnets. This fishery has an estimated bycatch of 158 Atlantic sturgeon per year, of which 16 percent (25 fish) die and another 20 percent are injured to some degree, although this estimate is dated (Collins *et al.,* 1996). Shad fishers also operate within the rivers, but neither fishing effort nor average numbers of Atlantic sturgeon encountered are known. Poaching of adult Atlantic sturgeon has been reported from the Winyah Bay area in recent years. Carcasses of large females have been found with the ovaries (caviar) removed.

The mouth of the Santee River, just south of Winyah Bay, has the largest shad landings in the Southeast (ASSRT, 2007), likely resulting in mortality and injury of sturgeon similar to that in the Winyah Bay shad fishery. Upriver bycatch levels are unknown. The Cooper River also has an active hook and line shad fishery because gillnets are restricted (ASSRT, 2007).

The two largest commercial fisheries likely to capture Atlantic sturgeon from the South Atlantic DPS in the state waters of South Carolina and Georgia are the American shad gillnet and shrimp trawl fisheries. Studies in Georgia on commercial gillnet fisheries for American shad (*Alosa sapidissima*) showed that they accounted for 52 percent of Atlantic sturgeon bycatch and the shrimp trawl fisheries accounted for 39 percent (Collins *et al.,* 1996). The American shad fisheries use sink gillnets and drift gillnets. Collins *et al.* (1996) documented a 16 percent capture-induced mortality rate for sturgeon in the American shad fishery.

There was a directed commercial fishery for Atlantic sturgeon in the ACE Basin prior to the 1985 fishery closure. The commercial sturgeon fishery operated in the lower and middle portions of both the Combahee and Edisto rivers. Commercial shad fisheries captured some juvenile Atlantic sturgeon, but most fishermen operate upriver from the areas of greatest abundance during that time of year. The shrimp trawl fishery in St. Helena Sound also captures juveniles, as evident from tag returns (ASSRT, 2007).

Although a few commercial sturgeon fishers apparently operated in the Port Royal river system prior to 1985, the landing of only one Atlantic sturgeon has been recorded (Smith and Dingley, 1984). Little, if any, shad fishing takes place in this system. It is not known whether there is any significant bycatch in the shrimp trawl fishery in this area.

During 1989 to 1991, the commercial shad gillnet fishery's bycatch in the Savannah River included more endangered shortnose sturgeon than juvenile Atlantic sturgeon. Collins *et al.* (1996) reported that two commercial fishermen collected 14 Atlantic and 189 shortnose sturgeon over the period of 1990 to 1992. It appears that abundance within the Savannah River is extremely low, as evidenced from low bycatch and reported captures over the last 15 years. Thus, bycatch may be a more serious impact if abundance is low and fishing effort is high.

Bycatch in the shad fishery in the Ogeechee River is a heightened concern because evidence suggests that this Atlantic sturgeon population is stressed and that complete recruitment failure has occurred in some years (ASSRT, 2007). Bycatch mortality in the estuarine and lower river shad fishery is suspected to be high, but no estimates of take are available (ASSRT, 2007).

Estimated annual total bycatch of Atlantic and shortnose sturgeon in the

shad gillnet fishery in the tidal portion of the Altamaha River during 1982 and 1983 averaged 372 sturgeon (Collins *et al.,* 1996). The mortality rate of sturgeon taken as bycatch in the Altamaha River during this time period was not determined. During a study conducted between 1986 and 1992 in the Altamaha River, 97 of 1,534 tagged juvenile Atlantic sturgeon were recaptured primarily by shad gillnets (52 percent) and shrimp trawls (39 percent) (Collins *et al.,* 1996). Juvenile Atlantic sturgeon from the Altamaha are relatively abundant in comparison to other rivers in the region, so a large percentage of the individuals in winter mixed-stock aggregations on the shelf are likely from this river. Most sturgeon occurring as shrimp trawl bycatch are from mixed-stock aggregations. Using the percentages of Atlantic and shortnose sturgeon from the 1986 to 1992 Altamaha catch data and applying them to the 1982 and 1983 total estimated sturgeon bycatch, it is expected that 89 percent (331 fish) of the catch consisted of Atlantic sturgeon (ASSRT, 2007). Also, assuming a 10 percent bycatch mortality rate for Atlantic sturgeon from drift nets (Stein *et al.,* 2004b), the dominant gear used in the shad gillnet fishery, it is estimated that 33 Atlantic sturgeon would die each year from the fishery. However, in their latest compliance report to the ASMFC, GADNR noted that less than 10 fish per year were estimated to have been captured in the Altamaha River anchored gillnet fishery during a 3-year study. All fish were juveniles and no injury or mortality was documented. GADNR also noted the season for gillnetting shad occurs while adults are at sea and juveniles are in the lower parts of the estuary. Since the 2007 status review, which ranked bycatch as a moderate threat in the Altamaha, the Georgia Board of Natural Resources has prohibited the use of gillnets for shad fishing in a large portion of the Altamaha.

Shad fishing effort is low in the Satilla River due to an apparently depleted shad population. However, because the Atlantic sturgeon population is depleted and highly stressed, any bycatch mortality could have an impact on the population (ASSRT, 2007).

The ASSRT concluded that bycatch presents a moderate threat to the Carolina DPS, while the threat of bycatch to the South Atlantic DPS was characterized as moderately low in each of the populations, with the exception of the Altamaha, where bycatch was deemed to pose a moderate threat, though we note again Georgia's prohibition of shad gillnet fishing in a large portion of the Altamaha since the status review. Historical overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations in the southeast, from which they have never rebounded. Further, we believe continued bycatch of Atlantic sturgeon in commercial fisheries is an ongoing impact to the Carolina and South Atlantic DPSs that is contributing to their endangered status. Atlantic sturgeon are particularly vulnerable to being caught in sink gillnets and fisheries using this type of gear account for most recorded Atlantic sturgeon bycatch. However, little data exist on bycatch in the Southeast, and high levels of bycatch underreporting are suspected (ASMFC, 2005; ASSRT, 2007; White and Armstrong, 2000). Further, total population abundances for the Carolina and South Atlantic DPSs are not available; therefore, it is not possible to calculate the percentages of the Carolina and South Atlantic DPSs subject to bycatch mortality based on the available bycatch mortality rates for individual fisheries. However, fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may access multiple river systems, they are subject to being caught in multiple fisheries throughout their range. Atlantic sturgeon taken as bycatch may suffer immediate mortality. In addition, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (*e.g.,* exposure to toxins and low DO). This may result in reduced ability to perform major life functions, such as foraging and spawning, or may even result in post-capture mortality. Several of the river populations in the South Atlantic DPS (*e.g.,* the Ogeechee and the Satilla) are stressed to the degree that any level of bycatch could have an adverse impact on the status of the DPS (ASSRT, 2007).

C. Disease or Predation

Very little is known about natural predators of Atlantic sturgeon. The presence of bony scutes is likely an effective adaptation for minimizing predation of sturgeon greater than 25 mm (Gadomski and Parsley, 2005). Gadomski and Parsley (2005) have shown that catfish and other species do prey on juvenile sturgeon, and concerns have been raised regarding the potential for increased predation on juvenile Atlantic sturgeon by introduced flathead catfish (Brown *et al.,* 2005). Atlantic sturgeon populations are persisting in the Cape Fear River, North Carolina, and Altamaha River, Georgia, where flatheads have been present for many years, at least in the absence of any directed fisheries for Atlantic sturgeon. Thus, further research is warranted to determine at what level, if any, flatheads and other exotic species prey upon juvenile Atlantic sturgeon and to what extent such predation is affecting the sturgeon populations.

While some disease organisms have been identified from wild Atlantic sturgeon, they are unlikely to threaten the survival of the wild populations. Disease organisms commonly occur among wild fish populations, but under favorable environmental conditions, these organisms are not expected to cause population-threatening epidemics. There is concern that non-indigenous sturgeon pathogens could be introduced, most likely through aquaculture operations. Fungal infections and various types of bacteria have been noted to have various effects on hatchery Atlantic sturgeon. Due to this threat of impacts to wild populations, the ASMFC recommends requiring any sturgeon aquaculture operation to be certified as disease-free, thereby reducing the risk of the spread of disease from hatchery origin fish. The aquarium industry is another possible source for transfer of non-indigenous pathogens or non-indigenous species from one geographic area to another, primarily through release of aquaria fish into public waters. With millions of aquaria fish sold to individuals annually, it is unlikely that such activity could ever be effectively regulated. Definitive evidence that aquaria fish could be blamed for transmitting a non-indigenous pathogen to wild fish (sturgeon) populations would be very difficult to collect (ASSRT, 2007).

In their status review, the ASSRT ranked the threat from disease and predation as a low risk. While information on the impacts of disease and predation on Atlantic sturgeon is limited, there is nothing to indicate that either of these factors is currently having any measurable adverse impact on Atlantic sturgeon. Therefore, we concur with the ASSRT, and we conclude that disease and predation are not contributing to the endangered status of either the Carolina or the South Atlantic DPS.

D. Inadequacy of Existing Regulatory Mechanisms

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. These regulatory mechanisms are described in detail in the status review report (see Section 3.4). We believe that the inadequacy of regulatory mechanisms to control bycatch and the modification and curtailment of Atlantic sturgeon habitat is contributing to the endangered status of the Carolina and South Atlantic DPSs.

Current regulatory mechanisms have effectively removed threats from legal, directed harvest in the United States, as well as incentives for retention of bycatch. The ASMFC was given management authority in 1993 under the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA) (16 U.S.C. 5101–5108), and it manages Atlantic sturgeon through an interstate fisheries management plan (IFMP). The moratorium prohibiting directed catch of Atlantic sturgeon was developed as an Amendment to the IFMP. The ACFCMA, authorized under the terms of the ASMFC Compact, as amended (Pub. L. 103–206), provides the Secretary of Commerce with the authority to implement regulations that are compatible to ASMFC FMPs in the Exclusive Economic Zone (EEZ) in the absence of an approved Magnuson-Stevens FMP. In 1999, it was under this authority that a similar moratorium was implemented for Atlantic sturgeon in Federal waters. The Amendment includes a stock rebuilding target of at least 20 protected mature age classes in each spawning stock, which is to be achieved by imposing a harvest moratorium. The Amendment requires states to monitor, assess, and annually report Atlantic sturgeon bycatch and mortality in other fisheries. The Amendment also requires that states annually report habitat protection and enhancement efforts. Finally, the Amendment states that each jurisdiction with a reproducing population should conduct juvenile assessment surveys (including CPUE estimates, tag and release programs, and age analysis), and states with rivers that lack a reproducing sturgeon population(s) but support nursery habitat for migrating juveniles should also conduct sampling.

While the ASMFC and NMFS have made significant strides in reducing the threats from direct harvest and retention of bycatch, those threats have not been eliminated, and continued bycatch of Atlantic sturgeon is contributing to the endangered status of the Carolina and South Atlantic DPSs. Although the FMP contains requirements for reporting bycatch, fishery managers, such as the ASMFC Atlantic Sturgeon Management Board, widely accept that Atlantic sturgeon bycatch is underreported or not reported at all based on research and anecdotal evidence (ASMFC, 2005; ASSRT, 2007; White and Armstrong, 2000). Abundance estimates are available only for two river systems (the Hudson and the Altamaha) even though the FMP states that each jurisdiction with a reproducing population should conduct juvenile assessment surveys (including CPUE estimates, tag and release programs, and age analysis). While the aforementioned mechanisms have addressed impacts to Atlantic sturgeon through directed fisheries, there are currently no mechanisms in place to address the significant impacts and risks posed to Atlantic sturgeon by commercial bycatch.

State and Federal agencies are actively employing a variety of legal authorities to implement proactive restoration activities for this species, and coordination of these efforts is being furnished through the ASMFC. Due to existing state and Federal laws, water quality and other habitat conditions have improved in many riverine habitats, although many systems still have DO and toxic contaminants issues, and habitat quality and quantity continue to be affected by dams, dredging, and/or altering natural flow conditions.

Though statutory and regulatory mechanisms exist that authorize reducing the impact of dams on riverine and anadromous species, such as Atlantic sturgeon, and their habitat, these mechanisms have proven inadequate for preventing dams from blocking access to habitat upstream and degrading habitat downstream. Hydropower dams are regulated by the FERC. The Federal Power Act, originally enacted in 1920, provides for cooperation between FERC and other Federal agencies, including resource agencies, in licensing and relicensing power projects. The Federal Power Act authorizes NMFS to recommend hydropower license conditions to protect, mitigate damages to, and enhance anadromous fish, including related habitat. The Federal Power Act also provides authority for NMFS to issue mandatory fishway prescriptions. FERC licenses have a term of 30 to 50 years, so NMFS' involvement in the licensing process to ensure the protection and accessibility of upstream habitat, and to improve habitat degraded by changes in water flow and quality from dam operations, may only occur twice or thrice a century. The Federal Power Act does not apply to non-hydropower dams, such as those operated by the Army Corps of Engineers for navigation purposes. Even where fish passage currently exists, evidence is rare that it effectively passes sturgeon, including Atlantic sturgeon. As mentioned in previous sections, dams in the Southeast are currently blocking access to over 60 percent of the habitat in three rivers with historical and/or current spawning Atlantic sturgeon populations (the Cape Fear River and Santee-Cooper System in the Carolina DPS and the St. Johns River in the South Atlantic DPS), though we are hopeful that NMFS' 2007 fishway prescription of passage for sturgeon through the lowest dams on both the Santee and Cooper Rivers will be implemented once FERC issues the new license for this project in the near future. In addition to the loss of important spawning and juvenile developmental habitat upstream, dam operations reduce the quality of the remaining habitat downstream by affecting water quality parameters (such as depth, temperature, velocity, and DO) that are important to Atlantic sturgeon. Therefore, the inadequacy of regulatory mechanisms to ensure safe and effective upstream and downstream passage to Atlantic sturgeon and prevent degradation of habitat downstream from dam operations in riverine habitat is contributing to the endangered status of the Carolina and South Atlantic DPSs.

Inadequacies in the regulation of water allocation also impact the South Atlantic DPS. Data concerning consumptive water use in this region are, at best, very limited. While extensive data exist concerning permitted water withdrawals, there is little information concerning actual withdrawals and virtually no information concerning water discharges. This is particularly the case for municipal and industrial uses because water use permits are not required for withdrawals less than 100,000 gpd (379 m^3pd) (Cummings *et al.,* 2003) and discharge permits are not required unless discharge contains selected toxic materials. Agricultural water use permits are not quantified, neither water withdrawals nor return flows are measured (Fisher *et al.,* 2003). While several other states have similar permitting thresholds, the majority require permits for water withdrawals less than 100,000 gpd (379 m^3pd) and some require a permit for any water withdrawal. The present limit in Georgia allows access to water in amounts required to satisfy the household needs of more than 300 households without a permit (Cummings *et al.,* 2003).

Fundamental requisites for basin water planning—data for historical,

unimpaired flows in the coastal regions' rivers—do not exist (Fisher *et al.,* 2003). There are 125 river gauges in the region's 7 river basins. However, 72 of these gauges are inactive, and 28 of the remaining 53 gauges do not provide consistent flow information. Moreover, historical data from many gauges have gaps, reflecting periods (sometimes extending over months) during which the gauge was inoperative. Also, there are extensive discharge areas between the last gauge in each river system and the point at which the river discharges into the ocean—thus, there are potentially large water supplies for which no information is available (Fisher *et al.,* 2003).

Water quality continues to be a problem, even with existing controls on some pollution sources. 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. Current regulatory regimes are not sufficiently effective in controlling water allocation issues (*e.g.,* no permit requirements for water withdrawals under 100,000 gpd (379 m^3pd) in Georgia and no restrictions on interbasin water transfers in South Carolina).

In their status review, the ASSRT ranked the threat from the inadequacy of regulatory mechanisms as moderately low to moderate. While some of the threats to the Carolina and South Atlantic DPSs have been ameliorated or reduced due to the existing regulatory mechanisms, such as the moratorium on directed fisheries for Atlantic sturgeon, bycatch is currently not being addressed through existing mechanisms. Further, water quality continues to be a problem even with existing controls on some pollution sources and water withdrawal, and dams continue to curtail and modify habitat, even with the Federal Power Act.

E. Other Natural or Manmade Factors Affecting the Species' Continued Existence

The ASSRT considered several manmade factors that may affect Atlantic sturgeon, including impingement and entrainment, ship strikes, and artificial propagation. The vast withdrawal of water from rivers that support Atlantic sturgeon populations was considered to pose a threat of impingement and entrainment; however, data are lacking to determine the overall impact of this threat on sturgeon populations, as impacts are dependent on a variety of factors (*e.g.,* the species, time of year, location of the intake structure, and strength of the intake current). Multiple suspected boat/ship strikes have been reported in several rivers. A large number of the mortalities observed in these rivers from potential ship strikes have been of large adult Atlantic sturgeon. Lastly, potential artificial propagation of Atlantic sturgeon was also a concern to ASSRT members, as both stock enhancement programs and commercial aquaculture can have negative impacts on a recovering population (*e.g.,* fish disease, escapement, outbreeding depression). In order to circumvent these potential threats, stock enhancement programs follow culture and stocking protocols approved by the ASMFC. Commercial aquaculture facilities are expected to maintain disease-free facilities and have safeguards in place to prevent escapement of sturgeon into the wild. While in at least one instance cultured Atlantic sturgeon have gone unaccounted for from a commercial aquaculture facility in Florida, this is not considered to be a significant threat, as this was a rare event. Mechanisms are in place at all facilities to prevent escapement of sturgeon; facilities are all land based, and most are not located in close proximity to any Atlantic sturgeon rivers.

Along the range of Atlantic sturgeon from the Carolina and South Atlantic DPSs, most, possibly all, populations are at risk of possible entrainment or impingement in water withdrawal intakes for commercial uses, municipal water supply facilities, and agricultural irrigation intakes. In North Carolina, over two billion gallons of water per day were withdrawn from the Cape Fear, Neuse, Tar, and Roanoke rivers in 1999 by agriculture and non-agricultural industries (NCDENR, 2006). Three surveys, included in the 2007 status review, have shown the direct impacts of water withdrawal on Atlantic sturgeon: (1) Hudson River Utility Surveys, (2) Delaware River Salem Power Plant survey, and (3) Edwin I. Hatch Nuclear Power Plant survey. Information on the Brunswick Nuclear Power Plant and its impacts on Atlantic sturgeon was provided by Progress Energy during the public comment period on the proposed listing rule. The Edwin I. Hatch Nuclear power plant (HNP) is located 11 miles north of Baxley, Georgia. The HNP uses a closed-loop system for main condenser cooling that withdraws from, and discharges to, the Altamaha River. Pre-operational drift surveys were conducted and only two *Acipenser* larvae were collected. Entrainment samples at HNP were collected for the years 1975, 1976, and 1980, and no *Acipenser* species were observed in the samples (Sumner, 2004). The Brunswick Nuclear Power Plant is located on the lower Cape Fear River. An average of 55 juvenile Atlantic sturgeon were impinged per year from 1975 to 1981. Plant modifications were implemented in the early 1980s as part of the NPDES permit. A fish diversion was installed in 1981 and a fish return system was installed in 1983. Only two impinged juveniles were observed between 1982 and 2010 and were returned alive to the river. Though most rivers have multiple intake structures which remove millions of gallons a day during the spring and summer months, it is believed that the migratory behavior of larval sturgeon allows them to avoid intake structures, since migration is active and occurs in deep water (Kynard and Horgan, 2002). Effluent from these facilities can also affect populations, as some facilities release heated water that acts as a thermal refuge during the winter months, but drastic changes in water temperature have the potential to cause mortality.

Locations that support large ports and have relatively narrow waterways are more prone to ship strikes (*e.g.,* Delaware, James, and Cape Fear rivers). One ship strike per 5 years is reported for the Cape Fear River within the Carolina DPS. Ship strikes have not been documented in any of the rivers within the South Atlantic DPS. While it is possible that ship strikes may have occurred that have gone unreported or unobserved, the lack of large ship traffic on narrow waterways within the range of the DPS may limit potential interactions.

Artificial propagation of Atlantic sturgeon for use in restoration of extirpated populations or recovery of severely depleted wild populations has the potential to be both a threat to the species and a tool for recovery. Within the range of the Carolina DPS, several attempts were made by Smith *et al.* (1980 and 1981) to hormonally-induce spawning and culture Atlantic sturgeon captured in the Atlantic Ocean off the Winyah Bay jetties. Fry were produced during each spawning attempt, but the fry lived less than a year. As a result of successful spawning of Hudson River Atlantic sturgeon from 1993 to 1998, USFWS' Northeast Fisheries Center (NEFC) is currently rearing five year-classes of domestic fish. These fish could potentially be used as broodstock for aquaculture operations and stock enhancement, provided that there is no risk to wild fish. Aquaculturists along the East Coast, including some in North

Carolina and South Carolina, have contacted the NEFC and expressed interest in initiating commercial production of Atlantic sturgeon. In 2006, La Paz Aquaculture Group was approved by North Carolina state resource agencies and ASMFC to produce Atlantic sturgeon for flesh and caviar sales. However, their first year of production was halted because remnant storms from Hurricane Katrina destroyed their fry stock. In August 2006, ASMFC reevaluated the La Paz permit, and voted to draft an addendum to allow La Paz to acquire Atlantic sturgeon from multiple Canadian aquaculture companies (previously restricted to one company), allowing them to resume Atlantic sturgeon culture. Resource managers who reviewed the permit found the La Paz facility to pose little threat to Atlantic sturgeon or shortnose populations due to the facility location (far inland), use of a recirculating system, and land application of any discharge (ASSRT, 2007).

In the range of the South Atlantic DPS, artificial propagation has been attempted for the purposes of both restoration and commercial profit. The St. Marys Fish Restoration Committee (SMFRC) is working with Florida and Georgia to reestablish Atlantic sturgeon in the St. Marys River. Efforts are currently underway to refine restoration approaches within the system. Phase 1 of the restoration plan includes a population and habitat assessment. Field investigations are being funded through ESA Section 6 and coordinated through Georgia DNR. The State of Florida has been involved in fish sampling and will continue to explore and refine sturgeon sampling strategies. Aquatic habitat and water quality surveillance work will continue to be accomplished by the St. Johns River Water Management District, the Environmental Protection Agency, Florida Department of Environmental Protection, USFWS, TNC, and the St. Marys River Management Committee. Phase 2 of the plan would include experimental transplanting of Atlantic sturgeon to assess environmental factors, habitat use at different life-stages, contaminants, migration-homing, *etc.* Upon approval from the ASMFC, the SMFRC transferred 12 Atlantic sturgeon from the Altamaha River in Georgia to the Bears Bluff National Fish Hatchery in South Carolina. The SMFRC hopes to develop and refine captive propagation techniques for predictable spawning and provide fish to approved researchers.

Aquaculturists in South Carolina and Florida have also contacted the NEFC and expressed interest in initiating commercial production of Atlantic sturgeon through use of the Hudson River broodstock. In 2001, the Canadian Caviar Company shipped 18,000 Atlantic sturgeon sac fry to the University of Florida. These fry were used to conduct early larval and feeding trials. Survivors of these experiments were transferred to four aquaculture businesses: (1) Evan's Fish Farm in Pierson, Florida; (2) Watts Aquatics in Tampa, Florida; (3) Hi-Tech Fisheries of Florida in Lakeland, Florida; and (4) Rokaviar in Homestead, Florida. According to information provided by FDACS in August 2011, Evan's Fish Farm is the only aquaculture facility still in possession of Atlantic sturgeon. They experienced a catastrophic systems failure in 2004 and currently have only one Atlantic sturgeon on their premises. The remaining Atlantic sturgeon obtained from Canada by Florida aquaculture facilities died in captivity.

The ASSRT ranked the threats from impingement/entrainment, ship strikes, and artificial propagation as low for both DPSs, with the exception of the threat from ship strikes as moderately low for the Carolina DPS. We concur with these rankings and conclude that none of these threats are contributing to the endangered status of the DPS.

Current Protective Efforts

Section 4(b)(1)(A) of the ESA requires the Secretary, when making a listing determination for a species, to take into account those efforts, if any, being made by any State or foreign nation to protect the species. In judging the efficacy of existing protective efforts, we rely on the Services' joint ''Policy for Evaluation of Conservation Efforts When Making Listing Decisions'' (''PECE;'' 68 FR 15100; March 28, 2003). The PECE is designed to guide determinations on whether any conservation efforts that have been recently adopted or implemented, but not yet proven to be successful, will result in recovering the species to the point at which listing is not warranted or contribute to forming a basis for listing a species as threatened rather than endangered. The purpose of the PECE is to ensure consistent and adequate evaluation of future or recently implemented conservation efforts identified in conservation agreements, conservation plans, management plans, and similar documents when making listing decisions. The PECE provides direction for the consideration of such conservation efforts that have not yet been implemented, or have been implemented but have not yet demonstrated effectiveness. The policy is expected to facilitate the development by states and other entities of conservation efforts that sufficiently improve a species' status so as to make listing the species as threatened or endangered unnecessary.

The Services established two basic criteria in the PECE: (1) The certainty that the conservation efforts will be implemented, and (2) the certainty that the efforts will be effective. Satisfaction of the criteria for implementation and effectiveness establishes a given protective effort as a candidate for consideration, but does not mean that an effort will ultimately change the risk assessment for the species. Through the PECE analysis, the Services ascertain whether the formalized conservation effort improves the status of the species at the time a listing determination is made.

We evaluated the current conservation efforts underway to protect and recover Atlantic sturgeon in making our listing determination. In the 2007 status review report and the proposed listing rule, we determined that only the following conservation efforts warrant consideration under the PECE for the Carolina and South Atlantic DPSs: The 1998 ASMFC FMP and the proposal by the SMFRC to restore Atlantic sturgeon to the St. Marys River. In addition, we evaluated North Carolina's NCCHPP and designation of AFSAs based on information submitted during the public comment period on the proposed listing rule.

The 1998 Amendment to the ASMFC Atlantic Sturgeon FMP strengthens conservation efforts by formalizing the closure of the directed fishery, and by banning possession of bycatch, eliminating any legal incentive to retain Atlantic sturgeon. However, bycatch is known to occur in several fisheries (ASMFC, 2007) and it is widely accepted that bycatch is underreported (ASMFC, 2005; ASSRT, 2007; White and Armstrong, 2000). Contrary to information available in 1998 when the Amendment was approved, Atlantic sturgeon bycatch mortality is a major stressor affecting the recovery of Atlantic sturgeon, despite actions taken by the states and NMFS to prohibit directed fishing and retention of Atlantic sturgeon. Therefore, there is considerable uncertainty that the Atlantic Sturgeon FMP will be effective in meeting its conservation goals. In addition, though the 1998 Amendment contains requirements for population surveys, it is highly uncertain these will be implemented, as there are limited resources for assessing current abundance of spawning females for each

of the DPSs and to date, abundance estimates have only been completed for one river within the range of the two DPSs considered here. For these reasons, there is great uncertainty regarding the implementation and effectiveness of the intended ASMFC FMP conservation effort for the Carolina and South Atlantic DPSs of Atlantic sturgeon.

The SMFRC is working with Florida and Georgia with the intention of reestablishing Atlantic sturgeon in the St. Marys River. Efforts are currently underway to refine restoration approaches within the system. As discussed in Section E, Phase 1 of the restoration plan includes a population and habitat assessment, and Phase 2 includes experimental transplanting of Atlantic sturgeon to assess environmental factors, habitat use at different life-stages, contaminants, migration-homing, *etc.* Atlantic sturgeon are believed to be extirpated in the St. Marys River. This conservation effort may increase our knowledge and understanding of Atlantic sturgeon status and habitat conditions in the St. Marys River, as well as provide methods for restoring a population there in the future. As previously discussed, artificial propagation of Atlantic sturgeon for use in restoration of extirpated populations or recovery of severely depleted wild populations has the potential to be both a threat to the species and a tool for recovery. Because it is in the earliest stages of planning, development, and authorization, the feasibility of any project or the potential degree of success for this effort is unknown. Therefore, the SMRFC efforts do not satisfy the PECE policy's standards for certainty of implementation or effectiveness.

The State of North Carolina adopted the NCCHPP in 2005 and its stated goals are: (1) Improving effectiveness of existing rules and programs protecting coastal fish habitats; (2) identifying, designating, and protecting strategic habitat areas (SHAs); (3) enhancing habitat and protecting it from physical impacts; and (4) enhancing and protecting water quality. The NCMFC approved SHAs for Region 1 (the waters and adjacent wetlands draining into and out of Albemarle Sound through Oregon Inlet to the adjoining coastal ocean) in North Carolina in January 2009, and is currently evaluating SHAs for other regions in North Carolina. SHAs represent priority habitat areas for protection due to their exceptional condition or imminent threat to their ecological functions supporting estuarine and coastal fish and shellfish species and will be incorporated into conservation and restoration efforts. One SHA (Bellows Bay to Knotts Island Bay) was identified in part due to the nearshore ocean areas that are important for Atlantic sturgeon and striped bass and another SHA (Chowan and Roanoke Rivers and western Albemarle Sound) may include one of the few Atlantic sturgeon spawning habitats in North Carolina. NCDMF also provides input to federal and state regulatory agencies of the location of habitats used by Atlantic sturgeon. NCDMF and the North Carolina Wildlife Resources Commission have designated Anadromous Fish Spawning Areas (AFSA) through rules for their respective jurisdictions. While these programs have excellent goals of increasing enforcement of existing regulations, identifying and protecting habitat important to the species, and monitoring these habitats, these actions are still in the early stages and it is not clear exactly what protections will be given to areas designated as SHAs or AFSAs. Therefore, the efforts associated with the NCCHPP and the designation of AFSAs do not satisfy the PECE policy's standards for certainty of implementation or effectiveness.

Listing Determinations

Carolina DPS

The Carolina DPS is estimated to number less than 3 percent of its historical population size (ASSRT, 2007). Prior to 1890, Secor (2002) estimated there were between 7,000 and 10,000 adult females in North Carolina and 8,000 adult females in South Carolina. Currently, there are estimated to be less than 300 adults spawning annually (total of both sexes) in the major river systems occupied by the DPS in which spawning still occurs, whose freshwater range occurs in the watersheds from the Roanoke River southward along the southern Virginia, North Carolina, and South Carolina coastal areas to the Cooper River. We have reviewed the status review report, as well as other available literature and information, and have consulted with scientists and fishery resource managers familiar with the Atlantic sturgeon in the Carolina DPS. We considered relevant substantial information and recommendations made by the peer reviewers and the public on the proposed listing rule. After reviewing the best scientific and commercial information available, we find that the Atlantic sturgeon Carolina DPS is in danger of extinction throughout its range as a result of a combination of habitat curtailment and alteration, bycatch in commercial fisheries, and inadequacy of regulatory mechanisms in ameliorating these impacts and threats, and have determined it should be listed as endangered.

South Atlantic DPS

The South Atlantic DPS is estimated to number less than 6 percent of its historical population size (ASSRT, 2007), with all river populations except the Altamaha estimated to be less than 1 percent of historical abundance. Prior to 1890, Secor (2002) estimated there were 8,000 adult spawning females in South Carolina and 11,000 adult spawning females in Georgia. Currently, there are an estimated 343 adults spawning annually in the Altamaha and less than 300 adults spawning annually (total of both sexes) in the other major river systems occupied by the DPS in which spawning still occurs, whose freshwater range occurs in the watersheds of the ACE Basin in South Carolina to the St. Johns River, Florida. We have reviewed the status review report, as well as other available literature and information, and have consulted with scientists and fishery resource managers familiar with the Atlantic sturgeon in the South Atlantic DPS. We considered relevant substantial information and recommendations made by the peer reviewers and the public on the proposed listing rule. After reviewing the best scientific and commercial information available, we find that the Atlantic sturgeon South Atlantic DPS is in danger of extinction throughout its range as a result of a combination of habitat curtailment and alteration, bycatch in commercial fisheries, and inadequacy of regulatory mechanisms in ameliorating these impacts and threats, and have determined it should be listed as endangered.

Effects of Listing

Conservation measures provided for species listed as endangered under the ESA include recovery actions (16 U.S.C. 1533(f)), critical habitat designations, Federal agency consultation requirements (16 U.S.C. 1536), and prohibitions on taking (16 U.S.C. 1538). Recognition of the species' endangered status through listing promotes conservation actions by Federal and state agencies, private groups, and individuals.

Identifying Section 7 Consultation Requirements

Section 7(a)(2) of the ESA requires Federal agencies to consult with NMFS to ensure that activities authorized, funded, or carried out by those agencies are not likely to jeopardize the

continued existence of the species or destroy or adversely modify critical habitat. We do not know how many section 7 consultations may be required for Federal agencies. From 2005 to 2010, there were 108 informal and 10 formal consultation requests for the shortnose sturgeon, a species whose range overlaps with that of Atlantic sturgeon in freshwater and estuarine habitats.

The Carolina and South Atlantic DPSs are distinguished based on genetic data and spawning locations. However, extensive mixing of the populations occurs in coastal waters. Therefore, the distributions of the DPSs outside of natal waters generally overlap with one another, and with fish from Northeast river populations. This presents a challenge in conducting ESA section 7 consultations because fish from any DPS could potentially be affected by a proposed project. Project location alone will likely not inform the section 7 biologist as to which populations to consider in the analysis of a project's potential direct and indirect effects on Atlantic sturgeon and their habitat. This will be especially problematic for projects where take could occur, because it is critical to know which Atlantic sturgeon population(s) to include in the jeopardy analysis. One conservative but potentially cumbersome method would be to analyze the total anticipated take from a proposed project as if all Atlantic sturgeon came from a single DPS and repeat the jeopardy analysis for each DPS the taken individuals could have come from. However, recently funded research may shed some light on the composition of mixed stocks of Atlantic sturgeon, relative to their rivers of origin, in locations along the East Coast. The specific purpose of the study is to evaluate the vulnerability to coastal bycatch of Hudson River Atlantic sturgeon, thought to be the largest stock contributing to coastal aggregations from the Bay of Fundy to Georgia. However, the mixed stock analysis will also allow NMFS to better estimate a project's effects on different components of a mixed stock of Atlantic sturgeon in coastal waters or estuaries other than where they were spawned. Results from the study are expected by early 2012. Genetic mixed stock analysis, such as proposed in this study, requires a high degree of resolution among stocks contributing to mixed aggregations and characterization of most potential contributory stocks. Fortunately, almost all extant populations have been characterized in previous genetic studies, though some additional populations will be characterized in this study. Genetic testing of mixed stocks will be conducted in eight coastal locales in both the Northeast and Southeast Regions. Coastal fisheries and sites were selected based on sample availabilities, bycatch concerns, and specific biological questions (*i.e.,* real uncertainty as to stock origins of the coastal aggregation).

Critical Habitat

Critical habitat is defined in section 3 of the ESA (16 U.S.C. 1532(3)) as: (1) The specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the ESA, on which are found those physical or biological features (a) essential to the conservation of the species and (b) that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by a species at the time it is listed upon a determination that such areas are essential for the conservation of the species. ''Conservation'' means the use of all methods and procedures needed to bring the species to the point at which listing under the ESA is no longer necessary.

Section 4(a)(3)(a) of the ESA (16 U.S.C. 1533(a)(3)(A)) requires that, to the extent prudent and determinable, critical habitat be designated concurrently with the listing of a species. Section 4(b)(6)(C)(ii) of the ESA provides for additional time to promulgate a critical habitat designation if such designation is not determinable at the time of final listing of a species. Designations of critical habitat must be based on the best scientific data available and must take into consideration the economic, national security, and other relevant impacts of specifying any particular area as critical habitat. The designation of critical habitat is not determinable at this time due to the extensive range of the Carolina and South Atlantic DPSs and extremely complex biological and physical requirements of Atlantic sturgeon. Although we have gathered information through the status review and public comment processes, we currently do not have enough information to determine which of these features are essential to the conservation of the two DPSs and may require special management considerations or protection. We will continue to gather and review other ongoing studies on the habitat use and requirements of Atlantic sturgeon to attempt to identify these features. Additionally, we need more time to gather the information needed to perform the required analyses of the impacts of the designation. Once areas containing the essential features are identified and mapped, and economic, national security, and other relevant impacts are considered, we will publish, in a separate rule, a proposed designation of critical habitat for the Carolina and South Atlantic DPSs.

Section 9 Take Prohibitions

ESA section 9(a) and 16 U.S.C. 1538 (a)(1)(B) take prohibitions apply to all species listed as endangered. These include prohibitions against the import, export, use in foreign commerce, or ''take'' of the species. 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.'' These prohibitions apply to all persons subject to the jurisdiction of the United States, including in the U.S. or on the high seas.

Identification of Those Activities That Would Constitute a Violation of Section 9 of the ESA

On July 1, 1994, we and USFWS published a policy to identify, to the maximum extent possible, those activities that would or would not constitute a violation of section 9 of the ESA (59 FR 34272; July 1, 1994). The intent of this policy is to increase public awareness of the effect of this listing on proposed and ongoing activities within the species' range. We will identify, to the extent known, specific activities that will not be considered likely to result in violation of section 9, as well as activities that will be considered likely to result in violation.

Activities that we believe could result in violation of section 9 prohibitions against ''take'' of the Atlantic sturgeon in the Carolina and South Atlantic DPSs include, but are not limited to, the following: (1) Capture and mortality in commercial and recreational fisheries; (2) poaching of individuals for meat or caviar; (3) marine vessel strikes; (4) destruction of or blocking access to riverine, estuarine, and marine habitat through such activities as agricultural and urban development, commercial activities, diversion of water for hydropower and public consumption, and dredge and fill operations; (5) impingement and entrainment in water control structures; (6) unauthorized collecting or handling of the species (permits to conduct these activities are available for purposes of scientific research or to enhance the propagation or survival of the DPSs); (7) releasing a captive Atlantic sturgeon into the wild; and (8) harming captive Atlantic sturgeon by, among other things, injuring or killing them through veterinary care, research, or breeding

activities outside the bounds of normal animal husbandry practices. Permits to conduct activities that may result in ''take'' of Atlantic sturgeon for scientific purposes or to enhance the propagation or survival of the DPSs may be issued under section 10 of the ESA. Such permits would be required to authorize take regardless of whether the sturgeon were in captivity at the time this final listing rule becomes effective, or are collected from the wild after this rule becomes effective.

ESA sections 10(a)(1)(A) and 10(a)(1)(B) provide NMFS with authority to grant exceptions to the section 9 take prohibitions. Section 10(a)(1)(A) scientific research and enhancement permits may be issued to entities (Federal and non-Federal) conducting research that involves a take of listed species. We have issued section 10(a)(1)(A) research and enhancement permits for other listed species for these purposes. ESA section 10(a)(1)(B) incidental take permits may be issued to non-Federal entities performing activities that may incidentally take listed species. The ESA also provides some exceptions to the prohibitions, without permits, for certain antique articles and species held in captivity at the time of listing. ESA section 10(h) allows antique articles of listed species to be excluded from essentially all the ESA prohibitions as long as they are at least 100 years old and meet certain other specified conditions. Section 9(b)(1) provides a narrow exemption for animals held in captivity at the time of listing: those animals are not subject to the import/export prohibition in section 9(a)(1)(A) or to protective regulations adopted by the Secretary under section 9(a)(1)(G), so long as the holding of the species in captivity, before and after listing, is not in the course of a commercial activity and does not violate the applicable prohibitions under ESA section 9(a)(1). However, 180 days after listing there is a rebuttable presumption that the exemption does not apply. Thus, in order to apply this exemption, the burden of proof for confirming the status of animals held in captivity prior to listing lies with the holder. The section 9(b)(1) exemption for captive wildlife would not apply to any progeny of the captive animals that may be produced post-listing.

Based on the best available information, we believe that the following actions will not result in a violation of ESA section 9: (1) Take or possession of Atlantic sturgeon acquired lawfully by permit issued by NMFS pursuant to section 10 of the ESA, or take in accordance with the terms of an incidental take statement in a biological opinion pursuant to section 7 of the ESA; (2) Federally approved projects that involve activities such as agriculture, managed fisheries, road construction, discharge of fill material, stream channelization, or diversion for which consultation under section 7 of the ESA has been completed and determined not likely to jeopardize the continued existence of the Atlantic sturgeon DPS, and when such activity is conducted in accordance with any terms and conditions given by NMFS in an incidental take statement in a biological opinion pursuant to section 7 of the ESA; (3) continued possession of live Atlantic sturgeon that were in captivity or in a controlled environment (*e.g.,* in aquaria) at the time of this listing, so long as the applicable prohibitions under an ESA section 9(a)(1) are not violated; and, (4) provision of care for live Atlantic sturgeon that were in captivity at the time of this listing.

Policies on Peer Review

On July 1, 1994, NMFS and USFWS published a series of policies regarding listings under the ESA, including a policy for peer review of scientific data (59 FR 34270; July 1, 1994), the Office of Management and Budget (2004) Bulletin on Peer Review. The intent of the peer review policies is to ensure that listings are based on the best scientific and commercial data available. We formally solicited the expert opinion of three appropriate and independent specialists regarding scientific or commercial data or assumptions related to the information considered for listing. We conclude that these experts' reviews satisfy the requirements for ''adequate [prior] peer review'' contained in the Bulletin (sec. II.2.), as well as the Services joint policy.

References

A complete list of the references used in this final rule is available on the internet at *http://sero.nmfs.noaa.gov/pr/sturgeon.htm.*

Classification

National Environmental Policy Act

The 1982 amendments to the ESA, in section 4(b)(1)(A), restrict the information that may be considered when assessing species for listing. Based on this limitation of criteria for a listing decision and the opinion in *Pacific Legal Foundation* v. *Andrus,* 675 F. 2d 825 (6th Cir. 1981), we have concluded that ESA listing actions are not subject to the environmental assessment requirements of the National Environmental Policy Act (NEPA) (See NOAA Administrative Order 216–6).

Executive Order 12866, Regulatory Flexibility Act and Paperwork Reduction Act

As noted in the Conference Report on the 1982 amendments to the ESA, economic impacts cannot be considered when assessing the status of a species. Therefore, the economic analysis requirements of the Regulatory Flexibility Act are not applicable to the listing process. In addition, this final rule is exempt from review under Executive Order 12866. This final rule does not contain a collection-of-information requirement for the purposes of the Paperwork Reduction Act.

Executive Order 13132, Federalism

Executive Order 13132 requires agencies to take into account any federalism impacts of regulations under development. It includes specific consultation directives for situations where a regulation will preempt state law, or impose substantial direct compliance costs on state and local governments (unless required by statute). Neither of those circumstances is applicable to this final listing determination. In keeping with the intent of the Administration and Congress to provide continuing and meaningful dialogue on issues of mutual state and Federal interest, the proposed rule was provided to the relevant agencies in each state in which the Carolina and South Atlantic DPSs occur, and these agencies were invited to comment. Their comments were addressed with other comments in the ''Public Comments'' section.

Executive Order 12898, Environmental Justice

Executive Order 12898 requires that Federal actions address environmental justice in the decision-making process. In particular, the environmental effects of the actions should not have a disproportionate effect on minority and low-income communities. The listing determination is not expected to have a disproportionately high effect on minority populations or low-income populations.

Coastal Zone Management Act (16 U.S.C. 1451 et seq.)

Section 307(c)(1) of the Federal Coastal Zone Management Act (CZMA) of 1972 requires that all Federal activities that affect any land or water use or natural resource of the coastal zone be consistent with the enforceable policies of approved state coastal zone management programs to the maximum extent practicable. We have determined that this action is consistent to the

maximum extent practicable with the enforceable policies of approved CZMA Programs of each of the states within the range of the two DPSs. Letters documenting NMFS' proposed determination, along with the proposed rule, were sent to the coastal zone management program offices in each affected state. A list of the specific state contacts and a copy of the letters are available upon request.

The North Carolina Department of Coastal Management (NCDCM) objected to our consistency determination and identified the following three relevant enforceable policies of their approved management program with which they believed listing Atlantic sturgeon as endangered would be inconsistent: (1) 15A NCAC07H.0203 Management Ojective of the Estuarine and Ocean System; (2) 15A NCAC 07H .0206 Estuarine Waters; and, (3) 15A NCAC 07H .0207 Public Trust Areas. NCDCM believes listing Atlantic sturgeon as proposed would be inconsistent with their objective of managing Atlantic sturgeon resources in a manner that would perpetuate the biological and economic values of marine resources within North Carolina's coastal zone because: (1) Sampling programs for many fish species would have to be immediately terminated, and (2) North Carolina's fishing industry would be affected since sampling and/or bycatch of Atlantic sturgeon would constitute unpermitted take. NCDCM expressed concern that during the time it takes to obtain ESA permits for research and bycatch in fisheries, the ability to monitor population trends and comply with data collection requirements of ASMFC's FMPs will be curtailed. NCDCM is concerned about prohibitions on gear and other hardships on North Carolina fisheries, as well as administrative burdens on the state, including having to provide observer coverage. NCDCM stated that a finding of concurrence with our consistency determination could be made if: (1) The listing was delayed until permits for take have been obtained for research and fisheries bycatch, and (2) coordination takes place with NCDMF and NCWRC to implement a data collection program to further examine the listing determination for Atlantic sturgeon.

Per 15 CFR 930.43(d) of the regulations implementing the CZMA, a Federal agency shall not proceed with the activity over the State agency's objection unless: (1) The Federal agency has concluded that under the ''consistent to the maximum extent practicable'' standard described in 15 CFR 930.32, consistency with the enforceable policies of the management program is prohibited by existing law applicable to the Federal agency, and the Federal agency has clearly described, in writing, to the State agency the legal impediments to full consistency (See 15 CFR 930.32(a) and 930.39(a)); or, (2) the Federal agency has concluded that its proposed action is fully consistent with the enforceable policies of the management program, though the State agency objects. As we discussed in our letter to NCDCM responding to their objection, section 4(b)(1)(A) of the ESA and 50 CFR 424.11(b) of the implementing regulations require that listing determinations be made solely on the basis of the best scientific and commercial data available to us and without reference to possible economic or other impacts of such a determination. In addition, sections 4(b)(3)(B) and 4(b)(6)(A) of the ESA establish mandatory deadlines under the ESA for determining whether listing of the species is warranted, and for associated rules. Those deadlines were triggered when NMFS received the listing petition from the NRDC. Therefore, per 15 CFR 930.43(d)(1), we are prohibited from considering the potential consequences, such as permitting requirements, increased regulatory responsibilities, and hardships on fisheries (*e.g.,* gear restrictions), in our listing determination, and we cannot enter into a partnership with NCDMF and NCWRC in lieu of listing Atlantic sturgeon. However, we believe these partnerships, such as the NMFS-funded section 6 project with NCDMF, North Carolina State University, South Carolina Department of Natural Resources, and the University of Georgia looking at movements of Atlantic and shortnose sturgeon, will play a crucial role in working toward conservation and recovery of the species. Further, as discussed in this final rule and in our letter to NCDCM, NMFS is taking steps that should minimize the potential impacts to the state of North Carolina's fishery sampling programs and fishing industry raised by NCDCM. For example, NMFS contacted known sturgeon researchers, at the time of publication of the proposed rule, requesting information on planned research activities to facilitate development of an expedited permitting process. We also informed NCDCM, and other North Carolina agencies, of the expedited process during a conference call in March 2011. Further, section 10(a)(1)(B) of the ESA allows NMFS to issue permits authorizing incidental take of listed species during the course of otherwise lawful activities, such as state fishery survey and sampling programs targeting species other than Atlantic sturgeon. Section 7 consultations required for any federally-authorized fisheries that take Atlantic sturgeon as bycatch would authorize such incidental take after ensuring the fishing activity would not jeopardize sturgeon. Based on these factors, we concluded pursuant to 15 CFR 930.43(d)(2) that this listing rule is consistent with the State's enforceable policies listed above that provide for managing the Atlantic sturgeon resources in a manner that would perpetuate the biological and economic values of marine resources within North Carolina's coastal zone.

List of Subjects in 50 CFR Part 224

Administrative practice and procedure, Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Dated: January 24, 2012.

Alan D. Risenhoover,

Acting Deputy Assistant Administrator for Regulatory Programs, National Marine Fisheries Service.

For the reasons set out in the preamble, 50 CFR part 224 is amended as follows:

PART 224—ENDANGERED MARINE AND ANADROMOUS SPECIES

■ 1. The authority citation for part 224 continues to read as follows:

Authority: 16 U.S.C. 1531–1543 and 16 U.S.C. 1361 *et seq.*

■ 2. In § 224.101 the table in paragraph (a) is amended by adding entries for Atlantic Sturgeon-Carolina DPS and Atlantic Sturgeon-South Atlantic DPS at the end of the table to read as follows:

§ 224.101 Enumeration of endangered marine and anadromous species.

Species		Where listed	Citation(s) for listing determination(s)	Citation(s) for critical habitat designation(s)
Common name	Scientific name			
*	*	* * *	*	*
Atlantic Sturgeon—Carolina DPS.	*Acipenser oxyrinchus oxyrinchus*.	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 Carolina DPS also includes Atlantic sturgeon held in captivity (*e.g.,* aquaria, hatcheries, and scientific institutions) and which are identified as fish belonging to the Carolina DPS based on genetics analyses, previously applied tags, previously applied marks, or documentation to verify that the fish originated from (hatched in) a river within the range of the Carolina DPS, or is the progeny of any fish that originated from a river within the range of the Carolina DPS.	[*Insert FR page number where the document begins*]; 2/6/12.	NA.
Atlantic Sturgeon—South Atlantic DPS.	*Acipenser oxyrinchus oxyrinchus*.	The South Atlantic DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) of the ACE (Ashepoo, Combahee, and Edisto) Basin southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. The marine range of Atlantic sturgeon from the South Atlantic DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The South Atlantic DPS also includes Atlantic sturgeon held in captivity (*e.g.,* aquaria, hatcheries, and scientific institutions) and which are identified as fish belonging to the South Atlantic DPS based on genetics analyses, previously applied tags, previously applied marks, or documentation to verify that the fish originated from (hatched in) a river within the range of the South Atlantic DPS, or is the progeny of any fish that originated from a river within the range of the South Atlantic DPS.	[*Insert FR page number where the document begins*]; 2/6/12.	NA.

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