NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT
SECTION 7 BIOLOGICAL AND CONFERENCE OPINION

Title:	Biological and Conference Opinion on the Issuance of a Permit (Number 25686) to the National Marine Fisheries Service's Southeast Fisheries Science Center to conduct research on sea turtles pursuant to section 10(a)(1)(A) of the Endangered Species Act of 1973
Consultation Conducted By:	Endangered Species Act (ESA) Interagency Cooperation Division, Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce
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TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

Page

1 INTRODUCTION

The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.) establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat they depend on. Section 7(a)(2) of the ESA requires Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species (ESA-listed) or adversely modify or destroy their designated critical habitat. Federal agencies must do so in consultation with the National Marine Fisheries Service (NMFS) for ESA-listed species or designated critical habitat that may be affected by the proposed action that are under NMFS jurisdiction (50 CFR §402.14(a)). If a Federal action agency determines that an action "may affect, but is not likely to adversely affect" ESA-listed species or designated critical habitat and NMFS concurs with that determination for species under NMFS jurisdiction, consultation concludes informally (50 CFR §402.13(c)). When an action "may affect, but is likely to adversely affect" threatened or endangered species, NMFS engages in formal consultation (50 CFR 402.14(g)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS provides an opinion stating whether the Federal agency's action is likely to jeopardize ESA-listed species or destroy or adversely modify designated critical habitat. If NMFS determines that the action is likely to jeopardize ESA-listed species or destroy or adversely modify critical habitat, in accordance with ESA section 7(b)(3)(A), NMFS provides a reasonable and prudent alternative that allows the action to proceed in compliance with section 7(a)(2) of the ESA. If incidental take of an ESA-listed species is expected, section 7(b)(4) requires NMFS to provide an incidental take statement (ITS), which exempts take incidental to an otherwise lawful action, and specifies the impact of any incidental taking, including necessary or appropriate reasonable and prudent measures to minimize such impacts and terms and conditions to implement the reasonable and prudent measures. NMFS, by regulation, has determined that an ITS must be prepared when take is "reasonably certain to occur" as a result of the proposed action (50 CFR §402.14(g)(7)). When the incidental take of ESA-listed marine mammals is reasonable certain to occur, the ITS specifies those measures that are necessary to comply with section 101(a)(5) of the Marine Mammal Protection Act of 1972 and applicable regulations with regard to such taking (50 C.F.R. §402.14(i)(iii)).

Section 7(a)(4) of the ESA requires federal agencies to confer with the Secretary on any action that is likely to jeopardize the continued existence of proposed species or result in the destruction or adverse modification of proposed critical habitat. For actions that are not likely to jeopardize the continued existence of a proposed species or adversely modify critical habitat, a conference can be requested by the action agency though it is not required. If requested by the federal action agency and deemed appropriate, the conference may be conducted in accordance with the procedures for formal consultation in 50 C.F.R. §402.14. An opinion issued at the conclusion of the conference may be adopted as the biological opinion when the species is listed or critical habitat is designated.

The Federal action agency for this consultation is the NMFS, Office of Protected Resources, Permits and Conservation Division (Permits Division). The Permits Division proposes to issue a permit to the NMFS Southeast Fisheries Science Center (SEFSC) to conduct research on sea turtles pursuant to section 10(a)(1)(A) of the ESA.

This consultation was completed in accordance with section 7(a)(2) of the statute (16 U.S.C. 1536 (a)(2)), associated implementing regulations (50 CFR §§402.01-402.17), and agency policy and guidance. This biological and conference opinion (opinion) was prepared by the NMFS Office of Protected Resources ESA Interagency Cooperation Division (hereafter referred to as "we" or "us"). This document represents NMFS's opinion on the effects of the proposed action on ESA-listed species and critical habitat that has been designated or proposed for those species. This opinion reflects the best available scientific information on the status and life history of ESA-listed species, the stressors resulting from the proposed action, the likely effects of those stressors on ESA-listed species and their habitats, the consequences of those effects to the fitness and survival of individuals, and the risk that those consequences pose to the survival and recovery of the threatened or endangered populations they represent.

A complete record of this consultation is on file electronically with the NMFS Office of Protected Resources in Silver Spring, Maryland.

1.1 Background

The incidental capture of ESA-listed sea turtles in commercial fishing gear threatens their recovery, and reducing this threat is a NMFS priority. The SEFSC develops and tests gear aboard fishing vessels for by-catch reduction research. This research evaluates modifications to fishing gear designed to mitigate sea turtle interactions with commercial fisheries operating in Federal and state waters in the Atlantic Ocean and Gulf of Mexico. The proposed bycatch reduction research involves the directed take of ESA-listed sea turtles through capture and post-capture handling and research procedures. The SEFSC has been a permit holder for similar research activities in the same areas since 2001, and, for each permit that included ESA-listed species, an ESA section 7 consultation was conducted. The conclusion of each of the biological opinions for these consultations was that the proposed action was not likely to jeopardize the continued existence of any ESA-listed species, and was not likely to result in the destruction or adverse modification of any designated critical habitats.

On May 5, 2017, we issued a biological opinion (NMFS 2016a) on the Permits Division issuance of a 5-year research permit (No. 20339) to the SEFSC to conduct research on sea turtles pursuant to section 10(a)(1)(A) of the ESA. The 2017 opinion concluded that the proposed action was not likely to jeopardize the continued existence of: the green turtle (*Chelonia mydas*) North Atlantic Distinct Population Segment (DPS), Kemp's ridley (*Lepidochelys kempii*), loggerhead (*Caretta*

caretta) Northwest Atlantic DPS, leatherback (*Dermochelys coriacea*), olive ridley (*Lepidochelys olivacea*) or hawksbill sea turtles (*Eretmochelys imbricata*); or five DPSs (Gulf of Maine, Carolina, South Atlantic, New York Bight, and Chesapeake Bay DPS) of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), Gulf sturgeon (*Acipenser oxyrinchus desotoi*), shortnose surgeon (*Acipenser brevirostrum*), and U.S. DPS of smalltooth sawfish (*Pristis pectinata*). We also concluded that the proposed action would not result in the destruction or adverse modification of designated critical habitat for any ESA-listed species.

Annual reports for the SEFSC's current research permit (No. 20339) were provided electronically to the NMFS consulting biologist. These annual reports demonstrate the applicant's compliance with the permit conditions.

In August 2019, the USFWS and NMFS (i.e., the Services) enacted a series of regulations that modified how the Services implemented the ESA. This consultation was initiated when the 2019 regulation changes were still in effect. On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order 2 days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological and conference opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

1.2 Consultation History

Our communication with the Permits Division and the applicant (SEFSC) regarding this consultation is summarized below:

- On July 20, 2021, the SEFSC submitted a new permit application (File No. 25686) to the Permits Division to continue the bycatch reduction study currently being conducted under Permit No. 20339.
- From August 25 through October 1, 2021, the Permits Division provided comments on the permit application and the SEFSC responded to those comments.
- On October 4, 2021, the SEFSC submitted a revised application, which the Permits Division deemed complete.
- On October 13, 2021, the Permits Division requested early technical assistance from us.
- On November 15, 2021, the Permits Division sent us a memo formally requesting initiation of the consultation, along with an initiation package.

- On December 8, 2021, we sent the Permits Division follow up questions regarding their consultation initiation package.
- On December 16, 2021, the Permits Division responded to our questions and provided additional information as requested.
- From February 28 through June 3, 2022, we provided questions and comments to the Permits Division based on our review of the biological assessment, the SEFSC application and the draft permit. During this time the Permits Division and the SEFSC responded to our questions and comments and provided additional information as requested. Several questions were related to the avoidance of gear interactions with Atlantic sturgeon near Duck, North Carolina.
- On May 12, 2022, the Permits Division, in accordance with the regulations at 50 C.F.R. section 222.304, granted an extension to the SEFSC to continue the activities authorized in Permit No. 20339-02 (set to expire on May 31, 2022) until 1) NMFS had made a decision on the new permit application (File No. 25686); or 2) the SEFSC had exhausted the total number of authorized takes for the fifth year of the permit.
- On June 27, 2022, the Permits Division emailed us a revised draft permit, the final permit application, and a file with responses from the SEFSC and the Permits Division addressing our comments and questions. The email also indicated that the following changes were made to the revised BA: 1) removed the Caribbean as part of the action area, and 2) removed the ITS for the Central and Southwest Atlantic DPS of scalloped hammerhead shark, because the revised action area no longer overlaps with this ESA-listed DPS. The email also confirmed the mutually agreed to final biological and conference opinion issuance date of April 1, 2023.
- On November 15, 2022, we notified the Permits Division that their consultation package was complete, and that we were initiating formal ESA section 7 consultation on the proposed action.
- On February 10, 2023, we emailed the Permits Division requesting they confirm with the applicant that the proposed research would not overlap with smalltooth sawfish critical habitat. Critical habitat for this species was not included in the Permits Division's BA. In a previous communication, the applicant responded that they have no plans to conduct gear research in smalltooth sawfish critical habitat, and they have indicated in their permit application that this area would be avoided.
- On February 15, 2023, we emailed the Permits Division asking if they had considered conferencing on proposed critical habitat for Nassau grouper. We also requested that they ask the applicant if they would be willing to avoid proposed critical habitat for Nassau grouper as part of the proposed action. On February 24, 2023, the Permits Division responded that the applicant would be willing to add a condition to the application to avoid Nassau grouper proposed critical habitat. The Permits Division also agreed to conference on Nassau grouper proposed critical habitat.

- On February 15, 2023, we provided the Permits Division with draft *Description of the Proposed Action* and *Action Area* sections of the biological and conference opinion for their review. The Permits Division responded and provided suggested edits.

2 THE ASSESSMENT FRAMEWORK

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species; or adversely modify or destroy their designated critical habitat.

"Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of an ESA-listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 C.F.R. §402.02).

"Destruction or adverse modification" means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of an ESA-listed species (50 C.F.R. §402.02).

This ESA section 7 formal consultation involves the following steps:

Description of the Proposed Action (Section 3): We describe the proposed action and those aspects (or stressors) of the proposed action that may alter the physical, chemical, and biotic environment, resulting in potential stressors. This section also includes the avoidance and minimization measures that have been incorporated into the project to reduce the effects to ESA-listed species.

Action Area (Section 4): We describe the action area with the spatial extent of the stressors from the action.

Species and Designated Critical Habitat that May be Affected (Section 5): We identify the ESA-listed species and designated critical habitat that are likely to co-occur with those stressors in space and time, and evaluate the status of those species and critical habitats. This section is divided into 2 subsections: 5.1) species and critical habitats that may be affected by the action, but are not likely to be adversely affected, and 5.2) species and critical habitats that may be affected by the action and are likely to be adversely affected. Species and critical habitats in subsection 5.1 are analyzed and not discussed further in the opinion. Species and critical habitats in subsection 5.2 are described in greater detail, identifying the current status of the species, their trends in abundance, recovery criteria, and designated critical habitat.

Environmental Baseline (Section 6): We describe the environmental baseline in the action area and the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impacts of state or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 C.F.R. §402.02).

Effects of the Action (Section 7): We evaluate the effects of the action on ESA-listed species and designated critical habitat. Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 C.F.R. §402.02).

During our evaluation, we determined that some stressors were not likely to adversely affect ESA-listed species (Section 7.1). The stressors that we determined were likely to adversely affect ESA-listed species or critical habitats were carried forward for additional analyses (Section 7.2). For those stressors likely to adversely affect ESA-listed species, we identify the number, age (or life stage), and gender, if possible, of ESA-listed individuals that are likely to be exposed to the stressors and the populations or subpopulations to which those individuals belong to the extent possible based on available data. This is our exposure analysis (Section 7.2.1). We evaluate the available evidence to determine how individuals of those ESA-listed species are likely to respond given their probable exposure. This is our response analysis (Section 7.2.2).

Cumulative Effects (Section 8): We describe the cumulative effects in the action area. Cumulative effects are the effects to ESA-listed species and designated critical habitat of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 C.F.R. §402.02).

Integration and Synthesis (Section 9): We integrate and synthesize by adding the effects of the action and cumulative effects to the environmental baseline in full consideration of the status of the species and critical habitat likely to be adversely affected, to formulate our opinion as to whether the action would reasonably be expected to: 1) reduce appreciably the likelihood of both the survival and recovery of the ESA-listed species in the wild by reducing its reproduction, numbers, or distribution; or 2) appreciably diminish the value of designated critical habitat as a whole for the conservation of an ESA-listed species.

Conclusion (Section 10): We state our conclusions regarding whether the action agency is able to ensure its action is not likely to jeopardize the continued existence of ESA-listed species or result in the destruction or adverse modification of designated critical habitat. If, in completing the last step in the analysis, we determine that the action under consultation is likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify designated critical habitat, we must identify a reasonable and prudent alternative(s) to the action, or indicate that to the best of our knowledge there are no reasonable and prudent alternatives (see 50 C.F.R. §402.14(h)(2)).

Incidental Take Statement: An ITS is included for those actions for which incidental take of ESA-listed species is reasonably certain to occur (50 CFR 402.14(i) and 50 CFR 402.14(g)(7)). Directed take of ESA-listed species resulting from research activities pursuant to section 10(a)(1)(A) of the ESA is not included in an ITS.

Conservation Recommendations (Section 11): As suggestions for the action agency's future ESA section 7(a)(1) actions, we also provide discretionary conservation recommendations (50 C.F.R. §402.14(j)).

Reinitiation Notice (Section 12): Finally, we identify the circumstances in which reinitiation of consultation is required (50 C.F.R. §402.16).

2.1 Evidence Available for this Consultation

To conduct the analyses necessary for this opinion and to comply with our obligation to use the best scientific and commercial data available, we considered all lines of evidence available through published and unpublished sources. We conducted electronic literature searches throughout this consultation, including within the NMFS Office of Protected Resources' electronic library. These searches were used to identify information relevant to the potential stressors and responses of ESA-listed species and designated critical habitat under NMFS's jurisdiction that may be affected by the proposed action to draw conclusions on risks the action may pose to the continued existence of these species and the value of designated (or proposed) critical habitat for the conservation of ESA-listed species. We also made use of the information and sources provided in the Permits Division's initiation package and follow up communications.

3 Description of the Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (50 C.F.R. §402.02.).

The Permits Division's proposed action is to issue a research permit to the SEFSC pursuant to Section 10(a)(1)(A) of the ESA of 1973, as amended (16 U.S.C. 1531 et seq). Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "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. The purpose of the proposed permit issuance is to allow an exception to the prohibition on takes established under the ESA. The permit will expire 5 years after the date of issuance and may be extended for up to 1 year per Federal regulation. In such cases, the Permits Division will authorize an extension for up to 1 year via a minor modification and no additional takes would be authorized during the extension; any takes that were allocated for the 5th year of the permit that were not used may be used during the extension. Thus, the annual takes proposed in the draft permit may be extended to cover a 6-year period.

The permit would authorize the permit holder to study loggerhead, Kemp's ridley, green, hawksbill, and leatherback sea turtles in inshore bays and estuaries, nearshore waters, and offshore waters of the Exclusive Economic Zone (EEZ) from: Cape Canaveral, Florida, northward to the New York/Connecticut border along the Atlantic coast; and Key West, Florida to Brownsville, Texas in the Gulf of Mexico. The purpose of the research permitted would be to evaluate modifications to commercial fishing gear to mitigate sea turtle interactions and capture under 2 projects: Project A - Turtle Excluder Device (TED) Evaluations in Atlantic and Gulf of Mexico Trawl Fisheries; and Project B - Evaluation of Longline Alternative Methods.

The SEFSC will take several measures, as specified in the permit application (SEFSC 2021) and draft permit (NMFS 2023), to minimize potential adverse effects of the proposed research activities to ESA-listed species. These include:

- Minimizing tow times to 30 minutes or less when TEDs are not used for directed captures, unless tow times are specifically exempted by regulation for the fishery;
- Use of real-time video cameras to observe the interactions with animals
- Trawling will not be initiated when marine mammals, except dolphins or porpoises, are observed in the vicinity;
- For night work, the area around the vessel will be monitored and the deck illuminated; and
- Measures to minimize adverse impacts from the proposed research procedures, as specified in the draft permit and previously analyzed in the sea turtle research programmatic (NMFS 2017b).

3.1 Turtle Excluder Device (TED) Evaluations in Atlantic and Gulf of Mexico Trawl Fisheries: Project A

The objective of Project A is to develop TEDs for trawl gear types used along the Atlantic coast and the Gulf of Mexico of the U.S. that are either not subject to the TED requirement or are required to use TEDs but may need additional studies directed at improving TED efficiency for turtle exclusion or target catch retention. This research will occur by 1) studying turtles within commercial fisheries where the capture of the animals is already authorized by an ESA Section 7 biological opinion and ITS, and 2) independent surveys operated by researchers or contracted vessels operating in state waters where capture and subsequent sampling of turtles would be authorized to test various experimental gear modifications. The proposed research, regardless of trawl gear type, will assess the effect of TED installation on the Catch Per Unit Effort (CPUE) of target catch. When wild turtles are incidentally captured, researchers will collect basic biological and ecological data to understand species composition, size distribution, movement patterns, habitat use, growth and genetic origin of turtles impacted by trawl fisheries.

In fisheries managed under Federal authority, researchers will fish gear within fishery guidelines, and all captures of sea turtles occurring in the fishery will be authorized by the ITS of the biological opinion issued for that particular fishery. In some cases the provision (50 CFR § 223.207) for use of experimental TEDs in shrimp trawl gear will be applied. In state waters, researchers conducting independent gear evaluations or contracting commercial fishing vessels will conduct experimental trawling on these vessels, and the capture of the turtles via trawling is requested under the authority of this permit. Requested take numbers include observed captures in control trawls, those turtles that are captured in the experimental trawls with TEDs, as well as turtles that will pass through the experimental trawls with TEDs but are not be captured (researchers may record the uncaptured turtles by video or sonar as they pass through the net).

The scope of work for Project A in both the Atlantic and Gulf of Mexico will include: 1) installation of approved and prototype TED designs aboard commercial trawlers, which may be single or double rigged; 2) installation of underwater video cameras or rapid updating high frequency sonar (DIDSON or ARIS) on the trawl to observe the behavior of turtles and their ability to escape through the TED; and 3) comparative assessments of the target catch from control (no TED) and experimental (TED equipped) trawls to determine the loss/gain associated with TED use. Cameras and or sonar gear will be used during some trips to detect the escape of fish or invertebrates through the TED escape opening during fishing operations.

3.2 Evaluation of Longline Gear Alternatives: Project B

The objective of Project B is to develop alternative techniques for the pelagic longline fisheries along the U.S. Atlantic coast and in the Gulf of Mexico that mitigate bycatch species, including sea turtles. Research on sea turtles under Project B will occur solely within longline commercial fisheries where the incidental capture is already exempted by an existing ESA Section 7 biological opinion and ITS (NMFS 2020). This project will involve evaluation of modifications to setting techniques that focus on “deep sets” (>100 meters [m]; 328 feet [ft]) for the pelagic longline fishery targeting yellowfin tuna as an alternative to traditional "shallow set" longline gear to avoid prohibited catches of bluefin tuna, with expected reductions in sea turtle bycatch as well. The scope of work for this project in both the Atlantic and Gulf of Mexico will include the development and evaluation of mitigation techniques, including the introduction of safe handling and release equipment to safely release sea turtles and other bycatch species in all fisheries aboard commercial fishing vessels. New release and handling equipment prototypes will be developed in the laboratory prior to field testing on live animals. When wild turtles are incidentally captured, researchers will collect basic biological and ecological data to understand species composition, size distribution, movement patterns, habitat use, growth and genetic origin of turtles impacted by this fishery. All turtles encountered during this research are expected to be captured only once, and all turtles will be handled per the guidance in the NMFS programmatic consultation (NMFS 2017b) and the Careful Release Protocols for Sea Turtle Release with Minimal Injury as applicable (NMFS 2019), and all applicable current permit conditions will be followed. If a recapture occurs, turtles will be identified, measured, and released without additional sampling.

3.3 Capture Methods

Turtles taken during Project A will be captured by otter trawl, skimmer trawl, butterfly net, or wing net gear set for fish or shellfish along the Atlantic Coast and in Gulf of Mexico. As noted above, sea turtles will be captured in commercial fisheries where the capture of the animals is already exempted by an ESA Section 7 biological opinion and ITS, and through fishery independent surveys, operated by researchers or contracted vessels, conducted in state waters where capture and subsequent sampling of turtles would be authorized under the proposed permit. Fishery independent trawl surveys will involve the use of a National Oceanic and Atmospheric Administration (NOAA) research vessel or a chartered commercial trawler (vessels would range in size from 7 to 40 m [30 to 131 ft]) to investigate candidate TED efficiency in excluding sea turtles. This research is conducted by mounting underwater cameras on a trawl in and around the candidate TED as a means of obtaining video of wild turtle escapement. The work will be conducted from October through April in a limited number of locations which are known to have high sea turtle abundance during certain times of the year, including the Cape Canaveral, FL shipping channel and the offshore waters of Georgia and South Carolina. Trawl types used for fishery independent work may include the following: traditional 2 and 4 - seam shrimp trawls with headrope lengths up to 70 ft; flounder trawls with headrope lengths up to 120 ft; and flynets with headrope lengths up to 150 ft and skimmer trawls with headrope lengths up to 30 ft. TED evaluations will occur both during daylight and evening hours. All commercial vessels that operate at night will have deck lights to allow crew to safely work. Deck lights on both commercial and research vessels are very bright to illuminate the work areas for safety and to illuminate the immediate area around the vessel. In addition, all vessels will be equipped with spotlights that can be used to illuminate objects ahead of the vessel.

During trawl sets to evaluate experimental TED installations, the incidental capture of sea turtles within the fishery will be highly unlikely, as the experimental TED will incorporate the minimum required opening dimensions for offshore waters (i.e., those large enough to exclude leatherback sea turtles) or the minimum dimensions for inshore waters, depending on the location of sampling. In some instances, trawls may be set without TEDs as a means of comparing target catch rates to sets made with a TED. Trawl sets made without TEDs have a greater potential to capture sea turtles. During trawl sets in which a TED is not installed in the trawl (i.e., tows to assess target catch rates without a TED), 1 of 2 methods to ensure a non-lethal turtle interaction will be employed: 1) tow time limitations, or 2) use of a real time video monitoring system that will allow researchers to know when a turtle enters the codend section of the trawl.

For trawling authorized under this permit (i.e., fishery independent), the following tow time limitations are a condition of the permit:

- When using a TED: Do not tow nets for longer than 240 minutes bottom time or in waters deeper than 200 m (656 ft).
- When not using a TED: Do not tow nets for longer than 30 minutes (doors in-doors out), unless specifically exempted by a regulation for the fishery as described in the permit application for longer durations by fishery, or in water deeper than 200 m (656 ft).

The use of a RF (radio frequency) real-time video monitoring system to detect turtle interactions during non-TED trawl sets in water depths of 50 m (164 ft) or less transmits real time video signals from the trawl to the towing vessel via a camera-to-surface cable. The terminal end of the cable is tethered to a float at the surface that houses an RF signal processor and transmitter (antennae). The video signal is then transmitted to the towing vessel where it is monitored by project personnel. The RF camera will be placed in the section of the trawl in which a TED would be installed (extension piece) just ahead of the codend. When a turtle is observed in the trawl with the RF camera system, the vessel captain will be instructed to commence haul back of the gear immediately to facilitate recovery of the animal if the net does not have a TED. In a TED trial, where the escape details are being evaluated, the turtle would be allowed up to 5 minutes to escape the TED. These cameras are equipped with lights and low light capabilities to visualize turtles at depth in low light conditions. If camera equipment malfunctions, the tow will be terminated and hauled back immediately.

Video monitoring of the trawl will also be used whenever conducting trawl testing in the vicinity of Duck, NC, where 75 Atlantic sturgeon were encountered on a single tow during research conducted in January 2008. In addition, the specific area where sturgeon have been captured in past research trawl sets (near Duck Pier) will be avoided by the applicant in future work. If sturgeon are observed in the net, researchers will immediately haul the gear.

Turtles may be captured by the following trawl types:

- Flynets and other High Opening Bottom Trawls: Typically 2-seam fish trawls constructed of graduated mesh sizes beginning with large mesh (16 in, 32 in, or 64 in stretched mesh) in the wings of the trawl following a slow 3:1 taper to smaller mesh sizes in the body, extension, and mesh sizes as small as 3 inches in the codend or bag section. The trawls are bottom tending with net sizes ranging from 80 to 100 ft (headrope length). Vertical height of these trawls when fished may be as much as 30 ft. Flynet vessels are single-rigged (towing 1 trawl) using a net reel for storage. Tow speeds are often between 3 and 4-knots with tow durations ranging from 10 to 240 minutes in cases where live video monitoring is used or a TED is installed. High opening bottom trawls, which are used to target scup (*Stenotomus chrysops*) and black sea bass (*Centropristis striata*), may have headrope lengths as long as 150 ft and mesh sizes up to 40 ft. Similar in general design, but of much smaller headrope size (40-75 ft) are trawls used to target inshore *Loligo* squid.

- Crab Trawls: Typically heavily chained 2-seam nets with headrope lengths from 25 to 50 ft depending on vessel size. Mesh sizes are required to be no smaller than 3 inches and no greater than 4 inches stretched mesh. The vertical opening of the trawl is approximately 3 ft and towing speed range from 2 to 4 knots depending on the horsepower of the vessel. Tow durations are 30 to 55 minutes due to the catch composition (mud associated with heavy chained nets).

- Shrimp Otter Trawls: Typically 4-seam or 2-seam in construction with headrope lengths from 12 to 100 ft depending on vessel size and location fished (inshore vs. offshore). Mesh sizes are fairly uniform throughout the Atlantic and Gulf of Mexico, ranging from 1.25 inch to 2 inch stretched. The vertical opening of a shrimp trawl is dependent on the target species of shrimp and may range from 3 to 16 ft. Towing speeds vary from 2 to 3 knots depending on size and horsepower of the towing vessel and personal preference of the fisher with tow durations up to 12 hours if equipped with TEDs. Portions of the fishery exempt from TED regulations (trawls that are hand retrieved; trawls with headropes less than 12 ft; bait shrimp trawls) must follow seasonal tow time limits (55 minute tow time limit from April through October and 75 minutes from November through March, from the time the codend enters the water until codend is retrieved from the water).

- Skimmer trawls: Used exclusively in the inshore waters of all states where the gear is allowed (Louisiana, Mississippi, Alabama, Florida, and North Carolina). The trawl is held open by a metal framework and is fished on the bottom. Skimmer trawls are "pushed" along the side of the vessel, rather than towed as conventional trawl gear. Because skimmers are typically rigged to fish higher in the water column, the potential for turtle capture may be greater than a lower opening otter trawl. The size of a skimmer trawl is regulated by each state and can vary from 15 to 30 ft in horizontal opening. For vessels not equipped with TEDs, a tow time limit follows fishery regulations (55-minute tow time limit from April through October and 75 minutes from November through March, from the time the codend enters the water until codend is retrieved from the water).

- Butterfly/Wing Nets: Consist of a square metal frame that forms the mouth of the net. Webbing is attached to the frame and tapers back to a codend. The nets can be fished from a stationary platform or a pair of nets can be attached to either side of a vessel. The vessel is then anchored in a tidal current to capture emigrating shrimp, or the nets are pushed through the water by the vessel. Tow times follow fishery regulations (55-minute tow time limit from April through October and 75 minutes from November through March, from the time the codend enters the water until codend is retrieved from the water).

Sea turtles taken on longline fishery gear (Project B) are either foul hooked, entangled, hooked in the mouth/beak, or have swallowed the hook. Leatherback sea turtles do not normally ingest the bait, but become entangled in the main and branch lines, and are usually released alive (Garrison 2003; Williams 1996). Most are foul hooked externally, often in the shoulder, armpit, and flipper areas. Loggerhead turtles frequently consume the bait and become hooked in the mouth or swallow the hook. Almost all loggerhead turtles are released alive, but they are sometimes released with hooks still embedded in their mouths or lower in the gastrointestinal tract when hook removal is not possible, and survival rates are unknown.

Commercial fishermen will fish gear within fishery guidelines, and all captures of sea turtles will occur in a fishery and are exempted by the ITS of the biological opinion issued for that particular fishery. All fisheries would be Federally managed or regulated and operating under normal fishing conditions, and researchers will conduct procedures on captured turtles.

For trawling authorized under this permit (i.e., fishery independent), researchers must comply with permit conditions to prevent interactions with marine mammals. Trawling must not be initiated when researchers observe marine mammals, except dolphins or porpoises, within the vicinity of the area being surveyed, and marine mammals must be allowed to leave or pass through the area safely before deploying nets. The applicant has also committed to monitor the surface for all ESA-listed species (including turtles and fish) during fishery independent surveys and, if observed, wait until the animals has passed before deploying trawls. If a marine mammal enters the trawl net, becomes entangled or dies, researchers must stop trawling activities immediately. If the animal is alive, it should be immediately freed from the net in a safe manner. If the animal is dead, researchers should hold the carcass and notify the appropriate NMFS Regional Stranding Coordinator within 8 hours (see https://www.fisheries.noaa.gov/contact-directory/marine-mammal-stranding-network-coordinators). If a North Atlantic right whale (*Eubalaena glacialis*) is seen, researchers must maintain a distance of at least 460 m (500 yards [yds]) from the animal. North Atlantic right whale sightings must be reported to the NMFS North Atlantic Right Whale Sighting Advisory System.

In the event of an interaction with a smalltooth sawfish, proper handling protocols as described in the NOAA Sawfish Handling and Release Guidelines will be followed to minimize injury and stress.

3.4 Sampling Methods

Turtles will be handled per the guidance in the NMFS programmatic consultation (NMFS 2017b) and the Careful Release Protocols for Sea Turtle Release with Minimal Injury as applicable (NMFS 2019), and all applicable current permit conditions will be followed. Trained scientific data collectors and/or co-investigators will be aboard each vessel participating in the study and will collect all relevant catch information. The data collectors will be trained in protected species handling and sampling by SEFSC staff experienced in sea turtle data collection. Researchers must have an experienced sea turtle veterinarian on call for emergencies, and a permitted rehabilitation facility identified for areas outside of Florida, should veterinary care be required on shore to treat a compromised turtle.

Each captured sea turtle will be assessed for general health condition and identified. As appropriate, turtles will be measured, photographed, weighed (when possible based on the size of the animal and availability of a scale), biopsied (skin), passive integrated transponder (PIT) and flipper tagged, and released. Researchers must not exceed a 4 hour maximum holding time for an animal from the time of capture to release.

Clean techniques for all general handling and measurements include regular handwashing or use of non-sterile disposable gloves and the cleaning and disinfection of equipment between individuals, as practicable. In the rare event that turtles need to be temporarily marked for identification (e.g., when multiple individuals are captured in the same haul or set), a non-toxic substance such as a livestock grease paint stick or non-toxic fingernail polish may be used.

Multi-frequency PIT tag readers will be used to scan for existing tags, and if a turtle is encountered without tags, they will be marked with 2 inconel flipper tags and one 125 -134.2 kilohertz PIT tag using a 10 or 12 millimeters (mm) PIT tag depending on turtle size. The flipper tagging sites will be disinfected using an aseptic technique, including a surgical scrub (e.g., povidone-iodine swab) and 70% isopropyl alcohol swab. For PIT tagging, the tagging site will be disinfected using aseptic technique including 2 alternating applications of a povidone-iodine swab and a 70% isopropyl alcohol swabs. PIT tags will be applied in the triceps superficialis muscle on hardshell turtles and in the dorsal musculature of the forelimb in leatherbacks. The minimum size turtle that would be given a flipper tag is 30 centimeters (cm) straight carapace length (SCL), and standard 681 Inconel tags will be used. The minimum size turtle that would be given a PIT tag is 20 cm SCL, and everyone tagging turtles smaller than 30 cm SCL will have specialized experience/training with turtles of this size. Turtles 20-30 cm SCL will be tagged with 10 mm PIT tags with a 16-gauge needle, and turtles 30 cm SCL will be tagged using either 10mm or 12 mm PIT tags until our supply of 12 mm tags is depleted and replaced with 10 mm tags.

Boated turtles larger than 20 cm SCL will have a 6mm tissue biopsy taken from the trailing edge of a rear flipper using a sterile biopsy punch, after the site has been disinfected using an aseptic technique, including 2 alternating applications of a povidone-iodine swab and 70% isopropyl alcohol swabs. Leatherback turtles and some large hardshell turtles will not be brought aboard fishing vessels unless they are equipped with a large turtle hoist apparatus. Therefore, if it is not possible to bring a turtle onboard and the researcher is equipped with remote biopsy tools, non-boated turtles may be biopsied using a surgical stainless steel 8 mm biopsy corer attached to an extended handle. They would collect a single carapace scrape for leatherbacks, and hardshell turtles would be sampled in the soft tissues (e.g., trailing edge of the rear flippers, shoulders) to collect 2 small tissue biopsy samples.

The following measurements will be taken using calipers for straight line measurements and a non-stretching flexible tape measure for curved measurements: (1) standard curved carapace length notch-to-tip; (2) standard curved carapace width; (3) SCL (standard) notch-to-tip; (4) SCL (minimum) notch-to-notch; (5) straight carapace width. Body depth measurements may be taken at the point of maximum carapace height using calipers. Weights are not taken by researchers on a regular basis, but in the event a research need arises, turtles small enough to be safely weighed (< 40 cm SCL) on a digital or durable fabric or mesh sling scale (disinfected between uses) may be weighed.

3.5 Proposed Sample Sizes

The numbers of individuals captured and research techniques performed provided in the draft SEFSC research permit for the proposed action are shown in the tables below. Table 1 shows the average annual sublethal take of all life stages of turtles (except hatchlings) in the Atlantic Ocean and Gulf of Mexico, and their estuarine and coastal environments, from capture (unless covered under another authority, as noted), handling, and research procedures under Project A: Turtle Excluder Device (TED) Evaluations in Trawl Fisheries. Table 2 shows the average annual sublethal take of all life stages of turtles (except hatchlings) in the Atlantic Ocean and Gulf of Mexico from handling and research procedures under Project B: Evaluation of Longline Alternative Methods. Table 3 shows the lethal take of all life stages of turtles (except hatchlings) in the Atlantic Ocean and Gulf of Mexico, and their estuarine and coastal environments, authorized for the life of the permit from 1) capture in fishery independent trawl surveys; and 2) handling of sea turtles captured in commercial fishery operations or in fishery independent trawl surveys. Any lethal take of turtles associated with capture during commercial fishery operations (i.e., fishery dependent) is exempted through an ITS for the ESA section 7 fishery consultation and associated NMFS biological opinion or through section 10(a)(1)(B) permits issued for each fishery.

Table 1. Average Annual Sublethal Take of all Life Stages of Turtles (except hatchlings) in the Atlantic Ocean and Gulf of Mexico, and their Estuarine and Coastal Environments, from Capture (unless covered under another authority, as noted), Handling, and Research Procedures under Project A: Turtle Excluder Device (TED) Evaluations in Trawl Fisheries

Sea Turtle Species / DPS	Take Action	Capture Details / Authority	Expected Annual Sublethal Take	Procedure
Loggerhead / Northwest Atlantic Ocean DPS	Handle/Release	Animals captured within fisheries managed by Federal authority	95	Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh
Loggerhead / Northwest Atlantic Ocean DPS	Capture/Handle /Release	Conduct experimental trawling Bottom Otter Trawl, Skimmer Trawl, Butterfly Net, Wing Net in waters managed by State authority	65	Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh
Kemp's Ridley	Handle/Release	Animals captured within fisheries managed by Federal authority	15	Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh
Kemp's Ridley	Capture/Handle /Release	Conduct experimental trawling Bottom Otter Trawl, Skimmer Trawl, Butterfly Net, Wing Net in waters managed by State authority	27	Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh
Leatherback	Handle/Release	Animals captured within fisheries managed by Federal authority	3	Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh

Leatherback	Capture/Handle /Release	Conduct experimental trawling Bottom Otter Trawl, Skimmer Trawl, Butterfly Net, Wing Net in waters managed by State authority	7	Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh
Green / North Atlantic DPS	Handle/Release	Animals captured within fisheries managed by Federal authority	7	Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh
Green / North Atlantic DPS	Capture/Handle /Release	Conduct experimental trawling Bottom Otter Trawl, Skimmer Trawl, Butterfly Net, Wing Net in waters managed by State authority	14	Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh
Hawksbill	Handle/Release	Animals captured within fisheries managed by Federal authority	3	Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh
Hawksbill	Capture/Handle /Release	Conduct experimental trawling Bottom Otter Trawl, Skimmer Trawl, Butterfly Net, Wing Net in waters managed by State authority	7	Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh
Unidentified	Other	Salvage of turtles that die within commercial fisheries managed by Federal authority	10	Salvage, (carcass, tissue, parts)

Table 2. Average Annual Sublethal Take of all Life Stages of Turtles (except hatchlings) in the Atlantic Ocean and Gulf of Mexico from Handling and Research Procedures under Project B: Evaluation of Longline Alternative Methods

Sea Turtle Species / DPS	Take Action	Capture Details / Authority	Expected Annual Sublethal Take	Procedure
Loggerhead / Northwest Atlantic Ocean DPS	Handle/Release	Animals captured within fisheries managed by Federal authority	3	Import/export/receive, parts; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh
Kemp’s Ridley	Handle/Release	Animals captured within fisheries managed by Federal authority	2	Import/export/receive, parts; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh
Leatherback	Handle/Release	Animals captured within fisheries managed by Federal authority	18	Import/export/receive, parts; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh
Green / North Atlantic DPS	Handle/Release	Animals captured within fisheries managed by Federal authority	2	Import/export/receive, parts; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh
Hawksbill	Handle/Release	Animals captured within fisheries managed by Federal authority	2	Import/export/receive, parts; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, skin biopsy; Weigh
Unidentified	Other	Salvage of turtles that die within commercial fisheries managed by Federal authority	10	Salvage, (carcass, tissue, parts)

Table 3. Lethal Take of all Life Stages of Turtles (except hatchlings) in the Atlantic Ocean and Gulf of Mexico, and their Estuarine and Coastal Environments, Authorized for the Life of the Permit

Sea Turtle Species / DPS	Take Action	Expected Lethal Take over Life of the Permit	Details
Loggerhead / Northwest Atlantic Ocean DPS	Unintentional mortality	3	Includes lethal take from capture in fishery independent trawl surveys and from handling of sea turtles captured in either commercial fishery operations or fishery independent trawl surveys
Kemp's Ridley	Unintentional mortality	2	Includes lethal take from capture in fishery independent trawl surveys and from handling of sea turtles captured in either commercial fishery operations or fishery independent trawl surveys
Leatherback	Unintentional mortality	2	Includes lethal take from capture in fishery independent trawl surveys and from handling of sea turtles captured in either commercial fishery operations or fishery independent trawl surveys
Green / North Atlantic DPS	Unintentional mortality	2	Includes lethal take from capture in fishery independent trawl surveys and from handling of sea turtles captured in either commercial fishery operations or fishery independent trawl surveys
Hawksbill	Unintentional mortality	2	Includes lethal take from capture in fishery independent trawl surveys and from handling of sea turtles captured in either commercial fishery operations or fishery independent trawl surveys

4 Action Area

Action area means all areas affected directly, or indirectly, by the Federal action, and not just the immediate area involved in the action (50 C.F.R. §402.02). Figure 1 shows the action area for the proposed SEFSC research, excluding the Caribbean (as shown in purple) and areas outside of the U.S. EEZ (dashed black line). Locations of Atlantic Coast work for Project A (i.e., TED Evaluations) will be in inshore bays and estuaries, nearshore waters (within 10 fathoms), and offshore waters of the EEZ from Cape Canaveral, Florida, northward to the New York/Connecticut border in water depths ranging from 40 to 200 m. Points of embarkation and disembarkation aboard commercial fishing vessels used in conducting project work will include: Cape Canaveral, FL; Mayport, FL; Brunswick, GA; Charleston, SC; Beaufort, NC; Wanchese, NC; Chincoteague, VA; Newport News, VA; Barnegat Light, NJ; Cape May, NJ; Shinnecock, NY; Point Judith, RI; and Gloucester, MA. For Gulf of Mexico fisheries, Project A operations may be conducted in inshore bays and estuaries, nearshore waters (within 10 fathoms) and offshore waters outside 10 fathoms) from Key West, Florida to Brownsville, Texas. Smalltooth sawfish critical habitat Nassau grouper proposed critical habitat will be avoided by researchers. Points of embarkation and disembarkation aboard commercial fishing vessels in the Gulf of Mexico include Key West, FL; Fort Myers, FL; Tampa, FL; Bon Secour, AL; Bayou La Batre, AL; Pascagoula, MS; Biloxi, MS; Grand Isle, LA; Morgan City, LA; Cameron, LA; Galveston, TX; Freeport, TX; Palacios, TX; Aransas Pass, TX; and Brownsville, TX. Locations for Project B (i.e., Evaluation of Longline Alternative Methods) will be in the coastal and offshore waters of the Gulf of Mexico. If the technique is found to be successful, additional Project B work may be conducted in the Atlantic. For both projects (A and B), because some (or all) of the work will be fishery dependent, specific areas of operation and, thus, locations of takes will be determined by the location of target catch aggregations at the time of a given trip.

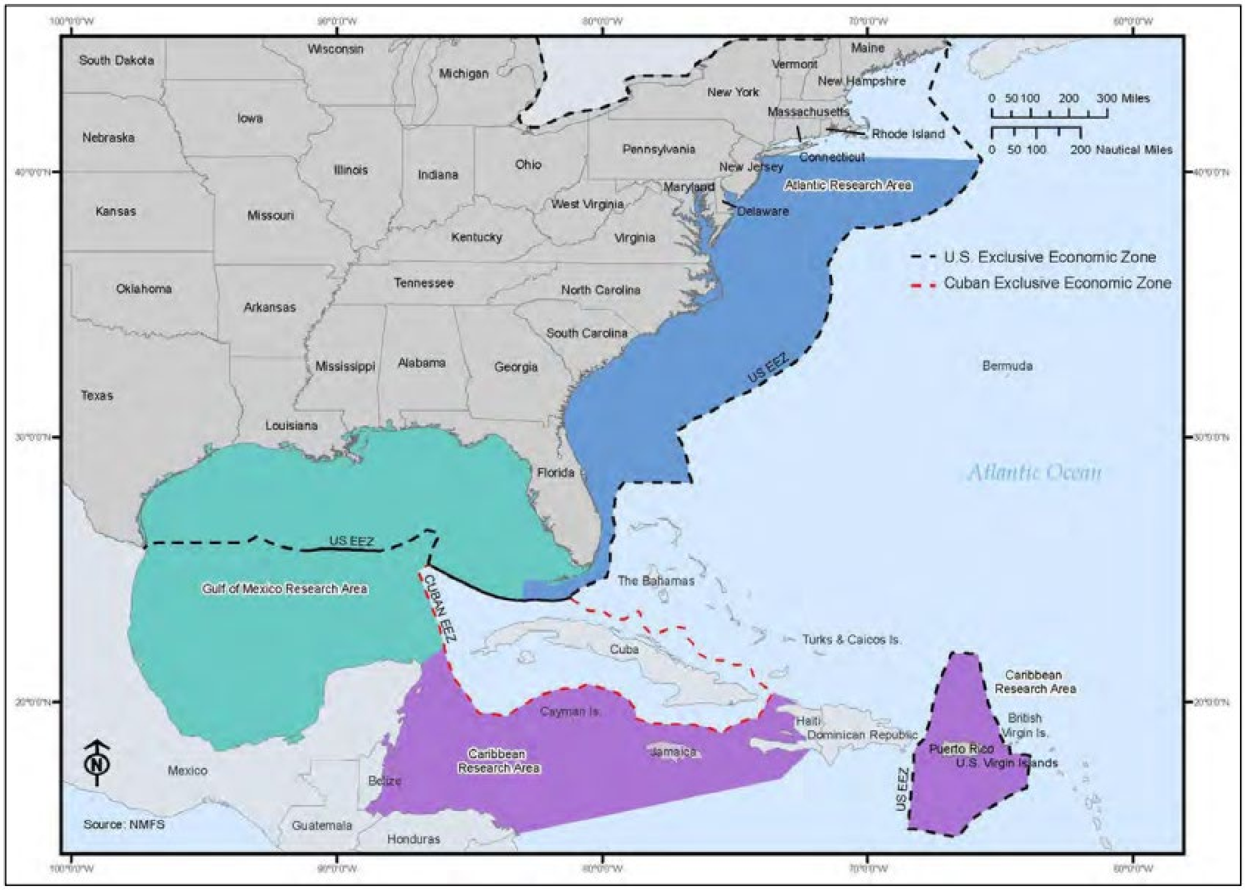

Figure 1. Action Area for Proposed SEFSC Research, Excluding the Caribbean (as shown in purple) and Areas Outside of the U.S. EEZ (dashed black line)

5 Species and Designated Critical Habitat that May be Affected

This section identifies the ESA-listed species and designated critical habitat that occur within the action area and overlap with the action in time and space such that they may be affected by the proposed action. This section also identifies the regulatory status of those species (Table 4). Section 5.1 identifies those species and critical habitats that may be affected but are not likely to be adversely affected by the proposed action because the effects of the proposed action, evaluated by each stressor, were deemed insignificant, discountable, or fully beneficial. In Section 5.2, we provide a summary of the biology, ecology, and population status of those species that are likely to be adversely affected by one or more stressors created by the proposed action, including detailed information on their life histories in the action area, if known. The species that are likely to be adversely affected by the proposed action are carried forward in our effects analysis (Section 7).

Table 4. ESA-listed Species and Designated (or proposed) Critical Habitat that may be Affected by the Proposed Action.

Species	ESA Status	Critical Habitat	Recovery Plan
Marine Mammals – Cetaceans			
North Atlantic Right Whale (*Eubalaena glacialis*)	E – 73 FR 12024	81 FR 4837	70 FR 32293 08/2004
Blue Whale (*Balaenoptera musculus)*	E – 35 FR 18319	-- --	07/1998 10/2018
Sei Whale (*Balaenoptera borealis*)	E – 35 FR 18319	-- --	12/2011
Sperm Whale (*Physeter macrocephalus*)	E – 35 FR 18319	-- --	75 FR 81584 12/2010
Fin Whale (*Balaenoptera physalus)*	E – 35 FR 18319	-- --	75 FR 47538 07/2010
Rice's whale (*Balaenoptera ricei)*	E - 84 FR 15446	-- --	
Marine Reptiles			
Green Turtle (*Chelonia mydas*) – North Atlantic DPS	T – 81 FR 20057	63 FR 46693*	FR Not Available 10/1991 – U.S. Atlantic
Hawksbill Turtle (*Eretmochelys imbricata)*	E – 35 FR 8491	63 FR 46693*	57 FR 38818
Kemp's Ridley Turtle (*Lepidochelys kempii*)	E – 35 FR 18319	-- --	03/2010 – U.S. Caribbean, Atlantic, and Gulf of Mexico 09/2011

Species	ESA Status	Critical Habitat	Recovery Plan
Leatherback Turtle (*Dermochelys coriacea*)	E – 35 FR 8491	44 FR 17710* and 77 FR 4170*	10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico 63 FR 28359
Loggerhead Turtle (*Caretta caretta*) – Northwest Atlantic Ocean DPS	T – 76 FR 58868	79 FR 39855	74 FR 2995 10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico 01/2009 – Northwest Atlantic
Fishes			
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) – Carolina DPS	E – 77 FR 5913	82 FR 39160*	3/2018- Outline
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) – Chesapeake Bay DPS	E – 77 FR 5879	82 FR 39160*	3/2018- Outline
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) – Gulf of Maine DPS	T – 77 FR 5879	82 FR 39160*	3/2018- Outline
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) – New York Bight DPS	E – 77 FR 5879	82 FR 39160*	3/2018- Outline
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) – South Atlantic DPS	E – 77 FR 5913	82 FR 39160*	3/2018- Outline
Gulf sturgeon (*Acipenser oxyrinchus desotoi*)	T - 56 FR 49653	68 FR 13369	1995
Shortnose Sturgeon (*Acipenser brevirostrum*)	E – 32 FR 4001	-- --	63 FR 69613
Ocean Whitetip Shark (*Carcharinus lonigmanus*)	T - 83 FR 4153	-- --	9/2018- Outline
Giant Manta Ray (*Mobula birostris*, formerly *Manta birostris*)	T – 83 FR 2916	-- --	-- --
Smalltooth Sawfish (*Pristis pectinata*) – U.S. portion of range DPS	E – 68 FR 15674	74 FR 45353*	74 FR 3566 01/2009
Nassau grouper (*Epinephelus striatus*)	T – 81 FR 42268	Proposed 87 FR 62930	8/2018- Outline

*Indicates that critical habitat exists for this species, but either does not overlap with the action area or there is no pathway for effects to the physical and biological features (PBFs) of this critical habitat.

5.1 Species and Critical Habitat Not Likely to be Adversely Affected

NMFS uses 2 criteria to identify the ESA-listed species and designated (or proposed) critical habitat that are not likely to be adversely affected by the proposed action. The first criterion is exposure, or some reasonable expectation of a co-occurrence, between one or more potential stressors associated with the proposed activities and ESA-listed species or critical habitat. If we conclude that an ESA-listed species or critical habitat is not likely to be exposed to the proposed activities, we must also conclude that the species or critical habitat is not likely to be adversely affected by those activities.

The second criterion is the probability of a response given exposure. An ESA-listed species or critical habitat that co-occurs with a stressor of the action but is not likely to respond to the stressor is also not likely to be adversely affected by the proposed action.

The probability of an effect on a species or designated (or proposed) critical habitat is a function of exposure intensity and susceptibility of a species to a stressor's effects (i.e., probability of response). An action warrants a "may affect, not likely to be adversely affected" finding when its effects are *wholly beneficial, insignificant* or *discountable*.

Wholly beneficial effects have an immediate positive effect without any adverse effects to the species or habitat. *Insignificant* effects relate to the size of the impact and should never reach the scale where take of a listed species or an impact to the conservation value of a physical or biological feature of critical habitat is expected. Based on best judgment, a reasonable person would not be able to meaningfully measure, detect, or evaluate insignificant consequences on the listed species and critical habitat. *Discountable* applies to those effects that are extremely unlikely to occur to the listed species or critical habitat. Based on best judgment, a reasonable person would not expect the effect to occur to the listed species or critical habitat. We applied these criteria to the ESA-listed species in Table 4. We summarize our results below for ESA-listed species and critical habitat that are not likely to be adversely affected by any stressor created by the proposed action.

5.1.1 Giant Manta Ray

Giant manta rays are commonly found offshore in oceanic waters, but are sometimes found in shallow waters (less than 10 m) during the day (Lawson et al. 2017; Miller and Klimovich 2017). In the Atlantic Ocean, giant manta rays have been observed as far north as New Jersey. The only abundance data for giant manta rays in the action area comes from the Flower Garden Banks Marine Sanctuary in the Gulf of Mexico, with more than 70 individuals estimated (Miller and Klimovich 2017).

Giant manta rays are very rare in the U.S. bottom longline, trawl, and gillnet fisheries operating in the western Atlantic (NMFS 2021a). NEFSC observer data from 2001-2018 confirm that 2 giant manta rays (both in 2014) and 7 unknown ray species were captured in bottom otter trawl gear, and another 4 rays captured in gillnet gear may have been giant manta rays. From 2008 through 2016, fisheries observers documented 3 giant manta rays in bottom longline fisheries (one in the Gulf of Mexico reef fish fishery and 2 in the South Atlantic shark bottom longline research fishery). During 2005-2012, 10 giant manta rays were reported as caught in Coastal Migratory Pelagics gillnet gear. Bycatch of manta rays is also low in the Southeast U.S. gillnet fisheries. The NMFS Southeast Gillnet Observer Program covers all anchored (sink and stab), strike, and drift gillnet fishing by vessels operating in waters from Florida to North Carolina and the Gulf of Mexico. From 1998-2015, the number of mantas (i.e., all species) observed captured in these fisheries ranged from 0 to 16, with no mantas of any species being caught as bycatch since 2013 based on observer data.

Given their low abundance in the action area and the relatively small amount of vessel activity proposed for fishery dependent sampling as a result of the proposed action, it is extremely unlikely that there will be interactions between giant manta rays and the research vessels or sampling gear. Because it is extremely unlikely that giant manta rays will interact with sampling gear or vessels, any effects of the proposed action on giant manta rays are discountable. Therefore, we conclude that this action may affect, but is not likely to adversely affect giant manta rays.

5.1.2 Oceanic Whitetip Shark

In the western Atlantic, oceanic whitetip sharks occur from Maine to Argentina, including the Caribbean and Gulf of Mexico. This highly migratory species is usually found offshore in the open ocean, on the outer continental shelf, or around oceanic islands (Bonfil et al. 2008; Young et al. 2018). Although oceanic whitetip sharks could potentially interact with the proposed research activities, these sharks are typically found farther offshore than the proposed action area. Oceanic whitetip sharks are also unlikely to interact with the proposed research trawl gear that is fished deeper in the water column than this species typically occupies. Given their offshore distribution and the relatively small amount of vessel activity proposed for fishery independent sampling, it is extremely unlikely that there will be interactions between oceanic whitetip sharks and the research vessels proposed for this action. In summary, we find that the likelihood that the proposed research activities will interact with oceanic whitetip sharks is discountable. Therefore, we conclude that this action may affect, but is not likely to adversely affect oceanic whitetip sharks.

5.1.3 Nassau Grouper

The distribution of Nassau grouper in Florida waters is from Cape Canaveral south through the Florida Keys and Florida Bay westward to the Dry Tortugas and Pulley Ridge. They are fairly uncommon in Florida and are considered rare in the Gulf of Mexico (NMFS 2013c). Historically, Nassau grouper was a component of the grouper fishery in Florida, suggesting once healthy subpopulations in southeastern U.S. mainland waters (Sadovy and Eklund 1999). However, due primarily to overexploitation by the end of the 20th century, this species is rarely encountered within Florida waters in more recent decades (Sadovy and Eklund 1999). Cumulative data from Reef Environmental Education Foundation[1] (REEF) showed 1,322 Nassau grouper in 9,706

[1] http://www.reef.org/db/reports/dist/species/TWA/0097/2003-01-01/2013-04-07

surveys (density index 1.2, sighting frequency 13.6%) over the 10-year period from 2003-2013. Surveys up the east coast of Florida to Jupiter Inlet reported 83 Nassau grouper in 6,763 surveys (density index 1.2, sighting frequency 1.2%) and on the west coast of Florida, from Cape Sable to Tampa Bay, 12 Nassau grouper in 590 surveys (density index 2, sighting frequency 2%).

Commercial landings of Nassau grouper off Florida's Atlantic coast were primarily by handlines, although catches from spearfishing took more than one quarter of the commercial landings in some years (Sadovy and Eklund 1999). In the eastern Gulf of Mexico, handlines and longlines accounted for 80-100% of Nassau grouper commercially landed, by weight, from 1986-1992 (Sadovy and Eklund 1999). Nassau grouper still occasionally show up as bycatch in various fisheries around south Florida, including hook-and-line, longline, and trap fisheries. While capture in trawl gear could occur, there is little information regarding incidental capture of Nassau grouper in this gear type. Given this species' affinity for habitat with benthic structure (e.g., coral reefs, boulders, rubble), bottom trawling operations would likely avoid many of the areas where this species is known to occur.

The applicant's bycatch data show that no interactions have occurred with this species in research trawl surveys over many years at sampling activity levels similar to those proposed. In addition, the applicant indicated they will avoid trawling in areas of proposed critical habitat for this species, further reducing the likelihood of capture in research trawl gear. Given their rare occurrence in the action area, the relatively small amount of fishery dependent research sampling proposed, and the avoidance of sampling in areas of proposed critical habitat where the species is more likely to be present, it is extremely unlikely that there will be interactions between Nassau grouper and the research vessels or sampling gear proposed for this action. Because it is extremely unlikely that Nassau grouper will interact with sampling gear or vessels, any effects of the proposed action on this species are discountable. Therefore, we conclude that this action may affect, but is not likely to adversely affect Nassau grouper.

5.1.4 Large Whale Species

The ESA-listed large whales shown in Table 4 could intermittently occur in the vicinity of an active fishery independent study location, and thus may be inadvertently approached or unintentionally exposed to interactions with research vessels and fishing gear when the proposed permitted research takes place. However, such encounters are expected to be extremely rare and, if they do occur, any effects are expected to be minor and short-term, with the whales temporarily leaving the area for a short period of time, if disturbed. The proposed research methods, in terms of capture gear and mitigations provided in the draft permit, are designed to limit large whale interactions and any potential impacts resulting from such interactions. These include the following:

- Researchers must make every effort to prevent interactions with marine mammals and must be aware of the presence and location of marine mammals at all times;
- Researchers must discontinue deployment of trawl nets when large whales are observed in the vicinity of the area being surveyed;

- Large whales must be allowed to leave or pass through the area safely before researchers can return to deploying gear; and
- If a North Atlantic right whale is seen, researchers must maintain a distance of at least 460 m (500 yds) from the animal.

Given the relatively small amount of vessel activity proposed for fishery independent sampling, the relatively low abundance of large whales in the action area, and the proposed mitigation measures, it is extremely unlikely (i.e., discountable) that there will be any vessel strikes of large whales by the research vessels proposed for this action. It is also extremely unlikely (i.e., discountable) that a large whale would be entangled in fishing gear deployed by the research vessels proposed for this action. Any disturbance of large whales resulting from vessel movement or noise would likely by minor and short-term, resulting in only insignificant effects on these species.

In summary, we find that any effects resulting from the proposed research activities on large whales are either discountable (i.e., for vessel strike and entanglement in fishing gear) or insignificant (i.e., for vessel noise and disturbance). Therefore, we conclude that this action may affect, but is not likely to adversely affect blue whales, fin whales, sei whales, sperm whales, Rice's whales, and North Atlantic right whales.

5.1.5 North Atlantic Right Whale Critical Habitat

Critical habitat for North Atlantic right whales was designated in 1994 and expanded in 2016. Presently, North Atlantic right whale designated critical habitat includes 2 major units: Unit 1 located in the Gulf of Maine and Georges Bank Region, and Unit 2 located off the coasts of North Carolina, South Carolina, Georgia, and Florida. Unit 1 does not overlap with the action area.

Unit 2 consists of an important calving area and contains the following PBFs essential to the conservation of the species: sea surface conditions associated with Force 4 or less on the Beaufort Scale, sea surface temperatures of 7 to 17 °Celsius (°C), and water depths of 6 to 28 m, where these features simultaneously co-occur over contiguous areas of at least 231 square nautical miles (NM^2) of ocean waters during the months of November through April. While the proposed research actions would directly overlap with some of these essential features, very few if any, effects are possible. For example, the proposed activities would not significantly alter the physical or oceanographic conditions within the action area, as only minor changes in water flow, current and noise level would be expected from the research vessels, and no changes in ocean bathymetry would occur. We find that any effects resulting from the proposed research activities on North Atlantic right whale critical habitat would be insignificant. Therefore, we conclude that this action may affect, but is not likely to adversely affect North Atlantic right whale critical habitat.

5.1.6 Northwest Atlantic DPS Loggerhead Sea Turtle Critical Habitat

On July 10, 2014, NMFS and the U.S. Fish and Wildlife Service designated critical habitat for the Northwest Atlantic Ocean DPS of loggerhead turtles along the U.S. Atlantic and Gulf of

Mexico coasts from North Carolina to Mississippi (79 FR 39856; Figure 2). The critical habitat is categorized into 38 occupied marine areas and 1,102.4 kilometers (km; 685 miles [mi]) of nesting beaches. These areas contain one or a combination of nearshore reproductive habitat, winter area, breeding areas, and migratory corridors.

As discussed previously, any effects of commercial fishing vessel (i.e., fishery dependent) sampling on ESA-listed species or critical habitat are covered under separate section 7 biological opinions and ITSs for those particular fisheries (NMFS 2021a). Potential overlap between the proposed fishery independent portion of the action area and loggerhead critical habitat occurs in the following areas and habitat types:

- North Carolina constricted migratory habitat, offshore winter habitat, and nearshore reproductive habitat;
- South Carolina nearshore reproductive habitat;
- Georgia nearshore reproductive habitat; and
- EEZ east coast *Sargassum* habitat.

NMFS identified PBFs essential to the conservation of loggerhead sea turtles for each of these habitat types as follows:

- Constricted Migratory Critical Habitat: 1) Constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways, and 2) passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas.
- Winter Critical Habitat: 1) Water temperatures above 10° C during the colder months of November through April, 2) continental shelf waters in proximity to the western boundary of the Gulf Stream, and 3) water depths between 20 and 100 m.
- Nearshore Reproductive Critical Habitat: 1) Nearshore waters with direct proximity to nesting beaches that support critical aggregations of nesting turtles (e.g., highest density nesting beaches) to 1.6 km (1 mi) offshore, 2) waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water, and 3) waters with minimal manmade structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents.
- *Sargassum* Critical Habitat: 1) Convergence zones, surface-water downwelling areas, and other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for the optimal growth of *Sargassum* and inhabitance of loggerheads, 2) *Sargassum* in concentrations that support adequate prey abundance and cover, 3) available prey and other material associated with *Sargassum* habitat such as, but not limited to, plants and cyanobacteria and animals endemic to the *Sargassum* community such as hydroids and copepods, and 4) sufficient water depth and proximity to available currents to ensure offshore transport, and foraging and cover requirements by

Sargassum for post-hatchling loggerheads, i.e., > 10 m depth to ensure not in surf zone.

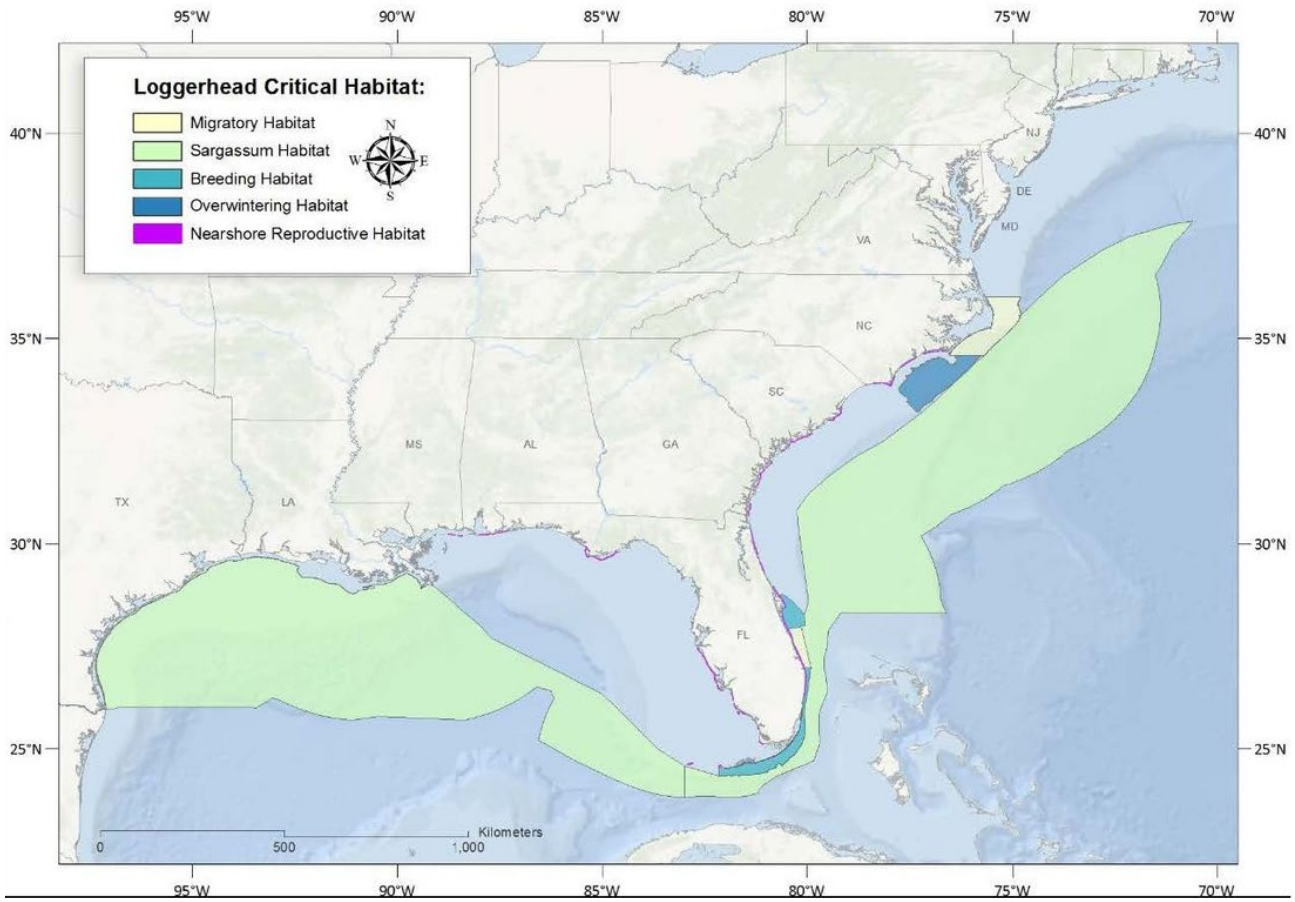

Figure 2. Map Identifying Designated Critical Habitat for the Northwest Atlantic Ocean DPS of Loggerhead Sea Turtle

Nearshore reproductive habitats are not expected to be impacted because all work will occur outside 1.6 km (1 mi) offshore from high density nesting beaches. Work within 1.6 km (1 mi) of shore (e.g., Panama City TED testing) does not overlap with loggerhead nearshore reproductive critical habitat. All feasible efforts will be made to avoid impacting nesting grounds, migratory routes, feeding sites, and benthic habitat in loggerhead critical habitat.

The anticipated volume, location, and times that the proposed fishery independent research capture gear will overlap with loggerhead critical habitat will not result in significant impacts on the movement of sea turtles through the surf zone and outward toward open water or during coastal migrations. Research vessel movement and dragging trawls through the water column could all result in some disturbance of *Sargassum* and the biotic communities they support. However, given the relatively low level of fishery independent research sampling proposed within the U.S. EEZ, we anticipate that the amount of *Sargassum* critical habitat disturbed will be extremely small relative to the large area designated as this type of habitat along the Atlantic

Coast and in the Gulf of Mexico (Figure 2). Therefore, any effects of the proposed action on *Sargassum* critical habitat will likely be insignificant. In addition, research vessels will likely try to avoid *Sargassum* to minimize the risk of fouling vessel propellers and sea turtle vessel strike.

In summary, we determine that the stressors associated with the proposed research activities will have an insignificant effect on the above-mentioned PBFs for loggerhead sea turtle Northwest Atlantic DPS designated critical habitat. Given the PBFs of designated critical habitat, we determine that the proposed action is not likely to adversely affect loggerhead sea turtle Northwest Atlantic DPS designated critical habitat.

5.1.7 Gulf Sturgeon Critical Habitat

NMFS and USFWS jointly designated Gulf sturgeon critical habitat on April 18, 2003 (50 CFR §226.214). Critical habitat units encompass a total of 2,783 river km (1,729 mi) and 6,042 km^2 (2,333 mi^2) of estuarine and marine habitats. NMFS's jurisdiction encompasses the 7 units (Units 8-14) in marine and estuarine waters (Figure 3). Gulf sturgeon use the lower riverine, estuarine, and marine environment during winter months primarily for feeding and for inter-river migrations.

NMFS and USFWS identified 7 habitat features essential for the conservation of Gulf sturgeon. Four of these features are found in the marine and estuarine units of critical habitat:

- Abundant food items, such as detritus, aquatic insects, worms, and/ or mollusks, within riverine habitats for larval and juvenile life stages; and abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, mollusk and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages;
- Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages;
- Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages; and
- Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats (e.g., an unobstructed river or a dammed river that still allows for passage).

As discussed previously, any effects of commercial fishing vessel (i.e., fishery dependent) operations on ESA-listed species or critical habitat are covered under separate section 7 biological opinions and ITSs for those particular fisheries (NMFS 2021a). There is potential for overlap between the proposed fishery independent portion of the action area and Gulf sturgeon critical habitat. However, given the anticipated volume, location, and times that the proposed fishery independent research capture gear would overlap with Gulf sturgeon critical habitat, significant impacts to prey, water/sediment quality or migratory pathways of this species are unlikely to occur. To further limit the potential for interactions with Gulf sturgeon while they are occupying areas of critical habitat, all late fall and winter (November-March) trawl activities will be limited to at least 1.6 km (1 mi) offshore of Gulf Islands National Seashore (NMFS 2021c).

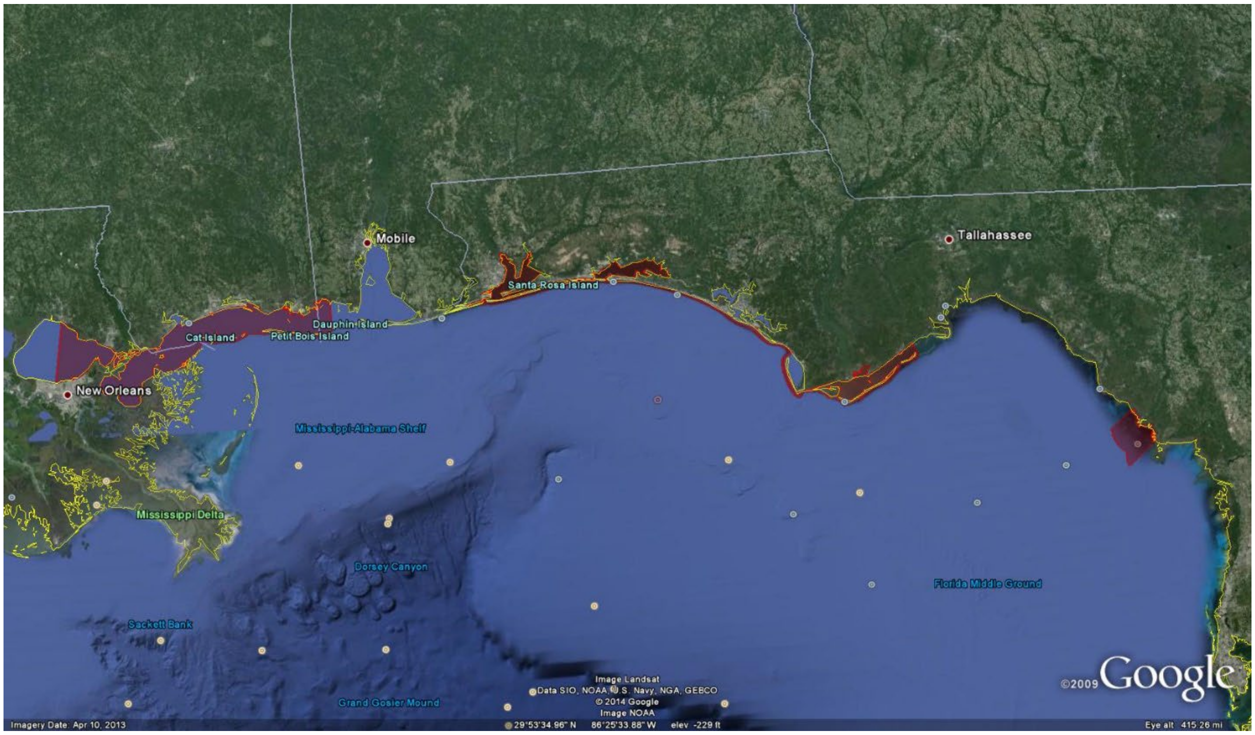

Figure 3. Gulf sturgeon Critical Habitat in Estuarine and Marine Waters: Units 8-14

In summary, the stressors associated with the proposed research activities will have an insignificant consequence on the above-mentioned PBFs. Given the PBFs used to designate critical habitat, we determine that the proposed action is not likely to adversely affect Gulf sturgeon designated critical habitat.

5.1.8 Nassau Grouper Proposed Critical Habitat

NMFS is proposing to designate critical habitat for the threatened Nassau grouper pursuant to section 4 of the ESA (87 FR 62930). Specific occupied areas proposed for designation as critical habitat contain approximately 2,353.19 km^2 (908.57 mi^2) of aquatic habitat located in waters off the coasts of southeastern Florida, Puerto Rico, Navassa, and the United States Virgin Islands (NMFS 2022c). Proposed critical habitat units off Florida that may overlap with the action area are shown in Figure 4.

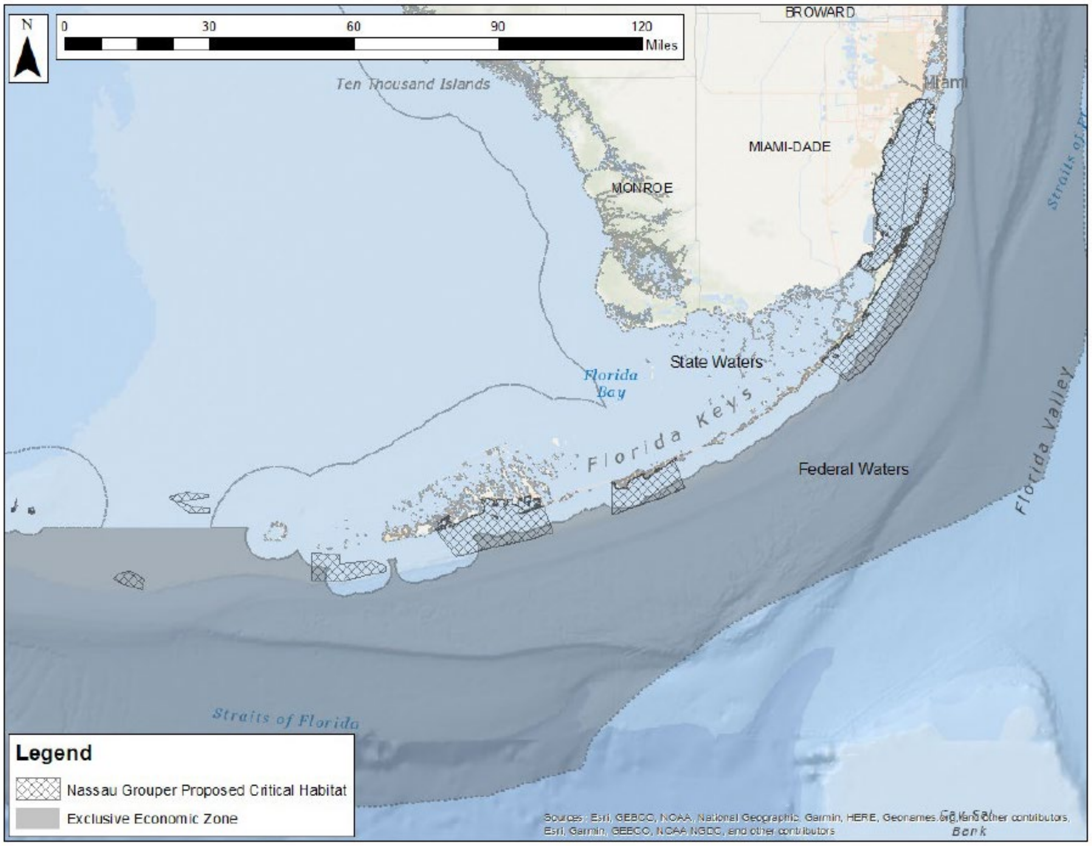

Figure 4. Nassau Grouper Proposed Critical Habitat Units off Florida (NMFS 2022c)

NMFS has identified the following features essential to the conservation of Nassau grouper:

1) Contiguous areas from nearshore to offshore necessary for development and growth of Nassau grouper containing a variety of natural or artificial benthic types that provide cover from predators and habitat for prey, consisting of the following: a) nearshore shallow subtidal marine nursery areas with substrate that consists of unconsolidated calcareous medium to very coarse sediments (not fine sand) and shell and coral fragments and may also include cobble, boulders, whole corals and shells, or rubble mounds, to support larval settlement and provide shelter from predators during growth and habitat for prey; b) intermediate hard bottom and seagrass areas in close proximity to the nearshore shallow subtidal marine nursery areas that protect growing fish from predation as they move from nearshore nursery areas into deeper waters and provide habitat for prey; c) offshore linear and patch reefs in close proximity to intermediate hard bottom areas that contain multiple benthic types: coral reef, colonized hardbottom, sponge habitat, coral rubble, rocky outcrops or ledges, and artificial habitat of sufficient complexity to function as a reef (e.g., shipwrecks) to provide shelter from predation during maturation and habitat for prey; and d) structures between the subtidal nearshore area and the intermediate hard bottom area and the offshore reef area including overhangs, crevices,

depressions, blowout ledges, holes, and other types of biological, geological, or artificial formations of varying sizes and complexity to support juvenile and adults as movement corridors that include temporary refuge opportunities that reduce predation risk as Nassau grouper move from nearshore to offshore habitats.

2) Contiguous areas from nearshore to offshore known marine areas used for spawning including adjacent areas used for movement and staging associated with reproduction (NMFS 2022c).

As discussed previously, any effects of commercial fishing vessel (i.e., fishery dependent) operations on ESA-listed species or critical habitat are covered under separate section 7 biological opinions and ITSs for those particular fisheries (NMFS 2021a). There is potential for overlap between the proposed fishery independent portion of the action area and proposed Nassau grouper critical habitat. However, the applicant indicated that they will avoid conducting research trawling in proposed Nassau grouper critical habitat. While research vessels may transit through proposed critical habitat, there is no pathway for effects from the stressors associated with vessel movement to the PBF associated with benthic habitat, as described above. In addition, given the low volume of vessel activity proposed, any effects on the contiguous marine areas used by Nassau grouper for spawning would be insignificant. No Nassau grouper spawning aggregation sites have been reported in Florida waters.

In summary, the stressors associated with the proposed research actions will have only insignificant effects on the above-mentioned PBFs of proposed Nassau grouper critical habitat. Therefore, we determine that the proposed action is not likely to adversely affect proposed Nassau grouper critical habitat.

5.2 Status of Species Likely to be Adversely Affected

This opinion examines the status of the following ESA-listed species (or DPSs) that are likely to be adversely affected by the proposed action: green turtle – North Atlantic DPS; hawksbill turtle; Kemp’s ridley turtle; leatherback turtle; loggerhead turtle – Northwest Atlantic DPS; Atlantic sturgeon - Gulf of Maine DPS, New York Bight DPS, Chesapeake Bay DPS, South Atlantic DPS, and Carolina DPS; shortnose sturgeon; Gulf sturgeon; smalltooth sawfish – U.S. portion of the range DPS; and Nassau grouper.

The evaluation of adverse effects in this opinion begins by summarizing the biology and ecology of those species that are likely to be adversely affected and what is known about their life histories in the action area. The status is determined by the level of risk that the ESA-listed species face based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This helps to inform the description of the species’ current “reproduction, numbers, or distribution” that is part of the jeopardy determination as described in 50 C.F.R. §402.02. More detailed information on the status and trends of these ESA-listed species, and their biology and ecology can be found in the listing regulations and critical habitat designations published in the Federal Register, status reviews, recovery plans, and on NMFS's website: https://www.fisheries.noaa.gov/species-directory/threatened-endangered.

5.2.1 Green Sea Turtle – North Atlantic DPS

The green turtle is globally distributed and commonly inhabits nearshore and inshore waters, occurring throughout tropical, sub-tropical and, to a lesser extent, temperate waters. Green turtles from the North Atlantic DPS range from the boundary of South and Central America (7.5° North, 77° West) in the south, throughout the Caribbean, the Gulf of Mexico, and the U.S. Atlantic coast to New Brunswick, Canada (48° North, 77° West) in the north (Figure 4). The range of the North Atlantic DPS then extends due east along latitudes 48° North and 19° North to the western coasts of Europe and Africa (Figure 4). Nesting occurs primarily in Costa Rica, Mexico, Florida, and Cuba.

The green turtle was listed under the ESA on July 28, 1978 (43 FR 32800). The species was separated into 2 ESA-listing designations: endangered for breeding populations in Florida and the Pacific coast of Mexico and threatened in all other areas throughout its range. On April 6, 2016, NMFS listed 11 DPSs of green turtles as threatened or endangered under the ESA. The North Atlantic DPS of green turtle, which is the only DPS that overlaps with the action area, is listed as threatened.

Life History

Age at first reproduction for females is 20 to 40 years. Green turtles lay an average of 3 nests per season with an average of 100 eggs per nest. The remigration interval (i.e., return to natal beaches) is 2 to 5 years. Nesting occurs primarily on beaches with intact dune structure, native vegetation, and appropriate incubation temperatures during summer months. After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to live for several years. During this life stage, green turtles feed close to the surface on a variety of marine algae and other life associated with drift lines and debris. Adult sea turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green turtles spend the majority of their lives in coastal foraging grounds, which include open coastlines and protected bays and lagoons. Adult green turtles feed primarily on seagrasses and algae, although they also eat jellyfish, sponges, and other invertebrate prey.

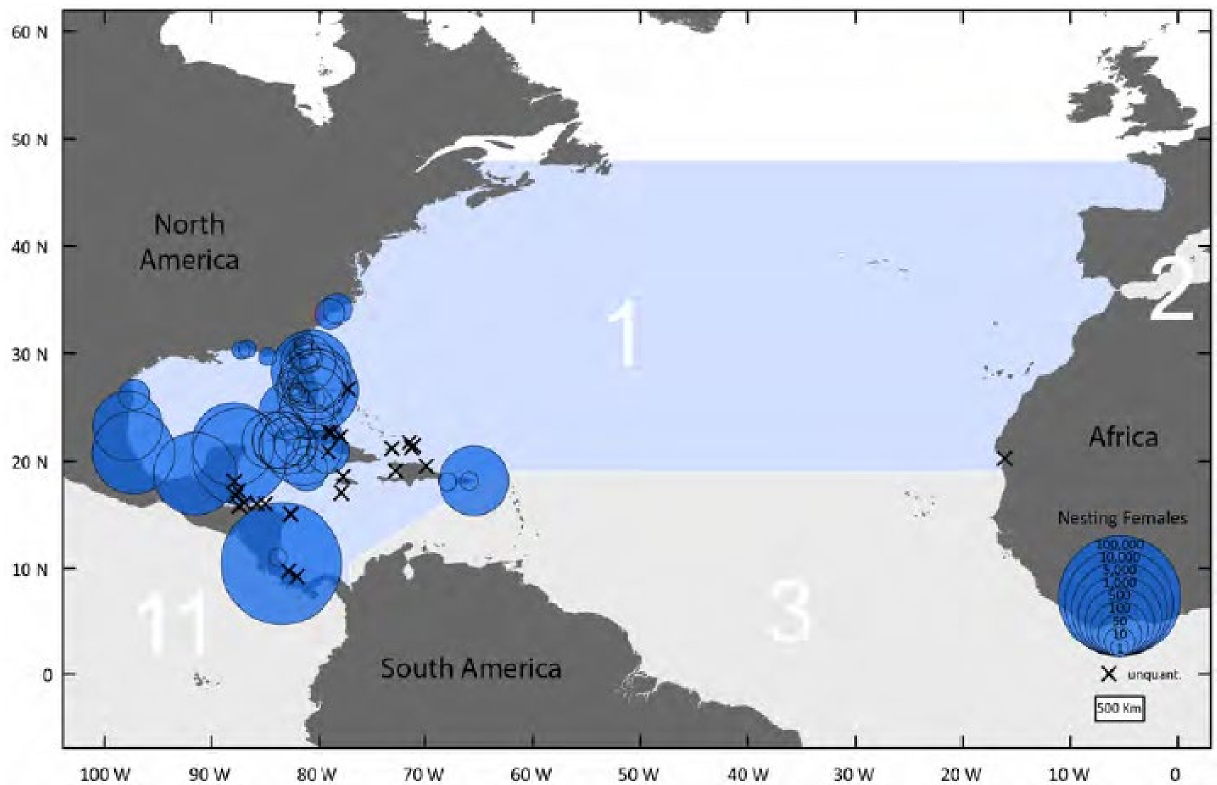

Figure 5. Geographic Range of the North Atlantic DPS of Green Turtles, with Location and Abundance of Nesting Females (Seminoff et al. 2015a)

Population Dynamics

The North Atlantic DPS exhibits the highest nester abundance, compared to other DPSs, with approximately 167,424 females at 73 nesting sites (Figure 4). The largest nesting site is in Tortuguero, Costa Rica, which hosts 79% of nesting females for this DPS (Seminoff et al. 2015a).

Many nesting sites worldwide suffer from a lack of consistent, standardized monitoring, making it difficult to characterize population growth rates for a DPS. For the North Atlantic DPS of green turtle, the available data indicate an increasing trend in nesting. There are no reliable estimates of population growth rate for the DPS as a whole, but estimates have been developed at a localized level. Modeling by Chaloupka et al. (2008) using data sets for 25 years or more show the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9%, and the Tortuguero, Costa Rica, population growing at 4.9%.

The North Atlantic DPS of green turtle has a globally unique haplotype, which was a factor in defining the discreteness of the population for the DPS. Evidence from mitochondrial DNA studies indicates that there are at least 4 independent nesting sub-populations in Florida, Cuba, Mexico, and Costa Rica (Seminoff et al. 2015a).

Status

Once abundant in tropical and sub-tropical waters, green turtles worldwide exist at a fraction of their historical abundance as a result of over-exploitation. Globally, egg harvest, the harvest of females on nesting beaches and directed hunting of sea turtles in foraging areas remain the 3 greatest threats to their recovery. In addition, bycatch in drift-net, longline, set-net, pound net, and trawl fisheries kill thousands of green turtles annually. Increasing coastal development (including beach erosion and re-nourishment, construction and artificial lighting) threatens nesting success and hatchling survival. On a regional scale, the different DPSs experience these threats as well, to varying degrees. Differing levels of abundance combined with different intensities of threats and effectiveness of regional regulatory mechanisms make each DPS uniquely susceptible to future perturbations. These threats will be discussed in further detail in the environmental baseline section of this opinion.

Historically, green turtles in the North Atlantic DPS were hunted for food, which was the principle cause of the population’s decline. Apparent increases in nester abundance for the North Atlantic DPS in recent years are encouraging but must be viewed cautiously, as the datasets represent a fraction of a green turtle generation, up to 50 years. While the threats of pollution, habitat loss through coastal development, beachfront lighting, and fisheries bycatch continue, the North Atlantic DPS appears to be somewhat resilient to future perturbations (Seminoff et al. 2015a).

Critical Habitat

Critical habitat designated for the North Atlantic DPS of green sea turtle does not overlap with the action area for this opinion.

Recovery Goals

In response to the current threats facing the species, NMFS developed goals to recover green turtle populations. Broadly, recovery plan goals emphasize the need to protect and manage nesting and marine habitat, protect and manage populations on nesting beaches and in the marine environment, increase public education, and promote international cooperation on sea turtle conservation topics. For complete downlisting/delisting criteria for recovery goals for the species see the 1991 recovery plan for the Atlantic populations of green turtles (NMFS and USFWS 1991).

5.2.2 Hawksbill Turtle

The hawksbill turtle has a circumglobal distribution throughout tropical and, to a lesser extent, sub-tropical oceans (Figure 6). The species was first listed under the Endangered Species Conservation Act and has been listed as endangered under the ESA since 1973.

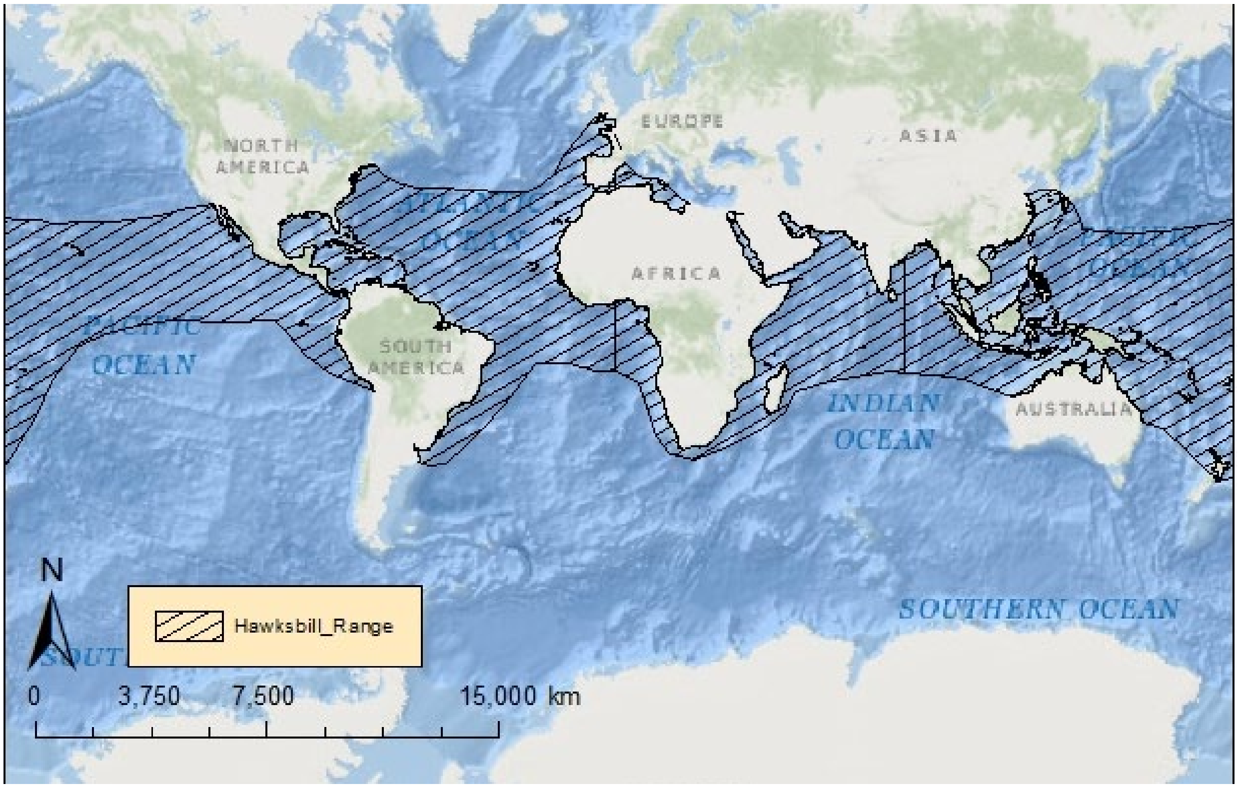

Figure 6. Hawksbill Turtle Range

Life History

Hawksbill turtles reach sexual maturity at 20 to 40 years of age. Females return to their natal beaches every 2 to 5 years to nest and nest an average of 3 to 5 times per season. Clutch sizes are large (up to 250 eggs). Sex determination is temperature dependent, with warmer incubation producing more females. Hatchlings migrate to and remain in pelagic habitats until they reach approximately 22 to 25 cm straight carapace length. As juveniles, they reside in coastal waters to forage and grow. As adults, hawksbill turtles use their sharp beak-like mouths to feed on sponges and corals. Hawksbill turtles are highly migratory and use a wide range of habitats during their lifetimes (Musick and Limpus 1997; Plotkin 2003). Satellite tagged hawksbill sea turtles have shown significant variation in movement and migration patterns. Distance traveled between nesting and foraging ranges from a few hundred to a few thousand kilometers (Horrocks et al. 2001; Miller et al. 1998).

In their oceanic phase, juvenile hawksbill turtles can be found in *Sargassum* mats; post-oceanic hawksbill turtles may occupy a range of habitats that include coral reefs or other hard-bottom habitats, sea grass, algal beds, mangrove bays and creeks (Bjorndal and Bolten 2010; Musick and Limpus 1997).

Population Dynamics

The following is a discussion of the species' population and its variance over time. This section includes: abundance, population growth rate, genetic diversity, and spatial distribution as it relates to the hawksbill turtle.

Surveys at 88 nesting sites worldwide indicate that 22,004 to 29,035 females nest annually (NMFS 2013b). In general, hawksbill turtles are doing better in the Atlantic Ocean and Indian Ocean than in the Pacific Ocean, where despite greater overall abundance, a greater proportion of the nesting sites are declining. Populations are distinguished generally by ocean basin and more specifically by nesting location. Our understanding of population structure is relatively poor. Genetic analysis of hawksbill turtles foraging off the Cape Verde Islands identified 3 closely-related haplotypes in a large majority of individuals sampled that did not match those of any known nesting population in the western Atlantic, where the vast majority of nesting has been documented (Mcclellan et al. 2010; Monzon-Arguello et al. 2010). Hawksbill turtles in the Caribbean Sea seem to have dispersed into separate populations (rookeries) after a bottleneck roughly 100,000 to 300,000 years ago (Leroux et al. 2012).

Status

Long-term data on hawksbill turtles indicate that 63 nesting sites have declined over the past 20 to 100 hundred years (historic trends are unknown for the remaining 25 sites). Recently 28 sites (68%) have experienced nesting declines, 10 have experienced increases, 3 have remained stable, and 47 have unknown trends. The greatest threats to hawksbill turtles are overharvesting of sea turtles and eggs, degradation of nesting habitat, and fisheries interactions. Adult hawksbill turtles are harvested for their meat and carapace, which is sold as tortoiseshell. Eggs are taken at high levels, especially in Southeast Asia where collection approaches 100% in some areas. In addition, lights on or adjacent to nesting beaches are often fatal to emerging hatchlings and alters the behavior of nesting adults. The species' resilience to additional perturbation is low.

Critical Habitat

Critical habitat designated for the hawksbill sea turtle does not overlap with the action area for this opinion.

Recovery Goals

See the 1993 recovery plan for the U.S. Caribbean, Atlantic, and Gulf of Mexico population of hawksbill turtles for complete downlisting/delisting criteria for recovery goals (NMFS and USFWS 1993). The following items were the top recovery actions identified to support in the hawksbill recovery plans:

- Identify important nesting beaches.
- Ensure long-term protection and management of important nesting beaches.
- Protect and manage nesting habitat; prevent the degradation of nesting habitat caused by seawalls, revetments, sand bags, other erosion-control measures, jetties, and breakwaters.

- Identify important marine habitats; protect and manage populations in marine habitat.
- Protect and manage marine habitat; prevent the degradation or destruction of important (marine) habitats caused by upland and coastal erosion.
- Prevent the degradation of reef habitat caused by sewage and other pollutants.
- Monitor nesting activity on important nesting beaches with standardized index surveys.
- Evaluate nest success and implement appropriate nest-protection on important nesting beaches.
- Ensure that law-enforcement activities prevent the illegal exploitation and harassment of sea turtles and increase law-enforcement efforts to reduce illegal exploitation.
- Determine nesting beach origins for juveniles and sub-adult populations.

5.2.3 Kemp's Ridley Turtle

The Kemp's ridley sea turtle range extends from the Gulf of Mexico to the Atlantic coast, with nesting beaches limited to a few sites in Mexico and Texas (Figure 7). The species was first listed under the Endangered Species Conservation Act and has been listed as endangered under the ESA since 1973.

Life History

Females mature at 12 years of age. The average remigration interval is 2 years. Nesting occurs from April to July in large arribadas, primarily at Rancho Nuevo, Mexico. Females lay an average of 2.5 clutches per season. The annual average clutch size is 97 to 100 eggs per nest. The nesting location may be particularly important because hatchlings can more easily migrate to foraging grounds in deeper oceanic waters, where they remain for approximately 2 years before returning to nearshore coastal habitats. Juvenile Kemp's ridley turtles use these nearshore coastal habitats from April through November, but move towards more suitable overwintering habitat in deeper offshore waters (or more southern waters along the Atlantic coast) as water temperature drops. Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 37 m deep, although they can also be found in deeper offshore waters. As adults, Kemp's ridley turtles forage on swimming crabs, fish, jellyfish, mollusks, and tunicates (NMFS et al. 2011).

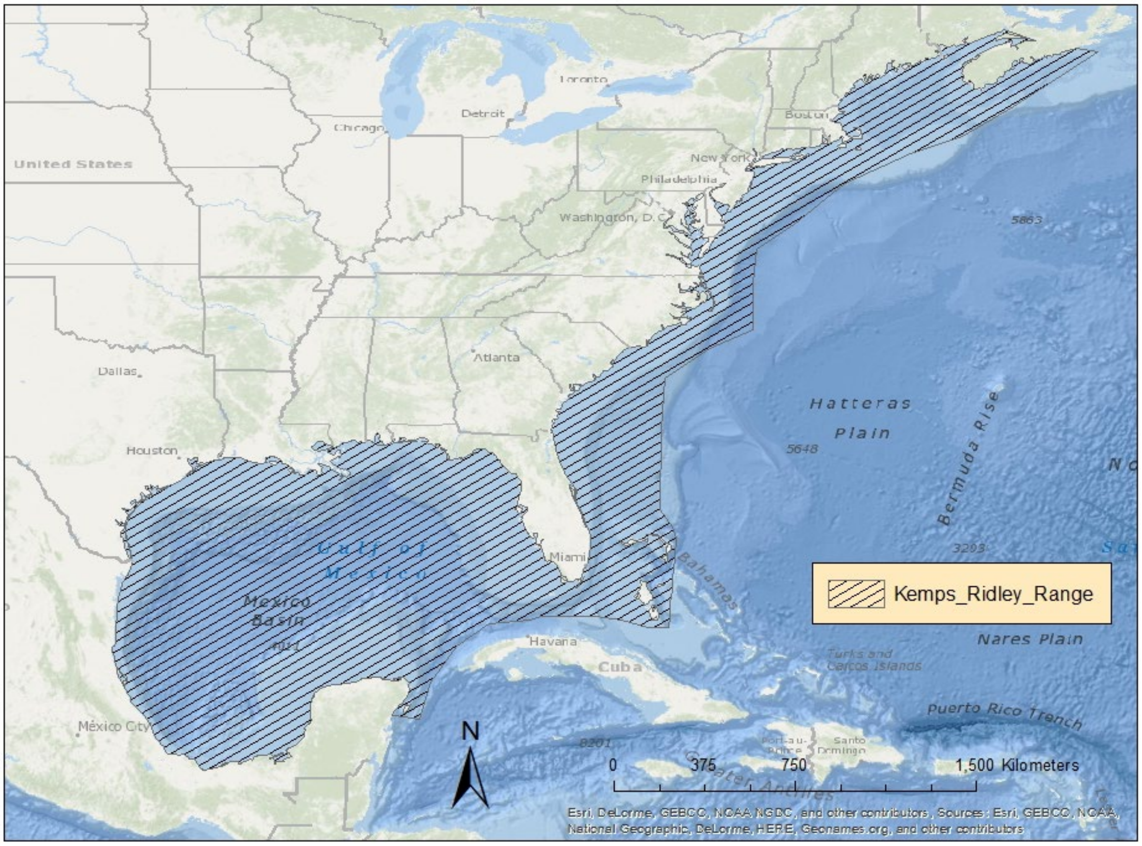

Figure 7. Kemp's Ridley Turtle Range

Population Dynamics

The following is a discussion of the species' population and its variance over time. This section includes abundance, population growth rate, genetic diversity, and spatial distributions as it relates to the Kemp's ridley turtle.

Of the sea turtle species in the world, the Kemp's ridley has declined to the lowest population level. Nesting aggregations at a single location (Rancho Nuevo, Mexico) were estimated at 40,000 females in 1947. By the mid-1980s, the population had declined to an estimated 300 nesting females. From 1980 through 2003, the number of nests at 3 primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased 15% annually (Heppell et al. 2005); however, due to subsequent declines in nest counts, decreased survival of immature and adult sea turtles, and updated population modeling, this rate is not expected to continue (NMFS and USFWS 2015). In 2014, there were an estimated 10,987 nests and 519,000 hatchlings released from 3 primary nesting beaches in Mexico (NMFS and USFWS 2015). The number of nests in Padre Island, Texas has increased over the past 2 decades, with 1 nest observed in 1985, 4 in 1995, 50 in 2005, and 197 in 2014 (NMFS and USFWS 2015).

Genetic variability in Kemp's ridley turtles is considered to be high, as measured by heterozygosis at microsatellite loci (NMFS et al. 2011). Additional analysis of the mitochondrial

DNA taken from samples of Kemp's ridley turtles at Padre Island, Texas showed 6 distinct haplotypes, with 1 of these also being found at Rancho Nuevo (Dutton et al. 2006).

The vast majority of Kemp's ridley turtles originate from breeding beaches at Rancho Nuevo on the Gulf of Mexico coast of Mexico. During spring and summer, juvenile Kemp's ridley turtles occur in the shallow coastal waters along the Atlantic continental shelf from New England to Florida, and from the northern Gulf of Mexico from Texas to north Florida. In the fall, most Kemp's ridley turtles migrate to deeper or more southern, warmer waters and remain there through the winter (Schmid 1998). As adults, many sea turtles remain in the Gulf of Mexico, with only occasional occurrence in the Atlantic Ocean (NMFS et al. 2011).

Status

The Kemp's ridley turtle was listed as endangered in response to a severe population decline, primarily the result of egg collection. In 1973, legal ordinances in Mexico prohibited the harvest of sea turtles from May to August, and in 1990, the harvest of all sea turtles was prohibited by presidential decree. In 2002, Rancho Nuevo was declared a sanctuary. A successful head-start program has resulted in re-establishment of nesting at Texan beaches. While fisheries bycatch remains a threat, the increased use of TEDs mitigates take. Fishery interactions and strandings, possibly due to forced submergence, appear to be the main ongoing threats to the species. It is clear that the species is steadily increasing; however, the species' limited range and low global abundance make it vulnerable to new sources of mortality as well as demographic and environmental randomness. The resilience of the Kemp's ridley turtle population to future perturbation is low.

Critical Habitat

No critical habitat has been designated for Kemp's ridley turtles.

Recovery Goals

In response to the current threats facing the species, NMFS developed goals to recover Kemp's ridley turtle populations. These threats will be discussed in further detail in the environmental baseline section of this opinion. See the 2011 Final Bi-National (U.S. and Mexico) Revised Recovery Plan for Kemp's ridley turtles for complete downlisting/delisting criteria for each of their respective recovery goals (NMFS and USFWS 2011). The following items were identified as priorities to recover Kemp's ridley turtles:

- Protect and manage nesting and marine habitats.
- Protect and manage populations on the nesting beaches and in the marine environment.
- Maintain a stranding network.
- Manage captive stocks.
- Sustain education and partnership programs.
- Maintain, promote awareness of and expand U.S. and Mexican laws.
- Implement international agreements.

- Enforce laws.

5.2.4 Leatherback Sea Turtle

Leatherback sea turtles are listed as endangered under the ESA throughout their global range. The leatherback turtle has the most extensive global distribution of any reptile and is distributed throughout the oceans of the world (Figure 8) from the equator to subpolar regions in both hemispheres. Leatherback turtles spend the majority of their lives at sea, where they develop, forage, migrate, and mate, nesting on beaches on every continent except Europe and Antarctica, and several islands of the Caribbean and the Indo-Pacific (Eckert et al. 2012b; NMFS and USFWS 2020). Seven populations are currently recognized: (1) Northwest Atlantic; (2) Southeast Atlantic; (3) Southwest Atlantic; (4) Northeast Indian; (5) Southwest Indian; (6) West Pacific; and (7) East Pacific Ocean populations (NMFS and USFWS 2020). For purposes of this opinion, we focus on the Northwest Atlantic population.

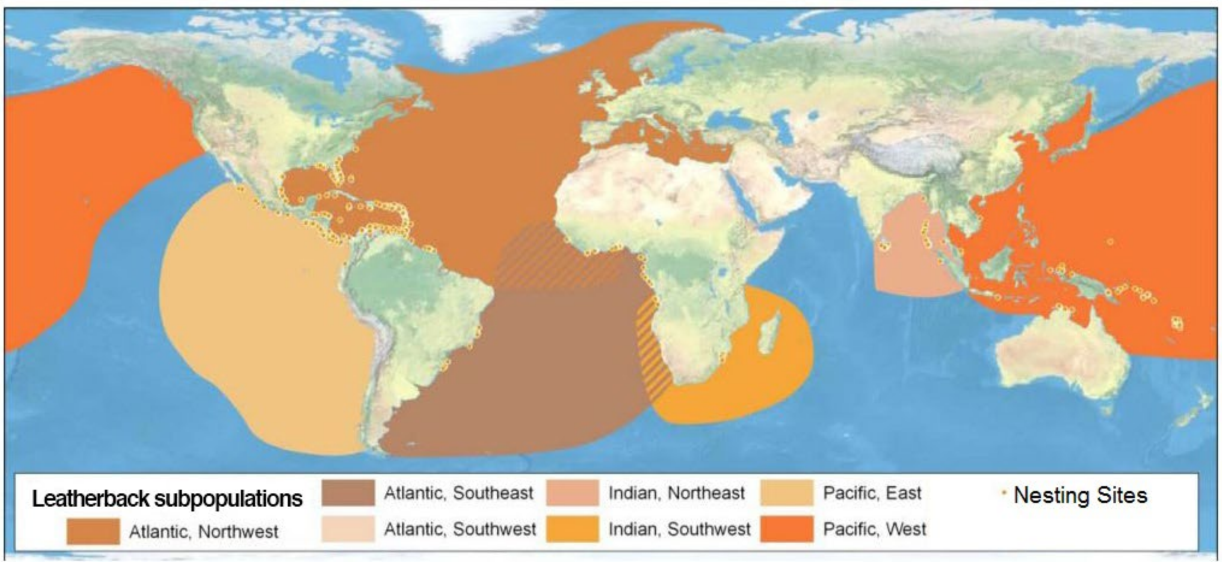

Figure 8. Leatherback Turtle Range [adapted from Wallace et al. (2013)]

<u>Life History</u>

Age at maturity has been difficult to ascertain, with estimates ranging from 5 to 29 years (Avens et al. 2009; Spotila et al. 1996). Females lay up to 7 clutches per season, with more than 65 eggs per clutch and eggs weighing greater than 80 grams (Reina et al. 2002; Wallace et al. 2007). The average clutch frequency based on data from Northwest Atlantic nesting beaches is 5.5 clutches per season (NMFS and USFWS 2020). The number of leatherback turtle hatchlings that make it out of the nest on the beach (i.e., emergent success) is approximately 50% worldwide (Eckert et al. 2012a). Females nest every 1 to 7 years. Natal homing, at least within an ocean basin, results in reproductive isolation between 5 broad geographic regions: eastern and western Pacific, eastern and western Atlantic, and Indian Ocean. Leatherback sea turtles undertake the longest migrations of any sea turtle, migrating long, transoceanic distances between their tropical nesting beaches and the highly productive temperate waters where they forage. During migrations or long distance movements, leatherbacks maximize swimming efficiency by traveling within 15 ft of the surface (Eckert 2002).

Leatherback turtles primarily feed on gelatinous zooplankton such as cnidarians (jellyfish and siphonophores) and tunicates (salps and pyrosomas) (Bjorndal 1997; USFWS 1998). These gelatinous prey are relatively nutrient-poor, such that leatherbacks must consume large quantities to support their body weight and energetic needs. Leatherback sea turtles feed from near the surface to depths exceeding 1,000 m, including nocturnal feeding on tunicate colonies within the deep scattering layer (Spotila 2004). Although leatherback sea turtles can dive deeper than any other reptile, most foraging dives are less than 80 m (Shillinger et al. 2011). Leatherback turtles weigh about 33% more on their foraging grounds than at nesting, indicating that they probably catabolize fat reserves to fuel migration and subsequent reproduction (Aguirre et al. 2006; James et al. 2005). Sea turtles must meet an energy threshold before returning to nesting beaches. Therefore, their remigration intervals (the time between nesting) are dependent upon foraging success and duration (Hays 2000; Price et al. 2004).

Population Dynamics

The following is a discussion of the species' population dynamics and its variance over time. This section includes abundance, population growth rate, genetic diversity, and spatial distribution as it relates to the leatherback turtle.

Sea turtles are difficult to study across all life stages due to their extensive distribution, certain cryptic life stages, complex life history, and remote habitats. As a result, status and trends of sea turtle populations are usually based on data collected on nesting beaches (e.g., number of adult females, number of nests, nest success, etc.). The spatial structure of male sea turtles and their fidelity to specific coastal areas is unknown; however, we describe the status of sea turtle populations based on the nesting beaches that females return to when they mature. We make inferences about the growth or decline of leatherback populations based on numbers of nests and trends in numbers of nests.

Based on the best available data, the total index of nesting female abundance for the leatherback Northwest Atlantic DPS is 20,659 females (NMFS and USFWS 2020). The total index of nesting female abundance for this DPS only includes available nesting data from recently and consistently monitored nesting beaches, and assumes a 3-year remigration interval. Nesting in the Northwest Atlantic population is characterized by many small nesting beaches. Only 1 site, Grande Riviere in Trinidad, hosts more than 5,000 nesting females, representing 29% of the total index of nesting female abundance. Relatively large nesting aggregations are also found in Matura (Trinidad), Chiriqui Beach (Panama), and Cayenne/Remire Montjoly (French Guiana) (NMFS and USFWS 2020). There are no leatherback nesting sites located within the action area for this opinion.

Although nesting trends vary by site, the leatherback Northwest Atlantic population appears to exhibit an overall decreasing trend in annual nesting activity (NMFS and USFWS 2020). This conclusion is supported by significant declines that have been observed at nesting beaches with the greatest historical or current nesting female abundance, most notably in Trinidad and Tobago (Grande Riviere, Fishing Pond, and Tobago), Suriname, and French Guiana (Awala-Yalimapo). The NALWG (2018) used a Bayesian regression model to estimate trends for all nesting sites, nesting aggregations, and for the regional population (which is equivalent to DPS) during 3 temporal scenarios: 1990 to 2017, 1998 to 2017, and 2008 to 2017. Overall nest trends were as follows:

- From 1990 to 2017: –4.21% annually (95% CI = −6.66 to −2.23)
- From 1998 to 2017: −5.37% annually (95% CI = −8.09 to −2.61)
- From 2008 to 2017: −9.32% annually (95% CI = −12.9 to −5.57)

The Northwest Atlantic leatherback population has a broad spatial distribution, for both foraging and nesting. There is significant genetic population structure, with subpopulations connected via various levels of gene flow and metapopulation dynamics (NMFS and USFWS 2020). Tagging and telemetry studies indicate considerable mixing of leatherback turtles among nesting beaches and at multiple foraging areas throughout the North Atlantic Ocean. The spatial distribution and structure of the Northwest Atlantic population likely reduces the risk of extinction (NMFS and USFWS 2020). The wide distribution of nesting and foraging areas likely buffers this population against local catastrophes or environmental changes. The fine-scale population structure, with movement of individuals and genes among nesting aggregations, indicates that this population has the capacity to withstand other catastrophic events.

The Northwest Atlantic population exhibits spatial diversity, as demonstrated by insular and continental nesting, diverse foraging habitats, multiple foraging areas, and moderate genetic diversity. Diverse nesting location and habitat provide the population some level of resilience against short-term spatial and temporal changes in the environment; however, high-abundance nesting occurs only at few locations (e.g., Trinidad, French Guiana, and Panama) (NMFS and USFWS 2020). The foraging diversity likely provides resilience against local reductions in prey availability or catastrophic events, such as oil spills, by limiting exposure to a limited proportion of the total population. Its moderate genetic diversity may provide the Northwest Atlantic population with the raw material necessary for adapting to long-term environmental changes (NMFS and USFWS 2020).

Status

The primary global threats to leatherback turtles include fisheries bycatch, harvest of nesting females, and egg harvesting. Additional threats to the Northwest Atlantic leatherback population include habitat loss, predation, disease, vessel strike, pollution, climate change, oil and gas activities, natural disasters, and channel dredging. Coastal development and shoreline armoring, erosion (natural and anthropogenic), and artificial lighting are some of the most significant stressors on nesting beach habitat, reducing nesting and hatching success (productivity). Habitat loss is also anticipated to increase over time with additional development and climate change.

Climate change may alter sex ratios (as temperature determines hatchling sex), range (through expansion of foraging habitat), and habitat (through the loss of nesting beaches, because of sea-level rise). Plastic ingestion is also common in leatherbacks and can block gastrointestinal tracts leading to death. Because of these threats, once large rookeries are now functionally extinct, and there have been range-wide reductions in population abundance.

This Northwest Atlantic leatherback population exhibits a decreasing nest trend that has become more pronounced in recent years (2008 to 2017), and the available nesting data reflect a steady decline for more than a decade (Group 2018; NMFS and USFWS 2020). Despite the population's abundance, spatial distribution, and diversity, the declining nest trends and productivity are of concern and place the Northwest Atlantic leatherback population's continued persistence in question. Overall, the latest 5-year leatherback status review concluded that the Northwest Atlantic leatherback population has a high extinction risk (NMFS and USFWS 2020).

Critical Habitat

Leatherback sea turtle critical habitat is not designated in the action area.

Recovery Goals

In response to the current threats facing the species, NMFS developed goals to recover leatherback turtle populations. These threats will be discussed in further detail in the environmental baseline section of this opinion. See the 1992 Recovery Plans for the U.S. Caribbean, Atlantic, and Gulf of Mexico leatherback turtles for complete downlisting/delisting criteria for each of their respective recovery goals (NMFS and USFWS 1992). The following items were the top 5 recovery actions identified to support in the Leatherback 5-Year Action Plan:

- Reduce fisheries interactions.
- Improve nesting beach protection and increase reproductive output.
- International cooperation.
- Monitoring and research.
- Public engagement.

5.2.5 Loggerhead Sea Turtle – Northwest Atlantic Ocean DPS

Loggerhead turtles are circumglobal and are found in the temperate and tropical regions of the Pacific, Indian, and Atlantic Oceans. Northwest Atlantic Ocean DPS of loggerhead turtles are found along eastern North America, Central America, and northern South America (Figure 9).

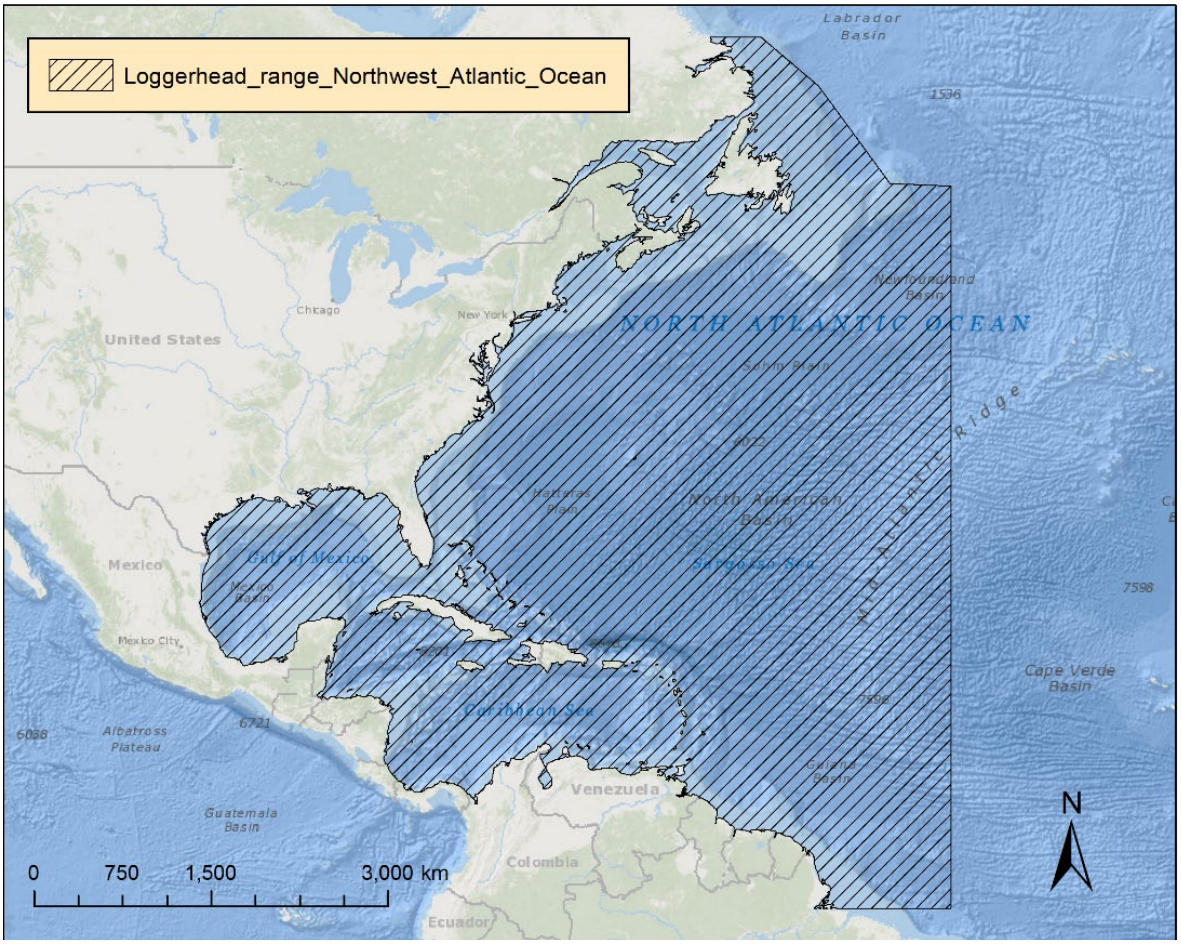

Figure 9. Northwest Atlantic Ocean DPS of loggerhead turtle range

The species was first listed as threatened under the ESA in 1978 (43 FR 32800). On September 22, 2011, the NMFS designated 9 DPSs of loggerhead turtles, with the Northwest Atlantic Ocean DPS of loggerhead turtle listed as threatened.

Life History

Mean age at first reproduction for female loggerhead turtles is 30 years. Females lay an average of 3 clutches per season. The annual average clutch size is 112 eggs per nest. The average remigration interval is 2.7 years. Nesting occurs on beaches, where warm, humid sand temperatures incubate the eggs. Temperature determines the sex of the sea turtle during the middle of the incubation period. Loggerhead sea turtles spend the post-hatchling stage in pelagic waters. The juvenile stage is spent first in the oceanic zone and later in the neritic zone (i.e., coastal waters). Coastal waters provide important foraging habitat, inter-nesting habitat, and migratory habitat for adult loggerhead turtles. Neritic juvenile loggerheads forage on crabs, mollusks, jellyfish and vegetation, whereas adults typically prey on benthic invertebrates such as mollusks and decapods.

Population Dynamics

The following is a discussion of the species' population and its variance over time. This section includes abundance, population growth rate, genetic diversity, and spatial distribution as it relates to the Northwest Atlantic Ocean DPS of loggerhead turtle.

The global abundance of nesting female loggerhead turtles is estimated at 43,320 to 44,560. Using a stage/age demographic model, the adult female population size of the Northwest Atlantic Ocean DPS is estimated at 20,000 to 40,000 females, and 53,000 to 92,000 nests annually (NMFS 2009a). In 2010, there were estimated to be approximately 801,000 loggerhead turtles (greater than 30 cm in size, inter-quartile range of approximately 521,000–1,111,000) in northwestern Atlantic continental shelf region based on aerial surveys (NMFS 2011b).

Based on genetic information, the Northwest Atlantic Ocean DPS of loggerhead turtle is further categorized into 5 recovery units corresponding to nesting beaches. These are the Northern Recovery Unit, Peninsular Florida Recovery Unit, Dry Tortugas Recovery Unit, Northern Gulf of Mexico Recovery Unit, and the Greater Caribbean Recovery Unit. A more recent analysis using expanded mitochondrial DNA sequences revealed that rookeries from the Gulf and Atlantic coasts of Florida are genetically distinct, and that rookeries from Mexico's Caribbean Sea coast express high haplotype diversity (Shamblin et al. 2014). Furthermore, the results suggest that the Northwest Atlantic Ocean DPS should be considered as 10 management units: (1) South Carolina and Georgia, (2) central eastern Florida, (3) southeastern Florida, (4) Cay Sal, Bahamas, (5) Dry Tortugas, Florida, (6) southwestern Cuba, (7) Quintana Roo, Mexico, (8) southwestern Florida, (9) central western Florida, and (10) northwestern Florida (Shamblin et al. 2012).

A comparison of recent 5-year-annual-average loggerhead nest counts with comparable data from other regions reveals that, worldwide, Florida is the most important nesting area for this species, likely hosting more than 40% of the nests laid globally (Ceriani et al. 2019). The Peninsular Florida Recovery Unit constitutes the large majority of nesting effort in the Northwest Atlantic Ocean DPS. From 1989 to 2018, this unit averaged an estimated 70,935 nests annually based on the Florida Fish and Wildlife Conservation Commission Statewide Nesting Beach Survey, and 47,433 nest annually based on the Florida Index Nesting Beach Survey (Ceriani et al. 2019). The Northern Recovery Unit, from North Carolina to northeastern Florida, is the second largest nesting aggregation in the Northwest Atlantic Ocean DPS, with an average of 5,215 nests from 1989 through 2008, and approximately 1,272 nesting females during this timeframe (NMFS and USFWS 2008).

Nesting on Florida index beaches showed an increase between 1989 and 1998 but a steep decline between 1998 and 2006 (Witherington et al. 2009). The nesting sub-population in the Florida panhandle has exhibited a significant declining trend from 1995 through 2005 (Conant et al. 2009; NMFS and USFWS 2007). Population model estimates predict an overall population decline of 17% for the St. Joseph Peninsula, Florida sub-population of the Northern Gulf of Mexico recovery unit (Lamont et al. 2014). However, more recent information about sea turtle nest counts in Florida indicate from 2007-2015 there has been an increase based upon the 26 core index beaches within 2015 (52,647) nests compared to 2013 and 2014; but this was lower than nest count data from 2012. Ceriani et al. (2019) found that annual loggerhead nest counts varied greatly in Florida between 1989 and 2018. While shorter time frames within the time series (e.g., before and after 2007) produced linear trends which may support both pessimistic (Witherington et al. 2009) and optimistic conclusions, the overall 30-yr pattern portrayed a general non-monotonic trend with wide fluctuations. For the Northern Recovery Unit, nest counts at loggerhead turtles nesting beaches in North Carolina, South Carolina, and Georgia declined at 1.9% annually from 1983 through 2005 (NMFS and USFWS 2007).

While in their oceanic phase, loggerhead turtles undergo long migrations using ocean currents. Individuals from multiple nesting colonies can be found on a single feeding ground. Loggerhead turtle hatchlings from the western Atlantic Ocean disperse widely, most likely using the Gulf Stream to drift throughout the Atlantic Ocean. Mitochondrial DNA evidence demonstrates that juvenile loggerhead turtles from southern Florida nesting beaches comprise the vast majority (71 to 88%) of individuals found in foraging grounds throughout the western and eastern Atlantic Ocean: Nicaragua, Panama, Azores and Madeira, Canary Islands and Adalusia, Gulf of Mexico, and Brazil (Masuda 2010).

Status

Due to declines in nest counts at index beaches in the U.S. and Mexico, and continued mortality of juveniles and adults from fishery bycatch, Conant et al. (2009) found the Northwest Atlantic Ocean DPS of loggerhead turtle was at risk and likely to decline in the foreseeable future. In the NMFS Fiscal Year 2019-2020 ESA Report to Congress, the population trend for this DPS is shown as stable (NMFS 2022f).

Critical Habitat

See Section 5.1.5 for a discussion of loggerhead sea turtle Northwest Atlantic DPS designated critical habitat.

Recovery Goals

In response to the current threats facing the species, NMFS developed goals to recover loggerhead sea turtle populations. These threats will be discussed in further detail in the environmental baseline section of this opinion. See the 2008 Final Recovery Plan for the Northwest Atlantic Population of Loggerheads (NMFS and USFWS 2008) for complete downlisting/delisting criteria for each of the following recovery objectives:

- Ensure that the number of nests in each recovery unit is increasing and that this increase corresponds to an increase in the number of nesting females.
- Ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes.
- Manage sufficient nesting beach habitat to ensure successfully nesting.

- Manage sufficient feeding, migratory, and interesting marine habitats to ensure successful growth and reproduction.
- Eliminate legal harvest.
- Implement scientifically based nest management plans.
- Minimize nest predation.
- Recognize and respond to mass/unusual mortality or disease event appropriately.
- Develop and implement local, state, Federal, and international legislation to ensure long-term protection of loggerhead sea turtles and their terrestrial and marine habitats.
- Minimize bycatch in domestic and international commercial and artisanal fisheries.
- Minimize trophic changes from fishery harvest and habitat alteration.
- Minimize marine debris ingestions and entanglement.
- Minimize vessel strike mortality.

5.2.6 Atlantic Sturgeon

Five DPSs of Atlantic sturgeon were listed under the ESA in 2012. The Gulf of Maine DPS is listed as threatened while the New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs are listed as endangered (Figure 10).

Life History

The general life history pattern of Atlantic sturgeon is that of a long lived, late maturing, iteroparous, anadromous species (ASSRT 2007; Dadswell 2006). Atlantic sturgeon spawn in freshwater, but spend most of their subadult and adult life in the marine environment.

Traditionally, it was believed that spawning within all populations occurred during the spring and early summer months (Smith 1985). More recent studies, however, suggest that spawning occurs from late summer to early autumn in 3 tributaries (James River and York River, Virginia, and Nanticoke River, Maryland) of the Chesapeake Bay (Balazik et al. 2012; Hager et al. 2014; Secor et al. 2021), Roanoke River, North Carolina (Smith et al. 2015), Edisto River, South Carolina (Collins et al. 2000), and in the Altamaha River, Georgia (Ingram and Peterson 2016). Sturgeon eggs are highly adhesive and are deposited on the bottom substrate, usually on hard surfaces (e.g., cobble) (Smith and Clugston 1997). Hatching occurs approximately 94 to 140 hours after egg deposition, and larvae assume a demersal existence (Smith et al. 1980). The yolk sac larval stage is completed in about 8 to 12 days, during which time the larvae move downstream to rearing grounds over a 6 to 12-day period (Kynard and Horgan 2002). During the first half of their migration downstream, movement is limited to nighttime. 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. The larvae grow rapidly and are 4 to 5.5 inches long at a month old (MSPO 1993).

Juvenile Atlantic sturgeon continue to move downstream into brackish waters, and eventually become residents in estuarine waters. Juvenile Atlantic sturgeon are resident within their natal

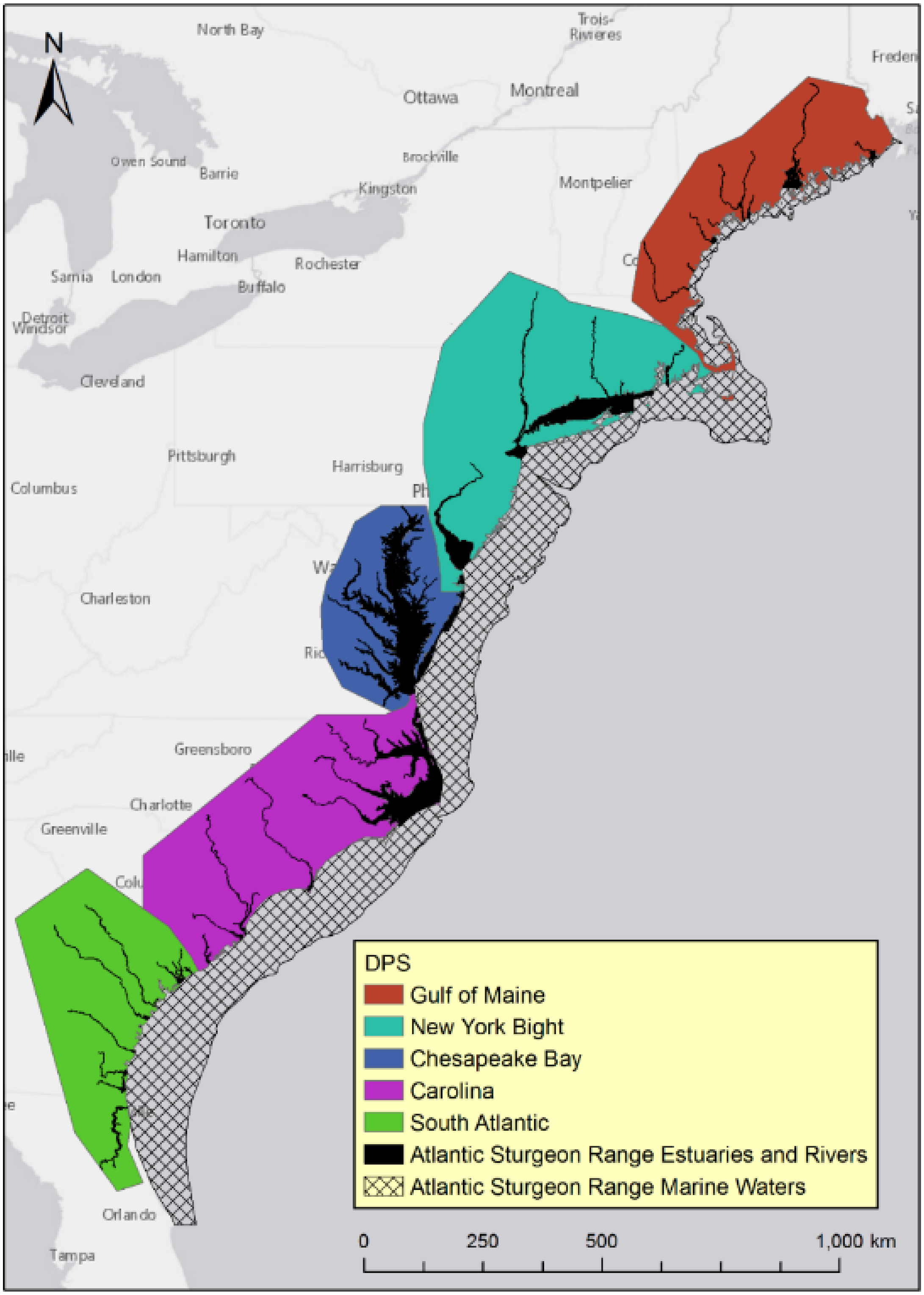

Figure 10. U.S. range of the Five Atlantic Sturgeon DPSs

estuaries for 1 to 6 years (Fox and Peterson 2019), depending on their natal river of origin, after which they emigrate as subadults to coastal waters (Dovel 1983) or to other estuaries seasonally (Waldman et al. 2013). Atlantic sturgeon undertake long marine migrations and utilize habitats up and down the East Coast for rearing, feeding, and migrating (Bain 1997; Dovel 1983; Stevenson 1997). Migratory subadults and adults are normally located in shallow (10-50 meter) nearshore areas dominated by gravel and sand substrate (Stein et al. 2004). Tagging and genetic data indicate that subadult and adult Atlantic sturgeon may travel widely once they emigrate from rivers (Bartron 2007; Rothermel et al. 2020; Rulifson et al. 2020; Wippelhauser et al. 2017; Wirgin et al. 2015). Once in marine waters, subadults undergo rapid growth (Dovel 1983; Stevenson 1997). Despite extensive mixing in coastal waters, Atlantic sturgeon display high site fidelity to their natal streams.

Atlantic sturgeon have been aged to 60 years (Mangin 1964), but this should be taken as an approximation because the age validation studies conducted to date show ages cannot be reliably estimated after 15-20 years as annuli become harder to read accurately (Stevenson and Secor 2000). Vital parameters of sturgeon populations generally show clinal variation with faster growth, earlier age at maturation, and shorter life span in more southern systems. Spawning intervals range from 1 to 5 years for male Atlantic sturgeon (Collins et al. 2000; Smith 1985) and 2 to 5 years for females (Breece et al. 2021; Hager et al. 2020; Schueller and Peterson 2010; Stevenson and Secor 2000). For Atlantic sturgeon from the York River, Virginia, Hager et al. (2020) found that both males and females return to spawn at more frequent intervals than has been reported in the literature (males once every 1.13 years and females once every 2.19 years, on average). Similarly, Breece et al. (2021) reported mean spawning intervals for Hudson River Atlantic sturgeon of 1.66 years for females and 1.28 years for males, Breece et al. (2021) with many fish spawning in consecutive years.

Fecundity of Atlantic sturgeon is correlated with age and body size, ranging from approximately 400,000 to 2 million eggs (Dadswell 2006; Mitchell et al. 2020; Smith et al. 1982; Van Eenennaam and Doroshov 1998). The average age at which 50% of Atlantic sturgeon maximum lifetime egg production is achieved is estimated to be 29 years, approximately 3 to 10 times longer than for most other bony fish species (Boreman 1997).

Atlantic sturgeon feed on mollusks, polychaeta worms, gastropods, shrimps, pea crabs, decapods, amphipods, isopods, and small fishes in the marine environment (Collins et al. 2006b; Guilbard et al. 2007; Savoy 2007). The sturgeon "roots" in the sand or mud with its snout, like a pig, to dislodge worms and mollusks that it sucks into its protrusible mouth, along with considerable amounts of mud. The Atlantic sturgeon has a stomach with very thick, muscular walls that resemble the gizzard of a bird. This enables it to grind such food items as mollusks and gastropods (MSPO 1993).

Population Dynamics

The Atlantic sturgeon's historic range included major estuarine and riverine systems that spanned from Hamilton Inlet on the coast of Labrador, Canada, to the Saint Johns River in

Florida (ASSRT 2007; Smith and Clugston 1997). Historically, Atlantic sturgeon were present in approximately 38 rivers in the United States from St. Croix, Maine, to the Saint Johns River, Florida, of which 35 rivers have been confirmed to have had historic spawning populations.

Atlantic sturgeon throughout their range exhibit ecological separation during spawning that has resulted in multiple, genetically distinct, interbreeding population segments. Studies have consistently found populations to be genetically diverse and indicate that there are between 7 and 10 populations that can be statistically differentiated (Grunwald et al. 2008; King et al. 2001; Waldman et al. 2002; Wirgin et al. 2007). However, there is some disagreement among studies, and results do not include samples from all rivers inhabited by Atlantic sturgeon. More recently, White et al. (2021) presented a range-wide microsatellite genetic baseline for Atlantic sturgeon that is comprised of 2510 individuals from 18 genetically distinct groups collected in 13 rivers and 1 estuary. Recent studies conducted indicate that genetically distinct populations of spring and fall-run Atlantic sturgeon can exist within a given river system (Balazik et al. 2017; Balazik and Musick 2015; Farrae et al. 2017).

In 2012, NMFS listed 5 DPSs of Atlantic sturgeon (Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic) based on low population sizes and the level of continuing threats such as degraded water quality, habitat impacts from dredging, bycatch in state and federally managed fisheries, and vessel strikes. Historically, each of these DPSs likely supported more than 10,000 spawning adults (ASSRT 2007; MSPO 1993; Secor and Niklitschek 2002). The best available data indicate that current numbers of spawning adults for each DPS are 1 to 2 orders of magnitude smaller than historical levels (ASSRT 2007; Kahnle et al. 2007).

Kazyak et al. (2021) performed a mixed-stock analysis of 1704 Atlantic sturgeon encountered across the U.S. Atlantic Coast. Fish sampled north of Cape Cod, MA and south of Cape Hatteras, NC were dominated by individuals from regional stocks; however, extensive stock mixing was found in the mid-Atlantic region, particularly in coastal environments where individuals from all 5 DPSs were commonly observed. Of the 41 individuals captured north of Cape Cod, 87.8% assigned to the Kennebec River population, which is the only population in the Gulf of Maine DPS, with the remainder assigned to Canadian Rivers. In the region sampled between Cape Hatteras and Cape Cod, 37.5% of individuals assigned to populations in the New York Bight DPS and 30.7% to populations in the Carolina DPS. Individual-based assignment testing indicated that Atlantic sturgeon sampled south of Cape Hatteras were primarily from the South Atlantic (91.2%) and Carolina (6.2%) DPSs.

<u>Critical Habitat</u>

Atlantic sturgeon critical habitat is not designated in the action area.

Atlantic Sturgeon DPS Specific Information

Gulf of Maine DPS

The Gulf of Maine DPS of Atlantic sturgeon was listed as threatened on February 6, 2012. The Gulf of Maine DPS historically supported at least 4 spawning subpopulations; however, today it is suspected that only 2 extant subpopulations exist (Penobscot and Kennebec) (ASSRT 2007). The Kennebec River is the primary spawning and nursery area for Gulf of Maine Atlantic sturgeon. Prior to any commercial fishing, the Kennebec supported approximately 10,000 to 15,000 spawning adults (ASSRT 2007; MSPO 1993). The construction of the Edwards Dam in 1837 was believed to have caused the commercial sturgeon catch to decline over 50% (MSPO 1993). Severe pollution in the river from the 1930's through the early 1970's is also believed to have been a major factor in the continued decline of the sturgeon population in the Kennebec.

Since 2017, there were several updates about reproduction, numbers, and distribution in the Gulf of Maine DPS. An open population estimate of marine-oriented Atlantic sturgeon (sub-adult and adult) foraging in the Saco River from May to November is between 1,400 and 6,800 individuals annually (Flanigan et al. 2021). The Kennebec River effective population size and 95% confidence limits (CL) were estimated at 67.0 (52.0-89.1) and 79.4 (60.3-111.7) by Waldman et al. (2019) (n = 62) and White et al. (2021) (n = 48). Effective population size is essentially an estimate of the number of breeding individuals in a population required to maintain the amount of genetic variability observed within samples from that population. Furthermore, 2 larval Atlantic sturgeon were captured just above the Kennebec River estuary between 24 and 25 °C in mid-July, confirming successful reproduction in this location (Wippelhauser et al. 2017). It was speculated that the Penobscot subpopulation was extirpated until a fisherman captured an adult Atlantic sturgeon in 2005, and a gillnet survey directed toward Atlantic sturgeon captured 7 in 2006 (ASSRT 2007). There is no current evidence that spawning is occurring in the Penobscot River (NMFS 2022d). Acoustic tag detections suggest that the adults that forage in the Penobscot River travel to the Kennebec River to spawn (Altenritter et al. 2017; Wippelhauser et al. 2017). Within the Penobscot, substrate has been severely degraded by upstream mills, and water quality has been negatively affected by the presence of coal deposits and mercury hot spots.

Wippelhauser et al. (2017) suggest Atlantic sturgeon use the upper Kennebec River, the Kennebec River estuary, and the Androscoggin River estuary for reproduction. It is unknown whether the Merrimack River supports a reproductive population of Atlantic sturgeon (ASMFC 2017). While the Androscoggin represents an additional known spawning location for this DPS, non-spawning individuals were observed to use the Penobscot, Androscoggin, Saco, Merrimack, St. John, and Minas Passage (Altenritter et al. 2017; Novak et al. 2017; Wippelhauser et al. 2017). Survival rates of all ages is estimated to be approximately 74% annually (95% confidence limits, 15-99%; ASMFC 2017).

A recovery outline was produced for Atlantic sturgeon (NMFS 2018c). The goal for recovery is to have reproductive populations across their historic range of sufficient size and diversity to support reproduction and recovery from mortality events. There have been no new threats identified to the Gulf of Maine DPS since 2017.

New York Bight DPS

The New York Bight DPS was listed as endangered under the ESA on February 6, 2012. The New York Bight DPS demographic risk is categorized as "high" due to its low productivity (e.g., relatively few adults compared to historical levels and irregular spawning success), low abundance (e.g., only a few known spawning populations and low DPS abundance, overall), and limited spatial distribution (e.g., limited spawning habitat within each of the few known rivers that support spawning) (NMFS 2022e). The New York Bight DPS' potential to recover is also considered high due to the following factors: 1) man-made threats that have a major impact on the species' ability to persist have been identified (e.g., bycatch in federally-managed fisheries, vessel strikes); 2) the DPS' response to those threats are well understood; 3) management or protective actions to address major threats are primarily under U.S. jurisdiction or authority; and management or protective actions are technically feasible with respect to reducing fisheries bycatch even if they require further testing (e.g., gear modifications to minimize dredge or fishing gear interactions) (NMFS 2022e).

The Connecticut, Hudson, and Delaware Rivers all support reproductive populations while the Taunton River population appears to be extirpated. A recent assessment of relatedness of these populations to others along the coast reveals, as was the case at the time of listing, that the Hudson and Delaware populations appear to be a separate group from other populations but also different from one another (White et al. 2021). The Connecticut River was not included in that study. A recent study using acoustic telemetry to estimate spawning duration and return intervals shows that Hudson River adults return much more frequently than previously thought; females every 1.66 years and males every 1.28 years (Breece et al. 2021). This is in agreement with recent studies conducted in the York River (Hager et al. 2020), both suggesting females, in particular, spawn more often than previously thought. In the Hudson River, males were on spawning grounds on average from May 27 through July 11 and females from June 8 through June 29. The average male is also more likely to travel further upriver than the average female (Breece et al. 2021).

The Hudson River most likely supports the largest population of Atlantic sturgeon in the United States. Effective population estimates for the Hudson River are 156 (95% CL, 138.3-176.1; n = 459; Waldman et al. 2019) and 145.1 (82.5-299.4; n = 307; White et al. 2021). Kazyak et al. (2020) produced an abundance estimate of the 2014 adult spawning run size of 466 individuals (95% CL, 310-745). While this spawning run size is nearly identical to that estimated by Kahnle et al. (2007), monitoring of relative abundance of juveniles from 2004 through 2019 has shown production may have doubled during those 16 years (Pendleton and Adams 2021).

In the Delaware River, the effective population size has been estimated to be 40 (95% CL, 34.7-46.2; n = 108) and 60.4 (42-85.6; n = 488) by Waldman et al. (2019) and White et al. (2021), respectively. The significant difference between estimates is likely due to sample size. Therefore, White et al.'s (2021) estimate is likely most accurate. Additionally, a recent close-kin mark-recapture estimate was produced for the Delaware River and suggests there are fewer than 250 adults (census) in the Delaware River population (White et al. 2022).

In the Connecticut River, despite only limited collection of juvenile sturgeon (n = 47), there is an estimate of effective population size of 2 (95% CL, 2-2.7; Waldman et al. 2019). This would suggest there has been a single spawning event in the Connecticut River that produced all of the juvenile fish collected or the spawning adults were so closely related as to be indistinguishable from a single pair. Either way, it is clear there is limited genetic diversity in this population and, unless these adults continue returning to the Connecticut River, it could take approximately 20 years to learn whether these juveniles have survived in sufficient numbers to sustain this new population.

Recent survival estimates do not suggest much of an improvement since the last estimates made during the commercial fishery (Boreman 1997; Kahnle et al. 1998). Melnychuk et al. (2017) provided an updated estimate of survival of Hudson River Atlantic sturgeon of approximately 88.22%, while for similar life stages over a longer time frame, the Atlantic States Marine Fisheries Service (ASMFC 2017) estimated survival of the entire New York Bight to be 91% (95% confidence limits, 71-99%).

A recovery outline was produced for Atlantic sturgeon (NMFS 2018b). The goal for recovery is to have reproductive populations across their historic range of sufficient size and diversity to support reproduction and recovery from mortality events. There have been no new threats identified to the New York Bight DPS since 2017.

Chesapeake Bay DPS

The Chesapeake Bay DPS was listed as endangered under the ESA on February 6, 2012. Historically, Atlantic sturgeon were common throughout the Chesapeake Bay and its tributaries (Kahnle et al. 1998). Based on U.S. Fish Commission landings data, approximately 20,000 adult female Atlantic sturgeon inhabited the Chesapeake Bay and its tributaries prior to development of a commercial fishery in 1890 (Secor 2002). At present, the Chesapeake Bay DPS has low abundance and the current numbers of spawning adults are 1 to 2 orders of magnitude smaller than historical levels. Atlantic sturgeon belonging to the Chesapeake Bay DPS are still captured and killed as a result of fishery interactions, vessel strikes, and dredging. The invasive blue catfish has become a more notable threat to native fish, including Atlantic sturgeon, in the Chesapeake Bay region (Bunch et al. 2021).

Despite research efforts, natal juveniles are rarely captured which suggests that the Chesapeake Bay DPS has low reproductive success (NMFS 2022b). Chesapeake Bay rivers once supported at least 6 historical spawning subpopulations (ASSRT 2007), but today reproducing populations are only known to occur in the James, York, and Nanticoke rivers. A recent assessment of relatedness of all Atlantic sturgeon populations showed that, when all populations along the coast are grouped, the James River (spring and fall runs) is most closely related to rivers in the northeast, while the York River is most closely related to rivers in the southeast (White et al. 2021). Edwards et al. (2020) noted an adult male Atlantic sturgeon was detected at the saltwater interface of the Patuxent River, which may indicate potential spawning. However, Kahn et al. (2019) noted that telemetry detections are not a meaningful indicator of whether a male is spawning. Because males are often in spawning condition during non-spawning situations (Van Eenennaam and Doroshov 1998), even if this individual had been captured and observed in spawning condition, that would not have been enough to suggest spawning was occurring in the Patuxent River.

The James River supports the largest population of Atlantic sturgeon within the DPS. A total of 373 different adult-sized Atlantic sturgeon (i.e., total count does not include recaptures of the same fish) were captured in the James River from 2009 through spring 2014 (Balazik and Musick 2015). Estimates of James River effective population size from separate studies and based on different age classes are similar, ranging from 32 to 62 sturgeon (NMFS 2022b). Balazik et al. (2012) reported empirical evidence that James River Atlantic sturgeon spawn in the fall, and a more recent study indicates that Atlantic sturgeon also spawn in the spring in the James River (i.e., dual spawning races) (Balazik and Musick 2015). In 2007, the Atlantic Sturgeon Status Review Team concluded that the James River had a moderately high risk (greater than 50% chance) of becoming endangered in the next 20 years, due to anticipated impacts from commercial bycatch (ASSRT 2007).

Kahn et al. (2019) estimated a spawning run size of up to 222 adults (but with yearly variability) in the Pamunkey River, a tributary of the York River in Virginia, based on captures of tagged adults from 2013-2018. The highest ranked stressor for the York River was commercial bycatch, which received a moderate risk rank (ASSRT 2007). New information for the Nanticoke River system suggests a small adult population based on a small total number of captures (i.e., 26 sturgeon) and the high rate of recapture across several years of study (Secor et al. 2021).

At the DPS level, the Chesapeake Bay DPS is estimated to have an apparent annual survival of approximately 88% (95% CL, 46-99%; ASMFC 2017). A recent estimate for adult York River Atlantic sturgeon by Kahn et al. (In Press) shows much higher survival than other estimates with an annual apparent survival of 99.2% (97.9-99.7%).

A recovery outline was produced for Atlantic sturgeon (NMFS 2018b). The goal for recovery is to have reproductive populations across their historic range of sufficient size and diversity to support reproduction and recovery from mortality events.

Carolina DPS

The Carolina DPS was listed as endangered under the ESA on February 6, 2012. The Carolina DPS ranges from the Albemarle Sound to the Santee-Cooper River and consists of 7 extant subpopulations; 1 subpopulation (Sampit) is believed to be extirpated. The current abundance of these subpopulations is likely less than 3% of their historical abundance based on 1890s commercial landings data (ASSRT 2007; Secor 2002).

Water quality issues represent either a moderate or moderately high risk for most subpopulations within this DPS (ASSRT 2007). The Pamlico Sound suffers from eutrophication and experiences periodically low dissolved oxygen events and major fish kill events, mainly in the Neuse Estuary of the Sound. The Cape Fear River is a natural blackwater river; however, the low dissolved oxygen concentrations in this river can also be attributed to eutrophication. Water quality is also a problem in Winyah Bay, where portions of the bay have high concentrations of dioxins that can adversely affect sturgeon development (Chambers et al. 2012). Commercial bycatch was a concern for all of the subpopulations examined by the Atlantic Sturgeon Status Review Team. The Cape Fear and Santee-Cooper rivers were found to have a moderately high risk (greater than 50%) of becoming endangered within the next 20 years due to impeded habitat from dams. The Cape Fear and Santee-Cooper are the most impeded rivers along the range of the species, where dams are located in the lower coastal plain and impede between 62 to 66% of the habitat available between the fall line and mouth of the river (ASSRT 2007). The Atlantic Sturgeon Status Review Team concluded that the limited habitat in which sturgeon could spawn and utilize for nursery habitat in these rivers likely leads to the instability of these subpopulations and to the entire DPS being at risk of endangerment.

Spawning likely occurs in the Roanoake, Tar/Pamlico, Neuse, Cape Fear, Pee Dee, Santee, and Cooper Rivers. Census abundance is not available for any system. The effective population size of juveniles collected in the Albemarle Sound is approximately 19 (95% CL, 16.5-20.6; n = 88; Waldman et al. 2019) to 29.5 (24.2-36.3; n = 71; White et al. 2021). There is also a new effective population size estimate for the Pee Dee River spring (n = 66) and fall (n = 50) spawning runs, amounting to 13.5 (11.9-15.3) and 82 (60.3-122.1), respectively (White et al. 2021). Also, updating Hightower et al. (2016), the ASMFC (2017) produced an updated survival estimate for the entire Carolina DPS, suggesting Atlantic sturgeon survival rates are approximately 78% (95% CL, 39-99%).

A recovery outline was produced for Atlantic sturgeon (NMFS 2018b). The goal for recovery is to have reproductive populations across their historic range of sufficient size and diversity to support reproduction and recovery from mortality events.

South Atlantic DPS

The South Atlantic DPS was listed as endangered under the ESA on February 6, 2012. This DPS historically supported 8 spawning subpopulations but currently supports 5 extant spawning populations (ASSRT 2007). The Altamaha and the Ashepoo, Savannah, Combahee and Edisto Basin subpopulations support the largest number of spawning adults. The current abundance of these subpopulations are suspected to be less than 6% of their historical abundance, extrapolated from the 1890s commercial landings (ASSRT 2007; Secor and Niklitschek 2002). Peterson et al. (2008) reported that approximately 324 and 386 adults per year returned to the Altamaha River in 2004 and 2005, respectively. These estimates however, were conducted in the spring. Ingram and Peterson (2016) used acoustic telemetry to show that adults in the Altamaha River display 2 different spawning migration strategies, those that enter the river in the spring and hold until spawning in the fall and those that enter the river in the fall and move directly to spawning habitat. Both the Edisto River and Ogeechee River appear to have a spring and a fall run (White et al. 2021). The Atlantic Sturgeon Status Review Team found that the South Atlantic DPS of Atlantic sturgeon had a moderate risk (greater than 50%) of becoming endangered in the next 20 years due primarily to dredging, degraded water quality, and commercial fisheries bycatch.

A census estimate was produced for the upper 20 km of the Savannah River (river kms 281-301) to estimate the number of purported spawning adults in that stretch on a given day over 50 sampling occasions. The maximum estimate of daily abundance in those 20 km was 35 to 55 adults of unknown sex (Vine et al. 2019). Effective population estimates were also produced for many rivers in the South Atlantic DPS. The Edisto River (n = 145) was estimated to have an effective population of 60 (95% CL, 51.9-69.0; Waldman et al. 2019), but was broken into 2 spawning populations by White et al. (2021) following the identification of 2 distinct spawning groups (Farrae et al. 2017) for estimates of a spring run (n = 123) of 16.4 (12.8-20.6) and a fall run (n = 373) of 47.9 (25.3-88.8). The Savannah River was estimated to have an effective population size (n = 161) of approximately 123 (103.1-149.4) and also (n = 134) of approximately 154.5 (99.6-287.7) by Waldman et al. (2019) and White et al. (2021), respectively. The Ogeechee River (n = 200) was estimated to have an effective population of 26 (23.9-28.2; Waldman et al. 2019), but was also broken into 2 spawning populations by White et al. (2021) for estimates of a spring run (n = 92) of 31.1 (24.3-40.2) and a fall run (n = 55) of 56.5 (36.3-103.6). The Altamaha River appears to support the largest Atlantic sturgeon population in the South Atlantic DPS, and one of the largest on the East Coast, with effective population estimates of 149 (128.7-174.3; n = 245; Waldman et al. 2019) and 141.7 (73.4-399; n = 189; White et al. 2021). The effective population estimates for the Satilla River population are 21 (18.7-23.2; n = 68; Waldman et al. 2019) and 11.4 (9.1-13.9; n = 74; White et al. 2021). Work in the St. Marys River on the Florida-Georgia border captured 25 fish including 14 river resident juveniles. Analysis of those individuals reveals an effective population size of 1 (1.3-2.0), but this is a known under-estimate because those individuals were from a single spawning event (Fox et al. 2018b; Waldman et al. 2019). The St. Johns River in Florida does not appear to support an extant population (Fox et al. 2018a). Survival within the entire DPS was estimated to be approximately 86% (54-99%; ASMFC 2017).

South of Cape Hatteras, Kazyak et al. (2021) showed that 91.2% of fisheries bycatch was from the South Atlantic DPS. In terms of population level distribution and susceptibility to commercial fisheries, 35.7% were from the Altamaha River, 21.4% from the Edisto River fall-run, 18.9% from the Savannah River, 7.2% from the Ogeechee River (both spring and fall), 5.5% Satilla, 3.7% Pee Dee (both spring and fall), and 2.0% Edisto spring-run. In the south, most offshore fish were from the Altamaha, followed by the Savannah (Kazyak et al. 2021). Within river movement studies also revealed that age-1 fish that were tagged in the summer remained in the rivers and overwintered before outmigrating between December and March (Fox and Peterson 2019). When observing the likelihood of becoming a coastally wandering sub-adult or remaining a river resident for another year, Fox and Peterson (2019) found that 36.7% returned as age 2 fish while 30.4% outmigrated as age 2. The St. Johns River, the furthest south in the South Atlantic DPS, has periodic use by sub-adults and adults, but is no longer spawning or rearing habitat.

A recovery outline was produced for Atlantic sturgeon (NMFS 2018b). The goal for recovery is to have reproductive populations across their historic range of sufficient size and diversity to support reproduction and recovery from mortality events.

5.2.7 Shortnose Sturgeon

Shortnose sturgeon were initially listed as endangered on March 11, 1967 under the Endangered Species Preservation Act of 1966. In 1994, the species was listed as endangered throughout its range under the ESA (38 FR 41370). Shortnose sturgeon are benthic fish that occur in large coastal rivers of eastern North America. They range from as far south as the St. Johns River, Florida (possibly extirpated from this system) to as far north as the Saint John River in New Brunswick, Canada.

Life History

The shortnose sturgeon is a relatively slow growing, late maturing, and long-lived fish species. The maximum recorded size was a shortnose sturgeon collected from the Saint John River, Canada, measuring 143 cm total length (TL) and weighing 23 kilograms (Dadswell et al. 1984). The maximum ages reported of female shortnose sturgeon by river system include 67 years for the St. John River (New Brunswick), 40 years for the Kennebec River, 37 years for the Hudson River, 34 years for the Connecticut River, 20 years for the Pee Dee River, and 10 years for the Altamaha River (Dadswell et al. 1984; Gilbert 1989). Female shortnose sturgeon generally outlive and outgrow males, which seldom exceed 30 years of age (Dadswell et al. 1984; Gilbert 1989). Shortnose sturgeon also exhibit sexually dimorphic growth and maturation patterns across latitudes (Dadswell et al. 1984). In the north, males reach maturity at 5 to 11 years, while females mature between 7 and 18 years. Shortnose sturgeon in southern rivers typically grow faster, mature at younger ages (2 to 5 years for males and 4 to 5 for females), but attain smaller maximum sizes than those in the north which grow throughout their longer lifespans (Dadswell et al. 1984).

Shortnose sturgeon are amphidromous, inhabiting large coastal rivers or nearshore estuaries within river systems (Buckley and Kynard 1985; Kieffer and Kynard 1993). Sturgeon spawn in upper, freshwater areas, and feed and overwinter in both fresh and saline habitats. Adult shortnose sturgeon typically prefer deep downstream areas with vegetated bottoms and soft substrates. During the summer and winter months, adults occur primarily in freshwater tidally influenced river reaches; therefore, they often occupy only a few short reaches of a river's entire length (Buckley and Kynard 1985). In the southern end of their range, during the summer adult and juvenile shortnose sturgeon congregate in cool, deep areas of rivers to seek refuge from high temperatures (Flournoy et al. 1992; Rogers and Weber 1995; Weber 1996). Older juveniles or subadults tend to move downstream in the fall and winter as water temperatures decline and the salt wedge recedes. In the spring and summer, they move upstream and feed mostly in freshwater reaches; however, these movements usually occur above the saltwater/freshwater river interface (Dadswell et al. 1984; Hall et al. 1991). Young-of-the-year shortnose sturgeon are believed to move downstream after hatching (Dovel 1983) but remain within freshwater habitats.

Shortnose sturgeon have been found in waters with temperatures as low as 2 to 3ºC (Dadswell et al. 1984) and as high as 34ºC (Heidt and Gilbert 1979). However, temperatures above 28ºC are thought to adversely affect shortnose sturgeon (Kynard 1997). In the Altamaha River, temperatures of 28 to 30ºC during summer months create unsuitable conditions and shortnose sturgeon are found in deep cool water refuges. DO also plays a role in temperature tolerance; i.e., increased stress levels and lower temperature tolerance in waters with low DO (Kahn and Mohead 2010; Niklitschek 2001).

Shortnose sturgeon are known to occur at a wide range of depths. A minimum depth of 0.6 m is necessary for adults to swim unimpeded. This species is known to occur at depths of up to 30 m, but are generally found in waters less than 20 m (Dadswell 1979; Dadswell et al. 1984). Shortnose sturgeon exhibit tolerance to a wide range of salinities from freshwater (Taubert 1980) to waters with salinity of 30 parts-per-thousand (Holland and Yelverton 1973). McCleave et al. (1977) reported adults moving freely through a wide range of salinities, crossing waters with differences of up to 10 parts-per-thousand within a 2-hour period. The tolerance of shortnose sturgeon to increasing salinity is thought to increase with age (Kynard 1997). Shortnose sturgeon typically occur in the deepest parts of rivers or estuaries where suitable oxygen and salinity values are present (Gilbert 1989).

While shortnose sturgeon do not undertake the long marine migrations documented for Atlantic sturgeon, telemetry data indicate that shortnose sturgeon do make localized coastal migrations (Dionne et al. 2013). Inter-basin movements have been documented among rivers within the Gulf of Maine, between the Gulf of Maine and the Merrimack, between the Connecticut and Hudson rivers, between the Delaware River and Chesapeake Bay, and among the rivers in the Southeast region (Dionne et al. 2013; Fernandes et al. 2010; Finney et al. 2006; Welsh et al. 2002). Non-spawning movements include rapid, directed post-spawning movements to downstream feeding areas in the spring, and localized, wandering movements in the summer and winter (Buckley and Kynard 1985; Dadswell et al. 1984). In the northern extent of their range, shortnose sturgeon exhibit 3 distinct movement patterns. These migratory movements are associated with spawning, feeding and overwintering activities. In the spring, as water temperatures reach between 7.0 and 9.7 ºC, pre-spawning shortnose sturgeon move from overwintering grounds to spawning areas.

Spawning occurs from late winter/early spring (southern rivers) to mid to late spring (northern rivers) depending upon location and water temperature. Shortnose sturgeon spawning migrations are characterized by rapid, directed and often extensive upstream movement (NMFS 1998). Once males begin spawning, 1 to 2 years after reaching sexual maturity, they will spawn every other year or annually depending on the river they inhabit (Dadswell 1979; NMFS 1998). Age at first spawning for females is around 5 years post-maturation, with spawning occurring approximately every 3 to 5 years (Dadswell 1979). Spawning is estimated to last from a few days to several weeks.

Shortnose sturgeon are believed to spawn at discrete sites within their natal river (Kieffer and Kynard 1996), typically at the farthest upstream reach of the river, if access is not obstructed by dams (NMFS 1998). Spawning occurs over channel habitats containing gravel, rubble, or rock-cobble substrates (Dadswell 1979; NMFS 1998). Additional environmental conditions associated with spawning activity include decreasing river discharge following the peak spring freshet, water temperatures ranging from 6.5 to 18ºC, and bottom water velocities of 0.4 to 0.8 m/sec (Dadswell 1979; Hall et al. 1991; Kieffer and Kynard 1996; NMFS 1998). Adult shortnose sturgeon typically leave the spawning grounds shortly after spawning.

Shortnose sturgeon are benthic omnivores that feed on crustaceans, insect larvae, worms, mollusks (Collins et al. 2006a; Moser and Ross 1995; Savoy and Benway 2004), oligochaete worms (Dadswell 1979) and off plant surfaces (Dadswell et al. 1984). Subadults feed indiscriminately, consuming aquatic insects, isopods, and amphipods along with large amounts of mud, stones, and plant material (Bain 1997; Dadswell 1979).

Population Dynamics

Historically, shortnose sturgeon are believed to have inhabited nearly all major rivers and estuaries along the entire east coast of North America. The NMFS Shortnose Sturgeon Recovery Plan identifies 19 populations based on the fish's strong fidelity to natal rivers and the premise that populations in adjacent river systems did not interbreed with any regularity (NMFS 1998). Both mtDNA and nDNA analyses indicate effective (with spawning) coastal migrations are occurring between adjacent rivers in some areas, particularly within the Gulf of Maine and the Southeast (King et al. 2014). The currently available genetic information suggests that shortnose sturgeon can be separated into smaller groupings that form regional clusters across their geographic range (SSSRT 2010). Both regional population and metapopulation structures may exist according to genetic analyses and dispersal and migration patterns (King et al. 2014; Wirgin et al. 2010). The Shortnose Sturgeon Status Review Team (SSSRT) concluded shortnose sturgeon across their geographic range include 5 genetically distinct groupings each of which have geographic ecological adaptations: 1) Gulf of Maine; 2) Connecticut and Housatonic Rivers; 3) Hudson River; 4) Delaware River and Chesapeake Bay; and 5) Southeast (SSSRT 2010). Three of these regional groups appear to be functioning as a metapopulation: Gulf of Maine, Delaware/Chesapeake Bay, and Southeast. The other 2 groups (Connecticut/Housatonic and the Hudson River) are thought to be evolutionarily significant. Two additional geographically separate populations occur behind dams in the Connecticut River (above the Holyoke Dam) and in Lake Marion on the Santee-Cooper River system in South Carolina (above the Wilson and Pinopolis Dams). Although these populations are geographically isolated, genetic analyses suggest individual shortnose sturgeon move between some of these populations each generation (Quattro et al. 2002; Wirgin et al. 2005; Wirgin et al. 2010). The SSSRT also recommended that each riverine population be considered as a separate management/recovery unit (SSSRT 2010).

The distribution of shortnose sturgeon is disjointed across their range, with northern populations separated from southern populations by a distance of about 400 km near their geographic center in Virginia. While this gap in the range of shortnose sturgeon has been well documented, a gravid shortnose sturgeon was captured in the lower James River, though after it was tagged it left the river and the Chesapeake Bay (Balazik et al. 2017).

Status

The 2010 SSSRT conducted a 3-step risk assessment for shortnose sturgeon at a riverine scale: (1) assess population health, (2) populate a “matrix of stressors” by ranking threats, and (3) review assessment by comparing population health scores to stressor scores. The Hudson River had the highest estimated adult abundance (30,000 to 61,000), followed by the Delaware (12,000), Kennebec Complex (9,000), and Altamaha (6,000) (SSSRT 2010). The SSSRT found evidence of an increasing abundance trend for the Kennebec Complex and ACE Basin populations; a stable trend for the Merrimack, Connecticut, Hudson, Delaware, Winyah Bay Complex, Cooper, Savannah, Ogeechee, and Altamaha populations; and a declining trend only for the Cape Fear population (all other populations had an unknown trend) (SSSRT 2010).

The SSSRT summarized continuing threats to the species in each of the 29 identified populations (SSSRT 2010). Dams represent a major threat to 7 shortnose sturgeon populations and a moderate threat to 7 additional populations. Dredging represents a major threat to 1 shortnose sturgeon population (Savannah River), a moderately high threat to 3 populations, and a moderate threat to 7 populations. Fisheries bycatch represents a major threat to 1 shortnose sturgeon population (Lakes Marion and Moultrie in Santee-Cooper Reservoir System), a moderately high threat to 4 populations, and a moderate threat to 10 populations (SSSRT 2010). Water quality represents a major threat to 1 shortnose sturgeon population (Potomac River), a moderately high threat to 6 populations, a moderate threat to 13 populations, and a moderately low threat to 1 population. Specific sources of water quality degradation affecting shortnose sturgeon include coal tar, wastewater treatment plants, fish hatcheries, industrial waste, pulp mills, sewage outflows, industrial farms, water withdrawals, and non-point sources. These sources contribute to the following conditions that may have adverse effects on shortnose sturgeon: nutrient loading, low DO, algal blooms, increased sedimentation, elevated contaminant levels (mercury, polychlorinated biphenyl [PCBs], dioxin, polycyclic aromatic hydrocarbons [PAHs], endocrine disrupting chemicals, cadmium), and low pH levels (SSSRT 2010). Impingement/entrainment at power plants and treatment plants was rated as a moderate threat to 2 shortnose sturgeon populations (Delaware and Potomac).

The largest shortnose sturgeon adult populations are found in the Northeastern rivers, and populations in southern rivers are considerably smaller by comparison. Peterson and Bednarski (2013) documented a 3-fold variation in adult abundance (707 to 2,122 individuals) over a 7-year period in the Altamaha River. Bahr and Peterson (2017) estimated the adult shortnose population in the Savannah River was 1,865 in 2013, 1,564 in 2014, and 940 in 2015. Their estimates of juvenile shortnose sturgeon ranged from 81-270 age 1 fish and 123-486 age 2+ fish over the course of the 3-year (2013-2015) study period. This study suggests that the Savannah River population is likely the second largest within the South Atlantic (Bahr and Peterson 2017).

Population trend estimates are available for 6 shortnose sturgeon spawning stocks: St John, Kennebec, Hudson, and Satilla are all decreasing slightly (-1%); Delaware and Ogeechee are stable (0%). Estimated adult survival rates for shortnose sturgeon are only available for 2 river populations: Satilla 84% and ACE Basin 89%. Regular spawning is known to occur in 12 spawning stocks, with intermittent spawning observed in 3 other river systems Major threats to shortnose sturgeon, defined as threats that if altered could lead to recovery, are currently identified for 4 river systems: dams in the Connecticut, Santee, and Cooper Rivers and water quality in the St. Mary’s River. One or more minor threats, defined as threats that likely result in a low level of mortality, have been identified for several other river populations. The most prevalent minor threats to shortnose sturgeon are water quality (ten populations), bycatch (8 populations), and impingement/entrainment (6 populations).

Critical Habitat

No critical habitat has been designated for shortnose sturgeon.

Recovery Goals

The Shortnose Sturgeon Recovery Plan was developed in 1998. The long-term recovery objective, as stated in the Plan, is to recover all 19 discrete populations to levels of abundance at which they no longer require protection under the ESA (NMFS 1998). To achieve and preserve minimum population sizes for each population segment, essential habitats must be identified and maintained, and mortality must be monitored and minimized. Accordingly, other key recovery tasks discussed in the Plan are to define essential habitat characteristics, assess mortality factors, and protect shortnose sturgeon through applicable federal and state regulations.

5.2.8 Gulf Sturgeon

Gulf sturgeon were listed as threatened effective October 30, 1991 (56 CFR §49653, September 30, 1991), after their stocks were greatly reduced or extirpated throughout much of their historic range by overfishing, dam construction, and habitat degradation. NMFS and the USFWS jointly manage Gulf sturgeon. In riverine habitats, USFWS is responsible for all consultations regarding Gulf sturgeon and critical habitat. In estuarine habitats, responsibility is divided based on the action agency involved (i.e., NMFS consults with the Department of Defense, U.S. Army Corps of Engineers, Bureau of Ocean Energy Management, and any other federal agencies not specifically mentioned at 50 CFR §226.214). In marine areas, NMFS is responsible for all consultations regarding Gulf sturgeon and critical habitat.

The Gulf sturgeon is 1 of 2 subspecies of the Atlantic sturgeon (USFWS 1995). The Gulf sturgeon is anadromous, and historically occurred in most river systems from the Mississippi river east to Tampa Bay, and in marine coastal/estuarine areas from the Central and Eastern Gulf of Mexico south to Florida Bay (Wooley and Crateau 1985). The current range of the sub-species extends from Lake Pontchartrain in Louisiana east to the Suwannee river system in Florida (Figure 11). Within that range, 7 major rivers are known to support reproducing populations: Pearl, Pascagoula, Escambia, Yellow, Choctawhatchee, Apalachicola, and Suwannee (USFWS 2009b).

Life History

Gulf sturgeon are long-lived, with some individuals reaching at least 42 years in age (Huff 1975). Age at sexual maturity ranges from 8 to 17 years for females and 7 to 21 years for males (Huff 1975). Chapman and Carr (1995) estimated that mature female Gulf sturgeon that weigh between 64 and 112 pounds (29-51 kilograms) produce an average of 400,000 eggs. Spawning intervals range from 1 to 5 years for males, while females require longer intervals ranging from 3 to 5 years (Fox et al. 2000; Huff 1975).

Gulf sturgeon move from the Gulf of Mexico into coastal rivers in early spring (i.e., March through May). Spawning occurs in the upper reaches of rivers in the spring when water temperature is around 15°C to 20°C. Fertilization is external; females deposit their eggs on the river bottom and males fertilize them. Gulf sturgeon eggs are demersal, adhesive, and vary in color from gray to brown to black (Huff 1975; Vladykov and Greely 1963). Parauka et al. (1991) reported that hatching time for artificially spawned Gulf sturgeon ranged from 85.5 hours at 18.4°C to 54.4 hours at about 23°C. After hatching, young-of-year individuals generally disperse downstream of spawning sites, though some may travel upstream as well (Clugston et al. 1995; Sulak and Clugston 1999), and move into estuarine feeding areas for the winter months. Tagging studies confirm that Gulf sturgeon exhibit a high degree of river fidelity (Carr 1983). Of 4,100 fish tagged, 21% (860 of 4,100 fish) were later recaptured in the river of their initial collection, 8 fish (0.2%) moved between river systems, and the remaining fish (78.8%) have not yet been recaptured (NMFS and USFWS 1995). After spawning, Gulf sturgeon move downstream to areas referred to as “summer resting” or “holding” areas.

In the fall, movement from the rivers into the estuaries and associated bays begins in September (at water temperatures around 23°C) and continues through November (Foster and Clugston 1997; Huff 1975; Wooley and Crateau 1985). Because the adult and large subadult sturgeon have spent at least 6 months fasting or foraging sparingly on detritus (Mason and Clugston 1993) in the rivers, it is presumed they immediately begin foraging. Telemetry data indicate Gulf sturgeon are found in high concentrations near the mouths of their natal rivers with individual fish traveling relatively quickly between foraging areas where they spend an extended period of time (Edwards et al. 2007; Edwards et al. 2003).

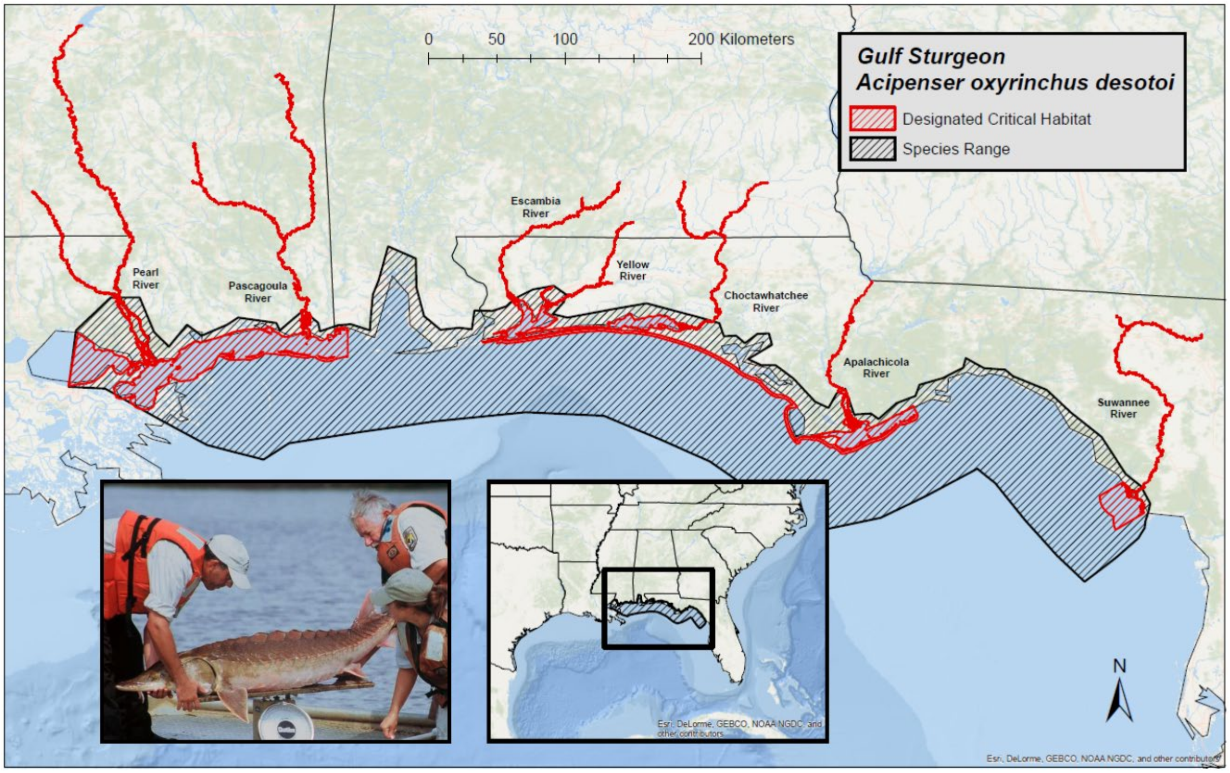

Figure 11. Gulf Sturgeon Range and Designated Critical Habitat

Most subadult and adult Gulf sturgeon spend the cool winter months (October/November through March/ April) in the bays, estuaries, and the nearshore Gulf of Mexico (Clugston et al. 1995; Fox et al. 2002; Odenkirk 1989). Tagged fish have been located in well-oxygenated shallow water (less than 7 m) areas that support burrowing macro invertebrates (Craft et al. 2001; Fox and Hightower 1998; Fox et al. 2002; Parauka et al. 2001; Rogillio et al. 2007; Ross et al. 2001b; Ross et al. 2009). These areas may include shallow shoals 5-7 ft (1.5-2.1 m), deep holes near passes (Craft et al. 2001), unvegetated sand habitats such as sandbars, and intertidal and subtidal energy zones (Abele and Kim 1986; Menzel 1971; Ross et al. 2009). Subadult and adult Gulf sturgeon overwintering in Choctawhatchee Bay (Florida) were generally found to occupy the sandy shoreline habitat at depths of 4-6 ft (2-3 m) (Fox et al. 2002; Parauka et al. 2001). These shifting, predominantly sandy, areas support a variety of potential prey items including estuarine crustaceans, small bivalve mollusks, ghost shrimp, small crabs, various polychaete worms, and lancelets (Abele and Kim 1986; AFS 1989; Menzel 1971). Preference for sandy habitat is supported by studies in other areas that have correlated Gulf sturgeon presence to sandy substrate (Fox et al. 2002).

Gulf sturgeon are described as opportunistic and indiscriminate benthivores that change their diets and foraging areas during different life stages. Their guts generally contain benthic marine invertebrates including amphiopods, lancelets, polychaetes, gastropods, shrimp, isopods, molluscs, and crustaceans (Carr et al. 1996; Fox et al. 2002; Huff 1975; Mason and Clugston 1993). Generally, Gulf sturgeon prey are burrowing species that feed on detritus and/or suspended particles, and inhabit sandy substrate. In the river, young-of-year sturgeon eat aquatic invertebrates and detritus (Mason and Clugston 1993; Sulak and Clugston 1999) and juveniles forage throughout the river on aquatic insects (e.g., mayflies and caddisflies), worms (oligochaete), and bivalves (Huff 1975; Mason and Clugston 1993). Adults forage sparingly in freshwater and depend almost entirely on estuarine and marine prey for their growth (Gu et al. 2001).

Population Dynamics

Currently, 7 rivers are known to support reproducing populations of Gulf sturgeon. The most recent abundance estimates reported in the 5-Year Review are shown in Table 5 (USFWS 2009b).

Table 5. Gulf Sturgeon Abundance Estimates and Confidence Intervals, by River and Year, for the 7 Major Rivers with Reproducing Populations (modified from USFWS [2009b]).

River	Year of Data Collection	Abundance Estimate[a]	Lower/Upper 95% CI[b]	Source
Pearl	2001	430	323/605	(Rogillio et al. 2001)
Pascagoula	2000	216	124/429	(Ross et al. 2001a)
Escambia	2015	372	241/576	(USFWS 2007)
Yellow	2012	398	111/1,859	(Berg et al. 2007)
Choctawhatchee	2008	3,314	not reported	(USFWS 2009a)
Apalachicola	2014	1,288	not reported	(Sulak et al. 2016)
Suwannee	2012-2013	9,743	not reported	(Sulak al. 2016)

a Estimates refer to numbers of individuals greater than a certain size, which varies between studies depending on sampling gear, and in some cases, numbers of individuals that use a particular portion of the river. Refer to original publication for details.

b Large confidence intervals (CI) around the mean estimates reflect the low capture probability in mark-recapture survey.

Gulf sturgeon abundance trends are typically assessed on a riverine basis. In general, Gulf sturgeon populations in the eastern portion of the range appear to be stable or slightly increasing, while populations in the western portion are associated with lower abundances and higher uncertainty (USFWS 2009b). Pine and Martell (2009) reported that, due to low recapture rates and sparse data, the population viability of Gulf sturgeon is currently uncertain.

When grouped by genetic relatedness, 5 regional or river-specific stocks emerge: (1) Lake Pontchartrain and Pearl River; (2) Pascagoula River; (3) Escambia, Blackwater and Yellow Rivers; (4) Choctawhatchee River; and (5) Apalachicola, Ochlocknee and Suwanee Rivers (Rudd et al. 2014; Stabile et al. 1996). Gene flow is low in Gulf sturgeon stocks, with each stock exchanging less than 1 mature female per generation (Waldman and Wirgin 1998).

Status

Past declines in the abundance of Gulf sturgeon has been attributed to targeted fisheries in the late 19th and early 20th centuries, habitat loss associated with dams and sills, habitat degradation associated with dredging, de-snagging, and contamination by pesticides, heavy metals, and other industrial contaminants, and certain life history characteristics (e.g. slow growth and late maturation) (56 FR 49653). Recent abundance data described in the 2022 5-Year Review (USFWS and NMFS 2022) indicate a roughly stable or slightly increasing population trend over the last decade in the eastern river systems (Florida), with a much stronger increasing trend in the Suwannee River. Populations in the western portion of the range (Mississippi and Louisiana) are believed to exhibit lower abundance than those in the eastern portion of the range. Effects of climate change (warmer water, sea level rise and higher salinity levels) could lead to accelerated changes in habitats utilized by Gulf sturgeon. The rate that climate change and corollary impacts are occurring may outpace the ability of the Gulf sturgeon to adapt given its limited geographic distribution and low dispersal rate. In general, Gulf sturgeon populations in the eastern portion of the range appear to be stable or slightly increasing, while populations in the western portion are associated with lower abundances and higher uncertainty (USFWS 2009b).

Critical Habitat

See Section 5.1.6 above.

Recovery Goals

The 1995 Recovery Plan outlined 3 recovery objectives: (1) to prevent further reduction of existing wild populations of Gulf sturgeon within the range of the subspecies; (2) to establish population levels that would allow delisting of the Gulf sturgeon by management units (management units could be delisted by 2023 if required criteria are met); and (3) to establish, following delisting, a self-sustaining population that could withstand directed fishing pressure within management units (USFWS 1995). Although the tasks outlined in the 1995 Recovery Plan address threats relative to listing factors (e.g., habitat modification, overutilization, water quality, etc.), the plan lacks criteria that would measure progress towards reducing these threats. The most recent Gulf sturgeon 5-year review recommended that criteria be developed in a revised recovery plan (USFWS 2009b)

5.2.9 Smalltooth Sawfish - U.S. portion of range DPS

The U.S. DPS of smalltooth sawfish was listed as endangered under the ESA effective May 1, 2003 (68 FR 15674). Although this species is reported to have a circumtropical distribution, NMFS identified smalltooth sawfish from the Southeast United States as a DPS. Within the United States, smalltooth sawfish have been captured in estuarine and coastal waters from New York southward through Texas, although peninsular Florida (Figure 12) has historically been the region of the United States with the largest number of recorded captures (NMFS 2010).

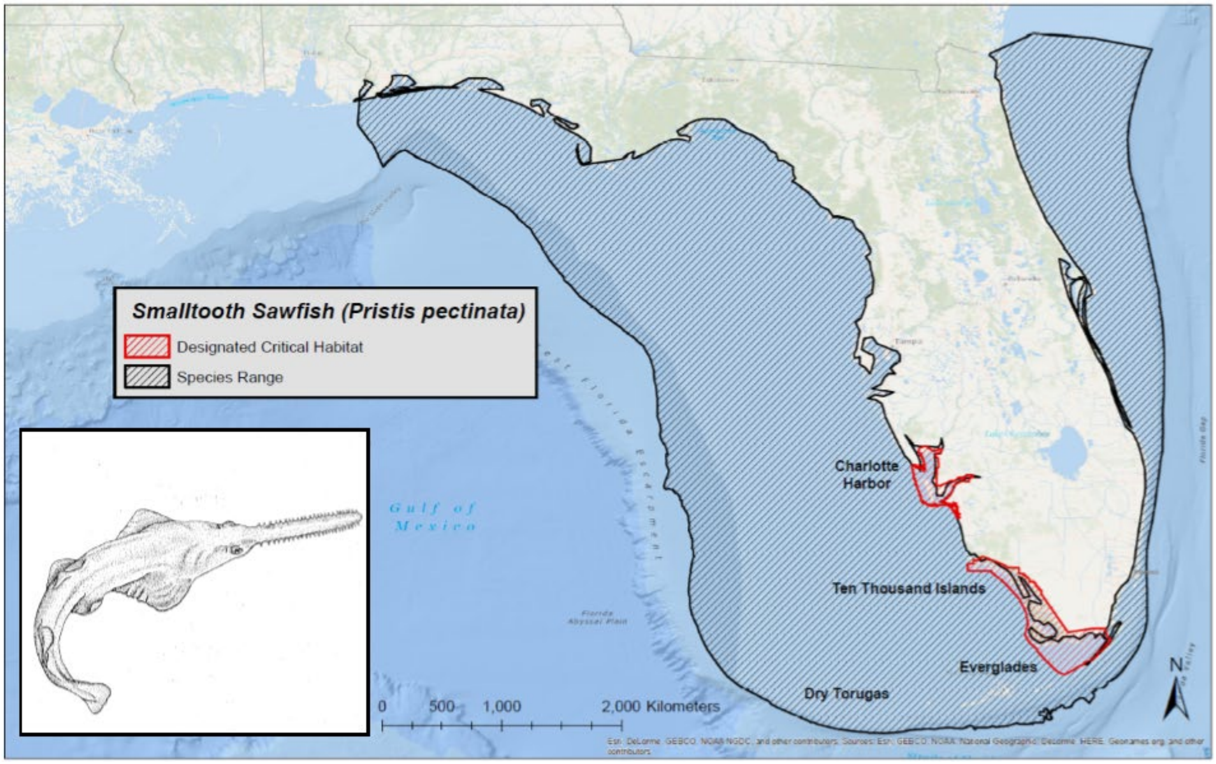

Figure 12. Smalltooth Sawfish U. S. DPS Range and Designated Critical Habitat

Life History

Smalltooth sawfish size at sexual maturity has been reported as 360 cm TL by Simpfendorfer (2005). Carlson and Simpfendorfer (2015) estimated that sexual maturity for females occurs between 7 and 11 years of age. As with all elasmobranchs, smalltooth sawfish are viviparous; fertilization is internal. The gestation period for smalltooth sawfish is estimated at 5 months based on data from the largetooth sawfish (Thorson 1976). Females move into shallow estuarine and nearshore nursery areas to give birth to live young between November and July, with peak parturition occurring between April and May (Poulakis et al. 2011). Litter sizes range between 10 and 20 individuals (Bigalow and Schroeder 1953; Carlson and Simpfendorfer 2015; Simpfendorfer 2005).

Neonate smalltooth sawfish are born measuring 67 – 81 cm (TL) and spend the majority of their time in the shallow nearshore edges of sand and mud banks (Poulakis et al. 2011; Simpfendorfer et al. 2010). Once individuals reach 100 – 140 cm (TL) they begin to expand their foraging range. Capture data suggests smalltooth sawfish in this size class may move throughout rivers and estuaries within a salinity range of 18 and 30 (practical salinity units). Individuals in this size class also appear to have the highest affinity to mangrove habitat (Simpfendorfer et al. 2011). Juvenile sawfish spend the first 2-3 years of their lives in the shallow waters provided in the lower reaches of rivers, estuaries, and coastal bays (Simpfendorfer et al. 2008; Simpfendorfer et al. 2011). As smalltooth sawfish approach 250 cm (TL) they become less sensitive to salinity changes and begin to move out of the protected shallow-water embayments and into the shorelines of barrier islands (Poulakis et al. 2011). Adult sawfish typically occur in more open-water, marine habitats (Poulakis and Seitz 2004).

Population Dynamics

The abundance of smalltooth sawfish in U.S. waters has decreased dramatically over the past century. Efforts are currently underway to provide better estimates of smalltooth sawfish abundance (NMFS 2014a). Current abundance estimates are based on encounter data, genetic sampling, and geographic extent. Carlson and Simpfendorfer (2015) used encounter densities to estimate the female population size to be 600. Chapman et al. (2011) analyzed genetic data from tissue samples (fin clips) to estimate the effective genetic population size as 250-350 adults (95% C.I. 142-955). Simpfendorfer (2002) estimated that the U.S. population may number less than 5% of historic levels based on the contraction of the species' range.

The abundance of juveniles encountered in recent studies (Poulakis et al. 2014; Seitz and Poulakis 2002; Simpfendorfer and Wiley 2004) suggests that the smalltooth sawfish population remains reproductively viable. The overall abundance appears to be stable (Wiley and Simpfendorfer 2010). Data analyzed from the Everglades portion of the smalltooth sawfish range suggests that the population growth rate for that region may be around 5% per year (Carlson and Osborne 2012; Carlson et al. 2007). Intrinsic rates of growth (λ) for smalltooth sawfish have been estimated at 1.08-1.14 per year and 1.237-1.150 per year by Simpfendorfer (2000) and Carlson and Simpfendorfer (2015) respectively. However, these intrinsic rates are uncertain due to the lack of long-term abundance data.

Chapman et al. (2011) investigated the genetic diversity within the smalltooth sawfish population. The study reported that the remnant population exhibits high genetic diversity (allelic richness, alleles per locus, heterozygosity) and that inbreeding is rare. The study also suggested that the protected population will likely retain greater than 90% of its current genetic diversity over the next century.

Recent capture and encounter data suggests that the current distribution is focused primarily to south and southwest Florida from Charlotte Harbor through the Dry Tortugas (Poulakis and Seitz 2004; Seitz and Poulakis 2002). Water temperatures (no lower than 16-18°C) and the availability of appropriate coastal habitat (shallow, euryhaline waters and red mangroves) are the major environmental constraints limiting the distribution of smalltooth sawfish.

Status

The decline in the abundance of smalltooth sawfish has been attributed to fishing (primarily commercial and recreational bycatch), habitat modification (including changes to freshwater flow regimes as a result of climate change), and life history characteristics (i.e. slow-growing, relatively late-maturing, and long-lived species) (NMFS 2009b; Simpfendorfer et al. 2011). These factors continue to threaten the smalltooth sawfish population. Recent records indicate there is a resident reproducing population of smalltooth sawfish in south and southwest Florida from Charlotte Harbor through the Dry Tortugas, which is also the last U.S. stronghold for the species (Poulakis and Seitz 2004; Seitz and Poulakis 2002; Simpfendorfer and Wiley 2004). While the overall abundance appears to be stable, low intrinsic rates of population increase suggest that the species is particularly vulnerable to rapid population declines (NMFS 2010).

Critical Habitat

Critical habitat for smalltooth sawfish was designated in 2009 (74 FR 45353) and includes 2 major units: Charlotte Harbor (221,459 acres) and Ten Thousand Islands/Everglades (619,013 acres) (Figure 11). These 2 units include essential sawfish nursery areas. The locations of nursery areas were determined by analyzing juvenile smalltooth sawfish encounter data in the context of shark nursery criteria (Heupel et al. 2007; Norton et al. 2012). Within the nursery areas, 2 features were identified as essential to the conservation of the species: red mangroves (Rhizophora mangle), and euryhaline habitats with water depths ≤0.9 m (74 FR 45353). The Charlotte Harbor unit includes areas which are moderate to highly developed (Cape Coral, Fort Myers) and includes a highly altered, flow-managed system (Caloosahatchee River). In contrast, the Ten Thousand Island/Everglades unit contains relatively undeveloped, pristine smalltooth sawfish habitat (Poulakis et al. 2014; Poulakis et al. 2011). Smalltooth sawfish critical habitat will not be affected by the proposed action as the applicant has indicated that they will avoid trawling in these areas (SEFSC 2021), and there is no pathway for effects to the PBFs of this critical habitat.

Recovery Goals

The 2009 Smalltooth Sawfish Recovery Plan (NMFS 2009b) contains complete downlisting/delisting criteria for each of the 3 following recovery goals. Minimize human interactions and associated injury and mortality. Specific criteria include:

- educational programs;
- handling and release guidelines;
- injury and mortality regulations; and, other State and/or Federal measures (not including those provided under the ESA);
- protect and/or restore smalltooth sawfish habitats, in particular existing mangrove shoreline habitat;
- assurance of availability and accessibility of both mangrove and non-mangrove habitat sufficient to support subpopulations of juvenile sawfish;
- appropriate freshwater flow regimes;
- identification and protection of habitat areas utilized by adult smalltooth sawfish; and
- ensure smalltooth sawfish abundance increases substantially and the species reoccupies areas from which it had been previously extirpated. Specific criteria include: annual increases in the relative abundance of juvenile smalltooth sawfish; annual increases in the relative abundance of adult smalltooth sawfish; verified records of adult smalltooth sawfish in outer regions of the species range.

6 ENVIRONMENTAL BASELINE

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 C.F.R. §402.02). The following information summarizes the principal natural and human-caused phenomena in the action area believed to affect the survival and recovery of the ESA-listed species discussed in Section 5.2.

6.1 Global Climate Change

There is a large and growing body of literature on past, present, and anticipated future impacts of global climate change, exacerbated and accelerated by human activities. Effects of climate change include sea level rise, increased frequency and magnitude of severe weather events, changes in air and water temperatures, and changes in precipitation patterns, all of which are likely to impact ESA-listed resources. NOAA's climate information portal provides basic background information on these and other measured or anticipated climate change effects (see https://www.climate.gov).

This section provides some examples of impacts to ESA-listed species and their habitats that have occurred or may occur in the action area as the result of climate change. We address climate change as it has affected ESA-listed species and continues to affect species, and we look to the foreseeable future to consider effects that we anticipate will occur as a result of ongoing activities. While the consideration of future impacts may also be suited to our cumulative effects analysis (Section 8), it is discussed here to provide a comprehensive analysis of the effects of climate change. While it is difficult to accurately predict the consequences of climate change to a particular species or habitat, a range of consequences are expected that are likely to change the status of the species and the condition of their habitats both within and outside of the action area.

In order to evaluate the implications of different climate outcomes and associated impacts throughout the 21st century, many factors have to be considered. The amount of future greenhouse gas emissions is a key variable. Developments in technology, changes in energy generation and land use, global and regional economic circumstances, and population growth must also be considered. Scenarios were developed by the Intergovernmental Panel on Climate Change (IPCC) to ensure that starting conditions, historical data, and projections are employed consistently across the various branches of climate science. Scenarios drive climate model projections for temperature, precipitation, sea level, and other variables. The IPCC working group assessed the climate response to five illustrative scenarios based on Shared Socio-economic Pathways (SSPs) that cover the range of possible future development of anthropogenic drivers of climate change found in the literature (IPCC 2023). High and very high greenhouse gas emissions scenarios (SSP3-7.0 and SSP5-8.522 32) have CO2 emissions that roughly double from current levels by 2100 and 2050, respectively. The intermediate emissions scenario (SSP2-4.5) has CO2 emissions remaining around current levels until the middle of the century (IPCC 2023). The very low and low greenhouse gas emissions scenarios (SSP1-1.9 and SSP1-2.6) have CO2 emissions declining to net zero around 2050 and 2070, respectively, followed by varying levels of net negative CO2 emissions. The lowest scenarios modeled limit global warming by 2100 to 1.5°C, while the highest scenarios modeled predict global warming levels of 4°C or greater (IPCC 2023).

The Paris Agreement aims to limit the future rise in global average temperature to 2°C, but the observed acceleration in carbon emissions over the last 15 to 20 years, even with a lower trend in 2016, has been consistent with higher future scenarios (Hayhoe et al. 2018). As there remains a fair amount of uncertainty regarding the implementation of mitigation measures with the goal of curbing pollutants contributing to global climate change, our ESA analyses are conducted based on the very high scenario.

Global surface temperature was 1.09°C higher in 2011–2020 than 1850–1900, with larger increases over land (1.59°C) than over the ocean (0.88°C) (IPCC 2023). Global surface temperature in the first two decades of the 21st century (2001-2020) was 0.99°C higher than 1850-1900 (IPCC 2023). Global surface temperature has increased faster since 1970 than in any other 50-year period over at least the last 2000 years (IPCC 2023). Global warming has led to more frequent heatwaves in most land regions and an increase in the frequency and duration of marine heatwaves (Allen et al. 2018). Average global warming up to 1.5°C as compared to pre-industrial levels is expected to lead to regional changes in extreme temperatures, and increases in the frequency and intensity of precipitation and drought (Allen et al. 2018). The average annual rate of sea level rise was 1.3 mm between 1901 and 1971, increasing to 1.9 mm between 1971 and 2006, and further increasing to 3.7 mm between 2006 and 2018 (IPCC 2023).

Additional consequences of climate change include increased ocean stratification, decreased sea-ice extent, altered patterns of ocean circulation, and decreased ocean oxygen levels (Doney et al. 2012). Further, ocean acidity has increased by 26% since the beginning of the industrial era (IPCC 2014) and this rise has been linked to climate change. Climate change is also expected to increase the frequency of extreme weather and climate events including, but not limited to, cyclones, tropical storms, heat waves, and droughts (IPCC 2014).

Changes in the marine ecosystem caused by global climate change (e.g., ocean acidification, salinity, oceanic currents, dissolved oxygen levels, nutrient distribution) could influence the distribution and abundance of lower trophic levels (e.g., phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish), ultimately affecting primary foraging areas of ESA-listed species including marine mammals, sea turtles, and fish. McMahon and Hays (2006) predicted increased ocean temperatures will expand the distribution of leatherback turtles into more northern latitudes. For ESA-listed species that undergo long migrations, if either prey availability or habitat suitability is disrupted by changing ocean temperatures regimes, the timing of migration can change or negatively impact population sustainability (Simmonds and Eliott 2009).

Climate change has the potential to impact species abundance, geographic distribution, migration patterns, and susceptibility to disease and contaminants, as well as the timing of seasonal activities and community composition and structure (Evans and Bjørge 2013; IPCC 2014; Kintisch 2006; Learmonth et al. 2006; MacLeod et al. 2005; McMahon and Hays 2006; Robinson et al. 2005). Though predicting the precise consequences of climate change on highly mobile marine species is difficult (Becker et al. 2018; Silber et al. 2017; Simmonds and Isaac 2007), recent research has indicated a range of consequences already occurring.

In sea turtles, sex is determined by the ambient sand temperature (during the middle third of incubation) with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25 to 35°C (Ackerman 1997). Increases in global temperature could skew future sex ratios toward higher numbers of females (Patrício et al. 2021). Over time, this can reduce genetic diversity, or even population viability, if males become a small proportion of populations (Hulin et al. 2009). Sea surface temperatures on loggerhead foraging grounds has also been linked to the timing of nesting, with higher temperatures leading to earlier nesting (Mazaris et al. 2009; Schofield et al. 2009). Green sea turtles emerging from nests at cooler temperatures likely absorb more yolk that is converted to body tissue than do hatchlings from warmer nests (Ischer et al. 2009). However, warmer temperatures may also decrease the energy needs of a developing embryo (Reid et al. 2009). Impacts on sea turtle nesting from loss of habitat will likely be exacerbated by sea level rise. The loss of leatherback nesting habitat because of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006; Baker et al. 2006).

Information on current effects of global climate change on Atlantic sturgeon is not available. While it is speculated that future climate change may affect sturgeon, it is difficult to predict the magnitude and scope of those potential impacts. Atlantic sturgeon could be affected by changes in river ecology resulting from increases in precipitation and changes in water temperature which may affect recruitment and distribution in these rivers. The effects of increased water temperature and decreased water availability are likely to have a more immediate effect on Atlantic sturgeon populations that migrate and spawn in river systems with existing water temperatures that are at or near the maximum for the species, including the South Atlantic and Carolina DPSs. Atlantic sturgeon prefer water temperatures up to approximately 28°C (82.4°F); these temperatures are experienced naturally in some areas of rivers during the summer months. If river temperatures rise and temperatures above 28°C are experienced in larger areas, sturgeon may be excluded from some habitats. The increased rainfall predicted by some models in some areas may increase runoff and scour spawning areas, while flooding events could cause temporary decreases in water quality. Rising temperatures predicted for all of the U.S. could exacerbate existing water quality problems with changes in dissolved oxygen and temperature.

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

Changes in oceanic conditions could also affect the marine distribution of Atlantic sturgeon or their marine and estuarine prey resources. Rising sea level may result in the salt wedge moving upstream in affected rivers. Atlantic sturgeon spawning occurs in fresh water reaches of rivers because early life stages have little to no tolerance for salinity. In river systems with dams or natural falls that are impassable by sturgeon, movement of the salt wedge further upstream would further restrict Atlantic sturgeon spawning and rearing habitat. The effects of climate change on ESA-listed sturgeon will not occur independently from other stressors. Rather, the anthropogenic stressors already affecting the fitness and survival of sturgeon – including bycatch, loss of migratory habitat from dams, contamination of riverine habitat and overall decreased water quality – will be compounded by the anticipated effects of climate change.

Habitat loss due to climate change represents a primary threat to smalltooth sawfish (Brame et al. 2019). Red mangroves and shallow (<1 m), euryhaline waters identified as habitat features essential for the conservation of smalltooth sawfish are likely to be affected by climate change, most notably through sea level rise (Brame et al. 2019). Sea level increases would reduce the amount of shallow water available for juvenile smalltooth sawfish in areas where shorelines are armored (e.g. seawalls). Reductions in the availability of shallow water or mangroves could have numerous ecological effects on sawfish, including increased sawfish predation, higher metabolic stress, and decreased body condition (Brame et al. 2019).

Given that sawfish distribution is limited to areas with water temperatures above 8−12°C, warming could result in a northward range expansion for the species. Increased air temperature may also allow northward expansion of red mangroves, thus providing a primary habitat feature for the species outside of the current range (Brame et al. 2019).

6.2 Fisheries Directed Harvest and Bycatch

Past directed commercial fisheries contributed to the steady decline in the population abundance of many populations of ESA-listed sturgeon. Between 1890 and 1905, Atlantic sturgeon populations were drastically reduced due to overfishing for sale of meat and caviar. Harvest records indicate that fisheries for sturgeon were conducted in every major coastal river along the Atlantic coast at one time, with fishing effort concentrated during spawning migrations (Smith 1985). Approximately 3,350 metric tons (7.4 million pounds) of sturgeon (Atlantic and shortnose combined) were landed in 1890 (Smith and Clugston 1997). The sturgeon fishery during the early years (1870 to 1920) was concentrated in the Delaware River and Chesapeake Bay systems. During the 1970s and 1980s sturgeon fishing effort shifted to the South Atlantic, which accounted for nearly 80% of total U.S. landings (64 metric tons). Prompted by research on juvenile production between 1985 and 1995 (Peterson et al. 2000), the Atlantic sturgeon fishery was closed by the ASMFC in 1998 when a coast-wide fishing moratorium was imposed for 20-40 years, or at least until 20 year classes of mature female Atlantic sturgeon were present (ASMFC 2008). NMFS followed this action by closing the EEZ to Atlantic sturgeon take in 1999. Poaching of Atlantic sturgeon continues and is a potentially significant threat to the species, but the present extent and magnitude of such activity is largely unknown.

Although directed fishing for Atlantic sturgeon is prohibited under the ESA, large numbers are still captured as “bycatch” in fishing operations targeting other species. The available bycatch data for federally managed fisheries indicate that sink gillnets and bottom otter trawl gear pose the greatest risk to Atlantic sturgeon; although, Atlantic sturgeon are also caught by hook and line, fyke nets, pound nets, drift gillnets and crab pots (ASFMC 2017). Mortality in both commercial and recreational fisheries has been, and still is, the primary threat responsible for the decline in smalltooth sawfish abundance (Brame et al. 2019).

Commercial fisheries bycatch also represents a significant threat to sea turtles throughout the action area, as sea turtles are highly vulnerable to incidental capture in many fisheries gears including tangle nets, trawls and longlines. Finkbeiner et al. (2011) compiled cumulative estimates of sea turtle bycatch across fisheries of the United States between 1990 and 2007, before and after implementation of fisheries-specific bycatch mitigation measures. Pre- and post-regulatory strata were identified for each fishery based on the first year a sea turtle bycatch mitigation strategy was mandated. For the Atlantic region, an annual mean of 345,800 turtle interactions and 70,700 deaths was estimated for the pre-regulatory strata across all fisheries included in this study. By comparison, an annual mean of 137,700 turtle interactions and 4,500 deaths was estimated for the post-regulatory strata.

6.2.1 Federally Managed Fisheries

In the Northwest Atlantic, NMFS Greater Atlantic Regional Office (GARFO) manages federal fisheries from Maine to Cape Hatteras, North Carolina; however, the management areas for some of these fisheries range from Maine through Virginia, while others extend as far south as Key West, Florida. The NMFS Southeast Regional Office (SERO) manages federal fisheries from Cape Hatteras, North Carolina to Texas, including Puerto Rico and the U.S. Virgin Islands. Both NMFS regional offices have conducted ESA section 7 consultation on all federal fisheries authorized under their jurisdiction.

Each of the most recent GARFO and SERO fishery consultations noted above have considered adverse effects to green, Kemp’s ridley, loggerhead, and leatherback sea turtles. In each of the fishery opinions, NMFS concluded that the ongoing action was likely to adversely affect but was not likely to jeopardize the continued existence of any sea turtle species. Each of these opinions included an ITS exempting a certain amount of lethal or non-lethal take resulting from interactions with the fisheries. Table 6 below shows the incidental take of ESA-listed turtles and Atlantic sturgeon exempted as a result of the 2021 biological opinion and ITS on the American Lobster, Atlantic Bluefish, Atlantic Deep-Sea Red Crab, Mackerel/Squid/Butterfish, Monkfish, Northeast Multispecies, Northeast Skate Complex, Spiny Dogfish, Summer Flounder/Scup/Black Sea Bass, and Jonah Crab Fisheries. Table 7 shows the exempted take for sea turtles from all other current section 7 fisheries consultations on the U.S. Atlantic coast.

Table 6. Average Annual Exempted Take of Sea Turtles and Atlantic Sturgeon over a 5-Year Period as a Result of the 2021 Biological Opinion and ITS on the American Lobster, Atlantic Bluefish, Atlantic Deep-Sea Red Crab, Mackerel/Squid/Butterfish, Monkfish, Northeast Multispecies, Northeast Skate Complex, Spiny Dogfish, Summer Flounder/Scup/Black Sea Bass, and Jonah Crab fisheries (NMFS 2021a)

Species	Average Annual Total Take	Average Annual Lethal Take
Sea Turtles		
Green, North Atlantic DPS	Gillnet: 2 Trawl: 6.4	Gillnet: 1.6 Trawl: 3.2
Kemp's ridley	Gillnet: 47.8 Trawl: 10.6	Gillnet: 37.4 Trawl: 5.4
Loggerhead, NWA DPS	Gillnet: 207.2 Trawl: 190.8 Pot/trap: 1	Gillnet: 161.6 Trawl: 95.4 Pot/trap: 0.8
Leatherback	Gillnet: 10.4 Trawl: 8 Pot/trap: 10	Gillnet: 8.2 Trawl: 4 Pot/trap: 6.4
Any combination of turtle species	Vessel strike: 3	Vessel strike: 3
Atlantic Sturgeon		
Atlantic sturgeon, Gulf of Maine DPS	Gillnet: 55 Trawl: 68	Gillnet: 11 Trawl: 4
Atlantic sturgeon, New York Bight DPS	Gillnet: 448 Trawl: 556	Gillnet: 90 Trawl: 28
Atlantic sturgeon, Chesapeake Bay DPS	Gillnet: 68 Trawl: 83	Gillnet: 13 Trawl: 4
Atlantic sturgeon, Carolina DPS	Gillnet: 16 Trawl: 20	Gillnet: 3 Trawl: 1
Atlantic sturgeon, South Atlantic DPS	Gillnet: 35 Trawl: 44	Gillnet: 7 Trawl: 2

Table 7. Exempted Take for Sea Turtles from all other Current Section 7 Fisheries Consultations on the U.S. Atlantic Coast

Fishery Management Plan	Date	Loggerhead	Kemp's ridley	Green	Leatherback
American lobster	July 31, 2014	1 (lethal or non-lethal)	0	0	7 (lethal or non-lethal)
Atlantic sea scallop	July 12, 2012 (amended November 2018)	322 (92 lethal) over 2 years in dredges; 700 (330 lethal) over 5 years in trawls	3 (2 lethal) in dredges and trawls combined	2 (lethal) in dredges and trawls combined	2 (lethal) in dredges and trawls combined
Red Crab	February 6, 2002	1 (lethal or non-lethal)	0	0	1 (lethal or non-lethal)
Coastal migratory pelagics	June 18, 2015, amended 2017	27 over 3 years (7 lethal)	8 over 3 years (2 lethal)	31 over 3 years (9 lethal)*	1 over 3 years (1 lethal)
South Atlantic snapper-grouper	December 1, 2016	629 (208 lethal) over 3 years	180 (59 lethal) over 3 years	111 (42 lethal) over 3 years	6 (5 lethal) over 3 years
Southeastern U.S. shrimp	April 26, 2021	72,670 (2,150 lethal) over 5 years	84,495 (8,505 lethal) over 5 years	21,214 (1,700 lethal) over 5 years	130 (5 lethal) over 5 years
HMS fisheries, excluding pelagic longline	January 10, 2020	91 (51 lethal) over 3 years	22 (11 lethal) over 3 years	46 (21 lethal) over 3 years	7 (3 lethal) over 3 years
HMS, pelagic longline	May 15, 2020	1080 (280 lethal) over 3 years	21 (8 lethal) combined Kemp's ridley, green (includes N. Atlantic and S. Atlantic DPS), hawksbill, or olive ridley over 3 years	996 (275 lethal) over 3 years	HMS, pelagic longline
South-Atlantic dolphin-wahoo	August 27, 2003	12 (2 lethal)	3 (1 lethal) combination of Kemp's ridley, green, or hawksbill	12 (1 lethal)	South-Atlantic dolphin- wahoo

For Atlantic sturgeon, incidental take from fisheries bycatch is also exempted for the following fisheries:

- Atlantic sea scallop - 1 sublethal annually, 1 lethal every 20 years from any DPS;
- Coastal Migratory Pelagics - 12 sublethal every 3 years, 0 lethal across all DPSs;
- Southeastern U.S. Shrimp (every 5 years) – Gulf of Maine DPS 2 sublethal, 0 lethal; New York Bight DPS 7 sublethal, 2 lethal; Chesapeake DPS 19 sublethal, 4 lethal; Carolina DPS 66 sublethal, 15 lethal; S. Atlantic DPS 103 sublethal, 24 lethal;
- HMS fisheries, excluding pelagic longline (every 3 years) – Gulf of Maine DPS 34 sublethal, 8 lethal; New York Bight DPS 170 sublethal, 36 lethal; Chesapeake DPS 40 sublethal, 9 lethal; Carolina DPS 10 sublethal, 5 lethal; S. Atlantic DPS 75 sublethal, 19 lethal;

Table 8 shows the estimated average annual turtle interactions in select commercial fishing gears in the Mid-Atlantic and Georges Bank regions. The 2017 Atlantic Sturgeon Benchmark Stock Assessment (ASFMC 2017) estimated that, on average, 1,139 Atlantic sturgeon (295 lethal; 25%) were caught in gillnet fisheries and 1,062 (41 lethal; 4%) were caught in otter trawl fisheries each year from 2000-2015. Atlantic sturgeon bycatch estimates for Northeast gillnet and trawl gear from 2011-2015 (approximately 761 fish per year for gillnets, 777 per year for trawls) are substantially lower than those from 2006-2010 (approximately 1,074 fish per year for gillnets, 1,016 per year for trawls) (ASFMC 2017).

Table 8. Estimated Average Annual Turtle Interactions in Select Commercial Fishing Gears in the Mid-Atlantic and Georges Bank Regions (numbers in parentheses are adult equivalents)

Gear	Years	Area	Estimated Interactions (adult equivalents)	Mortalities (adult equivalents)	Source
Sea Scallop Dredge	2009-2014	Mid-Atlantic	Loggerhead: 22 (2)	9-19* (1-2)	Murray (2015)
Sink Gillnet	2012-2016	Mid-Atlantic	Loggerhead: 141(3.8) Kemp's ridley: 29 Leatherbacks: 5.4 Unid. hardshell: 22.4	Loggerhead: 111.4 Kemp's ridley: 23 Leatherbacks: 4.2 Unid. hardshell: 17.6	Murray (2018)
Bottom Trawl	2014-2018	Mid-Atlantic and Georges Bank	Loggerhead: 116.6 (36.4) Kemp's ridley: 9.2 Green: 3.2 Leatherbacks: 5.2	Loggerhead: 54.4 (17.4) Kemp's ridley: 4.6 Green: 1.6 Leatherbacks: 2.6	Murray (2020)

*Of these interactions, 9-19 would result in mortality depending on whether loggerheads that interacted with chain mats without being captured (the unobservable but quantifiable interactions) survived.

The Gulf of Mexico reef fish fishery uses 2 basic types of gear: spear or powerhead, and hook-and-line gear. Hook-and-line gear used in the fishery includes both commercial bottom longline and commercial and recreational vertical line (e.g., handline, bandit gear, rod-and-reel). Prior to 2008, the reef fish fishery was believed to have relatively moderate levels of sea turtle bycatch attributed to the hook-and-line component of the fishery (i.e., approximately 107 captures and 41 mortalities annually, all species combined, for the entire fishery) (NMFS 2005). In 2008, SEFSC observer programs and subsequent analyses indicated that the overall amount and extent of incidental take for sea turtles specified in the incidental take statement of the 2005 opinion on the reef fish fishery had been severely exceeded by the bottom longline component of the fishery: approximately 974 captures and at least 325 mortalities estimated for the period July 2006-2007. In response, NMFS published an Emergency Rule prohibiting the use of bottom longline gear in the reef fish fishery shoreward of a line approximating the 50-fathom depth contour in the eastern Gulf of Mexico, essentially closing the bottom longline sector of the reef fish fishery in the eastern Gulf of Mexico for 6 months pending the implementation of a long-term management strategy. The Gulf of Mexico Fishery Management Council developed a long-term management strategy via a new amendment: Amendment 31 to the Reef Fish Fishery Management Plan (GMFMC 2010). The amendment included: (1) a prohibition on the use of bottom longline gear in the Gulf of Mexico reef fish fishery, shoreward of a line approximating the 35-fathom contour east of Cape San Blas, Florida, from June through August and ; (2) a reduction in the number of bottom longline vessels operating in the fishery via an endorsement program and a restriction on the total number of hooks that may be possessed onboard each Gulf of Mexico reef fish bottom longline vessel to 1,000, only 750 of which may be rigged for fishing.

The U.S. federal shrimp trawl fishery has reported the capture of 13 smalltooth sawfish from 2009 to 2018, although this number likely represents a small portion of actual captures given the low observer coverage of this fishery (Brame et al. 2019). Extrapolated total take estimates for the shrimp trawl fishery for the period 2008−2010 indicate that a total of 17−163 smalltooth sawfish were captured per year (Carlson and Scott-Denton 2011). The shrimp trawl fishery is of particular concern, as interactions with this fishery generally result in the mortality of large and likely mature sawfish, thus reducing reproductive potential within the population (Brame et al. 2019). While sawfish are also incidentally caught in the federal shark bottom longline fishery, based on the live release of large sawfish from longline gear, it is expected that sawfish are more resilient to capture on this gear in comparison to trawls and gill nets (Poulakis and Grubbs 2019; Prohaska et al. 2018).

6.2.2 State Managed Fisheries

Several fisheries for species not managed by a federal fishery management plan occur in state waters of the action area. Gear types used in these fisheries include hook-and-line, gillnet, trawl, pound net and weir, trap/pot, seines, and channel nets. ESA-listed sea turtles and fishes interact with these fishing gears in state waters. In most cases, there is limited observer coverage of these fisheries, and the extent of interactions with ESA-listed species is difficult to estimate.

In 2013, after amending their commercial fishing regulations to minimize incidental capture, the Georgia Department of Natural Resources received an ESA section 10 permit for incidental take of Atlantic sturgeon in the commercial shad fishery in state waters. The incidental take permit (ITP) allows the capture and live release of up to 180 Atlantic sturgeon annually, with a maximum of 5 incidental mortalities per year. A mortality rate of approximately 2.3% is anticipated based on recent research. The North Carolina Division of Marine Fisheries (NCDMF) developed a Conservation Plan to address Atlantic sturgeon take in the state's inshore gillnet fishery, and submitted an application for an ESA ITP to NMFS in April of 2012. In July 2014, NCDMF received an ESA section 10 permit for incidental take of Atlantic sturgeon that allows for take of up to 2,927 juvenile and small subadult Atlantic sturgeon annually, primarily in the form of capture and harassment, but in some cases lethal take.

NCDMF reported that no Atlantic sturgeon were observed in 958 observed tows conducted from 2001 to 2008 by commercial shrimp trawlers working in North Carolina waters (NCDMF 2014). Collins et al. (1996) reported that of 1,534 juvenile Atlantic sturgeon tagged in the Altamaha River, Georgia, 38 out of 97 (39%) were recaptured in shrimp trawls with the remainder captured in gillnet fisheries. Seven adult Atlantic sturgeon were captured (one killed) by a single shrimp trawler off Winyah Bay, South Carolina in October 2008 (Damon-Randall et al. 2010).

Information on the number of Atlantic sturgeon captures and mortalities in non-federal fisheries, which primarily occur in state waters, is extremely limited. An Atlantic sturgeon "reward program" provided commercial fishermen monetary rewards for reporting captures of Atlantic sturgeon in Maryland's Chesapeake Bay (Mangold et al. 2007). The data from this program show that Atlantic sturgeon have been caught in a wide variety of gear types, including hook and line, pound nets, gillnets, crab pots, eel pots, hoop nets, trawls, and fyke nets. Pound nets (58.9%) and gillnets (40.7%) accounted for the vast majority of captures (NMFS 2021a). Of the more than 2,000 Atlantic sturgeon reported in the reward program over 16 years (1996-2012), an estimated 10 fish died due to capture in commercial gear (NMFS 2021a).

Gulf sturgeon are also captured in state managed fisheries. The Gulf sturgeon recovery plan (USFWS and GSMFC 1995) documents that Gulf sturgeon are occasionally incidentally captured in state shrimp fisheries in bays and sounds along the northern Gulf of Mexico. There are 2 recorded interactions of a Gulf sturgeon with the shrimp trawl fishery: 1 in federal waters (January 1, 2011) and 1 in state waters of the Gulf of Mexico (December 15, 2009). In the Pearl River, Mississippi/Louisiana, a trammel/gillnet fishery is conducted for gar. Because of the gear (minimum of 3-in mesh square, up to 3,000 ft in length) and the year-around nature of the fishery, it is probable that Gulf sturgeon are intercepted in this fishery. While state regulations prohibit taking or possession of whole or any body parts, including roe, there is no reporting to determine capture or release rates.

Smalltooth sawfish are captured incidentally in recreational fisheries, although the level of mortality is likely low when sawfish are handled and released properly. However, researchers continue to receive reports of sawfish either being illegally retained or being released after the removal of their rostra (Brame et al. 2019).

6.3 Vessel Strike

Large sturgeon are susceptible to vessel collisions. The factors relevant to determining the risk to sturgeon from vessel strike are likely related to size and speed of the vessels, navigational clearance (i.e., depth of water and draft of the vessel) in the area where the vessel is operating, and the behavior of sturgeon in the area (e.g., foraging, migrating, etc.). The regular jumping and breaching behavior of sturgeon may also put them at risk of strikes by large vessels at the water surface (Edwards et al. 2007). Multiple studies have shown that Atlantic sturgeon are unlikely to move away from vessels or avoid areas with vessel activity (Balazik et al. 2020; DiJohnson 2019; Reine et al. 2014). In 2012, when Atlantic sturgeon were listed, vessel strikes were considered a primary threat to the New York Bight and Chesapeake Bay DPSs. In particular, sturgeon from the Hudson River spawning population were likely to be impacted by vessel strikes from large commercial vessels in the Delaware and James rivers due to the sturgeon's use of those non-natal estuaries. The Atlantic Sturgeon Status Review Team determined Atlantic sturgeon in the Delaware River are at a moderately high risk of extinction because of vessel strikes, and sturgeon in the James River are at a moderate risk from vessel strikes (ASSRT 2007). Balazik et al. (2012) estimated up to 80 sturgeon were killed by vessel strike between 2007 and 2010 in these 2 river systems combined. Brown and Murphy (2010) examined 28 dead Atlantic sturgeon from the Delaware River from 2005 through 2008 and found that 50% of the mortalities resulted from apparent vessel strikes, and 71% of these (10 out of 14) had injuries consistent with being struck by a large vessel. Eight of the fourteen vessel-struck sturgeon were adult-sized fish which, given the time of year the fish were observed, were likely migrating through the river to or from the spawning grounds. Based on evidence of Atlantic sturgeon vessel strikes since the listing, it is now apparent that vessel strikes are also occurring in the Hudson River (NMFS 2022e). For example, the New York Department of Environmental Conservation reported that at least 17 dead Atlantic sturgeon with vessel strike injuries were found in the river in 2019, of which at least 10 were adults (NMFS 2022e). Reported vessel strikes represent only minimum counts of the number of Atlantic sturgeon that are actually struck and killed by vessels because the majority of carcasses are either not found are not reported.

To date, there have been five documented Gulf Sturgeon mortalities that exhibited tell-tale signs of collision with large vessels (USFWS and NMFS 2022). This may be a result of low rates of Gulf Sturgeon ship strikes, or low rates of reporting where ship strikes are occurring. The threat of ship strikes may increase in areas of the northern Gulf of Mexico where barge and tug boat traffic associated with coastal protection, restoration, and infrastructure activities is expected to increase (USFWS and NMFS 2022).

Propeller and collision injuries and mortalities from private and commercial vessels are also a significant threat to ESA-listed sea turtles. Turtles swimming or feeding at or just beneath the surface of the water are particularly vulnerable to vessel strikes, which can result in serious injury and death (Hazel et al. 2007). Turtles may use auditory cues to react to approaching vessels rather than visual cues, making them more susceptible to strike as vessel speed increases (Hazel et al. 2007). Results from a study by Hazel et al. (2007) suggest that green turtles cannot consistently avoid being struck by vessels moving at relatively moderate speeds (i.e., greater than 4 km per hour).

Many recovered turtles display injuries that appear to result from interactions with vessels and their associated propulsion systems (Work et al. 2010). This is particularly true in nearshore areas with high vessel traffic along the U.S. Atlantic and Gulf of Mexico coasts. From 1997 to 2005, nearly 15% of all stranded loggerheads in the U.S. Atlantic and Gulf of Mexico were documented as having sustained some type of propeller or collision injury; although it is not known what proportion of these injuries were post or ante-mortem. In one study from Virginia, Barco et al. (2016) found that all 15 dead loggerhead turtles encountered with signs of acute vessel interaction were apparently normal and healthy prior to human-induced mortality.

The incidence of propeller wounds of stranded turtles from the U.S. Atlantic and Gulf of Mexico doubled from about 10% in the late 1980s to about 20% in 2004. Singel et al. (2007) reported a tripling of boat strike injuries in Florida from the 1980's to 2005. Over this time period, in Florida alone over 4,000 (~500 live; ~3500 dead) sea turtle strandings were documented with propeller wounds, which represents 30% of all sea turtle strandings for the state (Singel et al. 2007). These studies suggest that the threat of vessel strikes to sea turtles may be increasing over time as vessel traffic continues to increase in the southeastern U.S.

The Sea Turtle Stranding and Salvage Network reports a large number of vessel interactions (propeller injury) with sea turtles off coastal states such as New Jersey and Florida, where there are high levels of vessel traffic. The Virginia Aquarium & Marine Science Center Strandings Program reported an average of 62.3 sea turtle strandings per year in Virginia waters due to boat strikes from 2009-2014 (Barco 2015). The large majority of these (about 87%) were dead strandings. By sea turtle species, 73.3% of Virginia vessel strike strandings from 2009-2014 were loggerhead, 20.3% Kemp's ridley, 3.5% green, and 2.9% leatherback (Barco 2015).

6.4 Scientific Research and Enhancement Permits

Information obtained from scientific research is essential for understanding the status of ESA-listed species, obtaining specified critical biological information, and achieving species recovery goals. Research on ESA-listed species is granted an exemption to the ESA take prohibitions of section 9 through the issuance of section 10(a)(1)(A) permits. Research activities authorized through scientific research permits can produce various stressors on wild and captive animals resulting from capture, handling, and research procedures. As required by regulation, research conducted under a section 10(a)(1)(A) research permit cannot operate to the disadvantage of the species. Scientific research permits issued by NMFS are conditioned with mitigation measures to ensure that the impacts of research activities on target and non-target ESA-listed species are as minimal as possible.

Currently, there are 15 active sea turtle research permits with study areas that overlap the action area for this biological and conference opinion. All but 2 of these permits fall within the scope of the NMFS (2017b) sea turtle research permit programmatic biological opinion. Of the 7 research permits authorizing direct sea turtle capture, 4 authorize capture methods where there is no corresponding risk of forced submergence, and thus no incidental mortality issued (e.g., dip nets, cast nets, hand capture, or pound nets). The 3 remaining permits have directed takes authorized using trawls or tangle nets where unintended mortality is issued within the permit. Permit No. 23851 (South Carolina Department of Natural Resources) includes bottom trawling durations of 30 minutes (and 12 minute retrieval) and authorizes five incidental mortalities over 10 years; and Permit No. 21233 (NMFS Southeast Fisheries Science Center) includes capture by tangle or trawl nets fished at 30 minute intervals prior to checking and authorizes up to 9 incidental mortalities over 10 years (NMFS 2021b). The sea turtle research programmatic established mortality banks for each species, which represent the maximum total number of mortalities that could be authorized and used over each 10-year period. Table 9 shows the sea turtle mortality bank limits, lethal takes authorized, and lethal takes reported in the Atlantic Ocean and Gulf of Mexico. Only 1 sea turtle lethal take (Kemp's ridley) has been reported since 2018 when the programmatic opinion took effect.

Table 9. Programmatic Mortality Bank Limits and Takes of Sea Turtles in the Atlantic Ocean and Gulf of Mexico. Bank Limits and Takes are Authorized over 10 years (2018-2027) (NMFS 2022a).

Sea Turtle Species	Mortality Bank Limit	Authorized Lethal Takes	Reported Lethal Takes in 2021	Cumulative Reported Lethal Takes (2018-2027)
Green	10	3	0	0
Kemp's ridley	10	3	0	1
Hawksbill	5	1	0	0
Olive	5	1	0	0
Leatherback	10	3	0	0
Loggerhead	10	4	0	0

In 2017, we completed a programmatic consultation with the Permits Division on the implementation of a new sturgeon research program. Scientific research permits authorized under the sturgeon research program promote sturgeon conservation and recovery, and result in a net benefit to ESA-listed species and DPSs. As a condition of their permit, sturgeon researchers are required to follow specific protocols to avoid, minimize, and mitigate the unintended detrimental effects that may result from research activities such as capture, handling, or performing various invasive procedures. In addition to these standard protocols, as a condition of their permit researchers are required to consider additional precautionary measures to further minimize potential impacts on sturgeon. While these precautionary measures have proven highly effective at reducing detrimental impacts of research, and continue to improve over time, there remains some risk of sturgeon mortality, either (1) "in-hand" mortality as a direct result of capture, handling or performing a procedure, or (2) delayed mortality due to invasive procedures (e.g., surgery, gastric lavage) performed on captured fish. As such, some small amount of lethal take (i.e., mortality) is authorized for Atlantic sturgeon research through established mortality banks. Mortality banks limit the allowable lethal take for each spawning subpopulation based on its estimated abundance and a calculated river system health index. For details on sturgeon research permit mortality bank limits see the NMFS (2017a) programmatic biological opinion.

Currently, there are 14 active Atlantic sturgeon permits with study areas that overlap with the action area for this biological and conference opinion, all of which currently fall within the scope of the 2017 sturgeon research programmatic biological opinion. Two of these active permits (Permit Nos. 17225, 20458 and 20351) authorize capture and sampling Atlantic sturgeon in open ocean areas, while all the other active sturgeon permits have described action areas exclusively within river systems, beginning at the marine estuary to freshwater river tributaries (NMFS 2021b).

Scientific study of smalltooth sawfish has yet to pose a significant threat to the U.S. DPS. Current scientific studies are limited to a small number of researchers who carry out non-lethal research in the wild (NMFS 2018d). To date only one smalltooth sawfish had died during the course of scientific field studies.

6.5 Anthropogenic Sound

As anthropogenic noise continues to rise throughout the world's oceans, there is growing concern about the impact of sound on sea turtles. There are limited data on the hearing abilities of sea turtles, their uses of sounds, and their vulnerability to sound exposure. The functional morphology of the sea turtle ear is poorly understood and debated. Some evidence suggests that sea turtles are able to detect (Bartol and Ketten 2006; Bartol et al. 1999; Martin et al. 2012; Ridgway et al. 1969) and behaviorally respond to acoustic stimuli (DeRuiter and Doukara 2012; McCauley et al. 2000; Moein et al. 1995; O'Hara and Wilcox 1990). Sea turtles may use sound for navigation, locating prey, avoiding predators, and general environmental awareness (Dow Piniak et al. 2012). Anthropogenic sound within the action area includes explosions, seismic airguns/oil and gas exploration, pile driving, active sonar, offshore wind farms, shipping noise, and continuous sound sources.

In-water explosions may result in not only sea turtle death (Klima et al. 1988), but acoustic annoyance, physical discomfort to soft tissue areas, and injurious effects (e.g., gastrointestinal injury, carapace damage) (Viada et al. 2008). Offshore seismic surveys involve the use of high energy sound sources operated in the water column to probe below the seafloor. Most seismic sources involve the rapid release of compressed air to produce an impulsive signal. McCauley et al. (2000) conducted trials with caged sea turtles and an approaching-departing single air gun to gauge behavioral responses of green and loggerhead sea turtles. Their findings showed behavioral responses to an approaching air gun array at 166 decibels (dB) re: 1 micro Pascal root-mean-square (rms) and avoidance around 175 dB re: 1 micro Pascal rms. From measurements of a seismic vessel operating 3D air gun arrays in 100 to 120 m water depth this corresponds to behavioral changes at around 2 km and avoidance around 1 km. Avoidance behavior and physiological responses from airgun exposure may affect the natural behaviors of sea turtles (McCauley et al. 2000). The most common continuous sounds in the oceans are those produced by ships as well as smaller vessels. However, continuous sounds are also produced by other sources, such as vibratory pile drivers and vessels dredging for aggregates (Robinson et al. 2011). Shipping noise is a combination of the relatively continuous sound generated by large ocean tankers and more intermittent sounds generated by local inshore boat traffic. The frequency and sound pressure level of individual vessels varies widely by overall size, and engine and propeller size and configuration. The sounds of vessels are predominately low frequency (i.e., below 1 kilohertz) from onboard machinery, hydrodynamic flow around the hull, and from propeller cavitation, which is typically the dominant source of sound (Ross 1987; Ross 1993). Estimated source levels can range from less than 150 dB to over 190 dB (re 1 micro Pascal-rms at 1 m) for the largest commercial vessels (Arveson and Vendittis 2000; Hildebrand 2009; McKenna et al. 2012; Richardson et al. 1995). Low frequency sounds from larger vessels can travel hundreds of kilometers and can increase ambient noise levels over large areas of the ocean, interfering with sound communication in species using the same frequency range and potentially masking sounds of biological importance.

6.6 Military Operations

In 2018, NMFS issued a biological opinion (with revised ITS issued in October 2019) on the U.S. Navy Atlantic Fleet's military readiness training and testing activities (AFTT) and the promulgation of regulations for incidental take of marine mammals (NMFS 2018a). The action area includes the Gulf of Mexico and the western Atlantic, with some activities overlapping the action area for the proposed research permit. NMFS concluded that the action is not likely to jeopardize the continued existence of any ESA-listed species. The number and type of takes of sea turtles due to exposure to impulsive and non-impulsive acoustic stressors, ship shock trials, and vessel strike that are exempted for this action are shown in Table 10.

The 2018 AFTT opinion also anticipates the lethal take from vessel strike of: no more than 6 Atlantic sturgeon (up to 1 from the Gulf of Maine DPS, 1 from the New York Bight DPS, 6 from the Chesapeake Bay DPS, 6 from the Carolina DPS, and 1 from the South Atlantic DPS) combined from all DPSs over a 7-year period; and up to 1 Gulf sturgeon over a 7-year period. The ITS did not specify the amount or extent of take of Atlantic sturgeon, but rather used a surrogate expressed as a distance to reach effects in the water column with injury and sub-injury from acoustic stresses. In addition, based on the 2018 AFTT opinion, Navy explosives result in both sublethal and lethal effects to a small (unquantifiable) number of Atlantic sturgeon (all 5 DPSs), Gulf sturgeon, and smalltooth sawfish.

Table 10. The Number of Lethal and Non-lethal Takes of ESA-listed Sea Turtles Anticipated from Navy Atlantic Fleet Training and Testing Activities (NMFS 2018a)

Turtle Species	Impulsive and Non-Impulsive Acoustic Stressors (annual take)				Vessel Strike	
	Harassment (TTS/Behavioral)	Harm (PTS)	Harm (Slight Lung Injury)	Mortality	Mortality (over 7-year period)	Sublethal harm (annually)
Green – North Atlantic DPS	76/5,076	8	-	-	77	4
Hawksbill	313/24	-	-	-	-	4
Kemp's ridley	28/6,660	5			28	5
Loggerhead – Northwest Atlantic	772/46,178	80	17	2	105	11
Leatherback	348/3,299	22	2	-	7	3

Turtle Species	Small and Large Ship Shock Trials (over 7-year period)			
	Harassment (TTS)	Harm (PTS)	Harm (Slight Lung Injury)	Mortality
Green – North	36	2	-	-
Hawksbill	4	1	-	-
Kemp's ridley	27	2	2	-
Loggerhead	622	32	9	2
Leatherback	384	14	3	-

6.7 Marine Debris

Marine debris is a significant concern for ESA-listed species and sea turtles in particular. The initial developmental stages of all turtle species are spent in the open sea. During this time both the juvenile turtles and their buoyant food are drawn by advection into fronts (convergences, rips, and driftlines). The same process accumulates large volumes of marine debris, such as plastics and lost fishing gear, in ocean gyres (Carr 1987). An estimated 4 to 12 million metric tons of plastic enter the oceans annually (Jambeck et al. 2015). It is thought that sea turtles eat plastic because it closely resembles jellyfish, a common natural prey item (Schuyler 2014). Ingestion of plastic debris can block the digestive tract which can cause turtle mortality as well as sub-lethal effects including dietary dilution, reduced fitness, and absorption of toxic compounds (Laist et al. 1999; Lutcavage et al. 1997). Santos et al. (2015) found that a surprisingly small amount of plastic debris was sufficient to block the digestive tract and cause death. Gulko and Eckert (2003) estimated that between one-third and one-half of all sea turtles ingest plastic at some point in their lives. A more recent study by Schuyler et al. (2015) estimates that 52% of sea turtles globally have ingested plastic debris. Schuyler et al. (2016) synthesized the factors influencing debris ingestion by turtles into a global risk model, taking into account the area where turtles are likely to live, their life history stage, the distribution of debris, the time scale, and the distance from stranding location. They found that oceanic life stage turtles are at the highest risk of debris ingestion. Base on this model, olive ridley turtles are the most at-risk species; green, loggerhead, and leatherback turtles were also found to be at a high and increasing risk from plastic ingestion (Schuyler 2014). The regions of highest risk to global turtle populations are off the east coasts of the U.S., Australia, and South Africa; the East Indian Ocean, and Southeast Asia.

In addition to ingestion risks, sea turtles can also become entangled in marine debris such as fishing nets, monofilament line, and fish-aggregating devices (Laist et al. 1999; Lutcavage et al. 1997; NRC 1990). An estimated 640,000 tons of fishing gear is lost, abandoned, or discarded at sea each year throughout the world's oceans (Macfadyen et al. 2009). These "ghost nets" drift in the ocean and can fish unattended for decades (ghost fishing), killing huge numbers of marine animals. Turtles, in particular, are affected by ghost nets due to their tendency to use floating objects for shelter and as foraging stations (Dagorn et al. 2013; Kiessling 2003).

Ribic et al. (2011) used data from a national beach monitoring program to evaluate and compare amounts, composition, and trends of indicator marine debris in the U.S. Caribbean (Puerto Rico and the U.S. Virgin Islands) and the Gulf of Mexico from 1996 to 2003. Indicator items provided a standardized set that all surveys collected; each was assigned a probable source: ocean-based, land-based, or general-source. Probable ocean-based debris was related to activities such as recreational boating/fishing, commercial fishing and activities on oil/gas platforms (Ribic et al. 2011). Probable land-based debris was related to land-based recreation and sewer systems. General-source debris represented plastic items that can come from either ocean- or land-based sources; these items were plastic bags, strapping bands, and plastic bottles (excluding motor oil containers). Beaches along the eastern Gulf of Mexico had the lowest counts of debris; composition was dominated by land-based indicators, similar to that found for the U.S. Caribbean. Debris loads on beaches in the Gulf of Mexico are likely affected by Gulf circulation patterns, reducing loads in the eastern Gulf and increasing loads in the western Gulf (Ribic et al. 2011). Land-based indicators declined in the western Gulf of Mexico; total, ocean-based and general-source indicators remained unchanged (Ribic et al. 2011).

Ribic et al. (2010) documented regional differences in amounts and long-term trends of marine debris along the U.S. Atlantic coast from 1997-2007. The Southeast Atlantic had low land-based and general-source debris loads as well as no increases despite a 19% increase in coastal population. The Northeast (8% population increase) also had low land-based and general-source debris loads and no increases. The Mid-Atlantic (10% population increase) fared the worst, with heavy land-based and general-source debris loads that increased over time. Ocean-based debris did not change in the Northeast where the fishery is relatively stable; it declined over the Mid-Atlantic and Southeast and was correlated with declining regional fisheries (Ribic et al. 2010).

6.8 Pollution

Anthropogenic sources of marine pollution, while difficult to attribute to a specific federal, state, local, or private action, may affect ESA-listed species in the action area. Sources of pollutants in the action area include atmospheric loading of pollutants (e.g., polychlorinated biphenyls or PCBs); storm water runoff from coastal towns, cities, and villages; runoff into rivers emptying into bays; groundwater discharges; sewage treatment plant effluents; and oil spills. Oil spills, resulting from anthropogenic activities (e.g., commercial vessel traffic/shipping), directly and indirectly affect all components of the marine ecosystem. Degraded water quality from point and non-point sources can impact protected species. Run-off can introduce pesticides, herbicides, and other contaminants into the system on which these species depend. Contaminants could degrade habitat if pollution and other factors reduce the food available to marine animals.

A variety of heavy metals have been found in sea turtle tissues in levels that increase with turtle size. These include arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc, (Barbieri 2009; Fujihara et al. 2003; García-Fernández et al. 2009; Godley et al. 1999; Storelli et al. 2008). Cadmium has been found in leatherbacks at the highest concentration compared to any other marine vertebrate (Gordon et al. 1998). Newly emerged hatchlings have higher concentrations than are present when laid, suggesting that metals may be accumulated during incubation from surrounding sands (Sahoo et al. 1996). Arsenic has been found to be very high in green turtle eggs (Van de Merwe et al. 2009). Sea turtle tissues have been found to contain organochlorines, including chlorobiphenyl, chlordane, lindane, endrin, endosulfan, dieldrin, perfluorooctane sulfonate, perfluorooctanoic acid, dichloro-diphenyl-trichloroethane (DDT), and PCB (Alava et al. 2006; Gardner et al. 2003; Keller et al. 2005; Oros et al. 2009; Storelli et al. 2007). PCB concentrations are reportedly equivalent to those in some marine mammals, with liver and adipose levels of at least 1 congener being exceptionally high (Davenport et al. 1990; Oros et al. 2009). Levels of PCBs found in green sea turtle eggs are considered far higher than what is fit for human consumption (Van de Merwe et al. 2009).

Several studies have reported correlations between organochlorine concentration level and indicators of sea turtle health or fitness. Organochlorines have the potential to suppress the immune system of loggerhead sea turtles and may affect metabolic regulation (Keller et al. 2006; Oros et al. 2009). Accumulation of these contaminants can also lead to deficiencies in endocrine, developmental and reproductive health (Storelli et al. 2007). Females from sexual maturity through reproductive life should have lower levels of contaminants than males because contaminants are shared with progeny through egg formation. Balazs (1991) suggested that environmental contaminants are a possible factor contributing to the development of the viral disease fibropapillomatosis in sea turtles by reducing immune function. Day et al. (2007) investigated mercury toxicity in loggerhead sea turtles by examining trends between blood mercury concentrations and various health parameters. They concluded that subtle negative impacts of mercury on sea turtle immune function are possible at concentrations observed in the wild. Keller et al. (2004) investigated the possible health effects of organochlorine contaminants, such as PCBs and pesticides on loggerhead sea turtles. Although concentrations were relatively low compared with other species, they found significant correlations between organochlorine contaminants levels and health indicators for a wide variety of biologic functions, including immunity and homeostasis of proteins, carbohydrates, and ions. Synthetic buoyant pollutants such as plastic and oil have been known to aggregate together forming clusters that look similar to *Sargassum*-drifting communities, which have been observed as key habitats for young turtles, including the Kemp's ridley (NMFS and USFWS 2015).

The life histories of sturgeon species (i.e., long lifespan, extended residence in estuarine habitats, benthic foraging) predispose them to long-term, repeated exposure to environmental contamination and potential bioaccumulation of heavy metals and other toxicants (Dadswell 1979). Shortnose sturgeon collected from the Delaware and Kennebec Rivers had total toxicity equivalent concentrations of polychlorinated dibenzo-p-dioxins, polychlorinated dibenzofurans, PCBs, dichlorodiphenyldichloroethylene (DDE), aluminum, cadmium, and copper all above adverse effect concentration levels reported in the literature (Brundage III 2008). Dioxin and furans were detected in ovarian tissue from shortnose sturgeon caught in the Sampit River/Winyah Bay system (South Carolina).

Heavy metals and organochlorine compounds accumulate in sturgeon tissue, but their long-term effects are not well studied (Ruelle and Keenlyne 1993). High levels of contaminants, including chlorinated hydrocarbons, in several other fish species are associated with reproductive impairment (Billsson 1998; Cameron et al. 1992; Giesy et al. 1986; Hammerschmidt et al. 2002), reduced survival of larval fish (McCauley et al. 2015; Willford et al. 1981), delayed maturity and posterior malformations (Billsson 1998). Pesticide exposure in fish may affect anti-predator and homing behavior, reproductive function, physiological maturity, swimming speed, and distance (Beauvais et al. 2000; Scholz et al. 2000; Waring and Moore 2004). Sensitivity to environmental contaminants also varies by life stage. Early life stages of fish appear to be more susceptible to environmental and pollutant stress than older life stages. (Rosenthal and Alderdice 1976). Early life stage Atlantic and shortnose sturgeon are vulnerable to PCB and Tetrachlorodibenzo-p-dioxin (TCDD) toxicities of less than 0.1 parts per billion (Chambers et al. 2012). Increased doses of PCBs and TCDD have been correlated with reduced physical development of Atlantic sturgeon larvae, including reductions in head size, body size, eye development and the quantity of yolk reserves (Chambers et al. 2012). Juvenile shortnose sturgeon raised for 28 days in North Carolina's Roanoke River had a 9% survival rate compared to a 64% survival rate at non-riverine control sites (Cope et al. 2011). The reduced survival rate could not be correlated with contaminants, but significant quantities of retene, a paper mill by-product with dioxin-like effects on early life stage fish, were detected in the river (Cope et al. 2011).

Dwyer et al. (2005) compared the relative sensitivities of common surrogate species used in contaminant studies to 17 ESA-listed species, including Atlantic sturgeons. The study examined 96-hour acute water exposures using early life stages where mortality is an endpoint. Chemicals tested were carbaryl, copper, 4-nonphenol, pentachlorophenal and permethrin. Of the ESA-listed species, Atlantic sturgeon were ranked the most sensitive species tested for 4 of the 5 chemicals (Atlantic and shortnose sturgeon were found to be equally sensitive to permethrin). Additionally, a study examining the effects of coal tar, a byproduct of the process of destructive distillation of bituminous coal, indicated that components of coal tar are toxic to shortnose sturgeon embryos and larvae in whole sediment flow-through and coal tar elutriate static renewal (Kocan et al. 1993).

Nutrient loading from land-based sources, such as coastal communities and agricultural operations stimulate plankton blooms in closed or semi-closed estuarine systems. The effects on larger embayments are unknown. Rabalais et al. (2010) provide an example of the large area of the Louisiana continental shelf with seasonally depleted oxygen levels (< 2 mg/liter) that is caused by eutrophication from both point and non-point sources. The oxygen depletion, referred to as hypoxia, begins in late spring, reaches a maximum in mid-summer, and disappears in the fall. Since 1993, the average extent of mid-summer, bottom-water hypoxia in the northern Gulf of Mexico has been approximately 16,000 km^2, approximately twice the average size measured between 1985 and 1992. The hypoxic zone attained a maximum measured extent in 2002, when it was about 22,000 km^2 which is larger than the state of Massachusetts. The Gulf of Mexico hypoxic zone negatively impacts sea turtle and Gulf sturgeon habitats and prey availability which in turn can affect survival and reproductive fitness.

Evaluations of water and sediment quality in Gulf Sturgeon habitat on the northern Gulf of Mexico coast, have consistently shown elevated pollutant loading (USFWS and NMFS 2022). Widespread contamination has also been documented throughout the overwintering feeding habitat of the Gulf Sturgeon. Although the specific effects of these widely varied pollutants on sturgeon in their various life stages is not clearly understood, there is ample evidence summarized below to show potential deleterious effects to Gulf Sturgeon and their habitat (USFWS and NMFS 2022).

7 EFFECTS OF THE ACTION

Section 7 regulations (50 C.F.R. §402.02) define "effects of the action" as all consequences to ESA-listed species or designated critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see §402.17).

At the start of Section 5, we provided a complete list of ESA-listed species and designated critical habitat that may be affected by the proposed action. Further, in Section 5.1 we explained that some ESA-listed species and designated or proposed critical habitats were not likely to be adversely affected by any of the stressors associated with the proposed action. This is because any effects on these species and critical habitats were extremely unlikely to occur such that they were discountable, or the size or severity of the impact was so low as to be insignificant, including those effects that are undetectable, not measurable, or so minor that they cannot be meaningfully evaluated.

In this section, we focus on those species that are likely to be adversely affected by 1 or more stressors created by the proposed action. In Section 7.1, we discuss the stressors associated with the proposed action that we determined are not likely to adversely affect ESA-listed species. We do not carry these stressors forward in our effects analysis since there is no meaningful potential for these stressors to affect the survival or recovery of ESA-listed species. Finally, in Section 7.2, we analyze those stressors that are likely to result in adverse effects to ESA-listed species.

7.1 Stressors Not Likely to Adversely Affect ESA-listed Species

This section discusses stressors we determined may affect, but are not likely to adversely affect ESA-listed sea turtles, sturgeon and smalltooth sawfish because the effects of the stressors would be either insignificant or discountable.

7.1.1 Vessel Strike, Noise and Physical Disturbance

As discussed in Section 6.3 above, vessel strike represents a threat to both sea turtles and sturgeon. Vessel strike risk to these species is generally greater in areas with a high volume of vessel activity. For benthic species, such as Atlantic sturgeon, vessel strikes generally occur in nearshore, shallow water areas where the fish are more likely to come in contact with, or be sucked into, the vessel's propeller. Most of the fishery independent sampling proposed for this study would be in offshore areas where this is extremely unlikely to occur. There have been no reported incidents of vessel strike with any ESA-listed species in similar past research activities conducted by the SEFSC. In addition, we anticipate that trained researchers on-board these vessels will be highly vigilant to the presence of sea turtles (or other species) at or near the surface while the vessel is in transit or when fishing gear is in the water. Given the relatively small amount of vessel activity proposed for research vessel sampling, the slow tow speeds typically used (2-4 knots), the low density of ESA-listed species in the action area, and the safety measures that will be in place to avoid a vessels strike, it is extremely unlikely that there will be any vessel strikes of ESA-listed sea turtles or fish from the research vessels proposed for sampling as part of this action. Therefore, we find that any effects of vessels strike resulting from the proposed research activities on ESA-listed sea turtles or fishes are discountable.

Vessel noise and physical disturbance could result in a behavioral reaction from sea turtles and fish that are exposed. However, because the research vessel is moving an animal would only be exposed for a short period of time. In addition the noise from a single research vessel would not likely raise sound levels much above ambient. Therefore, any behavioral reaction from a sea turtle or fish exposed would likely be short-term and minor, with the animal returning to its previous state shortly after the research vessel passes through the area. Thus, we find that any effects of vessel noise or physical disturbance resulting from the proposed research activities on ESA-listed sea turtles or fish are insignificant.

In summary, we find that the stressors associated with vessels, including strike, vessel noise, and physical disturbance, resulting from the proposed action are not likely to adversely affect ESA-listed sea turtles, sturgeon or smalltooth sawfish species.

7.2 Stressors Likely to Adversely Affect ESA-listed Species

In this section of the biological opinion, we assess the probable effects of authorizing the proposed research on ESA-listed sea turtles and fish. The stressors resulting from research procedures that could affect sea turtles are capture, handling, PIT tagging, flipper tagging, and tissue sampling. When the proposed take of ESA-listed species is intentional and directed under a research program, the exposure is understood and will result in handling along with various procedures that result in different responses, each carrying differing levels of risk to ESA-listed species. Impacts from the research activities covered under this permit range from no effect, minor effects, to mortality of individual animals. Scientific research to assess bycatch reduction gear and handling and research techniques is recognized by NMFS as an important means of gathering valuable information for the conservation and recovery of species, while simultaneously limiting the impacts to wild animals.

In addition to sea turtles, we anticipate that the following non-target ESA-listed species would be incidentally captured in research fishing gears and exposed to the stress of capture and handling: Atlantic sturgeon (all 5 DPSs); shortnose sturgeon; Gulf sturgeon; and smalltooth sawfish.

7.2.1 Exposure Analysis

For research conducted under an ESA section 10(a)(1)(A) permit, our sea turtle exposure analysis is based on the number of animals (by species or DPS and life stage) that are authorized to be taken during research activities (as shown in Table 1 through Table 3 above). While the actual number of takes during research activities is often less than what is authorized in the permit, for our jeopardy analysis we conservatively use the authorized amount to represent the maximum potential impact to the species or DPS from the proposed action. Annual reports will be provided to NMFS detailing all research conducted, including the actual number of sea turtles taken. Our exposure analysis also includes incidental take of ESA-listed sturgeon and smalltooth sawfish.

Sea Turtles

In this research, the capture of ESA-listed sea turtles by commercial fishing vessels in the Atlantic Ocean and Gulf of Mexico is covered by the ITS associated with the section 7 biological opinion for each particular federally-managed commercial fishery. Additional fishery independent research sampling is proposed with directed take of sea turtles, conducted outside of these commercial fisheries, in Atlantic Ocean and Gulf of Mexico waters managed by state authority. The average annual number of sublethal captures using various types of trawl gear (i.e., bottom otter trawl, skimmer trawl, butterfly net, and wing net) anticipated for each sea turtle species (or DPS) as part of the proposed action are as follows: North Atlantic DPS green 14, Kemp's ridley 27, leatherback 7, Northwest Atlantic DPS loggerhead 65, and hawksbill 7. By life stage, the anticipated number of captures of sea turtles could include any combination of juveniles, subadults, or adults. Nesting beaches generally do not co-occur with the action area and the catch history over the past decade does not support hatchlings as interacting with the proposed trawl activities (hatchlings generally stay in relatively shallow areas of the water column, whereas trawl gear is typically deployed in deeper areas).

As part of the proposed action, the following research procedures will be performed on all sea turtles[2] that are captured alive in either commercial fishing vessel (fishery dependent) or research vessel (fishery independent) sampling: handling/measure/weight (if applicable), tissue samples, flipper tags, and PIT tags. The average annual number of individual turtles (captured in both fishery dependent and fishery independent sampling combined) that these procedures will be conducted on by species (or DPS) are as follows: North Atlantic DPS green 23, Kemp's ridley 44, leatherback 28, Northwest Atlantic DPS loggerhead 163, and hawksbill 12. By life stage, the anticipated number of sea turtles that the research procedures would be conducted on could include any combination of juveniles, subadults, or adults.

We expect that an individual sea turtle would be exposed to the stressors associated with capture, handling and procedures no more than once in a given year. This is due to the low number of expected captures anticipated to occur, the continuous movement of the research activities to new locations (the same can also be said for most the movements of individual sea turtles), and the hundreds to thousands of individuals that occur within each population.

While the large majority of sea turtles captured and handled as a result of the proposed action would be released alive and in good condition, some low level of mortality is possible. No sea turtle mortality has occurred in the applicant's prior performance conducting similar research. The proposed research permit authorizes the following level of unintentional mortality resulting

[2] Exceptions to this would be for turtles whose condition is compromised upon capture, and for turtles who have been previously tagged and would not need to be tagged again.

from either capture in fishery independent research vessel trawl surveys or from handling of sea turtles captured in either commercial fishery operations or research trawl surveys, over the life of the permit: North Atlantic DPS green 2; Kemp's ridley 2; leatherback 2; Northwest Atlantic DPS loggerhead 3; and hawksbill 2.

We accept these mortalities as being reasonably likely due to the frequency of trawl captures proposed and incidence of mortality in commercial trawling in the action area, as well as other research trawling under more restrictive conditions.

<u>ESA-listed Sturgeon and Smalltooth Sawfish</u>

The use of non-selective capture gear (e.g., trawl nets) by the applicant could result in the incidental capture of non-target ESA-listed fish species. While sea turtles are the subject of the proposed research, incidental capture of the following ESA-listed fish species could potentially occur during research (fishery independent) trawl surveys in state waters: Gulf sturgeon, shortnose sturgeon, Atlantic sturgeon, and smalltooth sawfish. If any ESA-listed fish species is taken (captured, injured, etc.) during fishery independent research, researchers must stop activities and submit an incident report to the Permits Division. Similar to sea turtles above, the capture of ESA-listed fishes by commercial fishing vessels in the Atlantic Ocean and Gulf of Mexico is covered by the ITS associated with the section 7 biological opinion for each particular federally managed commercial fishery.

The current SEFSC research permit (No. 20339) requires applicants to provide annual reports and supplementary data to help NMFS estimate the likely future levels of exposure. These reports provide us with the opportunity to evaluate the applicants' past performance as a mechanism to estimate future performance (individual exposure, response, and take). We use information from these reports along with other information regarding bycatch of ESA-listed fishes in trawl gear for our analysis to arrive at our estimates of exposure and response of non-target ESA-listed fish species to research trawling under the proposed permit. Our analysis also considers the history of sea turtle research interactions with these species, the proposed mitigation measures in place to avoid or minimize the effects of future interactions, and the potential future population growth of these species that could increase the risk of exposure to sea turtle research sampling gear.

Atlantic Sturgeon

Trawling gear used by the applicant during fishery independent research sampling could potentially interact with Atlantic sturgeon. Atlantic sturgeon bycatch in state managed commercial trawl fisheries is well documented, and remains a threat to all ESA-listed DPSs. Collins et al. (1996) reported that of 1,534 juvenile Atlantic sturgeon tagged in the Altamaha River, Georgia, 38 out of 97 (39%) were recaptured in shrimp trawls with the remainder captured in gill net fisheries. Seven adult Atlantic sturgeon were captured (one killed) by a single shrimp trawler off Winyah Bay, South Carolina in October 2008 (Damon-Randall et al. 2010). By contrast, the NCDMF reported that no Atlantic sturgeon were observed in 958 observed tows conducted from 2001 to 2008 by commercial shrimp trawlers working in North Carolina waters (NCDMF 2014).

To evaluate the potential for Atlantic sturgeon bycatch, we analyzed bycatch data from the applicant from 2001 to present. To date, we know of 3 trawl sets that resulted in Atlantic sturgeon bycatch under the applicant's current or previous permits for similar actions. All 3 sets were made in the vicinity of Duck Pier, Duck, North Carolina and all used flynets. The first occurred in 2008 when 80 Atlantic sturgeon were captured, of which 25% died. In 2009, 15 Atlantic sturgeon were captured in 2 trawls on a single day, with an unknown level of mortality. All individuals were of subadult size.

No Atlantic sturgeon have been captured during research trawl surveys conducted by the applicant in over 13 years. The applicant has conducted a significant amount of trawl gear sampling effort throughout a broad geographic range and, with the exception of this location, has not captured ESA-listed sturgeon. However, given the history of sturgeon bycatch in this area, the permit application indicates that the area around Duck Pier will be avoided, and real-time video monitoring of the trawl will be used when conducting trawl testing anywhere in the vicinity of Duck, North Carolina.

In all other areas, the applicant has proposed to use the real-time video monitoring system during all non-TED trawl sets in water depths of 50 m or less. We expect that, based upon the applicant's ability to identify sturgeon entering trawl nets in previous years, the applicant would have a high likelihood of observing Atlantic sturgeon entering the net via video monitoring. Although it is possible that a single individual might not be observed entering the net, data support trawls capturing not one but multiple individuals when the species is encountered. Therefore, even though one might be missed, we expect any subsequent individual(s) will be observed. If detected, the proposed permit requires that trawls be immediately hauled back and the sturgeon released using NMFS-recommended safe handling protocols.[3]

In determining the total number of Atlantic sturgeon captures, we assume that 1) up to 2 individuals may be captured during a single trawl (i.e., one individual may be missed during video monitoring, but not a second), and 2) up to 2 trawling events per year may capture Atlantic sturgeon (i.e., the maximum number of trawls per year that have captured Atlantic sturgeon according to applicant reports over the past 2 decades). It is reasonably likely that up to 4 Atlantic sturgeon would be captured during fishery independent trawling operations in any given year. However, considering that no Atlantic sturgeon have been captured during research trawl surveys conducted by the applicant in over 13 years, in combination with the proposed mitigation measures discussed above, we do not expect this species to be captured every year, or even in most years. Therefore, while we anticipate up to 4 Atlantic sturgeon could be captured in a single year, we do not expect the total captured over the life of the permit to exceed 8 fish.

[3] https://www.fisheries.noaa.gov/resource/outreach-materials/atlantic-sturgeon-safe-handling-and-release-guidelines

Given the proposed research sampling portion of the action area, captures of Atlantic sturgeon could include juveniles, subadults, or adults.

For our Atlantic sturgeon DPS analysis, we use information on stock composition of Atlantic sturgeon captured along the Atlantic coast based on a mixed-stock analysis presented by Kazyak et al. (2021). The authors present results for 3 latitudinal regions: "North" (i.e., north of Cape Cod, MA); "Mid" (i.e., Cape Cod through Cape Hatteras, NC), and "South" (i.e., south of Cape Hatteras to Florida border). Within the range of Atlantic sturgeon, fishery independent research sampling is proposed from Florida northward to the New York/Connecticut border. For sturgeon captured in offshore waters of the "Mid" region (n=633), Kazyak et al. (2022) assigned Atlantic sturgeon by DPS as follows: 2% Gulf of Maine DPS, 54% New York Bight DPS, 22% Chesapeake Bay DPS, 6% Carolina DPS, and 16% South Atlantic DPS. For sturgeon captured in riverine/estuarine environments of the "Mid" region (n=517) almost 61% were assigned to the Carolina DPS. For sturgeon captured in offshore waters of the "South" region (n=122), Kazyak et al. (2022) assigned Atlantic sturgeon by DPS as follows: 0% Gulf of Maine DPS, 2% New York Bight DPS, 3% Chesapeake Bay DPS, 11% Carolina DPS, and 84% South Atlantic DPS. The South Atlantic DPS also accounted for the large majority of captures in riverine/estuarine environments of the "South" region. Our quantitative analysis of Atlantic sturgeon exposure by DPS is constrained by the fact that we do not have specific information regarding fishery independent trawling locations.

Although all 5 DPSs could potentially be captured in research trawls, based on Kazyak et al. (2022) and the proposed action area, we expect a very small proportion will be from the Gulf of Maine DPS. Therefore, we estimate that 1 Gulf of Maine DPS Atlantic sturgeon is likely to be captured during fishery independent trawling operations over the life of the proposed permit. We expect a relatively high probability of capturing Carolina DPS fish, given the location (i.e., off NC) of past Atlantic sturgeon captures by the applicant and the high proportion of mid-Atlantic captures in estuarine waters that were assigned to this DPS. Similarly, depending on the location of sampling, we expect a relatively high probability of capturing either New York Bight (for Mid-Atlantic sampling) or South Atlantic DPS (for South Atlantic sampling) fish in their respective regions. Thus, of the 4 Atlantic sturgeon that are reasonably likely to be captured in a given year during fishery independent research trawling operations, we expect up to 2 could be from any of these 3 DPSs (i.e., Carolina, New York Bight, or South Carolina). We also expect that, of the 8 Atlantic sturgeon that are reasonably likely to be captured over the life of the permit, up to 4 could be from any of the following DPSs: Carolina, New York Bight, or South Carolina. While we also expect capture of Chesapeake Bay DPS Atlantic sturgeon, based on Kazyak et al. (2022), the likelihood of this occurring is somewhat lower as compared to capture of fish from the Carolina, New York Bight, or South Carolina DPS. Therefore, we anticipate that 1 Chesapeake Bay DPS Atlantic sturgeon is likely to be captured per year during the proposed fishery independent research trawling operations, and up to 2 fish from this DPS are likely to be captured over the life of the permit.

Gulf Sturgeon

There have been no reported incidental takes of Gulf sturgeon during permitted sea turtle research conducted by the SEFSC. However, trawling gear used by the applicant during fishery independent research sampling could potentially interact with Gulf sturgeon. Due to their life history, Gulf sturgeon could potentially interact with sea turtle research gear in marine, coastal, and estuarine environments.

Incidental take by commercial shrimpers was believed to be a significant threat to Gulf Sturgeon in the 1991 listing rule (56 FR 49653). Incidental bycatch in shrimp trawling and gill/trammel net fisheries still remains a threat to Gulf Sturgeon population recovery (USFWS and NMFS 2022). Reports of Gulf sturgeon capture in relocation trawls highlight the ongoing susceptibility of sturgeon to trawling gear. Relocation trawling associated with dredging activities typically involves operation of shrimp trawls to capture and relocate protected species away from dredging operations. Since 2009, 32 Gulf sturgeon were reported in relocation trawling off the coast of Alabama from 2012-2013 between Pensacola Pass and Mobile Bay, and 2 Gulf sturgeon were reported off the coast of Mississippi in 2018 (USFWS and NMFS 2022). Winter estuarine and coastal feeding presents a period of particular vulnerability for Gulf sturgeon to trawl capture and to dredging activities.

Based on the best available information, we estimate that the proposed action would result in the capture of up to 2 Gulf sturgeon in any given year during fishery independent research trawling operations. Considering that no Gulf sturgeon have been captured during research trawl surveys conducted by the applicant in the past, in combination with the proposed mitigation measures, we do not expect this species to be captured every year, or even most years. Therefore, while we anticipate up to 2 Gulf sturgeon could be captured in a single year, we do not expect the total captured over the life of the permit to exceed 4 fish. Given the proposed action area, captures of Gulf sturgeon could include juveniles, subadults, or adults.

Shortnose Sturgeon

There have been no reported incidental takes of shortnose sturgeon during permitted sea turtle research conducted by the SEFSC. However, trawling gear used by the applicant during fishery independent research sampling could potentially interact with this species. Due to their life history, shortnose sturgeon could potentially interact with sea turtle research gear in marine, coastal, and estuarine environments. Although past incidental capture of shortnose sturgeon is primarily from commercial shad gillnet fisheries, bycatch in the southern trawl shrimp fishery was estimated at 8% (Collins et al. 1996). Based on the best available information, we estimate that the proposed action could result in the capture of up to 2 shortnose sturgeon in any given year from fishery independent trawling operations. Considering that no shortnose sturgeon have been captured during research trawl surveys conducted by the applicant in the past, in combination with the proposed mitigation measures, we do not expect this species to be captured every year, or even most years. Therefore, while we anticipate up to 2 shortnose sturgeon could be captured in a single year, we do not expect the total captured over the life of the permit to exceed 4 fish. Shortnose sturgeon captured could include juveniles or adults.

Smalltooth Sawfish

Prior to their listing, smalltooth sawfish were a significant bycatch component in trawl fisheries in the southeastern U.S., and fisheries bycatch is considered a leading factor in the species' decline. Anecdotal information collected by NMFS port agents indicates that smalltooth sawfish are now taken very rarely in the shrimp trawl fishery (NMFS 2018d). The most recent records from Texas are from the 1980s. However, smalltooth sawfish are still caught in shrimp trawls in Florida; including 9 documented captures from 2009 to 2015. To estimate the expected level of exposure of the species to gear targeting sea turtles as part of the proposed action, NMFS (2017c) arrived at the following smalltooth sawfish catch per unit effort as bycatch in the Gulf of Mexico shrimp trawling fishery based on observer data (NMFS 2011a; Norton 2011): 1 capture every 1,112 trawl trips (averaging 7.75 hours tow time per trip). The permit application indicates that about 60 days of fishery independent research trawl survey work would be conducted annually under the permit as part of the proposed action, with much of this sampling effort likely occurring outside of the current range of this species. The applicant's bycatch data for the past 15 years show that no interactions have occurred with smalltooth sawfish during research trawl surveys based on similar levels of sampling activity. In addition, the applicant indicated that they will avoid sampling in smalltooth sawfish designated critical habitat, further reducing the likelihood of capturing this species. Thus, we expect the capture of a smalltooth sawfish during fishery independent research trawl sampling to be a relatively rare event. However, because this species is highly susceptible to capture in the proposed research gear, and researchers may sample in areas where this species is known to occur, we anticipate that up to 2 smalltooth sawfish are reasonably likely to be captured during fishery independent trawling operations over the life of the proposed permit.

7.2.2 Response Analysis

<u>Sea Turtles</u>

Trawls pose a greater risk of impacts from forced submergence to sea turtles compared to other capture gears authorized for sea turtle research. Metabolic changes that can impair a sea turtle's ability to function can occur within minutes of a forced submergence. While most voluntary dives appear to be aerobic, showing little if any increases in blood lactate and only minor changes in acid-base status, this is not the case in forcibly submerged sea turtles where oxygen stores are rapidly consumed, anaerobic glycolysis is activated, and acid-base balance is disturbed, sometimes to lethal levels (Lutcavage et al. 1997). Forced submergence of Kemp's ridley sea turtles in shrimp trawls resulted in an acid-base imbalance after just a few minutes (times that were within the normal dive times for the species) (Stabenau et al. 1991). Conversely, recovery times for acid-base levels to return to normal may be prolonged following forced submergence. Henwood and Stuntz (1987) found that it took as long as 20 hours for the acid-base levels of loggerhead sea turtles to return to normal after capture in shrimp trawls for less than 30 minutes. This effect is expected to be worse for sea turtles that are recaptured before metabolic levels have returned to normal. Physical and biological factors that increase energy consumption, such as high water temperatures and increased metabolic rates characteristic of small turtles, would be expected to exacerbate the harmful effects of forced submergence from trawl capture (NRC 1990).

Sea turtles forcibly submerged in any type of restrictive gear could eventually suffer fatal consequences from prolonged anoxia and/or seawater infiltration of the lung (Lutcavage et al. 1997). A study examining the relationship between tow time and sea turtle mortality showed that mortality was strongly dependent on trawling duration, with no mortality or serious injury in tows of 50 minutes or less, but increasing rapidly to 70% mortality after 90 minutes (Epperly et al. 2002; Henwood and Stuntz 1987). The association between tow times and sea turtle deaths was updated and reanalyzed by Epperly et al. (2002) and Sasso and Epperly (2006), studying seasonal differences in water temperature and the likelihood of mortality. In both warmer and cooler seasons, a rapid escalation in the mortality rate did not occur until after 50 minutes (Sasso and Epperly 2006), confirming the finding of Henwood and Stuntz (1987). Though rare, mortality has been observed in summer trawl tows as short as 15 minutes (Sasso and Epperly 2006).

If mortality is not directly observed during gear retrieval, it may occur after the turtle is released due to physiological stress and injury suffered during capture. Studies indicate that underwater entrapment in fishing gear (i.e., trawls and gillnets) followed by rapid decompression when gear is brought to the surface may cause gas bubble formation within the blood stream (i.e., embolism) and tissues leading to organ injury, impairment, and even post-release mortality in some bycaught turtles (Fahlman et al. 2017; Garcia-Parraga et al. 2014). However, given the shallower average depths of the fishery independent research hauls, in combination with relatively short tow durations (as compared to commercial trawl operations), we do not anticipate decompression sickness to occur as a result of the proposed research. In addition, post release mortality is not anticipated because compromised turtles will be held, and resuscitated if needed, until normal behavior returns.

In state waters with contracted vessels, trawl gear without TEDs will be towed for no longer than 30 minutes unless specific fisheries regulations exist requiring tow time limits in lieu of TEDs. In these cases, tow time limits will match those set by regulations (trawl fisheries exempt from TED use a 55-minute tow time limit from April through October and 75 minutes from November through March). Tow time is measured from the time the trawl door (or cod end, if no trawl door) enters the water until it is removed from the water. The regulatory tow time limits include a 15-minute allowance for setting and retrieving gear so that bottom time remains under 60 minutes. For non-TED trawl sets, real-time video monitoring systems will be used. If a turtle, marine mammal, or other ESA-listed species is observed in the trawl with the video monitoring system, the vessel captain is instructed to stop trawling and, if advisable, commence haul back of the gear immediately to facilitate recovery of the animal. As stated in Section 5.1.4, NMFS does not anticipate gear interactions with ESA-listed marine mammals, but there may be interactions with listed sea turtles, sturgeon, and smalltooth sawfish.

Potential sea turtle responses to capture include rapid swimming, diving, biting, and other attempts to escape, and physiological stress. Due to the mitigation measures in place, we anticipate the majority of sea turtles captured in trawl nets would quickly recover from the physiological effects of capture. In most cases, we do not expect injury or mortality because captured sea turtles will have time to recover from any stress associated with capture during holding for examination prior to release. This holding time should help minimize risks from the accumulation of other stressors that can cumulatively impair physiological function or result in sublethal or delayed effects that cannot be observed upon capture. In addition, veterinary assistance will be sought for any comatose, injured or compromised animals as a requirement of the permit. Researchers must also try to resuscitate any comatose animals.

Although the risk of serious injury or mortality from capture in research (fishery independent) trawl nets is low, there is the potential for this to occur in a small number of turtles. The proposed research permit authorizes the following levels of lethal take (i.e., mortality) of sea turtles from capture in fishery independent research trawls over the life of the permit: 3 Northwest Atlantic DPS loggerhead; 2 Kemp’s ridley; 2 North Atlantic DPS green; 2 leatherback; and 2 hawksbill. Sea turtle mortalities resulting from the proposed action could include any combination of juveniles, subadults, or adults.

The anticipated effects of proposed sampling of sea turtles (e.g., biopsy, PIT and Inconel flipper tagging, restraining, measuring, weighing) are expected to be minimal, and are not likely to manifest into any long-term adverse effects, reduced fitness, or mortality (NMFS 2017b). No mortalities or serious injuries have occurred as a result of sampling during previous research under this project, or under other similar projects by the applicant. Only minor short-term stress, discomfort, pain, and chance of infection are expected during skin biopsy sampling and PIT and flipper tagging. External flipper tags are small and not likely result in a significant increased drag forces while the tag is attached. No long-term detrimental effects are expected based on many years of the SEFSC conducting tagging and biopsy procedures on sea turtles. Risk of infection will be minimized by employing the standard measures described in the draft permit requiring the use of aseptic practices. In past studies, reactions of sea turtles to sampling has ranged from no reaction to a mild reaction, including pulling away a flipper or minor bleeding at the site. Overall, such impacts from handling and sampling are anticipated to be nominal, and will be managed with measures designed to keep animals as calm as possible until released (see Section 3.4 for details). Mitigation measures and research protocols required as a condition of the research permit further reduce the risk and severity of sub-lethal effects from authorized research activities. Consequently, handling and sampling procedures are not expected to result in additional injury, mortality, or long-term fitness consequences (NMFS 2017a); therefore, no population level effects are anticipated. The responses to the research techniques described above are discussed more thoroughly in Section 8.4 of the 2017 NMFS sea turtle research programmatic biological opinion (NMFS 2017b).

ESA-listed Sturgeon and Smalltooth Sawfish

As noted above in our exposure analysis, we anticipate a small number of ESA-listed sturgeon will be captured in fishery independent research trawl gear as part of the proposed action. Most sturgeon captured in trawl gear would likely experience a short-term, physiological stress response. For all species of sturgeon, research has revealed that stress from capture is affected by temperature, DO, and salinity (Kahn and Mohead 2010). Other factors affecting the level of stress or mortality risk from netting include the amount of time the fish is caught in the net, mesh size, net composition, and, in some instances, the researcher's experience level or preparedness. Analysis of the empirical evidence suggests that individuals collected in high water temperatures and low DO concentrations, combined with longer times in nets, were more at risk of mortality and stress (Kahn and Mohead 2010). However, except for very rare instances, results from previous sturgeon research trawl surveys indicate that capture in nets does not cause any effects on the vast majority of sturgeon beyond 24 hours post-release.

More long-term responses, including serious injury and mortality, have been reported from commercial fisheries bycatch of sturgeon. Wooley and Crateau (1985) estimated a Gulf sturgeon incidental mortality rate of 7.1% during the autumn and winter commercial shrimp trawl fishery in Apalachicola Bay in the early1980s. Other researchers have reported mortality rates of sturgeon (Atlantic and shortnose) captured in inshore and riverine fisheries ranging from 8% to 20% (Bahn et al. 2012; Collins et al. 1996). Atlantic sturgeon mortality from Northeast Fisheries Observer Program data (NMFS 2013a) collected from commercial otter trawl fisheries has been estimated at 5% Atlantic coast-wide.

Contributing to the mortality in commercial fisheries bycatch are the typically extended durations of commercial trawling tow times, ranging from 60 to 180 minutes in many fisheries. By contrast, for the proposed research in state waters with contracted vessels, trawl gear without TEDs will be towed by researchers for no longer than 30 minutes, unless specific fisheries regulations exist requiring tow time limits in lieu of TEDs. In these cases, tow time limits will match those set by regulations (trawl fisheries exempt from TED use a 55-minute tow time limit from April through October and 75 minutes from November through March). Tow time is measured from the time the trawl door (or cod end, if no trawl door) enters the water until it is removed from the water. The regulatory tow time limits include a 15-minute allowance for setting and retrieving gear so that bottom time remains under 60 minutes. In addition, for all non-TED trawl sets, real-time video monitoring systems will be used. When an ESA-listed species is observed in the trawl with the video monitoring system, the vessel captain will be instructed to stop trawling and if advisable, commence haul back of the gear immediately to facilitate recovery of the animal(s).

As discussed in our exposure analysis above, mortality of incidentally caught Atlantic sturgeon near Duck, North Carolina was reported in the past (2008-2009) by the applicant while conducting similar research. Although no mortalities have been reported since 2009, the applicant indicated that they would: 1) avoid sampling in the area of sturgeon past capture; and 2) use a real-time video monitoring system in the vicinity of Duck, and during all other non-TED trawl sets in water depths of 50 m or less, to minimize impacts to captured sturgeon. If detected, the proposed permit requires that trawls be immediately hauled back and the sturgeon released using NMFS-recommended safe handling protocols.

With the proposed video monitoring system, if a sturgeon is captured in research trawl gear it is likely that it would be released shortly after entering the net. Thus, we do not anticipate more than a short-term, physiological stress response in such individuals. Although a small number of sturgeon could be captured during trawl sets where video monitoring is not used, tow times would be 30 minutes or less in many cases, and would not exceed 60 minutes of bottom time in all cases. In all instances of sturgeon capture, the researcher will disentangle and release the animal as quickly as feasible. Where possible, depending on environmental conditions, fish will be kept in the water and returned to neutral buoyancy prior to release, which could be up to 120 minutes. Given that the proposed research tow times are considerably shorter than tow times typically used in commercial trawl fisheries, and the additional mitigation measures for the safe handling and release of captured sturgeon required as a condition of the permit, we expect capture mortality rates in research trawling to be significantly lower than those reported from commercial trawl fisheries, which generally range from 5-20%. Given the relatively small number of sturgeon captures and very low mortality rates anticipated from research trawling, it is unlikely that ESA-listed sturgeon will be seriously injured or killed as a result of the proposed action.

In summary, while the incidental capture of ESA-listed sturgeon species in trawl capture gear used by turtle researchers may result in short-term negative effects (i.e., elevated stress levels, net abrasion), we do not anticipate mortality, reduced fitness, or any long-term adverse effects to individual sturgeon. This conclusion can be reached as long as all of the sampling protocols, mitigation measures, and any other required conditions of the research permit are closely followed by the applicant.

Similar to sturgeon, smalltooth sawfish responses to capture in trawl nets could include a short-term, physiological stress response, injury and mortality. The severity of the response depends on a number of factors, including trawl tow time, and capture, handling and release techniques. As discussed above, tow times for the proposed research trawl surveys will, on average, be significantly shorter than commercial shrimp trawl fishery tow times, and video monitoring will be conducted for many of the tows. While smalltooth sawfish mortalities have been reported from incidental capture in commercial shrimp trawls (NMFS 2011b), it is likely that some individuals were either intentionally killed or not handled properly so that removal from nets would be made easier and safer. As a condition of the permit, researchers will follow proper handling protocols as described in the *NOAA Sawfish Handling and Release Guidelines* (NMFS 2018b) will be followed to minimize injury and stress to any captured smalltooth sawfish.

In summary, given the mitigation measures in place, and the small number of smalltooth sawfish interactions anticipated (i.e., up to 2 over the life of the permit), we do not anticipate mortality, reduced fitness, or any long-term adverse effects to individual smalltooth sawfish resulting from incidental capture in research (fishery independent) trawl gear. The incidental capture of smalltooth sawfish in trawl capture gear used by turtle researchers may result in short-term negative effects (i.e., elevated stress levels, net abrasion).

8 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 C.F.R. §402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

During this consultation, we searched for information on future State, tribal, local, or private actions that were reasonably certain to occur in the action area. We conducted electronic searches of business journals, trade journals, and newspapers using Google Scholar, and other electronic search engines. We did not find any information about non-Federal actions other than what has already been described in the Environmental Baseline (Section 6), most of which we expect would continue in the future. In particular, we are reasonably certain that threats associated with climate change, pollution, vessel strike, and bycatch will continue in the future. An increase in these activities could similarly increase the magnitude of their effects on ESA-listed species, and for climate change an increase in the future is considered likely to occur. For many of the activities and associated threats identified in the environmental baseline, and other unforeseen threats, the magnitude of increase and the significance of any anticipated effects remain unknown. The best scientific and commercial data available provide little specific information on any long-term effects of these potential sources of disturbance on populations of ESA-listed species. Thus, this opinion assumes effects in the future would be similar to those in the past and, therefore, are reflected in the anticipated trends described in the Species and Designated Critical Habitat that May be Affected (Section 5) and Environmental Baseline (Section 6) sections.

9 INTEGRATION AND SYNTHESIS

The *Integration and Synthesis* section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action and the effects caused by the action that are reasonably certain to occur. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of a listed species," which is to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 C.F.R. §402.02). Therefore, the jeopardy analysis considers both the survival and recovery of the species. In this section, we add the *Effects of the Action* (Section 7) to the *Environmental Baseline* (Section 6) and the *Cumulative Effects* (Section 8) to formulate the agency's biological and conference opinion as to whether the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of a ESA-listed species in the wild by reducing its numbers, reproduction, or distribution. These assessments are made in full consideration of the *Status of the Species Likely to be Adversely Affected* (Section 5.2).

The following discussions separately summarize the probable risks the proposed action poses to threatened and endangered species as described above.

9.1.1 Atlantic Sturgeon

In 2012, NMFS listed 5 DPSs of Atlantic sturgeon under the ESA. The Gulf of Maine DPS is currently listed as threatened while the New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs are currently listed as endangered. Primary threats contributing to the sharp decline of Atlantic sturgeon populations in the 20th century were commercial fisheries, habitat curtailment, and alteration from dams and dredging. Efforts made over the past few decades to reduce the impact of these threats have slowed the rate of decline for many sturgeon populations. While fisheries bycatch, vessel strikes, and impingement and entrainment still represent sources of mortality, the impact of these activities on sturgeon populations are expected to either remain at current levels, or possibly decrease with additional research efforts, conservation measures, and the continued implementation of existing environmental regulations.

While the proposed action would likely result in sublethal adverse effects to a small number of Atlantic sturgeon from all 5 DPSs, we do not anticipate mortality or serious injury of any Atlantic sturgeon. Based on our sturgeon exposure and response analysis (Section 7.2), we determined that sub-lethal effects on Atlantic sturgeon resulting from incidental capture and handling will be minimal, short-term (i.e., elevated stress levels, net abrasion), and not likely to result in any reduced fitness or loss of fecundity in individual fish. Our conclusion regarding the minimal impact of sublethal adverse effects is based on the commitment by researchers to adhere to the required mitigation measures and safe handling and release procedures specified in the permit for avoiding and minimizing adverse effects to Atlantic sturgeon.

The proposed research permit authorizes up to 4 sublethal takes in any given year and up to 8 sublethal takes over the life of the permit of ESA-listed Atlantic sturgeon from capture in trawls used during fishery independent research sampling. Of these captures, we expect the following by DPS: South Atlantic – up to 2 per year and up to 4 over the life of the permit; Carolina – up to 2 per year and up to 4 over the life of the permit; New York Bight – up to 2 per year and up to 4 over the life of the permit; Chesapeake Bay - up to 1 per year and up to 2 over the life of the permit; and Gulf of Maine - up to 1 over the life of the permit DPS. Given the proposed action area, captures of Atlantic sturgeon could include juveniles, subadults, or adults.

The sublethal impacts to Atlantic sturgeon DPSs in the action area are not anticipated to result in appreciable reductions in overall reproduction or numbers for any DPS. Therefore, we do not anticipate any measurable or detectable reductions in survival rate or trajectory of recovery of any ESA-listed Atlantic sturgeon DPS. In addition, no reduction in the distribution or current geographic range of Atlantic sturgeon DPSs is expected as a result of the proposed action. Based on the evidence available, including the Environmental Baseline, Effects of the Action, and Cumulative Effects, effects resulting from stressors caused by issuance of the proposed research permit to the SEFSC would not be expected to appreciably reduce the likelihood of the survival of any of the Atlantic sturgeon DPSs (i.e., Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, or South Atlantic) in the wild by reducing the reproduction, numbers, or distribution of these populations. We also conclude that effects from issuance of the proposed research permit to the SEFSC would not be expected, directly or indirectly, to appreciably reduce the likelihood of recovery of any of the Atlantic sturgeon DPSs in the wild by reducing the reproduction, numbers, or distribution of these populations.

9.1.2 Shortnose Sturgeon

Shortnose sturgeon were initially listed as endangered on March 11, 1967 under the Endangered Species Preservation Act of 1966. In 1994, the species was listed as endangered throughout its range under the ESA (38 FR 41370). Dams represent a major threat to 7 (out of 29 identified) shortnose sturgeon populations and a moderate threat to 7 additional populations (SSSRT 2010). Dredging represents a major threat to 1 shortnose sturgeon population (Savannah River), a moderately high threat to 3 populations, and a moderate threat to 7 populations. Fisheries bycatch represents a major threat to 1 shortnose sturgeon population (Lakes Marion and Moultrie in Santee-Cooper Reservoir System), a moderately high threat to 4 populations, and a moderate threat to 10 populations (SSSRT 2010). Water quality represents a major threat to 1 shortnose sturgeon population (Potomac River), a moderately high threat to 6 populations, a moderate threat to 13 populations, and a moderately low threat to 1 population. Impingement/entrainment at power plants and treatment plants was rated as a moderate threat to 2 shortnose sturgeon populations (Delaware and Potomac).

For shortnose sturgeon, the largest adult populations are found in the Northeastern Rivers (i.e., Hudson, Delaware, Kennebec and St. John). Shortnose sturgeon populations in southern rivers are considerably smaller by comparison with the largest in this region occurring in the Altamaha and Savannah Rivers. The Shortnose Sturgeon Status Review Team (2010) evaluated the extinction risk for 3 shortnose populations (Hudson, Cooper, and Altamaha) and concluded that the estimated probability of extinction was zero for all 3 under the default assumptions, despite the long (100-year) horizon and the relatively high year-to-year variability in fertility and survival rates. Regular spawning is known to occur in 12 river systems.

While the proposed action may result in sublethal adverse effects to a small number of shortnose sturgeon, we do not anticipate mortality or serious injury of any individuals. Based on our sturgeon exposure and response analysis (Section 7.2), we determined that sub-lethal effects on shortnose sturgeon resulting from incidental capture and handling will be minimal, short-term (i.e., elevated stress levels, net abrasion), and not likely to result in any reduced fitness or loss of fecundity to individual fish. Our conclusion regarding the minimal impact of sublethal adverse effects is based on the commitment by researchers to adhere to the required mitigation measures and safe handling and release procedures specified in the permit for avoiding and minimizing adverse effects on shortnose sturgeon.

The proposed research permit authorizes up to 2 sublethal takes in any given year and up to 4 sublethal takes over the life of the permit of shortnose sturgeon from capture in trawls used during fishery independent research sampling. Given the proposed research sampling portion of the action area, captures of shortnose sturgeon could include juveniles or adults.

The sublethal impacts expected to occur to shortnose sturgeon in the action area are not anticipated to result in appreciable reductions in overall reproduction or numbers. Therefore, we do not anticipate any measurable or detectable reductions in survival rate or trajectory of recovery of shortnose sturgeon. In addition, no reduction in the distribution or current geographic range of this species is expected as a result of the proposed action. Based on the evidence available, including the Environmental Baseline, Effects of the Action, and Cumulative Effects, effects resulting from stressors caused by issuance of the proposed research permit to the SEFSC would not be expected to appreciably reduce the likelihood of the survival of the shortnose sturgeon in the wild by reducing the reproduction, numbers, or distribution of this species. We also conclude that effects from issuance of the proposed research permit to the SEFSC would not be expected, directly or indirectly, to appreciably reduce the likelihood of recovery of shortnose sturgeon in the wild by reducing the reproduction, numbers, or distribution of this species.

9.1.3 Gulf Sturgeon

Gulf sturgeon were listed as threatened in 1991 due to a combination stressors including overfishing, dam construction, and habitat degradation. Currently, 7 rivers are known to support reproducing populations of Gulf sturgeon. Recent abundance data described in the 2022 status update (USFWS and NMFS 2022) indicate a roughly stable or slightly increasing population trend over the last decade in the eastern river systems (Florida), with a much stronger increasing trend in the Suwannee River. Populations in the western portion of the range (Mississippi and Louisiana) are believed to exhibit lower abundance than those in the eastern portion of the range.

Effects of climate change (warmer water, sea level rise and higher salinity levels) could lead to accelerated changes in habitats utilized by Gulf sturgeon.

While the proposed action may result in sublethal adverse effects to a small number of Gulf sturgeon, we do not anticipate mortality or serious injury of any individuals. Based on our sturgeon exposure and response analysis (Section 7.2), we determined that sub-lethal effects on Gulf sturgeon resulting from incidental capture and handling will be minimal, short-term (i.e., elevated stress levels, net abrasion), and not likely to result in any reduced fitness or loss of fecundity to individual fish. Our conclusion regarding the minimal impact of sublethal adverse effects is based on the commitment by researchers to adhere to the required mitigation measures and safe handling and release procedures specified in the permit for avoiding and minimizing adverse effects on Gulf sturgeon.

The proposed research permit authorizes up to 2 sublethal takes of Gulf sturgeon in any given year, and up to 4 sublethal takes over the life of the permit, from capture in trawls used during fishery independent research sampling. Given the proposed research sampling portion of the action area, captures of Gulf sturgeon could include juveniles, subadults or adults.

The sublethal impacts expected to occur on Gulf sturgeon in the action area are not anticipated to result in appreciable reductions in overall reproduction or numbers. Therefore, we do not anticipate any measurable or detectable reductions in survival rate or trajectory of recovery of Gulf sturgeon. In addition, no reduction in the distribution or current geographic range of this species is expected as a result of the proposed action. Based on the evidence available, including the Environmental Baseline, Effects of the Action, and Cumulative Effects, effects resulting from stressors caused by issuance of the proposed research permit to the SEFSC would not be expected to appreciably reduce the likelihood of the survival of the Gulf sturgeon in the wild by reducing the reproduction, numbers, or distribution of this species. We also conclude that effects from issuance of the proposed research permit to the SEFSC would not be expected, directly or indirectly, to appreciably reduce the likelihood of recovery of Gulf sturgeon in the wild by reducing the reproduction, numbers, or distribution of this species.

9.1.4 Smalltooth Sawfish

The U.S. DPS of smalltooth sawfish was listed as endangered under the ESA effective May 1, 2003. The decline in the abundance of this species has been attributed to fishing (primarily commercial and recreational bycatch), habitat modification (including changes to freshwater flow regimes as a result of climate change), and life history characteristics (i.e. slow-growing, relatively late-maturing, and long-lived species) (NMFS 2009b; Simpfendorfer et al. 2011). These factors continue to threaten the smalltooth sawfish population. Recent records indicate there is a resident reproducing population of smalltooth sawfish in south and southwest Florida from Charlotte Harbor through the Dry Tortugas, which is also the last U.S. stronghold for the species (Poulakis and Seitz 2004; Seitz and Poulakis 2002; Simpfendorfer and Wiley 2004). While the overall abundance appears to be stable, low intrinsic rates of population increase suggest that the species is particularly vulnerable to rapid population declines (NMFS 2010).

While the proposed action may result in sublethal adverse effects to up to 2 smalltooth sawfish over the life of the permit, we do not anticipate mortality or serious injury of this individual. Based on our exposure and response analysis (Section 7.2), we determined that sub-lethal effects on smalltooth sawfish resulting from incidental capture and handling will be minimal, short-term (i.e., elevated stress levels, net abrasion), and not likely to result in any reduced fitness or loss of fecundity to individual fish. Our conclusion regarding the minimal impact of sublethal adverse effects is based on the commitment by researchers during the permitting process to adhere to the required mitigation measures and safe handling and release procedures specified in the permit for avoiding and minimizing adverse effects on smalltooth sawfish.

The proposed research permit authorizes up to 2 sublethal take of this species over the life of the permit from capture in trawls used during fishery independent research sampling. Given the proposed research sampling portion of the action area, the captured smalltooth sawfish could be either juveniles or adults.

The sublethal impacts expected to occur to smalltooth sawfish in the action area are not anticipated to result in appreciable reductions in overall reproduction or numbers. Therefore, we do not anticipate any measurable or detectable reductions in survival rate or trajectory of recovery of the smalltooth sawfish U.S. portion of the range DPS. In addition, no reduction in the distribution or current geographic range of this species is expected as a result of the proposed action. Based on the evidence available, including the Environmental Baseline, Effects of the Action, and Cumulative Effects, effects resulting from stressors caused by issuance of the proposed research permit to the SEFSC would not be expected to appreciably reduce the likelihood of the survival of the smalltooth sawfish U.S. portion of the range DPS in the wild by reducing the reproduction, numbers, or distribution of this populations. We also conclude that effects from issuance of the proposed research permit to the SEFSC would not be expected, directly or indirectly, to appreciably reduce the likelihood of recovery of the smalltooth sawfish U.S. portion of the range DPS in the wild by reducing the reproduction, numbers, or distribution of this population.

9.1.5 Sea Turtles

The major anthropogenic stressors that contributed to the sharp decline of sea turtle populations in the past include habitat degradation, direct harvest, commercial fisheries bycatch, and marine debris. Bycatch reduction devices (i.e., TEDs) have reduced the incidental take of sea turtles in many U.S. commercial fisheries, including those operating within the action area. TEDs, which are required in federal shrimp trawl fisheries, are estimated to have reduced mortality of sea turtles by approximately 95% (NMFS 2014b). Mitigation measures required in other federal and state fisheries (e.g., gillnet, pelagic longline, pound nets) have also resulted in reduced sea turtle interactions and mortality rates. Increased conservation awareness at the international scale has also led to greater global protection of sea turtles. All 6 ESA-listed sea turtles are listed in CITES Appendix I, and many countries now have regulations banning turtle harvest and export. Among the countries that still allow directed take of sea turtles, harvest has decreased by more than 60% over the past 3 decades (Humber et al. 2014).

Implementation of the Clean Water Act of 1972 resulted in estuarine and coastal water quality improvements throughout the range of many sea turtle species. While vessel strikes, power plants, dredging, pollutants, oil spills, and hydromodification still represent sources of mortality, sea turtle mortalities resulting from these activities are expected to either remain at current levels, or possibly decrease with additional research efforts, conservation measures, and the continued implementation of existing environmental regulations. In addition, many activities that result in sea turtle take have already undergone formal section 7 consultation and are covered for take by an existing ITS; some of which would presumably need to reinitiate consultation with NMFS in the future to continue the activity.

While sea turtle populations are still at risk, efforts made over the past few decades to reduce the impact of the major threats have slowed the rate of decline. Abundance trends for several populations (or subpopulations) of ESA-listed sea turtles are currently reported as being stable or increasing based on trends in estimated adult female nesters. These include the green turtle North Atlantic DPS which has shown an increasing population trend in recent years, the loggerhead Northwest Atlantic DPS which is reported as having a stable population trend, and the Northwest Atlantic leatherback subpopulation which is also reported as having a stable population trend (NMFS 2022f). It is likely that some current threats to sea turtles, such as global climate change, will increase in the future. Marine debris and habitat degradation could also increase, while other threats are likely to remain at current levels or possibly decrease. However, it is difficult to predict the magnitude of sea turtle threats in the future or their impact on sea turtle populations.

The proposed action would have both sublethal and lethal effects to ESA-listed sea turtles. Based on our exposure and response analysis (Section 7.2), we determined that sub-lethal effects on sea turtles resulting from handling and research procedures authorized under the proposed action will be minimal, and are not likely to manifest into any long-term adverse effects, reduced fitness, or mortality. Only minor short-term stress, discomfort, pain, and chance of infection are expected during skin biopsy sampling and PIT and flipper tagging. Similarly, while the capture of sea turtles in trawls may result in short-term negative effects (i.e., elevated stress levels, net abrasion), with the exception of those very rare instances of capture mortality, these activities are not expected to result in reduced fitness or have any long-term adverse effects on individual sea turtles. Our conclusion regarding the minimal impact of sublethal effects is based on the assumption that researchers will adhere to the required mitigation measures and research protocols specified in the permit for avoiding and minimizing adverse effects on ESA-listed sea turtles.

The proposed research permit authorizes the following level of unintentional mortality resulting from either capture in fishery independent research trawl surveys or from handling of sea turtles captured in either commercial fishery operations or fishery independent research trawl surveys over the life of the permit: North Atlantic DPS green 2, Kemp's ridley 2, leatherback 2, Northwest Atlantic DPS loggerhead 3, and hawksbill 2. Sea turtle mortalities resulting from the proposed action could include any combination of juveniles, subadults, or adults.

The mortality of any individual sea turtle from a population represents the loss of 100% of that turtle's reproductive potential. Mortality of an adult female nester can result in negative population levels impacts. For long-lived species, such as sea turtles, mortality of juveniles or subadults affects future reproductive potential and could have effects on a population for decades. However, for all 5 species, the authorized number of lethal takes in the proposed research permit represents an extremely small fraction of the estimated population size.

For the Kemp's ridley sea turtle, an estimated nesting female abundance of 4,872 was derived from information in the most recent 5-year status review for this species (NMFS and USFWS 2015). Even if all mortalities from the proposed action were nesting females, the lethal take of 2 Kemp's ridley turtles would represent the loss of less than 0.05% of the nesting female population over a 5-year period. This extremely low estimated mortality rate will not result in an appreciable reduction in overall reproduction, numbers, or distribution of this species. It is also highly conservative because mortalities are likely to include a mix of juveniles, adult males, and adult females.

The adult female population size of the loggerhead Northwest Atlantic DPS is estimated at 20,000 to 40,000 females (NMFS 2009a). Even if all mortalities from the proposed action were nesting females, the lethal take of 3 loggerhead turtles would represent the loss of less than 0.02% of the nesting female population (based on the lower limit of estimated abundance) over a 5-year period. This extremely low estimated mortality rate will not result in an appreciable reduction in overall reproduction, numbers, or distribution of this DPS. It is also highly conservative because mortalities are likely to include a mix of juveniles, adult males, and adult females.

For the North Atlantic DPS green turtle, the estimated nesting female abundance based on the latest 5-year status review is 167,424 (Seminoff et al. 2015b). The lethal take of 2 green turtles over 5 years will not result in an appreciable reduction in overall reproduction, numbers, or distribution of this DPS.

The estimated total index of nesting female abundance for the Northwest Atlantic leatherback population is 20,659 females (NMFS and USFWS 2020). Even if all mortalities from the proposed action were nesting females, the lethal take of 2 leatherback turtles would represent the loss of less than 0.02% of the Northwest Atlantic nesting female population over a 5-year period. This extremely low estimated mortality rate will not result in an appreciable reduction in overall reproduction, numbers, or distribution of this species.

Based on data from hawksbill sea turtle nesting sites worldwide, this species has an estimated 22,000 to 29,000 annual female nesters (NMFS 2013b). Even if all mortalities from the proposed action were nesting females, the lethal take of 2 hawksbill turtles would represent the loss of less than 0.02% of the nesting female population over a 5-year period. This extremely low estimated mortality rate will not result in an appreciable reduction in overall reproduction, numbers, or distribution of this species.

Based on the evidence available, including the Environmental Baseline, Effects of the Action, and Cumulative Effects, effects resulting from stressors caused by the proposed issuance of a research permit to the SEFSC would not be expected to appreciably reduce the likelihood of the survival of the following ESA-listed sea turtles in the wild by reducing the reproduction, numbers, or distribution of these populations: green sea turtle – North Atlantic DPS; hawksbill sea turtle; Kemp's ridley sea turtle; leatherback sea turtle; and loggerhead sea turtle – Northwest Atlantic DPS. We also conclude that effects from the proposed issuance of a research permit to the SEFSC would not be expected, directly or indirectly, to appreciably reduce the likelihood of recovery of the following ESA-listed sea turtles in the wild by reducing the reproduction, numbers, or distribution of this species: green sea turtle – North Atlantic DPS; hawksbill sea turtle; Kemp's ridley sea turtle; leatherback sea turtle; and loggerhead sea turtle – Northwest Atlantic DPS. Therefore, we do not anticipate any measurable or detectable reductions in survival rate or trajectory of recovery of any ESA-listed sea turtle species or DPS.

10 CONCLUSION

After reviewing the current status of the ESA-listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS'S biological and conference opinion that the proposed action is not likely to jeopardize the continued existence of: green sea turtle – North Atlantic DPS; hawksbill sea turtle; Kemp's ridley sea turtle; leatherback sea turtle; loggerhead sea turtle – Northwest Atlantic DPS; Atlantic sturgeon - Gulf of Maine DPS, New York Bight DPS, Chesapeake Bay DPS, South Atlantic DPS, and Carolina DPS; shortnose sturgeon; Gulf sturgeon; and smalltooth sawfish - U.S. portion of range DPS.

It is also NMFS'S biological and conference opinion that the proposed action is not likely to adversely affect the following ESA-listed species and designated or proposed critical habitat: giant manta ray; oceanic whitetip shark; Nassau grouper; blue whale, fin whale, sei whale, sperm whale; Rice's whale; North Atlantic right whale; North Atlantic right whale designated critical habitat; loggerhead sea turtle Northwest Atlantic DPS designated critical habitat; Gulf sturgeon critical habitat; and Nassau grouper proposed critical habitat.

11 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to ESA-listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. NMFS has issued interim guidance on the term "harass," defining it as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering" (NMFS 2016b). We considered NMFS's interim definition of harassment in evaluating whether the proposed activities are likely to result in harassment of ESA-listed species.

Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

We do not expect incidental take of ESA-listed sea turtles as a result of the proposed action because all activities that may affect sea turtles would be undertaken in a directed manner as authorized by the permit. However, we do expect incidental take of smalltooth sawfish U.S. DPS, Atlantic sturgeon of any DPS, Gulf sturgeon and shortnose sturgeon. All species and DPSs are listed as endangered, except the Gulf of Maine DPS of Atlantic sturgeon and the Gulf sturgeon, which both have protective regulations issued under section 4(d) of the ESA for threatened species requiring exemption for incidental take (78 FR 69310).

11.1 Amount or Extent of Take

Section 7 regulations require NMFS to specify the impact of any incidental take of endangered or threatened species; that is, the amount or extent, of such incidental taking on the species (50 CFR § 402.14(i)(1)(i)). The amount of take represents the number of individuals that are expected to be taken by actions while the extent of take or "the extent of land or marine area that may be affected by an action" may be used if we cannot assign numerical limits for animals that could be incidentally taken during the course of an action (51 FR 19953). We anticipate the proposed permit is likely to result in the incidental take of ESA-listed species by capture and harassment.

This ITS exempts the take of 4 Atlantic sturgeon per year, but not to exceed take of 8 Atlantic sturgeon over the life of the permit, as a result of capture during proposed fishery independent research trawling operations. Of these takes, we expect the following by DPS: South Atlantic – up to 2 per year and up to 4 over the life of the permit; Carolina – up to 2 per year and up to 4 over the life of the permit; New York Bight – up to 2 per year and up to 4 over the life of the permit; Chesapeake Bay - up to 1 per year and up to 2 over the life of the permit; and Gulf of

Maine - up to 1 over the life of the permit DPS. By life stage, captures of Atlantic sturgeon could include juveniles, subadults, or adults.

This ITS exempts the take of 2 shortnose sturgeon per year, but not to exceed take of 4 shortnose sturgeon over the life of the permit, as a result of capture during proposed fishery independent research trawling operations. Shortnose sturgeon captured could include juveniles or adults.

This ITS exempts the take of 2 Gulf sturgeon per year, but not to exceed take of 4 Gulf sturgeon over the life of the permit, as a result of capture during proposed fishery independent research trawling operations. Gulf sturgeon captured could include juveniles, subadults or adults.

This ITS exempts the take of 2 smalltooth sawfish from the U.S. portion of range DPS over the life of the permit as a result of capture during proposed fishery independent research trawling operations. Smalltooth sawfish captured could include juveniles or adults.

For all ESA-listed fish species captured by trawl nets during sea turtle research, we anticipate a behavioral and stress response that would constitute harassment. Capture durations are sufficiently short that we do not expect more severe pathological effects, including serious injury or mortality, to occur. Individuals will be handled and released according to specified NMFS guidelines for sturgeon and sawfish as a condition of the permit. Additional mitigation measures, including reduced tow times and video monitoring, will further minimize adverse effects from take of these species.

11.2 Effects of the Take

In this opinion, we determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to ESA-listed species.

11.3 Reasonable and Prudent Measures

The measures described below are nondiscretionary, and must be undertaken by the Permits Division so that they become binding conditions for the exemption in section 7(o)(2) to apply. Section 7(b)(4) of the ESA requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA and the proposed action may incidentally take individuals of ESA-listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species. To minimize such impacts, reasonable and prudent measures, and term and conditions to implement the measures, must be provided. Only incidental take resulting from the agency actions and any specified reasonable and prudent measures and terms and conditions identified in the incidental take statement are exempt from the taking prohibition of section 9(a), pursuant to section 7(o) of the ESA.

“Reasonable and prudent measures” are nondiscretionary measures to minimize the amount or extent of incidental take (50 C.F.R. §402.02). NMFS believes the reasonable and prudent measure described below is necessary and appropriate to minimize the impacts of incidental take on threatened and endangered species:

- The Permits Division must ensure that all researchers implement and monitor the effectiveness of mitigation measures incorporated as part of the proposed permit. In addition, the Permits Division must inform us if take is exceeded.

11.4 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the Permits Division must comply with the following term and condition, which implements the Reasonable and Prudent Measure described above and outlines the mitigation, monitoring, and reporting measures required by the section 7 regulations (50 CFR 402.14(i)). This term and condition is non-discretionary. If the researchers or Permits Division fail to ensure compliance with this term and condition, the protective coverage of section 7(o)(2) may lapse.

- To implement the reasonable and prudent measure above, the Permits Division shall report to us the number of incidental takes for each ESA-listed species that occurs under the permit upon expiration of the permit. Any take exceedance must be reported immediately.

12 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to help implement recovery plans or develop information (50 C.F.R. §402.02). We did not identify conservation recommendations associated with this action.

13 Reinitiation Notice

This concludes formal consultation on the Permits Division's proposed action to issue a permit (Permit No. 25686) to the SEFSC for bycatch reduction research on sea turtles pursuant to section 10(a)(1)(A) of the Endangered Species Act of 1973. Consistent with 50 C.F.R. §402.16(a), reinitiation of formal consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and:

(1) The amount or extent of taking specified in the ITS is exceeded.
(2) New information reveals effects of the agency action that may affect ESA-listed species or critical habitat in a manner or to an extent not previously considered.
(3) The identified action is subsequently modified in a manner that causes an effect to the listed species or designated critical habitat that was not considered in this opinion.
(4) A new species is listed, or critical habitat designated under the ESA that may be affected by the action.

NMFS is developing a proposed rule to designate critical habitat for the North Atlantic DPS of green sea turtle. Reinitiation may be required if critical habitat is designated while the SEFSC permit is still in affect and if the proposed action may affect this critical habitat.

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