NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7
BIOLOGICAL OPINION

Title: Biological Opinion on the Issuance of Permit No. 20339 to the NMFS Southeast Fisheries Center and Permit No. 19621-01 to Michael Arendt (South Carolina Department of Natural Resources, Marine Resources Division) for Scientific Research on Sea Turtles

Consultation Conducted By: Endangered Species Act Interagency Cooperation Division, Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce

Action Agency: NOAA's National Marine Fisheries Service, Office of Protected Resources, Permits and Conservation Division

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Approved: Donna S. Wieting

Donna S. Wieting
Director, Office of Protected Resources

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1 INTRODUCTION

The Endangered Species Act of 1973, as amended (ESA; 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 insure 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. Federal agencies must do so in consultation with National Marine Fisheries Service (NMFS) for threatened or endangered species (ESA-listed), or designated critical habitat that may be affected by the action that are under NMFS jurisdiction (50 C.F.R. §402.14(a)). If a Federal action agency determines that an action "may affect, but is not likely to adversely affect" endangered species, threatened species, or designated critical habitat and NMFS concurs with that determination for species under NMFS jurisdiction, consultation concludes informally (50 C.F.R. §402.14(b)).

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 listed species or destroy or adversely modify critical habitat, NMFS provides a reasonable and prudent alternative that allows the action to proceed in compliance with section 7(a)(2) of the ESA. If an incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts and terms and conditions to implement the reasonable and prudent measures.

The action agency for this consultation is the NMFS, Office of Protected Resources, Permits and Conservation Division (hereafter referred to as "the Permits Division") for its issuance of scientific research permits pursuant to section 10(a)(1)(A) of the ESA. The Permits Division proposes to issue scientific research permits:

- No. 20339 for the handling, measuring, weighing, photographing, tagging (flipper and passive integrated transponder (PIT)), skin biopsy sampling, and releasing of green, Kemp's ridley, loggerhead, leatherback, olive ridley, hawksbill, and unidentified/hybrid sea turtles in the Atlantic Ocean, Gulf of Mexico, Caribbean Sea and its tributaries, offshore waters, and international waters; and

- No. 19621-01 for the capturing, handling, marking, measuring, weighing, photographing, tagging (flipper and passive integrated transponder (PIT)), skin biopsy sampling, and salvaging of incidentally caught green, Kemp's ridley, loggerhead, leatherback, and olive ridley sea turtles during commercial fishing operations and trawl surveys in the waters of South Carolina, Georgia, and Florida.

This consultation, biological opinion, and incidental take statement, were completed in accordance with section 7(a)(2) of the statute (16 U.S.C. 1536 (a)(2)), associated implementing regulations (50 C.F.R. §§401-16), and agency policy and guidance was conducted by NMFS Office of Protected Resources Endangered Species Act Interagency Cooperation Division (hereafter referred to as “we”).This biological opinion (opinion) and incidental take statement were prepared by NMFS Office of Protected Resources Endangered Species Act Interagency Cooperation Division in accordance with section 7(b) of the ESA and implementing regulations at 50 C.F.R. §402.

This document represents NMFS opinion on the effects of these actions on green (North Atlantic distinct population segment (DPS)), Kemp’s ridley, loggerhead, leatherback, olive ridley, and hawksbill sea turtles; smalltooth sawfish (United States DPS); Atlantic sturgeon (Gulf of Maine, Carolina, South Atlantic, New York Bight, and Chesapeake Bay DPSs); shortnose sturgeon; and Gulf sturgeon. A complete record of this consultation is on file at NMFS Office of Protected Resources in Silver Spring, Maryland.

1.1 Background

Permit No. 20339 for the NMFS Southeast Fisheries Science Center (SEFSC) is to continue long-term projects to evaluate modifications to commercial fishing gear to mitigate sea turtle interactions. Their work began in 2006 under Permit No. 1570, and continuing through 2018 under Permit No. 16253. Their proposed permit includes two projects: Project A, turtle excluder device evaluations in Atlantic and Gulf of Mexico trawl fisheries; and Project B, evaluation of longline gear and longline alternative gear along the United States Atlantic coast and the Gulf of Mexico. Proposed research is aimed to reduce incidental turtle bycatch and would provide new stock assessment data for loggerhead, Kemp’s ridley, leatherback, green, hawksbill, olive ridley, and unidentified/hybrid sea turtles. The permit would authorize researchers to take turtles for research that have been legally captured in commercial fisheries, and also to conduct trawl surveys for sea turtles independent of the fisheries to evaluate fishing gear design modifications.

Permit No. 19621-01 for the South Carolina Department of Natural Resources (SCDNR), Marine Resources Division, is a modification to the existing Permit No. 19621. Permit No. 19621 authorizes the capture (by trawl or tangle net), marking, biological sampling, and tagging of green, Kemp's ridley, leatherback, and loggerhead sea turtles in the waters of South Carolina, Georgia, and Florida. The purpose of the research is to assess the distribution, relative abundance, demographic structure, and health of foraging sea turtles in these state waters. Relevant to this request, Project 3 authorizes trawl surveys for sea turtles in the Port Canaveral shipping channel entrance from February 2017 through May 2019. The permit expires on June 15, 2021. The permit modification would authorize the following:

1) The taking of olive ridley sea turtles during all research projects;

2) Expanding the area for Project 3 to include coastal shoals adjacent to the Cape Canaveral channel;

3) Extending the duration of Project 3 through October 2020; and

4) Increasing the annual take of green and loggerhead sea turtles and authorize double tagging and tissue sampling of a small subset of these animals under Project 3.

1.2 Consultation History

The following dates are important to the history of the consultation on Permit No. 20339:

- The NMFS SEFSC Permit No. 20339 application was submitted on March 22, 2016
- NMFS SEFSC submitted a revised application on July 27, 2016 with responses to comments
- The Permits Division deemed the application for Permit No. 20339 complete August 1, 2016
- Early technical assistance/review of Permit No. 20339 was requested of the ESA Interagency Cooperation Division on August 15, 2016.
- On December 18, 2016, the ESA Interagency Cooperation Division initialized formal consultation

The following dates are important to the history of the consultation on Permit No. 19621-01:

- The SCDNR, Marine Resources Division Permit No. 19621-01 application was submitted on October 14, 2016
- The Permits Division deemed the application for Permit No. 19621-01 complete October 24, 2016 and began early technical assistance/review with the ESA Interagency Cooperation Division
- On December 18, 2016, the ESA Interagency Cooperation Division initialized formal consultation

Because of similarities in the proposed action of permit issuance and the activities that will be conducted by the NMFS SEFSC and SCDNR, Marine Resources Division under each permit, we have batched these two consultations into one biological opinion.

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 designated critical habitat for the conservation of an ESA-listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (50 C.F.R. §402.02).

An ESA section 7 assessment involves the following steps:

Description of the Proposed Action (Section 3), *Interrelated and Interdependent Actions* (Section 4), and *Action Area* (Section 5), and We describe the proposed action, identify any interrelated and interdependent actions, and describe the action area with the spatial extent of those stressors.

Status of Endangered Species Act Protected Resources (Section 6): 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 habitat. In this Section, we also identify those *Species and Designated Critical Habitat Not Likely to be Adversely Affected* (Section 6.1), and those *Species and Designated Critical Habitat Likely to be Adversely Affected* (Section 6.2).

Environmental Baseline (Section 7): We describe the environmental baseline in the action area including: past and present impacts of Federal, state, or private actions and other human activities in the action area; anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation, impacts of state or private actions that are contemporaneous with the consultation in process.

Effects of the Action (Section 8): We identify the number, age (or life stage), and gender of ESA-listed individuals that are likely to be exposed to the stressors and the populations or subpopulations to which those individuals belong. We also consider whether the action "may affect" designated critical habitat. This is our exposure analysis. We evaluate the available evidence to determine how individuals of those ESA-listed species are likely to respond given their probable exposure. We also consider how the action may affect designated critical habitat. This is our response analyses. We assess the consequences of these responses of individuals that are likely to be exposed to the populations those individuals represent, and the species those populations comprise. This is our risk analysis. The adverse modification analysis considers the impacts of the proposed action on the essential habitat features and conservation value of designated critical habitat.

Cumulative Effects (Section 9): Cumulative effects are the effects to ESA-listed species and designated critical habitat of future state or private activities that are reasonably certain to occur within the action area 50 C.F.R. §402.02. Effects from future Federal actions that are unrelated to the proposed action are not considered because they require separate ESA section 7 compliance.

Integration and Synthesis (Section 10): In this section, we integrate the analyses in the opinion to summarize the consequences to ESA-listed species and designated critical habitat under NMFS' jurisdiction.

Conclusion (Section 11); With full consideration of the status of the species and the designated critical habitat, we consider the effects of the action within the action area on populations or subpopulations and on essential habitat features when added to the environmental baseline and the cumulative effects to determine whether the action could reasonably be expected to:

- Reduce appreciably the likelihood of survival and recovery of ESA-listed species in the wild by reducing its numbers, reproduction, or distribution, and state our conclusion as to whether the action is likely to jeopardize the continued existence of such species; or
- Appreciably diminish the value of designated critical habitat for the conservation of an ESA-listed species, and state our conclusion as to whether the action is likely to destroy or adversely modify 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, then we must identify reasonable and prudent alternative(s) to the action, if any, or indicate that to the best of our knowledge there are no reasonable and prudent alternatives. See 50 C.F.R. §402.14.

In addition, we include an *Incidental Take Statement* (Section 12) that specifies the impact of the take, reasonable and prudent measures to minimize the impact of the take, and terms and conditions to implement the reasonable and prudent measures. ESA section 7 (b)(4); 50 C.F.R. §402.14 (i). We also provide discretionary *Conservation Recommendations* (Section 13) that may be implemented by action agency. 50 C.F.R. §402.14 (j). Finally, we identify the circumstances in which *Reinitiation of Consultation* is required (Section 14). 50 C.F.R. §402.16.

To comply with our obligation to use the best scientific and commercial data available, we collected information identified through searches of google scholar, web of science, literature cited sections of peer reviewed articles, species listing documentation, and reports published by government and private entities. This opinion is based on our review and analysis of various information sources, including:

- Information submitted by the Permits Division and the applicant
- Government reports (including NMFS biological opinions and stock assessment reports)
- NOAA technical memos
- Peer-reviewed scientific literature

These resources were used to identify information relevant to the potential stressors and responses of ESA-listed species and designated critical habitat under NMFS' 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 critical habitat for the conservation of ESA-listed species.

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. The proposed actions are the issuance of two scientific research permits:

- Permit No. 20339 to Bonnie Ponwith, NMFS Southeast Fisheries Center
- Permit No. 19621-01 to Mike Arendt, South Carolina Department of Natural Resources, Marine Resources Division

3.1 Permit No. 20339 to Bonnie Ponwith, NMFS Southeast Fisheries Science Center

The proposed action is the issuance of the scientific research Permit No. 20339 to Bonnie Ponwith, NMFS Southeast Fisheries Science Center, pursuant to section 10(a)(1)(a) of the ESA, to conduct research on green, Kemp's ridley, leatherback, loggerhead, hawksbill, olive ridley, and unidentified/hybrid hardshell sea turtles for research. The turtles will be legally captured in commercial fisheries and in addition, SEFSC would conduct trawl surveys for sea turtles independent of the fisheries to evaluate fishing gear design modifications. The purpose of their research is to assist in the development and testing of gear aboard commercial fishing vessels to mitigate interactions and capture of sea turtles.

The research objectives are split into two projects, A and B. Project A will evaluate turtle excluder devices (TED) in Atlantic and Gulf of Mexico trawl fisheries. The objective of the proposed research 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. These fisheries operate within the migratory path of leatherbacks, loggerheads, greens, and Kemp's ridley sea turtles during seasons when turtles are likely to be present. This research will occur by 1) studying animals within commercial fisheries where the capture of the animals is already authorized by an ESA Section 7 biological opinion 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. Although trawl fisheries may be evaluated, research will focus on the following fisheries: flynet and high opening bottom trawl; crab trawl; shimp trawl; skimmer trawls; Gulf of Mexico shrimp trawl; butterfly and wing nets; and groundfish. The proposed annual take of each sea turtle species under Permit No. 20339, Project A is found in Table 1.

Although sturgeon interactions are not expected, if a sturgeon is captured incidentally during the course of research, it will be disentangled and released immediately. If possible, all individuals will be kept in the water and returned to neutral buoyancy prior to release. In addition, video monitoring of the trawl will be used when conducting trawl testing in the vicinity of Duck, North Carolina, where seventy-five Atlantic Sturgeon were encountered on a single tow during research conducted in January 2008. If sturgeon are observed in the net, researchers will immediately haul the gear. Smalltooth sawfish are not expected to be encountered given their limited range, but the potential does exist. The Permit Division anticipates that smalltooth sawfish interactions could occur over the life of the permit. In the event of an interaction, proper handling protocols as described in the NOAA Sawfish Handling and Release Guidelines will be followed to minimize injury and stress. The proposed incidental take under Permit No. 20339, Project A is found in Table 2.

Project B will study modifications to longline fisheries gear and evaluate longline alternative gear. The objective of the proposed research is to develop sea turtle bycatch mitigating gear modifications in the pelagic and bottom longline fisheries along the United States Atlantic coast, Gulf of Mexico, and Caribbean Sea and its tributaries. These fisheries operate within the migratory path of leatherbacks, loggerheads, greens, and Kemp's ridley sea turtles during seasons when turtles are likely to be present. Research on sea turtles under Project B will occur solely within longline commercial fisheries where the incidental capture is already authorized by an existing ESA Section 7 biological opinion. In order for these fisheries to continue to operate, it is imperative that mitigation measures be developed to reduce the impact of longline gear on endangered and threatened sea turtle species. The research proposed also includes 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. Research will involve testing of modified hook designs such as circle hooks and/or bait and baiting techniques and other gear modifications and changes in fishing tactics in pelagic and bottom longline fisheries. In addition, other hook and line gear will be evaluated as an alternative to traditional longline gear. Finally, evaluation of gear modifications in other hook and line fisheries will be conducted to evaluate potential for reducing bycatch species and incidental takes of sea turtles and marine mammals. The proposed annual take of each sea turtle species under Permit No. 20339, Project B is found in Table 3.

Table 1. Proposed annual take of sea turtles under Permit No. 20339, Project A.

Species	Listing Unit	Number of Animals	Take Action	Collect Method	Procedures
Green Sea Turtle	North Atlantic DPS[1]	35	Handle/ Release	Capture under other authority[2]	Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: tissue; Weigh
		15	Capture/ Handle/ Release	Net, trawl[3]	
		2	Unintentional Mortality	Net, trawl[4]	Salvage (carcass, tissue, parts); Unintentional mortality
Kemp's ridley Sea Turtle	Range-wide	80	Handle/ Release	Capture under other authority[2]	Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: tissue; Weigh
		25	Capture/ Handle/ Release	Net, trawl[3]	
		2	Unintentional Mortality	Net, trawl[4]	Salvage (carcass, tissue, parts); Unintentional mortality
Loggerhead Sea Turtle	Range-wide	150	Handle/ Release	Capture under other authority[2]	Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: tissue; Weigh
		70	Capture/ Handle/ Release	Net, trawl[3]	
		3	Unintentional Mortality	Net, trawl[4]	Salvage (carcass, tissue, parts); Unintentional mortality
Leatherback Sea Turtle	Range-wide	65	Handle/ Release	Capture under other authority[2]	Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: tissue; Weigh
		20	Capture/ Handle/ Release	Net, trawl[3]	
		1	Unintentional Mortality	Net, trawl[4]	Salvage (carcass, tissue, parts); Unintentional mortality
Olive ridley Sea Turtle	Range-wide	20	Handle/ Release	Capture under other authority[2]	Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: tissue; Weigh
		10	Capture/ Handle/ Release	Net, trawl[3]	
		1	Unintentional Mortality	Net, trawl[4]	Salvage (carcass, tissue, parts); Unintentional mortality
Hawksbill Sea Turtle	Range-wide	20	Handle/ Release	Capture under other authority[2]	Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: tissue; Weigh
		10	Capture/ Handle/ Release	Net, trawl[3]	
		1	Unintentional Mortality	Net, trawl[4]	Salvage (carcass, tissue, parts); Unintentional mortality
Unidentified Sea Turtle	N/A	50	Handle/ Release	Capture under other authority[2]	Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: tissue; Weigh
	N/A	25	Capture/ Handle/ Release	Net, trawl[3]	

[1] DPS = distinct population segment; [2]Animals captured within fisheries managed by Federal authority; [3] Animals captured by fishermen contracted by researchers to conduct experimental trawling in waters managed by State authority; [4] Unintentional mortalities caused by forcible submergence/drowning during trawl captures. Total requested is for the five-year duration of the permit, and not an annual number.

Table 2. Proposed incidental take of non-target species during trawl surveys under Permit No. 20339, Project A.

Species	Listing Unit	Number of Animals Annually	Take Action	Collect Method[3]
Shortnose Sturgeon	Range-wide	2	Incidental Take	Trawl
Atlantic Sturgeon	Gulf of Maine, Carolina, South Atlantic, New York Bight, and Chesapeake Bay DPS[1]	4	Incidental Take	Trawl
Gulf Sturgeon	Range-wide	2	Incidental Take	Trawl
Smalltooth Sawfish	U.S. DPS[1]	3[2]	Incidental Take	Trawl

[1] DPS = distinct population segment; [2] Over the life of the entire permit (5 years); [3] Fish must be released alive.

Table 3. Proposed annual take of sea turtles under Permit No. 20339, Project B.

Species	Listing Unit	Number of Animals	Take Action	Collect Method	Procedures
Green Sea Turtle	North Atlantic DPS[1]	10	Handle/ Release	Capture under other authority[2]	Import/export/receive, parts; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: tissue; Weigh
Kemp's ridley Sea Turtle	Range-wide	10	Handle/ Release	Capture under other authority[2]	Import/export/receive, parts; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: tissue; Weigh
Loggerhead Sea Turtle	Range-wide	30	Handle/ Release	Capture under other authority[2]	Import/export/receive, parts; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: tissue; Weigh
Leatherback Sea Turtle	Range-wide	30	Handle/ Release	Capture under other authority[2]	Import/export/receive, parts; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: tissue; Weigh
Olive ridley Sea Turtle	Range-wide	10	Handle/ Release	Capture under other authority[2]	Import/export/receive, parts; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: tissue; Weigh
Hawksbill Sea Turtle	Range-wide	10	Handle/ Release	Capture under other authority[2]	Import/export/receive, parts; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: tissue; Weigh
Unidentified Sea Turtle	N/A	10	Handle/ Release	Capture under other authority[2]	Import/export/receive, parts; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: tissue; Weigh

[1] DPS = distinct population segment; [2]Animals captured within fisheries managed by Federal authority

3.1.1 Capture

Under Project A of Permit No. 20339, sea turtles are incidentally caught during commercial fishing operations throughout state waters and the Exclusive Economic Zone of the United States in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea and its tributaries. Turtles taken during this project will be captured by otter trawl, skimmer trawl, wing net, or butterfly net gear set for fish or shellfish in the mid-Atlantic and Gulf of Mexico. During trawl sets to evaluate experimental TED installations, the incidental capture of sea turtles 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 minimum dimensions for inshore waters. 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 the potential to capture sea turtles. Turtles may be captured by bottom trawls while foraging or resting on the bottom or in the water column as a bottom trawl as it is deployed or retrieved. NOAA divers involved in TED development have observed the behavior of sea turtles overtaken by trawls. In some instances, captured turtles may be capable of out swimming a trawl and escaping. More likely, turtles that are overtaken actively seek an escape, moving from side to side in the trawl, making contact with the trawl webbing. As the turtle tires, it cannot keep pace with the trawl movement and steadily falls toward the codend section or bag, where it will remain until the trawl is retrieved. When a turtle is captured, its presence in the trawl may not be noted until after the trawl has been retrieved in its entirety and the catch is removed, or dumped, on the deck of the vessel. The turtle will likely be mixed in with substantial amounts of fishery target catch.

As a component of this project, some fishery independent trawling is expected to be conducted. This work will involve the use of a NOAA research vessel or a chartered commercial trawler to investigate candidate TED efficiency in excluding sea turtles. This work 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. This work will be conducted in a limited number of locations which are known to have high sea turtle abundance during certain times of the year. These locations include the Cape Canaveral, Florida shipping channel and the offshore waters of the Georgia and South Carolina. Work may be conducted from October through April. Trawl types used for this work may include: traditional 2 and 4 seam shrimp trawls with headrope lengths up to 70 feet; flounder trawls with headrope lengths up to 120 feet; and fly nets with headrope lengths up to 150 feet and skimmer trawls with headrope lengths up to 30 feet.

The species of turtles that could be taken during this project include loggerhead, green, leatherback, Kemp's ridley, hawksbill, and olive ridley. The proposed research will occur in the Western Atlantic from Southern Florida to New York and the Gulf of Mexico in water depths ranging from 40 to 200 meters. Turtles taken during this project will be captured by bottom or midwater trawling gear set for fish or shellfish. During trawl sets that are conducted to evaluate experimental TED installation, the incidental capture of a sea turtle will be highly unlikely, as the experimental TED will incorporate the minimum required opening dimensions for either offshore waters or inshore waters. During trawl sets in which a TED is not installed in the trawl (i.e., tows to assess target catch rates without a TED), one of two methods to ensure a non-lethal turtle interaction will be employed. The first method will involve a tow time limitation as described below, while the second will involve the use of a real time video monitoring system that will allow the researchers to know when a turtle enters the codend section of the trawl. 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 meters 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. 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). This area typically has the smallest trawl diameter. The placement of the camera in this area will allow the observer to view all objects that are in transit to the codend section. 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. NOAA Fisheries has used the RF video system successfully for trawl observations of captured turtles during TED tests conducted aboard the R/V Georgia Bulldog from 2002 to 2004.

In state waters with contracted vessels, all captures will be authorized under this permit and not the incidental take statement of a biological opinion. In these cases, 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, such as the skimmer trawl fishery, which has a 55 minute tow time limit. Testing must be conducted under commercial conditions and shorting tow time limits would potentially bias results of the testing. As an alternative, real-time video cameras may be used to observe the capture of animals which will allow researchers to remove turtles from the nets within 20 minutes of capture. Trawling will not be initiated when marine mammals (with the exception of dolphins or porpoises) are observed in the vicinity and researchers will make every effort to prevent interactions with all marine mammals. During skimmer trawl operations, a minimum of two staff, one on each side (port/starboard) of the vessel, will inspect the gear every five minutes to monitor for the presence of marine mammals. Prior to retrieving skimmer trawl tail bags, the vessel will be slowed from the active towing speed to 0.5 to 1.0 knots to allow animals that may be in the net to escape. In addition, video monitoring of the trawl will be used when conducting trawl testing in the vicinity of Duck, North Carolina. Turtles may be captured by the following trawl types: flynets and other open high bottom trawls, crab trawl fishery, shrimp trawls, skimmer trawls, and butterfly/wing nets.

3.1.1.1 Flynets and other High Opening Bottom Trawls

Flynets and other high opening bottom trawls vary in mesh size and headrope length depending on the targeted catch. Flynets are typically two-seam fish trawls constructed of graduated mesh sizes beginning with large mesh (16 inch, 32 inch, or 64 inch 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 a small as 3-inch in the codend or bag section. The trawls are bottom tending with net sizes ranging from 80 to 100 feet (headrope length). Vertical height of these trawls when fished may be as much as 30 feet. Flynet vessels are single-rigged (towing one trawl) using a net reel for storage. Tow speeds are often between three and four knots with tow durations ranging from 10 minutes to several hours High opening bottom trawls which are used to target scup and black sea bass may have headrope lengths as long as 150 feet and mesh sizes up to 40 ft. Similar in general design, but of much smaller headrope size (40 to 75 feet) are trawls used to target inshore Loligo squid.

3.1.1.2 Crab Trawl Fishery

Crab trawls are typically heavily chained 2 seam nets with headrope lengths from 25 to 50 feet 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 feet and towing speed range from 2 to 4 knots depending on the horsepower of the vessel.

3.1.1.3 Shrimp trawls

Shrimp otter trawls are typically 4-seam or 2-seam in construction with headrope lengths from 12 feet to 100 feet 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 inches to 2 inches. The vertical opening of a shrimp trawl is dependent on the target species of shrimp and may range from 3 feet for trawls target brown and pink shrimp to 16 ft for trawls targeting white shrimp. Towing speeds vary from 2 to 3 knots depending on size and horsepower of the towing vessel and personal preference of the fisher.

3.1.1.4 Skimmer trawls

Skimmer trawls are used exclusively in the inshore waters of all states where the gear is allowed (Louisiana, Mississippi, Alabama, Florida, and North Carolina). Originally designed to catch white shrimp by fishing the entire water column, today skimmers may also be rigged with low opening nets and are used to target brown shrimp. 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. This allows the vessel operator to maneuver the nets in confined areas such as bayous and sloughs or along the edge of channels. 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 catch may be retrieved and dumped without interruption of the towing process as the codends may be lifted to the deck of the boat without raising the entire net out of the water. The size of a skimmer trawl is regulated by each state and can vary from 15 to 30 feet in horizontal opening.

3.1.1.5 Butterfly/Wing Nets

Butterfly nets, sometimes called "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. As with skimmer trawls, the catch may be picked up and dumped without raising the entire net out of the water.

For Project B of Permit No. 20339, researchers will fish gear within fishery guidelines, and all captures of sea turtles will occur in a fishery and are authorized by the incidental take statement of the biological opinion done for the fishery. All fisheries are federally managed or regulated. In addition, alternatives to longline gear such as "Buoy Gear" and "Greenstick" may also be explored. Sea turtle bycatch with these alternative gears is expected to be unlikely.

3.1.2 Handling and Sampling

All turtles will be handled and sampled in accordance with the methods in NMFS-SEFSC-TM-579, the SEFSC Sea Turtle Research Techniques Manual (NMFS SEFSC 2008). Each captured animal will be assessed for general health condition and identified, and then as appropriate they will be measured, photographed, weighed (when possible) biopsied (skin), PIT and flipper tagged, and released.

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 two inconel flipper tags and one 125 to 134.2 kilohertz PIT tag. The tagging site will be disinfected using a povidone-iodine swab, an isopropyl alcohol swab, another povidone-iodine swab, and a second alcohol swab.

Flipper tags will be cleaned prior to use and applied along the trailing edge of the rear flippers just proximal to the first scale. PIT tags will be applied in the triceps superficialis muscle on hardshells and in the dorsal musculature of the forelimb in leatherbacks. Boated turtles will have a 6 millimeter tissue biopsy taken from the trailing edge of a rear flipper using a sterile biopsy punch, after the site has been disinfected using a povidone-iodine swab, an isopropyl alcohol swab, another povidone-iodine swab, and then a second alcohol swab. The minimum size turtle that we would PIT or flipper tag is 30 centimeters straight carapace length.

Photographs and morphometric data will be archived by the SEFSC. Biopsy samples collected for genetic and stable isotope analysis will be cataloged and sent to the National Sea Turtle Genetics Laboratory in La Jolla, California. Tagging data, including PIT tag data, will be archived with the Cooperative Marine Turtle Tagging Program, currently managed by the Archie Carr Center for Sea Turtle Research at the University of Florida. In the event of a gear interaction, turtles will be handled according to gear removal protocols in NMFS-SEFSC-TM-580, Careful Release Protocols for Sea Turtle Release with Minimal Injury (NMFS SEFSC 2008).

3.1.3 Salvage of Parts and Import/Export Activities

NOAA Fisheries SEFSC currently holds an ESA/CITES (Convention on International Trade in Endangered Species) permit #15US045532/9 to import salvaged sea turtle carcasses and parts and tissue samples from live animals from the high seas and foreign ports. All carcasses salvaged and biopsy samples obtained from animals taken during commercial fishing operations and NMFS research activities, generally on the high seas of the Atlantic Ocean under Project B (e.g., previous importations have occurred during pelagic longline research on the high seas), will be landed in United States ports in almost all cases. NOAA Fisheries does not intend to ship the carcasses or biopsy samples back to the United States from foreign ports of landing except in rare cases. In those instances, proper CITES procedures will be followed.

Wild animals incidentally captured and killed as a result of interaction with fishing gear while NMFS-permitted researchers are aboard will be salvaged, stored on ice or frozen and returned to a United States shore for scientific studies in cases where this is possible. These carcasses otherwise would be returned dead to the sea. Wild turtles incidentally captured alive as a result of interaction with fishing gear during NMFS-permitted directed research, will have biopsy tissue samples (6 to 8 millimeters) taken for genetic analysis and scientific study.

The purposes of the scientific studies include health assessment and demographic studies. The researchers do not propose to purposefully take protected sea turtles, just to fully utilize those that are incidentally captured or killed during observed fishing operations. All researchers will be working under a NMFS permit and with fisheries/research activities for which there has been a biological opinion issued and an ESA Section 7 consultation with NMFS. The pelagic stage of sea turtles, found on the high seas, is a life stage for which there is little information, and much more is needed to make management decisions about activities impacting this stage.

The purpose of import is to conduct genetic analysis in order to determine population structure and identify stock origin of sea turtles at key forage areas, migratory corridors as well as stock origin of stranding and fisheries bycatch. These are priority actions in the NMFS-USFWS (United States Fish and Wildlife Service) Recovery Plans for sea turtles, and the results of these studies will allow identification of fisheries that are impacting declining nesting stocks, as well as forage areas and migratory corridors that are linked to different nesting stocks. This information will directly enhance recovery efforts on behalf of these endangered species.

Any carcasses retrieved will be bagged and shipped on ice in coolers. Once landed at a United States port, biopsy samples and carcasses will be shipped to NMFS facilities along the United States east and Gulf Coast for necropsy by staff holding current NMFS and/or USFWS permits. A comprehensive examination including measurements will be conducted on all animals. Tissue samples will be taken from non-frozen animals for histopathological examination and for contaminant analyses. The researchers will attempt to identify the mechanism of death (e.g., drowning, hook puncture of major blood vessel, etc.) for any carcass. Hard parts will be salvaged for aging and life history studies. Tissue biopsies will be collected for genetic studies. Gut contents will be salvaged for diet studies.

3.2 Permit No. 19621-01 to Mike Arendt, South Carolina Department of Natural Resources, Marine Resources Division

The proposed action is the issuance of the scientific research Permit No. 19621-01 to Mike Arendt, South Carolina Department of Natural Resources, Marine Resources Division, pursuant to section 10(a)(1)(a) of the ESA. Permit No. 19621 authorizes the capture (by trawl or tangle net), marking, biological sampling, and tagging of green, Kemp's ridley, leatherback, and loggerhead sea turtles in the waters of South Carolina, Georgia, and Florida. The purpose of the research is to assess the distribution, relative abundance, demographic structure, and health of foraging sea turtles in these state waters. Relevant to this request, Project 3 authorizes trawl surveys for sea turtles in the Port Canaveral shipping channel entrance from February 2017 through May 2019. The permit expires on June 15, 2021. The permit modification would authorize the following:

1) The taking of olive ridley sea turtles during all research projects;
2) Expanding the area for Project 3 to include coastal shoals adjacent to the Cape Canaveral channel;
3) Extending the duration of Project 3 through October 2020; and
4) Increasing the annual take of green and loggerhead sea turtles and authorize double tagging and tissue sampling of a small subset of these animals under Project 3.

Take for olive ridley sea turtles is necessary due to an unexpected take of this species occurring in 2016 under the prior permit 15566-05. The olive ridley turtle was identified upon genetic analysis after the permit had expired. Project 3 would also allow for new collaborations and funding sources to meet the existing permitted research objectives. The proposed annual take of each sea turtle species under Permit No. 19621-01 are found in Tables 4-8. Table 9 shows the proposed authorized mortality over the life of the permit for all projects, and Table 10 is the proposed incidental take under Permit No. 19621-01.

Table 4. Proposed annual take of sea turtles under Permit No. 19621-01, Study 1, Charleston, South Carolina.

Species	Listing Unit	Number of Animals	Take Action	Collect Method	Procedures
Green Sea Turtle	North Atlantic DPS[1]	3	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
Kemp's ridley Sea Turtle	Range-wide	5	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Instrument (e.g. satellite tag, VHF[2] tag), epoxy attachment; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, scute scraping, cloacal swab; Ultrasound; Weigh
Loggerhead Sea Turtle	Northwest Atlantic DPS[1]	40	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Instrument (e.g. satellite tag, VHF[2] tag), epoxy attachment; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, scute scraping; Ultrasound; Weigh
		70	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
Leatherback Sea Turtle	Range-wide	1	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
Olive ridley Sea Turtle	Range-wide	1	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh

[1] DPS = distinct population segment; [2] VHF = very high frequency

Table 5. Proposed annual take of sea turtles under Permit No. 19621-01, Study 2, Brunswick, Georgia and St. Simons Sound.

Species	Listing Unit	Number of Animals	Take Action	Collect Method	Procedures
Green Sea Turtle	North Atlantic DPS[1]	16	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, scute scraping, cloacal swab; Ultrasound; Weigh
		24	Capture/ Handle/ Release	Net, tangle	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, scute scraping, cloacal swab; Ultrasound; Weigh
Kemp's ridley Sea Turtle	Range-wide	44	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
		4	Capture/ Handle/ Release	Net, tangle	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
		20	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Instrument (e.g. satellite tag, VHF[2] tag), epoxy attachment; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, scute scraping; Ultrasound; Weigh; Laparoscopy; Transport
		20	Capture/ Handle/ Release	Net, tangle	Collect: tumors, Epibiota removal; Instrument (e.g. satellite tag, VHF[2] tag), epoxy attachment; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, scute scraping; Ultrasound; Weigh; Laparoscopy; Transport
Loggerhead Sea Turtle	Northwest Atlantic DPS[1]	48	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
		12	Capture/ Handle/ Release	Net, tangle	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
Leatherback Sea Turtle	Range-wide	1	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
		1	Capture/ Handle/ Release	Net, tangle	Collect: tumors, Epibiota removal; Mark: carapace; Tag: PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
Olive ridley Sea Turtle	Range-wide	1	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh

[1] DPS = distinct population segment; [2] VHF = very high frequency

Table 6. Proposed annual take of sea turtles under Permit No. 19621-01, Study 3, Port Canaveral, Florida Shipping Channel Entrance and adjacent shoals.

Species	Listing Unit	Number of Animals	Take Action	Collect Method	Procedures
Green Sea Turtle	North Atlantic DPS[1]	9	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Instrument (e.g. satellite tag, VHF[2] tag)[3], epoxy attachment; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, tissue; Ultrasound; Weigh
Kemp's ridley Sea Turtle	Range-wide	15	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper; Measure; Photograph/Video; Sample: blood, fecal, scute scraping, cloacal swab; Ultrasound; Weigh
Loggerhead Sea Turtle	Northwest Atlantic DPS[1]	35	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
		455	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
		85	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, cloacal swab; Ultrasound; Weigh
		40	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Instrument (e.g. satellite tag, VHF[2] tag), epoxy attachment; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, cloacal swab, scute scraping; Ultrasound; Weigh
		9	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Instrument (e.g. satellite tag, VHF[2] tag)[3], epoxy attachment; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, tissue; Ultrasound; Weigh
Leatherback Sea Turtle	Range-wide	1	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
Olive ridley Sea Turtle	Range-wide	1	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh

[1] DPS = distinct population segment; [2] VHF = very high frequency; [3] Up to 2 tag attachments at a time.

Table 7. Proposed annual take of sea turtles under Permit No. 19621-01, Study 4, Winyah Bay, South Carolina to St. Augustine, Florida.

Species	Listing Unit	Number of Animals	Take Action	Collect Method	Procedures
Green Sea Turtle	North Atlantic DPS[1]	3	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Instrument (e.g. satellite tag, VHF[2] tag), epoxy attachment; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, cloacal swab, scute scraping; Ultrasound; Weigh
Kemp's ridley Sea Turtle	Range-wide	35	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
		10	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Instrument (e.g. satellite tag, VHF[2] tag), epoxy attachment; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, cloacal swab, scute scraping; Ultrasound; Weigh
Loggerhead Sea Turtle	Northwest Atlantic DPS[1]	135	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
		20	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Instrument (e.g. satellite tag, VHF[2] tag), epoxy attachment; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, cloacal swab, scute scraping; Ultrasound; Weigh
		5	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Instrument (e.g. satellite tag, VHF[2] tag), epoxy attachment; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, cloacal swab, scute scraping; Ultrasound; Weigh
Leatherback Sea Turtle	Range-wide	1	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
Olive ridley Sea Turtle	Range-wide	1	Capture/ Handle/ Release	Net, trawl	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh

[1] DPS = distinct population segment; [2] VHF = very high frequency

Table 8. Proposed annual take of sea turtles under Permit No. 19621-01, Study 5, Coastal South Carolina Waters.

Species	Listing Unit	Number of Animals	Take Action	Collect Method	Procedures
Green Sea Turtle	North Atlantic DPS[1]	46	Capture/ Handle/ Release	Net, tangle	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
		10	Capture/ Handle/ Release	Net, tangle	Collect: tumors, Epibiota removal; Instrument (e.g. satellite tag, VHF[2] tag), epoxy attachment; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, cloacal swab, scute scraping; Ultrasound; Weigh
Kemp's ridley Sea Turtle	Range-wide	46	Capture/ Handle/ Release	Net, tangle	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
		10	Capture/ Handle/ Release	Net, tangle	Collect: tumors, Epibiota removal; Instrument (e.g. satellite tag, VHF[2] tag), epoxy attachment; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, cloacal swab, scute scraping; Ultrasound; Weigh
Loggerhead Sea Turtle	Northwest Atlantic DPS[1]	18	Capture/ Handle/ Release	Net, tangle	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
		10	Capture/ Handle/ Release	Net, tangle	Collect: tumors, Epibiota removal; Instrument (e.g. satellite tag, VHF[2] tag), epoxy attachment; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, cloacal swab, scute scraping; Ultrasound; Weigh
Leatherback Sea Turtle	Range-wide	1	Capture/ Handle/ Release	Net, tangle	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh
Olive ridley Sea Turtle	Range-wide	1	Capture/ Handle/ Release	Net, tangle	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal; Ultrasound; Weigh

[1] DPS = distinct population segment; [2] VHF = very high frequency

Table 9. Proposed authorized mortality of adult, subadult, and juvenile sea turtles captured in all Projects over the life of the Permit No. 19621-01.

Species	Listing Unit	Number of Animals	Take Action	Collect Method	Procedures
Green Sea Turtle	North Atlantic DPS[1]	1	Unintentional Mortality	Net, tangle or trawl	Unintentional mortality
Kemp's ridley Sea Turtle	Range-wide	1	Unintentional Mortality	Net, tangle or trawl	Unintentional mortality
Loggerhead Sea Turtle	Northwest Atlantic DPS[1]	2	Unintentional Mortality	Net, tangle or trawl	Unintentional mortality
Leatherback Sea Turtle	Range-wide	1	Unintentional Mortality	Net, tangle or trawl	Unintentional mortality

[1] DPS = distinct population segment

Table 10. Proposed incidental take of non-target species under Permit No. 19621-01 over the life of the permit.

Species	Listing Unit	Number of Animals	Take Action	Collect Method[2]
Shortnose Sturgeon	Range-wide	5	Incidental Take	Net, trawl
Atlantic Sturgeon	Carolina and South Atlantic DPS[1]	10	Incidental Take	Net, trawl
Smalltooth Sawfish	U.S. DPS[1]	2	Incidental Take	Net, trawl

[1] DPS = distinct population segment; [2] Fish must be released alive

3.3 Capture

Capture techniques under Permit No. 19621 (NMFS 2016b) will also apply to Permit No. 19621-01. A summary of each capture technique is provided, with additional details found in the previous biological opinion.

Researchers will capture sea turtles using trawl as well as tangle nets. Trawl nets will be deployed on both port and starboard sides of the research vessel. The primary trawl net used in this research is the NMFS Turtle Net, which is also routinely used to capture sea turtles in shipping channels (Dickerson et al. 1995; Arendt et al. 2012a; Arendt et al. 2012b). NMFS Turtle Nets are flat nets with a four-seam, four-legged, two-bridal design. Nets will be brought on-board using winches, sea turtles removed, and immediately checked for health status and existing tags.

During randomized sampling in coastal waters, tow time will be restricted to 42 minutes between the doors entering the water and returning to the water surface, with a target bottom tow time of 30 minutes. Research purposes require a 30-minute bottom tow time in coastal waters between Winyah Bay, South Carolina and St. Augustine, Florida. However, researchers anticipate reducing the tow time to less than 20 minutes of bottom time during sampling in the Charleston, South Carolina and Port Canaveral, Florida shipping channels. Researchers anticipate a target bottom tow time of 15 minutes during estuarine sampling in St. Simon's Sound, Georgia and in South Carolina estuaries.

Trawling will be done primarily by two research trawlers, but estuarine trawling in South Carolina may be contracted out to local shrimp boat operators. Trawling in coastal South Carolina waters will be completed by *R/V Lady Lisa*, a 75-foot St. Augustine-built wooden trawler based in Charleston, South Carolina. Sampling in coastal waters off Georgia and Florida will be completed by the *R/V Georgia Bulldog*, a 72-foot St. Augustine-built wooden trawler based in Brunswick, Georgia.

All trawling will be conducted during daylight hours, from about one hour after sunrise until one hour before sunset. Researchers anticipate eight or more trawling events per day, producing 50 or more trawling events in St. Simon's Sound, Georgia, 100 or more trawling events for the Port Canaveral, Florida shipping channel, 150 or more trawling events in the Charleston, South Carolina shipping channel and coastal waters off Brunswick, Georgia, and 300 or more trawling events between Winyah Bay, South Carolina and St. Augustine, Florida.

There exists a slight potential for injury (primarily in the form of net abrasion to the skin and flippers) during the capture and handling processes, as turtles that are caught in the net webbing (rather than the cod end) are removed from nets. This danger is mitigated by 'pinching' off sections of the net webbing with rope to prevent sea turtles from rolling in the net as it is safely brought aboard. Every effort will be made to efficiently examine, measure, weigh, sample, tag, and photograph sea turtles so that they can be released at the point of capture within 30 minutes of removal from the net.

Researchers will use large mesh (40 centimeters stretched) tangle nets of the same height (3.7 meters), length (230 meters), and webbing material (number 18 nylon twine) as described by Ehrhart et al. (2007). Researchers plan to fish only one net instead of the two nets simultaneously fished by Ehrhart et al. (2007) but plan to increase two nets as field personnel experience increases. Also comparable to Ehrhart et al. (2007), the top line of this tangle net will consist of 0.635 centimeter diameter braided polypropylene, with surface floats attached every 10 meters along the top line for buoyancy during net deployment. The bottom line will consist of number 30 continuous core lead line, which allows the bottom of the net to sink to the seafloor while minimizing snagging associated with external weights.

Tangle nets will be set generally parallel to shore to minimize variability in set depth along the length of the deployed net, and in areas with at least 2 meters of water at low tide to ensure reliable access to service the net across all stages of the tide. While moving downwind and down current, a Danforth (8 kilograms) anchor with 1.5 meters of chain connected to the top line of the net by a 15-meter nylon line will be deployed from the bow of a 6.4-meter research vessel. After confirming that the anchor is holding, the net will then be slowly paid out from the vessel while moving down-current and down-wind to ensure that the webbing is deployed away from the vessel's propeller. During this deployment process, at least two field hands will ensure that the bottom line is not twisted over the top line and attach surface floats at 10-meter intervals between the end and the beginning of the net. A second Danforth anchor with identical rigging configuration will be attached to the terminal end of the net and deployed once the 15-m lanyard is taut to further secure the net position and prevent net drift.

One tangle net per vessel will be set only during daylight hours and fished between high and low tides (but not necessarily in that order), between April and October. Target soak time is three hours, during which time the researchers will be constantly watching the net. Hand-over-hand net retrieval will be used to ensure that the entire net (top line to bottom line) is inspected. A minimum of one research vessel will be assigned to each net and will conduct hand-over-hand inspection in the same direction as the net was deployed. This should ensure that any point on the net is checked at least once every 15 minutes.

3.4 Handling, Restraint and Release

Handling, restraint and release techniques under Permit No. 19621 (NMFS 2016b) will also apply to Permit No. 19621-01. A summary of each technique is provided, with additional details found in the previous biological opinion.

Captured marine life will be brought on board and removed from the tangle net; large-hoop dip nets will be available for boarding and subduing larger sea turtles. Once brought on board, sea turtles will be carefully removed from the net and examined for pre-existing tags. All captured sea turtles will be transferred to a second vessel for processing. Captured sea turtles will be placed in padded containers to keep them safely restrained until they can be processed, as well as during epoxy curing for the sub-set of sea turtles that receive telemetry transmitters.

Temporary marking of the carapace using a yellow crayon may be used to distinguish individual sea turtles following blood collection and prior to measurement and tagging for sampling events when two or more sea turtles of the same species are collected. All sea turtles will be tagged and photographed prior to being released, approximately 20 minutes after being removed from nets and the onset of data collection. Sea turtles will be released back into the ocean by lowering them over the side of the vessel, consistent with NMFS-approved guidance (SEFSC 2008). Sea turtles will be released as close to the capture location as possible (generally within one-half nautical mile of the sampling transect), with emphasis on releasing sea turtles in areas where they will be unlikely to be immediately recaptured by the research vessel or other trawlers operating in the general area.

3.5 Flipper and Passive Integrated Transponder Tagging

Flipper and passive integrated transponder tagging techniques under Permit No. 19621 (NMFS 2016b) will also apply to Permit No. 19621-01 with one exception: the modified permit would authorize the double tagging of a small subset of green and loggerhead sea turtles. A summary of each technique is provided, with additional details found in the previous biological opinion.

All sea turtles will receive a PIT tag (125 kilohertz), and all sea turtles greater than 5 kilogram will also receive two Inconel flipper tags. Triple tagging minimizes the probability that project-tagged sea turtles cannot be identified should they be re-sighted. PIT tags are sterile-packed whereas flipper tags must be cleaned to remove oil and residue prior to application. Tag insertion sites (between the first and second scales on the trailing edge of the front flippers for Inconel tags right front shoulder for PIT tags) will be alternately wiped with Betadine scrub and alcohol (repeated twice) prior to tag application. All sea turtles less than 30 centimeters straight carapace length will receive a sub-cutaneous injection of lidocaine (less than 0.5 milliliter) at the site of the PIT tag injection site prior to receiving the PIT tag

The purpose of double-tagging these sea turtles is to ground-truth the capability of an extensive array of acoustic receivers that has been used to monitor the occurrence of hundreds of acoustically-tagged fish at this sand resource site for several years, but which has been relatively depauperate in regards to sea turtle habitat utilization. The same transmitter attachment techniques described for attachment of telemetry devices in other study jobs will be used for Project 3, and the same care to select appropriate sized sea turtles for carrying transmitter devices will also be used when selecting individuals for double-tagging.

3.6 Acoustic and Satellite Tagging

Acoustic and satellite tagging techniques under Permit No. 19621 (NMFS 2016b) will also apply to Permit No. 19621-01. A summary of each technique is provided, with additional details found in the previous biological opinion.

Acoustic transmitters will be opportunistically attached to overtly healthy sea turtles. Opportunistic attachment is defined as the first individuals captured in a given study area. However, when it is preferable to stagger transmitter deployments over the sampling season, only the first few individuals captured in a given research cruise will receive acoustic transmitters. V16-series transmitters measuring 16 mm in diameter with a maximum length of 98 millimeters will be attached to sea turtles that weigh at least 5 kilograms given that the transmitter plus attachment epoxy should not weigh more than 100 grams (2 percent of body mass). Smaller diameter and length (48 millimeters) V13- or V9-series transmitters will be used for sea turtles weighing less than 5 kilograms.

Transmitters will be placed on a flat surface of the carapace near the center of the body to evenly distribute transmitter weight as much as possible. Loose keratin and biogenic fouling will be removed from the carapace to provide a clean epoxy attachment surface. Epoxy will also cover multiple scute seams to further increase the probability of transmitter attachment for one year. This carapace cleaning process includes gentle leverage and mild scraping with a chisel and scrubbing via plastic mesh pad. The cleared area will be rinsed, then dried prior to sanding the same area with sand paper (100 grit) to produce a smooth finish for the epoxy to adhere to. After sanding is completed, the preparation area will be treated with Betadine and then wiped clean with an alcohol (70 percent isopropenol) to ensure a dry surface for the epoxy to contact.

The seam associated with the fourth and fifth vertebral scutes and the fourth costal scute of sea turtles provides a good location for both distribution of transmitter package weight, submergence of the transmitter when sea turtles surface to breathe, elevating the transmitter above the seafloor for resting sea turtles, and reducing contact or snagging with trawl gear during future recapture events. After the carapace surface has been cleaned, a base layer of SonicWeld epoxy will be secured to the carapace. The transmitter will be embedded in the epoxy with the transducer end of the transmitter extending less than 0.25 inch past the epoxy base. Additional epoxy will be used to encase the transmitter in a protective shell that includes a tear-drop shaped, hydrodynamically efficient fairing in front of transmitter to reduce drag and limit the effects of the transmitter on the sea turtle's energetics (Watson and Granger 1998). The time between removing the epibionts to completion of epoxy curing will be approximately 30 minutes.

Data from transmitters will be collected through the placement of a VR2W receiver near the mouth of the trawl net (and occasionally deployed 2 m below the keel of the trawler while anchored at night). However, data will be predominantly collected independent of this trawl survey by receivers maintained by other research studies. Acoustic transmission of data will occur at a frequency of 69.0 kHz which should not affect sea turtles that hear at low (1 kHz) frequencies (Moein Bartol and Musick 2003) or predators (Corwin 1989).

Satellite transmitters will be opportunistically attached to overtly healthy sea turtles. Preparation of the carapace for attachment of satellite transmitters will be identical to procedures for attaching acoustic transmitters; however, satellite transmitters will be attached along the scute seams associated with the second vertebral and first costal scutes. Following carapace cleaning, the transmitter will be positioned on the carapace to ensure flush contact with the carapace, and then the perimeter of the transmitter attachment location will be lightly traced with a Sharpie marker. Quick-setting Power's T-308 marine epoxy resin will then be applied to the carapace within the confines of the marker tracing and built up approximately 0.5 inch, after which the transmitter base will be placed atop the epoxy and gently agitated while pushed downward to make contact with the carapace. The displaced epoxy will then be built back up along the perimeter of the transmitter in a sloped fashion so that it will be thickest closest to the transmitter but thin and flared approximately 2-3 inches around the entire transmitter. During this reforming process, additional T-308 epoxy may be added to ensure solid adherence to the carapace. Sea turtles will be kept shaded and moist with wet towels while the T-308 epoxy cures, and the temperature of the epoxy will be monitored with a laser thermometer during the curing process as well. If the temperature exceed 43° C, cool water will be added to the curing epoxy to reduce the temperature. Once the T-308 epoxy has cured completely, approximately 20 minutes after initial mixing, Sonic Weld putty epoxy will be placed over the T-308 epoxy and satellite transmitter to create a smooth hydrodynamic surface (Mansfield et al. 2009).

Transmitters for attachment to adult male loggerhead sea turtles will either be the TAM-4525-3 or the replacement model for this design; these transmitters weigh 443 grams and, coupled with the weight of attachment epoxy, should weigh less than 2 percent of body mass (Winter 1996) for most sea turtles over 60 centimeters straight carapace length (roughly 38 kilograms). However, in the interest of achieving minimal drag (Jones et al. 2013), researchers will deploy the smallest possible satellite transmitters that are capable of providing a year of battery life. Transmitters will be coated with anti-fouling paint prior to their attachment, and the same paint will be applied to cured epoxy to discourage biological fouling, further minimizing drag.

3.7 Morphometrics

Morphometric techniques under Permit No. 19621 (NMFS 2016b) will also apply to Permit No. 19621-01. A summary of each technique is provided, with additional details found in the previous biological opinion.

All sea turtles will be examined for general physical condition, with emphasis on:

- examining the shell, skin and flippers for trauma, epibionts, tumors, bites, missing or defective anatomical features, foreign bodies, sloughing of tissues, oil and tar,
- examining the eyes, nares, and oral cavity for discharge, sunkeness (sign of dehydration), corneal lesions, and tumors or foreign bodies,
- responsiveness to light touch and overall coordination,
- examination of muscle mass for signs of chronic disease or malnutrition (i.e., sunken plastron, baggy skin), and
- observation of shallow (one breath/minute) or rapid (greater than 5 breaths/minute) breathing and head-raising when breathing.

A suite of morphometric measurements will be collected for all sea turtles. Six straight-line measurements (cm) will be determined using tree calipers: minimum and notch-tip carapace length, carapace width, head width, and body depth. Curved measurements of carapace length and width will be determined using a nylon tape measure. Additional curved measurements will include plastron width and two tail length measurements (tip of plastron to tip of tail and tip of cloaca to tip of tail). Measurements will generally be made while sea turtle movements on deck are restricted by placing them atop of foam-filled go-kart tires. Body weight will be measured using spring scales. Sea turtles will be placed in a nylon mesh harness and carefully raised off of the deck using a winch. Photographs may be taken.

3.8 Blood Sampling

Blood sampling techniques under Permit No. 19621 (NMFS 2016b) will also apply to Permit No. 19621-01. A summary of the technique is provided, with additional details found in the previous biological opinion.

Blood samples will be collected for all sea turtles more than 3 kilograms in body weight. Blood will be collected in vacutainer tubes (with or without a heparin agent) using a vacutainer hub and a sterile 21-guage, 1.5-inch vacutainer needle. Blood will be collected from the dorsal cervical sinus as described by Owens and Ruiz (1980), with sea turtles oriented head-down in a reclined position to facilitate blood flow to the cervical sinus. Prior to inserting the sterile vacutainer needle, the blood draw site will be cleaned with alcohol-soaked gauze. A maximum of four blood sticks (two per side of the neck) will be attempted per sea turtle. A maximum of 45 milliliters of blood will be collected per individual and no more than 3 milliliters/kilograms of body weight. Repeat blood collection of recaptured sea turtles will only occur if more than 45 days has passed since the last blood collection, and repeat blood sampling would be at 50 percent of the initially authorized volume (1.5 milliliters/kilograms).

3.9 Biopsy and Tissue Sampling

Biopsy and tissue sampling techniques under Permit No. 19621 (NMFS 2016b) will also apply to Permit No. 19621-01 with one exception: the modified permit would authorize the tissue sampling of a small subset of green and loggerhead sea turtles. A summary of each technique is provided, with additional details found in the previous biological opinion.

Keratin biopsies will be collected from a distal and medial location on the third costal scute (left or right side) in an area devoid of abnormalities or epibionts but cleaned with an alcohol swab from a subset of loggerhead, green, and Kemp’s ridley sea turtles. A sterile 6-mm biopsy punch will be pushed and twisted/rotated through the carapace approximately 6 mm deep, at which point a small cracking noise will be heard indicating that biopsy punch has reached the bottom of the scute. Once the scute bottom has been reached, the biopsy punch will be gently rocked side-to-side to sever the sample. The biopsy wound will be swabbed with Betadine and silver sulfadiazine cream applied after sample extraction.

Unusual growths or lesions on soft or hard tissues will be photographed and a portion of the growth/lesion gently removed by appropriately trained personnel using a 6-mm biopsy tool as appropriate. This procedure will only be performed opportunistically and in situations where collecting the biopsy sample can be done without causing injury to the animal.

3.10 Cloacal Swabbing

Cloacal swabbing techniques under Permit No. 19621 (NMFS 2016b) will also apply to Permit No. 19621-01. A summary of the technique is provided, with additional details found in the previous biological opinion.

A subset of green, loggerhead, and Kemp’s ridley sea turtles will receive cloacal swabbing. Cloacal swabs will be opportunistically collected using previously permitted techniques to culture the bacteria that may be present. Sterile-packed swabs penetrate the cloaca roughly 5 centimeters, after which the swab is inserted into a media tube and cryo-preserved. The goal of this research is to document bacterial communities found in turtles as they relate to possible antibacterial release in marine systems.

3.11 Laparoscopy

Laparoscopy techniques under Permit No. 19621 (NMFS 2016b) will also apply to Permit No. 19621-01. A summary of the technique is provided, with additional details found in the previous biological opinion.

Because laparoscopy is an invasive procedure, it will only be performed by a highly-trained veterinarian under aseptic conditions, to include autoclave, gas, or chemical sterilization of all surgical equipment in between uses. Laparoscopy may be conducted on up to 20 Kemp's ridley sea turtles annually at the Georgia Sea Turtle Center in 2016 and 2017 to verify sex. Kemp's ridley sea turtles receiving this procedure would be captured in coastal waters either off Brunswick, Georgia or in the estuarine waters of St. Simon's Sound, Georgia. To maximize efficiency for both field sampling and laparoscopic examination, all Kemp's ridley sea turtles captured on designated days would receive laparoscopic examination. Kemp's ridley sea turtles would be held in individualized containers containing foam padding and sufficient seawater to maintain moisture. A tarp will be used to provide shade protection. Ideally, all Kemp's ridley sea turtles would be captured in the estuary to minimize transfer and holding time. Once a combined total of five Kemp's ridley sea turtles had been captured across all research sampling activities, or if any Kemp's ridley has been held in a container for three hours, sampling would cease in order to concentrate on transporting Kemp's ridleys to the Georgia Sea Turtle Center. Five Kemp's ridley sea turtles per week for each of four sampling weeks will be targeted.

Laparoscopy will begin with sea turtles being anesthetized in dorsal recumbency with injectable anesthetics (dexmedetomidine, ketamine and butorphanol), intubated, and ventilated with oxygen. Sevoflurane will only be used if the sea turtle struggles. The animal will then be turned left side up and foam wedges and tape will be used to secure the animal. The inguinal incision site will then be scrubbed multiple times at the surgical site alternating between Chlorhexadine surgical scrub and 70 percent alcohol. Betadine solution will also be applied to the site as a final surgical prep solution. The surgical site will be completely draped with sterile towels. A local anesthetic (2 percent lidocaine) will be injected at the surgical site prior to making a small incision (roughly 0.5 to 1 centimeter) with a sterile scalpel blade, through which hemostats will be inserted to enter the body cavity. A trocar/cannula will then be placed followed by a laparoscope through the cannula. Medical grade CO_2 will be used to inflate the coelomic cavity if necessary for visualization of reproductive organs. Following laparoscopic evaluation, CO_2 will be removed from the body cavity with a syringe, extension set, three-way stop cock, and needle. Once the gas is extracted, the cannula will be removed and the incision closed with absorbable sutures. Sea turtles will then be transported to circular tanks approximately 8 feet in diameter and 4 feet deep. Seawater will be introduced to the tanks via a flow-through design. Only one sea turtle will be placed in the holding tank at a time, and its buoyancy and diving ability will be monitored.

Once normal buoyancy has been confirmed (generally within 20 minutes), sea turtles will be transported back to the general capture area via small boat and released over the side. Sea turtles may be tagged with acoustic or satellite transmitters (methods described below in section 2.5.9) to document normal behavior following laparoscopy. Should darkness, inclement weather, or uncertainty regarding health status of a sea turtle become a factor, the sea turtles will be held overnight at the Georgia Sea Turtle Center and monitored throughout the night. Boat transport to coastal release areas will also occur on the following day.

3.12 Ultrasound

Ultrasound techniques under Permit No. 19621 (NMFS 2016b) will also apply to Permit No. 19621-01. A summary of the technique is provided, with additional details found in the previous biological opinion.

Ultrasonography will be used to evaluate gonadal development of juvenile loggerheads greater than 75 centimeters straight carapace length as well as adult loggerheads. Ultrasonography will occur at sea using a portable Sonosite 180Plus. Imaging will occur with the sea turtle in supine position while resting on a foam-filled rubber tire. Imaging may also occur with sea turtles in an upright position while resting on a rubber tire. A coupling gel will be used to ensure transmission of the ultrasonic signal. Procedure time should be approximately 10 minutes.

4 Interrelated and Interdependent Actions

Interrelated actions are those that are part of a larger action and depend on that action for their justification. *Interdependent* actions are those that do not have independent utility apart from the action under consideration. For the proposed permits, there are no interrelated or interdependent actions.

5 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). The proposed action area for Permit No. 20339 includes the state waters of the Atlantic Ocean, Gulf of Mexico, Caribbean Sea and its tributaries, offshore waters and international waters (Figure 1). The objective of the proposed research under Project A of Permit No. 20339 is to develop turtle excluder devices for trawl gear types used along the Atlantic coast, Gulf of Mexico, Caribbean Sea and its tributaries. The research will take place Locations of Atlantic coast work for Project A will be in inshore bays and estuaries, nearshore waters and offshore waters of the Exclusive Economic Zone from Cape

Canaveral, Florida, northward to the New York/Connecticut border. Because 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. 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 operations may be conducted in inshore bays and estuaries, nearshore waters and offshore waters from Key West, Florida to Brownsville, Texas. Points of embarkation and disembarkation aboard commercial fishing vessels in the Gulf of Mexico include Key West, FL; Fort Meyers, 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; Brownsville, TX. Project B under Permit No. 20339 is to develop sea turtle bycatch mitigation gear modifications in the pelagic and bottom longline fisheries in the coastal and offshore waters of the Western Atlantic Ocean, Gulf of Mexico, and Caribbean Sea.

The action area for Permit No. 19621 is the coastal waters of South Carolina, Georgia, and Florida. This action area was evaluated under the current permit (NMFS 2016b). The permit modification for Permit No. 19621-01 would expand the action area for Project 3 of research to include coastal shoals adjacent to the Cape Canaveral channel (Figure 2).

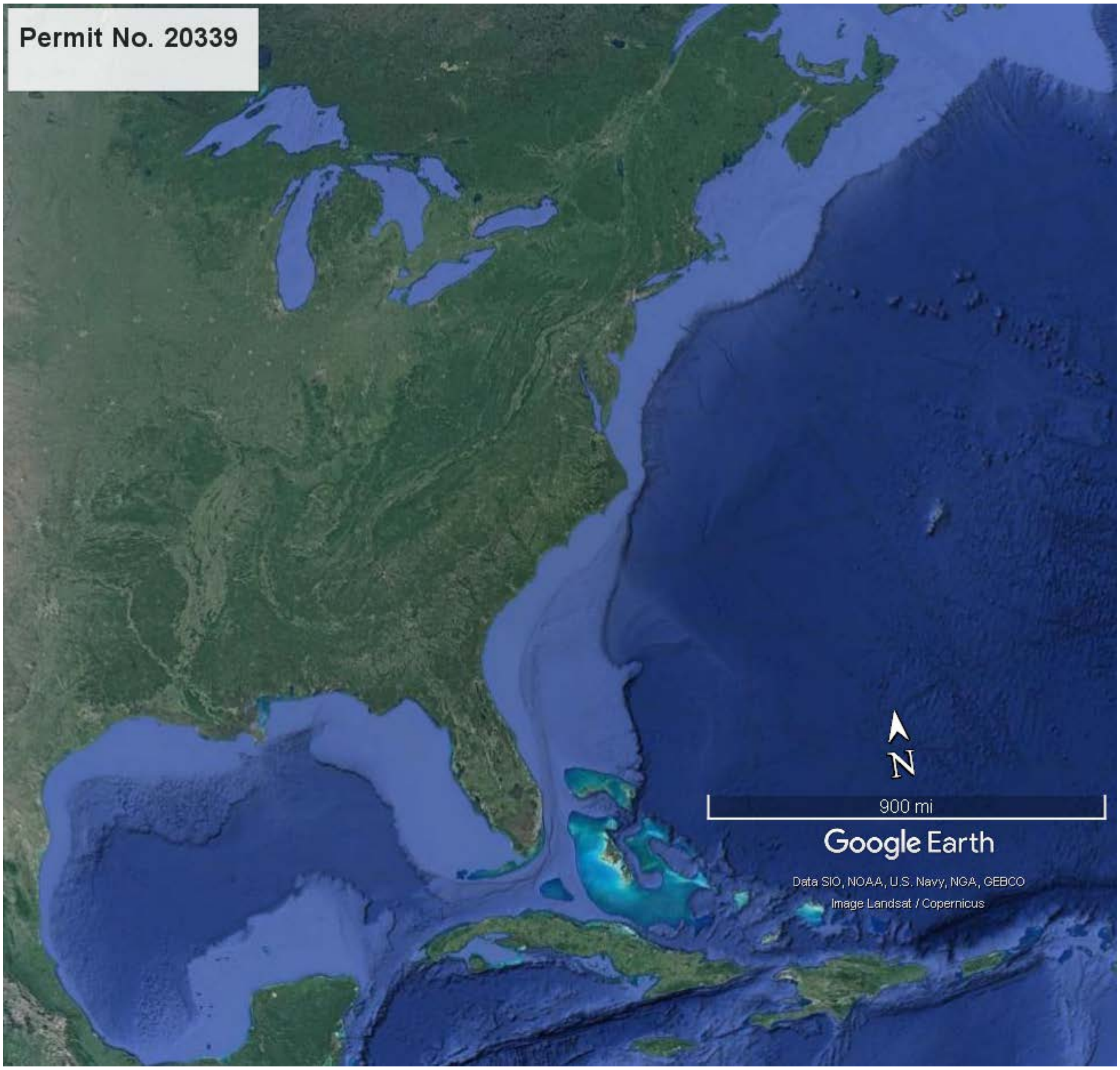


Figure 1. Action area for Permit No. 20339, the Atlantic Ocean state waters, Gulf of Mexico, Caribbean Sea and its tributaries, offshore waters, and international waters.

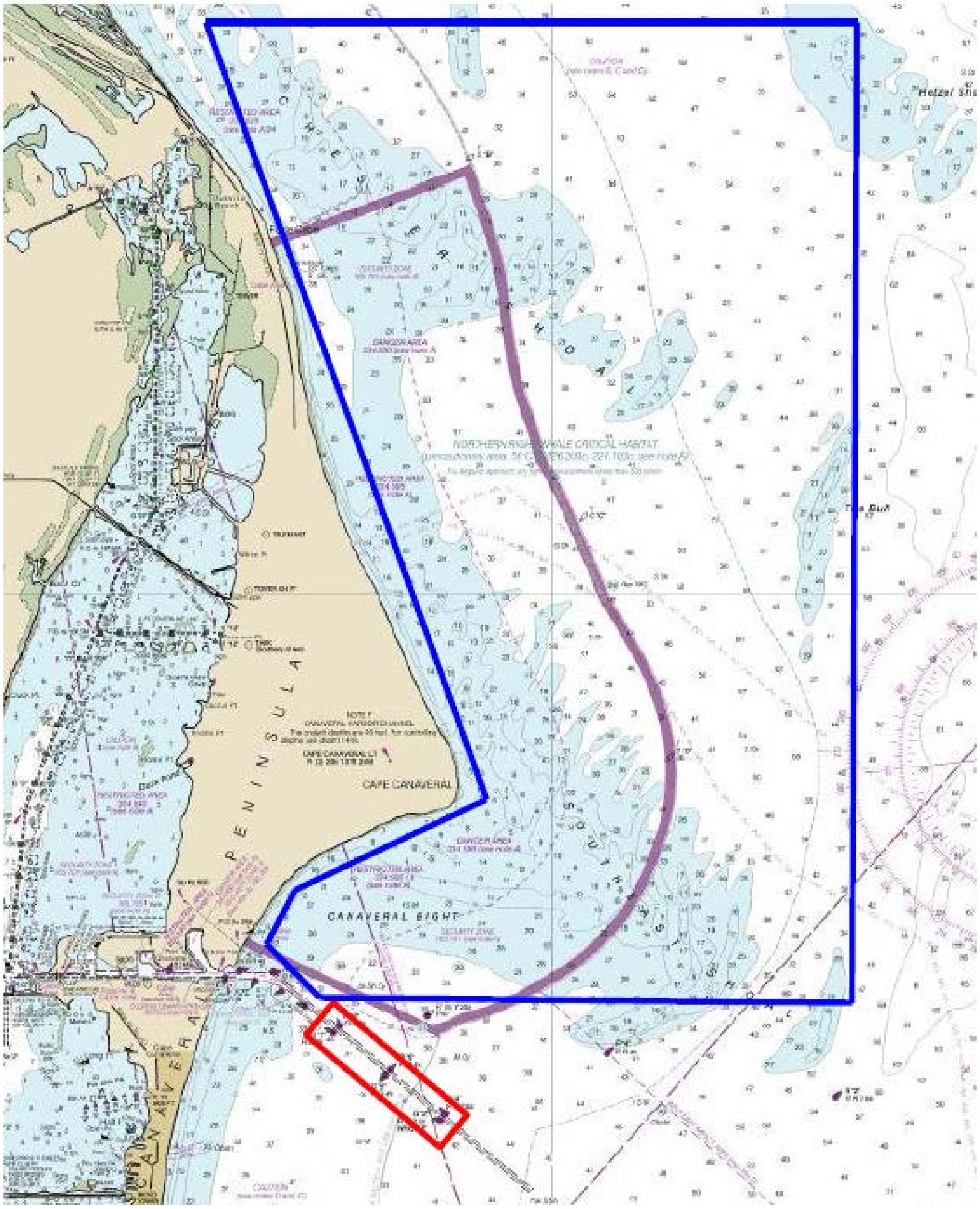


Figure 2. Proposed channel trawling zone (red line) and proposed maximum trawling zone for Canaveral Shoals, Florida, for Permit No. 19621-01.

6 Status of Endangered Species Act Protected Resources

This section identifies the ESA-listed species that potentially occur within the action area that may be affected by the issuance of Permit Nos. 20339 and 19621-01. It then summarizes the biology and ecology of those species and what is known about their life histories in the action areas. The status is determined by the level of risk that the ESA-listed species and designated critical habitat face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This section also breaks down the species and designated critical habitats that may be affected by the proposed action, describing whether or not those species and designated critical habitats are likely to be adversely affected by the proposed action. The species and designated critical habitats deemed likely to be adversely affected by the proposed action are carried forward through the remainder of this opinion.

This section helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02.

The species potentially occurring within the action area that may be affected by the proposed actions are listed in Tables 11 (Permit No. 20339) and Table 12 (Permit No. 19621-01), along with their regulatory status.

Table 11. ESA-listed species and designated critical habitat that may be affected by the Permit Division's proposed Permit No. 20339.

Species	ESA Status	Critical Habitat	Recovery Plan
Green sea turtle (*Chelonia mydas*): North Atlantic DPS	Threatened 81 FR 20057 04/06/2016	63 FR 46693 09/02/1998	FR Notice Not Available U.S. Atlantic 1991
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered 35 FR 18319 12/02/1970	--	75 FR 12496 U.S. Caribbean, Atlantic, and Gulf of Mexico 2010
Loggerhead sea turtle (*Caretta caretta*): Northwest Atlantic DPS	Threatened 76 FR 58868 09/22/2011	79 FR 39856 07/10/2014	74 FR 2995 Northwest Atlantic 2009
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered 35 FR 8491 06/02/1970	Designated, Not in Action Area	N/A U.S. Caribbean, Atlantic and Gulf of Mexico 1992
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered 35 FR 8491 06/02/1970	63 FR 46693 Atlantic 09/02/1998	57 FR 38818 U.S. Caribbean, Atlantic, and Gulf of Mexico 1992
Olive ridley sea turtle (*Lepidochelys olivacea*)	Threatened 43 FR 32800 07/28/1978	--	--
Shortnose Sturgeon (*Acipenser brevirostrum*)	Endangered 32 FR 4001 03/11/1967	--	63 FR 69613 Range-wide 1998
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) Carolina, South Atlantic, New York Bight, Chesapeake Bay DPS	Endangered 77 FR 5914 77 FR 5880 02/06/2012	81 FR 36077 (Proposed)	--
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) Gulf of Maine DPS	Threatened 77 FR 5880 02/06/2012	81 FR 35701 (Proposed)	--
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)	Threatened 56 FR 49653 09/30/1991	68 FR 13370 04/18/2003	FR Notice Not Available Range-wide 1995
Smalltooth Sawfish (*Pristis pectinata*) U.S. DPS	Endangered 68 FR 15674 04/01/2003	74 FR 45353 09/02/2009	74 FR 3566 U.S. Population 2009

Table 12. ESA-listed species and designated critical habitat that may be affected by the Permit Division's proposed Permit No. 19621-01.

Species	ESA Status	Critical Habitat	Recovery Plan
Green sea turtle (*Chelonia mydas*): North Atlantic DPS	Threatened 81 FR 20057 04/06/2016	Designated, Not in Action Area	FR Notice Not Available U.S. Atlantic 1991
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered 35 FR 18319 12/02/1970	--	75 FR 12496 U.S. Caribbean, Atlantic, and Gulf of Mexico 2010
Loggerhead sea turtle (*Caretta caretta*): Northwest Atlantic DPS	Threatened 76 FR 58868 09/22/2011	79 FR 39856 07/10/2014	74 FR 2995 Northwest Atlantic 2009
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered 35 FR 8491 06/02/1970	Designated, Not in Action Area	N/A U.S. Caribbean, Atlantic and Gulf of Mexico 1992
Olive ridley sea turtle (*Lepidochelys olivacea*)	Threatened 43 FR 32800 07/28/1978	--	--
Shortnose Sturgeon (*Acipenser brevirostrum*)	Endangered 32 FR 4001 03/11/1967	--	63 FR 69613 Range-wide 1998
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) Carolina and South Atlantic DPS	Endangered 77 FR 5914 02/06/2012	81 FR 36077 (Proposed)	--
Smalltooth Sawfish (*Pristis pectinata*) U.S. DPS	Endangered 68 FR 15674 04/01/2003	74 FR 45353 09/02/2009	74 FR 3566 U.S. Population 2009
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)	Threatened 56 FR 49653 09/30/1991	68 FR 13370 03/19/2003	FR Notice Not Available Range-wide 1995

6.1 Species and Designated Critical Habitat Not Likely to be Adversely Affected

NMFS uses two criteria to identify the ESA-listed or critical habitat that are not likely to be adversely affected by the proposed action, as well as the effects of activities that are interrelated to or interdependent with the Federal agency's 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 designated critical habitat. If we conclude that an ESA-listed species or designated 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. ESA-listed species or designated critical habitat that is exposed to a potential stressor but is likely to be unaffected by the exposure is also not likely to be adversely affected by the proposed action. We applied these criteria to the ESA-listed species in Tables 11 and 12 and we summarize our results below.

An action warrants a "may affect, not likely to be adversely affected" finding when its effects are wholly *beneficial, insignificant* or *discountable*. *Beneficial* effects have an immediate positive effect without any adverse effects to the species or habitat. Beneficial effects are usually discussed when the project has a clear link to the ESA-listed species or its specific habitat needs and consultation is required because the species may be affected.

Insignificant effects relate to the size or severity of the impact and include those effects that are undetectable, not measurable, or so minor that they cannot be meaningfully evaluated. Insignificant is the appropriate effect conclusion when plausible effects are going to happen, but will not rise to the level of constituting an adverse effect. That means the ESA-listed species may be expected to be affected, but not harmed or harassed.

Discountable effects are those that are extremely unlikely to occur. For an effect to be discountable, there must be a plausible adverse effect (i.e., a credible effect that could result from the action and that would be an adverse effect if it did impact a listed species), but it is very unlikely to occur.

6.1.1 North Atlantic Green and Hawksbill Sea Turtle Designated Critical Habitat

In 1998, NMFS designated critical habitat for the North Atlantic green sea turtle to include the coastal waters surrounding Culebra Island, Puerto Rico, and the hawksbill sea turtle to include the coastal waters surrounding Mona and Monito Islands, Puerto Rico (63 FR 46693). Designated critical habitat for green turtles including the waters surrounding the island of Culebra from the mean high water line seaward to three nautical miles. These waters include Culebra’s outlying Keys including Cayo Norte, Cayo Ballena, Cayos Geniqui, Isla Culebrita, Arrecife Culebrita, Cayo de Luis Pena, Las Hermanas, El Mono, Cayo Lobo, Cayo Lobito, Cayo Botijuela, Alcarraza, Los Gemelos, and Piedra Steven. Sea grasses are a principal dietary component of juvenile and adult green turtles. The Culebra Archipelago is important green sea turtle development and feeding habitat that includes sea grasses such as *Thalassia testudium*. The coral reefs and other topographic features within these waters provide green turtles with shelter during inter-foraging periods. Designated critical habitat for hawksbill sea turtles includes the waters surrounding the islands of Mona and Monito, Puerto Rico, from the mean high water line seaward to three nautical miles. Therefore, the action area overlaps with the designated critical habitat for hawksbill sea turtles. The coral reefs of Mona and Monito Islands provide foraging habitat (e.g. sponges) for hawksbill sea turtles, and the ledges and caves of the reefs provide shelter for rest and refuge from predators.

The action area for Permit No. 20339 overlaps with the designated critical habitat for green and hawksbill sea turtles. The SEFSC has noted that they will avoid all seagrass and live bottom habitat within their application. In addition, the permit would require researchers to avoid such areas. The Permits Division has determined that the issuance of Permit No. 20339 is not likely to affect the designated critical habitat for green and hawksbill sea turtles. It is extremely unlikely that the research activities will affect the designated critical habitat, therefore, the actions are discountable. We concur with the Permits Division that the issuance of Permit No. 20339 is not likely to adversely affect the designated critical habitat for green and hawksbill sea turtles.

6.1.2 Northwest Atlantic Loggerhead Sea Turtle Designated Critical Habitat

Researchers under Permit Nos. 20339 and 19621-01 may work in areas designated as loggerhead nearshore reproductive, breeding, and migratory critical habitat (79 FR 39855). The temporary operation of a vessel and gear (e.g., stationary nets and trawl) to catch sea turtles is expected to result in little to no alteration of the identified essential features of this habitat, which include access to habitat, water chemistry, live bottom habitat, and prey species. Mitigation measures of the permits would prevent setting or dragging nets over live bottom. Because the vessels and use of gear is only temporary (i.e., not a permanent structure), the research activities would not prevent turtles from accessing marine habitat and nesting beaches. In terms of affects to prey species, loggerheads have a varied diet of marine plants, invertebrates, and jellyfish. The trawl's large mesh webbing could catch a small number of larger fish species, such as sharks and rays, but by design is not likely to catch loggerhead prey species.

The Permits Division has determined that the issuance of Permit Nos. 20339 and 19621-01 is not likely to affect the designated critical habitat for loggerhead sea turtles. It is extremely unlikely that the research activities will affect the designated critical habitat, therefore, the actions are discountable. We concur with the Permits Division that the issuance of Permit Nos. 20339 and 19621-01 is not likely to adversely affect the designated critical habitat for loggerhead sea turtles.

6.1.3 Gulf and Atlantic Sturgeon Designated Critical Habitat

Critical habitat has been designated for gulf sturgeon (68 FR 13370) and proposed for Carolina and South Atlantic DPSs of sturgeon (81 FR 36077). Atlantic sturgeon proposed essential physical features include: suitable hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0 to 0.5 parts per thousand range); transitional salinity zones inclusive of waters with a gradual downstream gradient of 0.5 to 30 parts per thousand and soft substrate (e.g., sand, mud) downstream of spawning sites; water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, reservoirs, gear, etc.) between the river mouth and spawning sites; and water quality conditions. The primary constituent elements essential for the conservation of Gulf sturgeon are those habitat components that support feeding, resting, and sheltering, reproduction, migration, and physical features necessary for maintaining the natural processes that support these habitat components. The primary constituent elements include: abundant prey items within riverine habitats for larval and juvenile life stages, and within estuarine and marine habitats and substrates for juvenile, subadult, and adult life stages; riverine spawning sites with substrates suitable for egg deposition and development, such as limestone outcrops and cut limestone banks, bedrock, large gravel or cobble beds, marl, soapstone or hard clay; riverine aggregation areas; a flow regime necessary for normal behavior, growth, and survival of all life stages in the riverine environment; and necessary for maintaining spawning sites in suitable condition; water quality; and sediment quality.

Gulf sturgeon occur in the action area for Permit No. 20339 and Atlantic sturgeon occur in the action area for both Permit Nos. 20339 and 19621-01. The temporary tow of a bottom or mid-water trawl in marine waters is not likely to significantly alter any of the above primary constituent elements for Gulf or Atlantic sturgeon. Trawling does not affect water quality, discharge rates or sturgeon prey resources. Trawling would not occur in riverine habitat. Trawling would not result in permanent obstruction or destruction of habitat because (1) researchers would avoid trawling in sturgeon spawning grounds, and (2) the permits would require that researchers must avoid trawling in sensitive live or hard bottom habitat (such as limestone outcrops). The Permits Division has determined that the issuance of Permit Nos. 20339 and 19621-01 is not likely to affect the designated critical habitat for gulf and Atlantic sturgeon. It is extremely unlikely that the research activities will affect the designated critical habitat, therefore, the actions are discountable. We concur with the Permits Division that the issuance of Permit Nos. 20339 and 19621-01 is not likely to adversely affect the designated critical habitat for gulf and Atlantic sturgeon.

6.1.4 Smalltooth Sawfish Designated Critical Habitat

Critical habitat for smalltooth sawfish is designated for Gasparilla Sound/Charlotte Harbor, Florida, in Florida Bay, and along the southwest coast of Florida in the Ten Thousands Islands area (74 FR 45353). Smalltooth sawfish may also be present in the action area. This species has a small range, and within the United States, is restricted to southern Florida. Adults are typically found offshore, in water that is deeper than where activities would occur (< 8m). Adults migrate into estuaries and mangrove swamps to give birth, and juveniles and neonates can be found in these environments.

Although primary constituent elements were not identified, the mangrove and adjacent shallow euryhaline habitat are important nursery habitat for smalltooth sawfish. Nursery habitat consisting of areas adjacent to red mangroves and euryhaline habitats less than 0.9 m deep in southwestern Florida were later determined to be particularly significant (Norton et al. 2012). No activities under Permit Nos. 20339 and 19621-01 are expected to potentially adversely affect the mangrove and adjacent shallow euryhaline habitat in the critical habitat. The Permits Division has determined that the issuance of Permit Nos. 20339 and 19621-01 is not likely to affect the designated critical habitat for smalltooth sturgeon. It is extremely unlikely that the research activities will affect the designated critical habitat, therefore, the actions are discountable. We concur with the Permits Division that the issuance of Permit Nos. 20339 and 19621-01 is not likely to adversely affect the designated critical habitat for smalltooth.

6.1.5 North Atlantic Right Whales and Designated Critical Habitat

The North Atlantic right whale, *Eubalaena glacialis*, can be found in the action area from December through March for calving. For Permit No. 20339, research would not occur within this designated critical habitat. Right whales are not expected to be affected by the proposed activities under Permit No. 19621-01 because (1) the timing of the proposed turtle surveys have minimal overlap with the right whale calving season, and (2) the permit would include mitigation measures requiring researchers to monitor the area and stop surveys if right whales are within 500 yards.

Mr. Arendt's proposed trawl surveys (February to October) for Permit No. 19621-01 are the only proposed activities that would have some minimal overlap with the timing of right whale's occurrence. This equates to 10 days of trawling in the Port Canaveral shipping channel entrance from 2017, through October 2020 (Project 3). These trawls days would occur during February and March overlapping with the calving season that runs through March; however, as stated above, researchers would have to remain 500 yards from right whales and stop activities when they are present. Designated critical habitat for right whales is found in the action area in the southeast United States (calving habitat) (81 FR 4837). This critical habitat only overlaps with the requested study area of Permit No. 19621-01. None of the turtle surveys will adversely modify the essential features of the right whale's critical habitat (which include water temperature, calm sea state, and water depth) because operation of a research vessel or trawl would not significantly alter any of these oceanographic features. Further, the SEFSC would avoid working in this habitat as noted in the application.

The Permits Division has determined that the issuance of Permit Nos. 20339 and 19621-01 is not likely to affect right whales nor their designated critical habitat. It is extremely unlikely that the research activities will affect the designated critical habitat or the species, therefore, the actions are discountable. We concur with the Permits Division that the issuance of Permit Nos. 20339 and 19621-01 is not likely to adversely affect right whales nor their designated critical habitat.

6.1.6 Johnson's Seagrass and Designated Critical Habitat

Critical habitat for Johnson's seagrass, *Halophila johnsonii*, is found in the area (65 FR 17786); however, mitigation measures of the permits would prevent researchers from trawling over the species and their critical habitat as part of conditions within Section III B.5 of Permit No. 20339 and Permit No. 19621-01.

The Permits Division has determined that the issuance of Permit Nos. 20339 and 19621-01 is not likely to affect Johnson's seagrass nor its designated critical habitat. It is extremely unlikely that the research activities will affect Johnson's seagrass nor its designated critical habitat, therefore, the actions are discountable. We concur with the Permits Division that the issuance of Permit Nos. 20339 and 19621-01 is not likely to adversely affect Johnson's seagrass nor its designated critical habitat.

6.1.7 Listed Corals and Designated Critical Habitats

The impact of the proposed activities on listed coral species was also considered. However, it was determined to be highly unlikely that netting activities would occur on established coral reefs because mitigation measures of the permits would prevent researchers from trawling over the species as part of conditions within Section III B.5 of Permit No. 20339 and Permit No. 19621-01.

The Permits Division has determined that the issuance of Permit Nos. 20339 and 19621-01 is not likely to affect listed corals nor their designated critical habitats. It is extremely unlikely that the research activities will affect any listed coral species or their designated critical habitats, therefore, the actions are discountable. We concur with the Permits Division that the issuance of Permit Nos. 20339 and 19621-01 is not likely to adversely affect listed corals nor their designated critical habitats.

6.2 Species and Critical Habitat Likely to be Adversely Affected

This opinion examines the status of each species that would be affected by the proposed action. 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. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution" 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 Web site: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm.

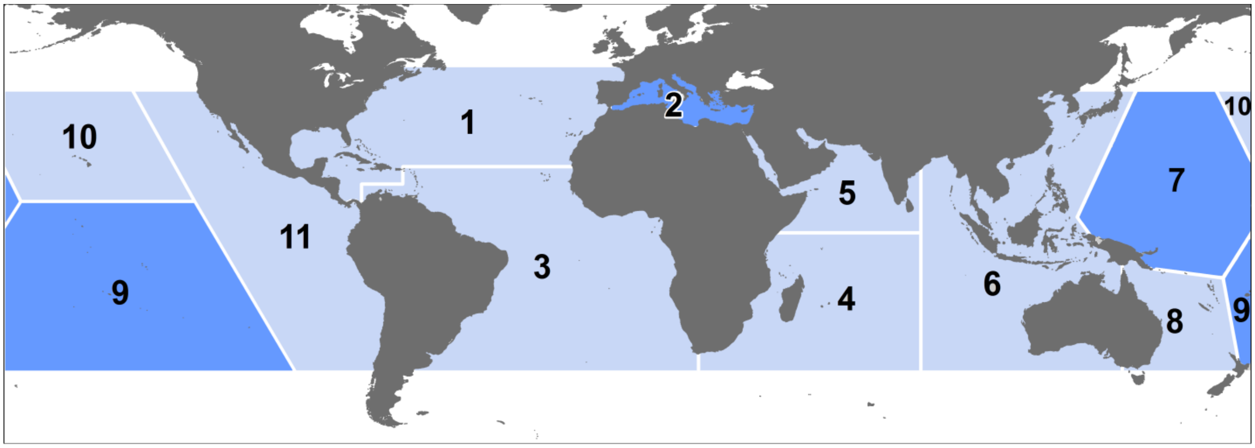
6.2.1 Green Sea Turtle, North Atlantic Distinct Population Segment

Green sea turtles were listed under the ESA on July 28, 1978 (43 FR 32800). The species was separated into two 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 eleven DPSs of green sea turtles as threatened or endangered under the ESA (81 FR 20057) (Table 13).

Table 13. Green sea turtle information bar, North Atlantic Distinct Population Segment

Species	Common Name	Distinct Population Segment	ESA Status	Critical Habitat	Recovery Plan
Chelonia mydas	Green sea turtle	North Atlantic	Threatened 81 FR 20057 04/06/2016	63 FR 46693 09/02/1998	FR Notice Not Available U.S. Atlantic 1991

Eight DPSs are listed as threatened: Central North Pacific, East Indian-West Pacific, East Pacific, North Atlantic, North Indian, South Atlantic, Southwest Indian, and Southwest Pacific. Three DPSs are listed as endangered: Central South Pacific, Central West Pacific, and Mediterranean (Figure 3).



Threatened (light blue) and endangered (dark blue) green turtle DPSs:
1. North Atlantic, 2. Mediterranean, 3. South Atlantic, 4. Southwest Indian, 5. North Indian, 6. East Indian-West Pacific, 7. Central West Pacific, 8. Southwest Pacific, 9. Central South Pacific, 10. Central North Pacific, and 11. East Pacific.

Figure 3. Map depicting Distinct Population Segment boundaries for green sea turtles.

6.2.1.1 Species Description

The green sea turtle (*Chelonia mydas*) is the largest of the hardshell marine turtles, growing to a weight of 350 pounds (159 kilograms) and a straight carapace length of greater than 3.3 feet (1 meter). It has a circumglobal distribution, occurring throughout nearshore tropical, subtropical and, to a lesser extent, temperate waters. Their shell is black, gray, green, brown, or yellow on top and yellowish white on bottom (Figure 4).

Figure 4. Green sea turtle, *Chelonia mydas*. Credit: Andy Bruckner, National Oceanic and Atmospheric Administration.

6.2.1.2 Life History

Age at first reproduction for females is 20 to 40 years. Green sea turtles lay an average of three 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 sea turtles feed close to the surface on a variety of marine algae and other life associated with drift lines and debris. Adult turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green sea 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.

6.2.1.3 Population Dynamics

The following is a discussion of the species' population and its variance over time. This section is broken down into: abundance, population growth rate, genetic diversity, and distribution as it relates to the North Atlantic DPS green sea turtle.

Abundance

Worldwide, nesting data at 464 sites indicate that 563,826 to 564,464 females nest each year (Seminoff et al. 2015). Compared to other DPSs, the North Atlantic DPS exhibits the highest nester abundance, with approximately 167,424 females at 73 nesting sites and available data indicate an increasing trend in nesting. The largest nesting site in the North Atlantic DPS is in Tortuguero, Costa Rica, which hosts 79 percent of nesting females for the DPS (Seminoff et al. 2015).

Population Growth Rate

For the North Atlantic DPS, 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 of 25 years or more show the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9 percent, and the Tortuguero, Costa Rica, population growing at 4.9 percent.

Genetic Diversity

The North Atlantic DPS 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 subpopulations in Florida, Cuba, Mexico and Costa Rica (Seminoff et al. 2015). More recent genetic analysis indicates that designating a new western Gulf of Mexico management unit might be appropriate (Shamblin et al. 2016).

Distribution

Green turtles from the North Atlantic DPS range from the boundary of South and Central America (7.5°N, 77°W) in the south, throughout the Caribbean, the Gulf of Mexico, and the U.S. Atlantic coast to New Brunswick, Canada (48°N, 77°W) in the north. The range of the DPS then extends due east along latitudes 48°N and 19°N to the western coasts of Europe and Africa.

6.2.1.4 Status

Once abundant in tropical and subtropical waters, green sea 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 turtles in foraging areas remain the three greatest threats to their recovery. In addition, bycatch in drift-net, long-line, set-net, pound-net and trawl fisheries kill thousands of green sea 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.

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 sea 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.

6.2.1.5 Status Within the Action Area

Four regions support nesting concentrations of particular interest in the North Atlantic DPS: Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, and Quintana Roo); United States (Florida), and Cuba. Seminoff et al. (2015) identified 73 nesting sites within the North Atlantic DPS, although some represent numerous individual beaches. Tortuguero, Costa Rica is the most important nesting concentration for green turtles in the North Atlantic DPS. In 2010, the estimated number of nesters was 30,052-64,396 (Seminoff et al. 2015). In the United States, green turtles nest primarily along the central and southeast coast of Florida where an estimated 8,426 females nest annually.

6.2.1.6 Critical Habitat

On September 2, 1998, NMFS designated critical habitat for green sea turtles (63 FR 46694), which include coastal waters surrounding Culebra Island, Puerto Rico. Seagrass beds surrounding Culebra provide important foraging resources for juvenile, subadult and adult green sea turtles. Additionally, coral reefs surrounding the island provide resting shelter and protection from predators. This area provides important developmental habitat for the species. Activities that may affect the critical habitat include beach renourishment, dredge and fill activities, coastal construction, and freshwater discharge. Due to its location, this critical habitat would be accessible by individuals of the North Atlantic DPS.

6.2.1.7 Recovery Goals

See the 1991 Recovery Plan for the Atlantic green sea turtle for complete down-listing criteria for the following recovery goals:

> 1) The level of nesting in Florida has increased to an average of 5,000 nests per year for at least six years. Nesting data must be based on standardized surveys.
>
> 2) At least 25 percent (105 kilometers) of all available nesting beaches (420 kilometers) is in public ownership and encompass at least 50 percent of nesting activity.
>
> 3) A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.
>
> 4) All priority one tasks have been successfully implemented.

6.2.2 Kemp's Ridley Sea Turtles

Kemp's ridley was first listed under the Endangered Species Conservation Act (35 FR 8491) and listed as endangered under the ESA since 1973 (Table 14).

Table 14. Kemp's Ridley sea turtle information bar.

Species	Common Name	Distinct Population Segment	ESA Status	Critical Habitat	Recovery Plan
Lepidochelys kempii	Kemp's ridley sea turtle	None Designated	Endangered 35 FR 18319 1970	--	75 FR 12496 U.S. Caribbean, Atlantic, and Gulf of Mexico 2010

6.2.2.1 Species Description

The Kemp's ridley is considered to be the most endangered sea turtle, internationally (Zwinenberg 1977; Groombridge 1982; TEWG 2000). Its range extends from the Gulf of Mexico to the Atlantic coast, with nesting beaches limited to a few sites in Mexico and Texas. Kemp's ridley sea turtles the smallest of all sea turtle species, with a nearly circular top shell and a pale yellowish bottom shell (Figure 5).

Figure 5. Kemp's ridley sea turtle, *Lepidochelys kempii*. Credit: National Oceanic and Atmospheric Administration.

6.2.2.2 Life History

Adult Kemp's ridley sea turtles have an average straight carapace length of 2.1 ft (65 cm). Females mature at 12 years of age. The average remigration 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 sea 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 120 feet (37 meters) deep, although they can also be found in deeper offshore waters. As adults, *they* forage on swimming crabs, fish, jellyfish, mollusks, and tunicates (NMFS and USFWS 2011).

6.2.2.3 Population Dynamics

The following is a discussion of the species' population and its variance over time. This section is broken down into: abundance, population growth rate, genetic diversity, and distribution as it relates to the Kemp's ridley sea turtle.

Abundance

Of the sea turtles 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. In 2014, there were an estimated 10,987 nests and 519,000 hatchlings released from three primary nesting beaches in Mexico (NMFS and USFWS 2015). The number of nests in Padre Island, Texas has increased over the past two decades, with one nest observed in 1985, four in 1995, 50 in 2005, 197 in 2009, and 119 in 2014 (NMFS and USFWS 2015).

Population Growth Rate

From 1980 to 2003, the number of nests at three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased 15 percent annually (Heppell et al. 2005); however, due to recent declines in nest counts, decreased survival at other life stages, and updated population modeling, this rate is not expected to continue (NMFS and USFWS 2015).

Genetic Diversity

Genetic variability in Kemp's ridley turtles is considered to be high, as measured by heterozygosis at microsatellite loci (NMFS and USFWS 2011). Additional analysis of the mitochondrial DNA taken from samples of Kemp's ridley turtles at Padre Island, Texas, showed six distinct haplotypes, with one found at both Padre Island and Rancho Nuevo (Dutton et al. 2006).

Distribution

The Kemp's ridley occurs from the Gulf of Mexico and along the Atlantic coast of the U.S. (TEWG 2000). Kemp's ridley sea turtles have occasionally been found in the Mediterranean Sea, which may be due to migration expansion or increased hatchling production (Tomas and Raga 2008). The vast majority of individuals stem from breeding beaches at Rancho Nuevo on the Gulf of Mexico coast of Mexico. During spring and summer, juvenile Kemp's ridleys occur in the shallow coastal waters of the northern Gulf of Mexico from south Texas to north Florida. In the fall, most Kemp's ridleys migrate to deeper or more southern, warmer waters and remain there through the winter (Schmid 1998). As adults, many turtles remain in the Gulf of Mexico, with only occasional occurrence in the Atlantic Ocean (NMFS and USFWS 2011).

6.2.2.4 Status

The Kemp's ridley was listed as endangered in response to a severe population decline, primarily the result of egg collection. In 1973, legal ordinances 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 the reestablishment of nesting at Texan beaches. While fisheries bycatch remains a threat, the use of turtle excluder devices mitigates take. Fishery interactions and strandings, possibly due to forced submergence, appear to be the main 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, all of which are often difficult to predict with any certainty. Therefore, its resilience to future perturbation is low.

6.2.2.5 Status Within the Action Area

During the mid-20th century, the Kemp's ridley was abundant in the Gulf of Mexico. Historic information indicates that tens of thousands of Kemp's ridleys nested near Rancho Nuevo, Mexico, during the late 1940s (Hildebrand 1963). From 1978 through the 1980s, arribadas were 200 turtles or less, and by 1985, the total number of nests at Rancho Nuevo had dropped to approximately 740 for the entire nesting season, which was a projection of roughly 234 turtles (USFWS and NMFS 1992; TEWG 2000). Beginning in the 1990s, an increasing number of beaches in Mexico were being monitored for nesting, and the total number of nests on all beaches in Tamaulipas and Veracruz in 2002 was over 6,000; the rate of increase from 1985 ranged from 14-16 percent (TEWG 2000; USFWS 2002; Heppell et al. 2005). In 2006, approximately 7,866 nests were laid at Rancho Nuevo with the total number of nests for all the beaches in Mexico estimated at about 12,000 nests, which amounted to about 4,000 nesting females based on three nests per female per season (Rostal et al. 1997; USFWS 2006; Rostal 2007). Considering remigration rates, the population included approximately 7,000 to 8,000 adult female turtles at that time (Márquez et al. 1989; TEWG 2000; Rostal 2007). The 2007 nesting season included an arribada of over 4,000 turtles over a three-day period at Rancho Nuevo (NMFS and USFWS 2007b). The increased recruitment of new adults is illustrated in the proportion of first time nesters, which has increased from 6 percent in 1981 to 41 percent in 1994. NMFS (2015) identified noticeable drops in the number of nests in Texas and Mexico in 2010, 2013, and 2014.

6.2.2.6 Critical Habitat

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

6.2.2.7 Recovery Goals

See the 2011 revised Recovery Plan for the Kemp's ridley sea turtle for complete down-listing criteria for the following recovery goals:

1) A population of at least 10,000 nesting females in a season (as estimated by clutch frequency per female per season) distributed at the primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) in Mexico is attained. Methodology and capacity to implement and ensure accurate nesting female counts have been developed.

2) Recruitment of at least 300,000 hatchlings to the marine environment per season at the three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) in Mexico is attained to ensure a minimum level of known production through in situ incubation, incubation in corrals, or a combination of both.

3) An average population of at least 40,000 (Hildebrand 1963) nesting females per season (as measured by clutch frequency per female per season and annual nest counts) over a 6-year period distributed among nesting beaches in Mexico and the U.S. is attained. Methodology and capacity to ensure accurate nesting female counts have been developed and implemented.

4) Ensure average annual recruitment of hatchlings over a 6-year period from in situ nests and beach corrals is sufficient to maintain a population of at least 40,000 nesting females per nesting season distributed among nesting beaches in Mexico and the U.S into the future. This criterion may rely on massive synchronous nesting events (i.e., arribadas) that will swamp predators as well as rely on supplemental protection in corrals and facilities.

6.2.3 Loggerhead Sea Turtles, Northwest Atlantic Distinct Population Segment

The species was first listed as threatened under the Endangered Species Act in 1978 (43 FR 32800) (Table 15). On September 22, 2011, the NMFS designated nine distinct population segments (DPSs) of loggerhead sea turtles: South Atlantic Ocean and southwest Indian Ocean as threatened as well as Mediterranean Sea, North Indian Ocean, North Pacific Ocean, northeast Atlantic Ocean, northwest Atlantic Ocean, South Pacific Ocean, and southeast Indo-Pacific Ocean as endangered (75 FR 12598).

Table 15. Loggerhead sea turtle information bar, Northwest Atlantic Distinct Population Segment.

Species		Distinct			
Caretta caretta	Loggerhead sea turtle	Northwest Atlantic	Threatened 76 FR 58868 09/22/2011	79 FR 39856 07/10/2014	74 FR 2995 Northwest Atlantic 2009

6.2.3.1 Species Description

Loggerhead sea turtles are circumglobal, and are found in the temperate and tropical regions of the Indian, Pacific and Atlantic Oceans. The loggerhead sea turtle is distinguished from other turtles by its large head and powerful jaws (Figure 6). Recent ocean-basin scale genetic analysis supports this conclusion, with additional differentiation apparent based upon nesting beaches (Shamblin et al. 2014).

Figure 6. Loggerhead sea turtle, *Caretta caretta*. Credit: National Oceanic and Atmospheric Administration.

6.2.3.2 Life History

Mean age at first reproduction for female loggerhead sea turtles is 30 years (SD = 5). Females lay an average of three 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 turtle during the middle of the incubation period. 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 loggerheads.

6.2.3.3 Population Dynamics

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

Abundance

There is general agreement that the number of nesting females provides a useful index of the species' population size and stability at this life stage, even though there are doubts about the ability to estimate the overall population size (Bjorndal et al. 2005). Adult nesting females often account for less than 1 percent of total population numbers. The global abundance of nesting female loggerhead turtles is estimated at 43,320 to 44,560 (Spotila 2004).

Using a stage/age demographic model, the adult female population size of the DPS is estimated at 20,000 to 40,000 females, and 53,000 to 92,000 nests annually (NMFS SEFSC 2009). Based on genetic information, the Northwest Atlantic Ocean DPS is further categorized into five recovery units corresponding to nesting beaches. These are: Northern Recovery Unit, Peninsular Florida Recovery Unit, Dry Tortugas Recovery Unit, Northern Gulf of Mexico Recovery Unit, and the Greater Caribbean Recovery Unit.

Population Growth Rate

The population growth rate for four of the recovery units for the Northwest Atlantic DPS (Peninsular Florida, Northern, Northern Gulf of Mexico, and Greater Caribbean) all exhibit negative growth rates (Conant et al. 2009). Nest counts taken at index beaches in Peninsular Florida show a significant decline in loggerhead nesting from 1989-2006, most likely attributed to mortality of oceanic-stage loggerheads caused by fisheries bycatch (Witherington et al. 2009). Loggerhead nesting on the Archie Carr National Wildlife Refuge (representing individuals of the Peninsular Florida subpopulation) has fluctuated over the past few decades. There was an average of 9,300 nests throughout the 1980s, with the number of nests increasing into the 1990s until it reached an all-time high in 1998, with 17,629 nests. From that point, the number of loggerhead nests at the Refuge have declined steeply to a low of 6,405 in 2007, increasing again to 15,539, still a lower number of nests than in 1998 (Bagley et al. 2013).

For the Northern recovery unit, nest counts at loggerhead nesting beaches in North Carolina, South Carolina and Georgia declined at 1.9 percent annually from 1983 to 2005 (NMFS and USFWS 2007c). The nesting subpopulation in the Florida panhandle has exhibited a significant declining trend from 1995-2005 (NMFS and USFWS 2007c; Conant et al. 2009). Recent model estimates predict an overall population decline of 17 percent for the St. Joseph Peninsula, Florida subpopulation of the Northern Gulf of Mexico recovery unit (Lamont et al. 2014).

Genetic Diversity

There are nine loggerhead DPSs, which are geographically separated and genetically isolated, as indicated by genetic, tagging, and telemetry data. Our understanding of the genetic diversity and population structure of the different loggerhead DPSs is being refined as more studies examine samples from a broader range of specimens using longer mitochondrial DNA sequences.

Based on genetic analysis of nesting subpopulations, the Northwest Atlantic Ocean DPS is further divided into five recovery units: Northern, Peninsular Florida, Dry Tortugas, Northern Gulf of Mexico, and Greater Caribbean (Conant et al. 2009). 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 coast express high haplotype diversity (Shamblin et al. 2014). Furthermore, the results suggest that the Northwest Atlantic Ocean DPS should be considered as ten 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).

Distribution

Loggerheads are circumglobal, occurring throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian oceans, returning to their natal region for mating and nesting. Adults and sub-adults occupy nearshore habitat. While in their oceanic phase, loggerheads undergo long migrations using ocean currents. Individuals from multiple nesting colonies can be found on a single feeding ground.

Loggerhead hatchlings from the western Atlantic disperse widely, most likely using the Gulf Stream to drift throughout the Atlantic Ocean. Mitochondrial DNA evidence demonstrates that juvenile loggerheads from southern Florida nesting beaches comprise the vast majority (71 to 88 percent) of individuals found in foraging grounds throughout the western and eastern Atlantic: Nicaragua, Panama, Azores and Madiera, Canary Islands and Adalusia, Gulf of Mexico and Brazil (Masuda 2010).

6.2.3.4 Status

Due to declines in nest counts at index beaches in the United States and Mexico, and continued mortality of juveniles and adults from fishery bycatch, the Northwest Atlantic Ocean DPS is at risk and likely to decline in the foreseeable future (Conant et al. 2009).

6.2.3.5 Status Within the Action Area

The greatest concentration of loggerheads occurs in the Atlantic Ocean and the adjacent Caribbean Sea, primarily on the Atlantic coast of Florida, with other major nesting areas located on the Yucatán Peninsula of Mexico, Columbia, Cuba, and South Africa (Márquez 1990; LGL Ltd. 2007). Among the five subpopulations (also termed recovery units) in the Northwest Atlantic Ocean DPS, loggerhead females lay 53,000-92,000 nests per year in the southeastern U.S. and the Gulf of Mexico, and the total number of nesting females are 32,000-56,000 (TEWG 1998; NMFS 2001).

Loggerheads associated with the Peninsular Florida recovery unit occur in higher frequencies in the Gulf of Mexico (where they represent about 10 percent of the loggerhead captures). The Peninsular Florida recovery unit is the largest loggerhead nesting assemblage in the Northwest Atlantic Ocean DPS. A near-complete state-wide nest census (all beaches including index nesting beaches) undertaken from 1989 to 2007 showed a mean of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females annually (NMFS and USFWS 2008). The statewide estimated total for 2010 was 73,702 (FFWCC 2016). The 2010 index nesting number is the largest since 2000. With the addition of data through 2010, the nesting trend for the Northwest Atlantic Ocean DPS is slightly negative and not statistically different from zero (no trend) (NMFS and USFWS 2010).

An analysis of Florida index nesting beach data shows a 26 percent nesting decline between 1989 and 2008, and a mean annual rate of decline of 1.6 percent despite a large increase in nesting for 2008, to 38,643 nests (NMFS and USFWS 2008; Witherington et al. 2009; www.myfwc.com 2016). In 2009, nesting levels, while still higher than the lows of 2004, 2006, and 2007, dropped below 2008 levels to approximately 32,717 nests, but in 2010, a large increase was seen, with 47,880 nests on the index nesting beaches (FFWCC 2016). Although not directly comparable to these index nesting numbers, nesting counts from 2011-2015 have shown a generally stable trend (www.seaturtle.org 2016).

The Peninsular Florida recovery unit of loggerheads may be critical to the survival of the species in the Atlantic because of the recovery unit's size, and in the past it was considered second in size only to the Oman nesting aggregation (NMFS and USFWS 1991). The Peninsular Florida recovery unit increased at about 5.3 percent per year from 1978-1990, and was initially increasing at 3.9-4.2 percent after 1990. An analysis of nesting data from 1989-2005, a period of more consistent and accurate surveys than in previous years, showed a detectable trend and, more recently (1998-2005), analysis revealed evidence of a declining trend of approximately 22.3 percent (FFWCC 2006, 2007; Witherington et al. 2009). Nesting data from the Archie Carr Refuge (one of the most important nesting locations in southeast Florida) over the last six years shows nests declined from approximately 17,629 in 1998 to 7,599 in 2004, also suggesting a decrease in recovery unit size. Loggerhead nesting is thought to consist of just 60 nesting females in the Caribbean and Gulf of Mexico (www.nmfs.noaa.gov/pr 2006). Based on the small sizes of almost all nesting aggregations in the Atlantic, the large numbers of individuals killed in fisheries, and the decline of the only large nesting aggregation, the DPS is determined to be in decline (Conant et al. 2009).

6.2.3.6 Critical Habitat

NMFS has designated critical habitat for the Northwest Atlantic Ocean DPS loggerhead sea turtles. On July 10, 2014, NMFS and FWS designated critical habitat for the Northwest Atlantic Ocean DPS loggerhead sea turtles along the U.S. Atlantic and Gulf of Mexico coasts from North Carolina to Mississippi (79 FR 39856). These areas contain one or a combination of nearshore reproductive habitat, winter area, breeding areas, and migratory corridors. The critical habitat is categorized into 38 occupied marine areas and 685 miles of nesting beaches. The physical or biological features and primary constituent elements identified for the different habitat types include waters adjacent to high density nesting beaches, waters with minimal obstructions and manmade structures, high densities of reproductive males and females, appropriate passage conditions for migration, conditions that support Sargassum habitat, available prey, and sufficient water depth and proximity to currents to ensure offshore transport of post-hatchlings.

6.2.3.7 Recovery Goals

See the 2009 Final Recovery Plan for the Northwest Atlantic population of loggerhead for complete down-listing criteria for the following recovery goals:

1) 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.

2) 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.

3) Manage sufficient nesting beach habitat to ensure successful nesting.

4) Manage sufficient feeding, migratory, and inter-nesting marine habitats to ensure successful growth and reproduction.

5) Eliminate legal harvest.

6) Implement scientifically based nest management plans.

7) Minimize nest predation.

8) Recognize and respond to mass/unusual mortality or disease events appropriately.

9) Develop and implement local, state, Federal, and international legislation to ensure long-term protection of loggerheads and their terrestrial and marine habitats.

10) Minimize bycatch in domestic and international commercial and artisanal fisheries.

11) Minimize trophic changes from fishery harvest and habitat alteration.

12) Minimize marine debris ingestion and entanglement.

13) Minimize vessel strike mortality

6.2.4 Leatherback Sea Turtles

The species was first listed under the Endangered Species Conservation Act (35 FR 8491) and listed as endangered under the ESA since 1973 (Table 16).

Table 16. Leatherback sea turtle information bar.

Species		**Distinct**			
Dermochelys coriacea	Leatherback sea turtle	None Designated	Endangered 35 FR 8491 06/02/1970	Designated, Not in Action Area	N/A U.S. Caribbean, Atlantic and Gulf of Mexico 1992

6.2.4.1 Species Description

The leatherback sea turtle is unique among sea turtles for its large size, wide distribution (due to thermoregulatory systems and behavior), and lack of a hard, bony carapace. It ranges from tropical to subpolar latitudes, worldwide. Leatherbacks are the largest living turtle, reaching lengths of six feet long, and weighing up to one ton. Leatherback sea turtles have a distinct black leathery skin covering their carapace with pinkish white skin on their belly (Figure 7).

Figure 7. Leatherback sea turtle, *Dermochelys coriacea*. Credit: R. Tapilatu.

6.2.4.2 Life History

Age at maturity has been difficult to ascertain, with estimates ranging from 5 to 29 years (Spotila et al. 1996; Avens et al. 2009). Females lay up to seven 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 number of leatherback hatchlings that make it out of the nest on to the beach (i.e., emergent success) is approximately 50 percent worldwide (Eckert et al. 2012). Females nest every 1 to 7 years. Natal homing, at least within an ocean basin, results in reproductive isolation between five broad geographic regions: eastern and western Pacific, eastern and western Atlantic, and Indian Ocean. Leatherback sea turtles migrate long, transoceanic distances between their tropical nesting beaches and the highly productive temperate waters where they forage, primarily on jellyfish and tunicates. These gelatinous prey are relatively nutrient-poor, such that leatherbacks must consume large quantities to support their body weight. Leatherbacks weigh ~33 percent more on their foraging grounds than at nesting, indicating that they probably catabolize fat reserves to fuel migration and subsequent reproduction (James et al. 2005; Wallace et al. 2006). 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).

6.2.4.3 Population Dynamics

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

Abundance

Leatherbacks are globally distributed, with nesting beaches in the Pacific, Atlantic, and Indian oceans. Detailed population structure is unknown, but is likely dependent upon nesting beach location. Based on estimates calculated from nest count data, there are between 34,000 and 94,000 adult leatherbacks in the North Atlantic (TEWG 2007). In contrast, leatherback populations in the Pacific are much lower. Overall, Pacific populations have declined from an estimated 81,000 individuals to less than 3,000 total adults and subadults (Spotila et al. 2000). Population abundance in the Indian Ocean is difficult to assess due to lack of data and inconsistent reporting. Available data from southern Mozambique show that approximately 10 females nest per year from 1994-2004, and about 296 nests per year counted in South Africa (NMFS 2013c).

Population Growth Rate

Population growth rates for leatherback sea turtles vary by ocean basin. Counts of leatherbacks at nesting beaches in the western Pacific indicate that the subpopulation has been declining at a rate of almost 6 percent per year since 1984 (Tapilatu et al. 2013). Leatherback subpopulations in the Atlantic Ocean however are showing signs of improvement. Nesting females in South Africa are increasing at an annual rate of 4 to 5.6 percent, and from 9 to 13 percent in Florida and the U.S. Virgin Islands (TEWG 2007), believed to be a result of conservation efforts.

Genetic Diversity

Analyses of mitochondrial DNA from leatherback sea turtles indicates a low level of genetic diversity, pointing to possible difficulties in the future if current population declines continue (Dutton et al. 1999). Further analysis of samples taken from individuals from rookeries in the Atlantic and Indian oceans suggest that each of the rookeries represent demographically independent populations (NMFS 2013c).

Distribution

Leatherback sea turtles are distributed in oceans throughout the world. Leatherbacks occur throughout marine waters, from nearshore habitats to oceanic environments (Shoop and Kenney 1992). Movements are largely dependent upon reproductive and feeding cycles and the oceanographic features that concentrate prey, such as frontal systems, eddy features, current boundaries, and coastal retention areas (Benson et al. 2011).

6.2.4.4 Status

The leatherback sea turtle is an endangered species whose once large nesting populations have experienced steep declines in recent decades. The primary threats to leatherback sea turtles include: fisheries bycatch, harvest of nesting females, and egg harvesting. As a result of these threats, once large rookeries are now functionally extinct, and there have been range-wide reductions in population abundance. Other threats include loss of nesting habitat due to development, tourism, and sand extraction. Lights on or adjacent to nesting beaches alter nesting adult behavior and are often fatal to emerging hatchlings as they are drawn to light sources and away from the sea. Plastic ingestion is common in leatherbacks and can block gastrointestinal tracts leading to death. 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, as a result of sea-level rise. The species' resilience to additional perturbation is low.

6.2.4.5 Status Within the Action Area

North Atlantic leatherbacks likely number 34,000-94,000 individuals, with females numbering 18,800 and the eastern Atlantic segment numbering 4,700 (TEWG 2007). Trends and numbers include only nesting females and are not a complete demographic or geographic cross-section. In 1996, the entire western Atlantic population was characterized as stable at best (Spotila et al. 1996), with roughly 18,800 nesting females. A subsequent analysis indicated that by 2000, the western Atlantic nesting population had decreased to about 15,000 nesting females (NMFS 2005). Spotila et al. (1996) estimated that the entire Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, totaled approximately 27,600 nesting females, with an estimated range of 20,082-35,133. This is consistent with other estimates of 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) (TEWG 2007).

In the Caribbean, Atlantic and Gulf of Mexico, leatherback populations are generally increasing. In the United States, the Atlantic coast of Florida is one of the main nesting areas in the continental United States. Data from this area reveals a general upward trend of, though with some fluctuation. Florida index nesting beach data from 1989-2014, indicate that number of nests at core index nesting beach ranged from 27 to 641 in 2014. In the U.S. Caribbean, nesting in Puerto Rico, St. Croix, and the U.S. Virgin Islands continues to increase as well, with some shift in the nesting between these two islands.

6.2.4.6 Critical Habitat

On March 23, 1979, leatherback critical habitat was identified adjacent to Sandy Point, St. Croix, Virgin Islands from the 183 meter isobath to mean high tide level between 17° 42’12” N and 65°50’00” W (44 FR 17710). This habitat is essential for nesting, which has been increasingly threatened since 1979, when tourism increased significantly, bringing nesting habitat and people into close and frequent proximity; however, studies do not support significant critical habitat deterioration.

On January 20, 2012, NMFS issued a final rule to designate additional critical habitat for the leatherback sea turtle (50 CFR 226). This designation includes approximately 43,798 kilometers squared stretching along the California coast from Point Arena to Point Arguello east of the 3000 meter depth contour; and 64,760 kilometers squared stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 meter depth contour. The designated areas comprise approximately 108558 kilometers squared of marine habitat and include waters from the ocean surface down to a maximum depth of 80 meters. They were designated specifically because of the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae (i.e., jellyfish), of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

6.2.4.7 Recovery Goals

See the 1992 Recovery Plan for the U.S. Caribbean, Atlantic, and Gulf of Mexico for complete down-listing criteria for the following recovery goals:

1) The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico, St. Croix, U.S. Virgin Islands, and along the east coast of Florida.

2) Nesting habitat encompassing at least 75 percent of nesting activity in U.S. Virgin Islands, Puerto Rico and Florida is in public ownership.

3) All priority one tasks have been successfully implemented.

6.2.5 Olive Ridley Sea Turtles

The olive ridley sea turtle was listed July 28, 1978 as two populations: the breeding colony populations on Pacific coast of Mexico as endangered and all other populations as threatened (43 FR 32800) (Table 17).

Table 17. Olive ridley sea turtle information bar.

Species	Common Name	Distinct Population Segment	ESA Status	Critical Habitat	
Lepidochelys olivacea	Olive ridley sea turtle	None	Threatened 43 FR 32800 07/28/1978	--	Threatened 43 FR 32800 07/28/1978

6.2.5.1 Species Description

The olive ridley sea turtle is olive/grayish-green (darker in the Atlantic than in the Pacific) with a heart-shaped top shell ("carapace") and 5-9 pairs of costal "scutes" with 1-2 claws on their flippers (Figure 8). Their hatchlings emerge mostly black with a greenish hue on their sides.

Figure 8. Olive ridley sea turtle, *Lepidochelys olivacea*. Credit: Robert Pitman, National Oceanic and Atmospheric Administration.

6.2.5.2 Life History

The olive ridley has one of the most extraordinary nesting habits in the natural world. Large groups of turtles gather off shore of nesting beaches. Then, all at once, vast numbers of turtles come ashore and nest in what is known as an "arribada". During these arribadas, hundreds to thousands of females come ashore to lay their eggs. At many nesting beaches, the nesting density is so high that previously laid egg clutches are dug up by other females excavating the nest to lay their own eggs.

There are many theories on what triggers an arribada, including offshore winds, lunar cycles, and the release of pheromones by females. Despite these theories, scientists have yet to determine the actual cues for ridley arribadas. Not all females nest during an arribada, instead some are solitary nesters. Some olive ridleys employ a mixed nesting strategy. For example, a single female might nest during an arribada, as well as nest alone during the same nesting season. Arribada nesting is a behavior found only in the genus Lepidochelys: Kemp's ridley sea turtles and olive ridley sea turtles. Although other turtles have been documented nesting in groups, no other turtles (marine or otherwise) have been observed nesting in such mass numbers and synchrony. Olive ridleys reach sexual maturity around 15 years, a young age compared to some other sea turtle species. Females nest every year, once or twice a season, laying clutches of approximately 100 eggs. Incubation takes about 2 months.

6.2.5.3 Population Dynamics

The following is a discussion of the species' population and its variance over time. This section is broken down into: abundance, population growth rate, genetic diversity, and distribution as it relates to the olive ridley sea turtle.

Abundance

The olive ridley is considered the most abundant sea turtle in the world, with an estimated 800,000 nesting females annually. Until recent historical times and the advent of modern commercial exploitation of sea turtles, the olive ridley was superabundant in the eastern Pacific, undoubtedly outnumbering all other sea turtle species combined in the area. For example, Carr (1972) states that more than 1,000,000 olive ridleys were commercially harvested in Mexico during 1968 alone, and Cliffton et al. (1982) estimated that a minimum of 10,000,000 olive ridleys swam in the seas off Pacific Mexico before the recent era of exploitation.

Population Growth Rate

The olive ridley may be the most abundant sea turtle on the planet, but some argue that it is also the most exploited. According to the Marine Turtle Specialist Group of the IUCN there has been a 50 percent reduction in population size since the 1960's. Although some nesting populations have increased in the past few years, the overall reduction is greater than the overall increase.

In the Western Atlantic Ocean (Surinam, French Guiana, and Guyana), there has, since 1967, been an 80 percent reduction in certain nesting populations. In the Eastern Atlantic Ocean, lack of data and trends on specific nesting beaches make it difficult to estimate nesting populations. Along the entire west coast of Africa, nesting females and eggs are regularly taken for consumption, except where research stations have been established. This impact is likely extremely devastating to the entire Eastern Atlantic population (Plotkin 2007).

Still, not all populations are depleted. Some nesting populations are currently stable and/ or increasing. In Sergipe, Brazil, strict nest protection has led to increases of the nesting population over the past 20 years. In La Escobilla, Mexico, conservation measures, such as increased nesting beach protection and closure of the turtle fishery in 1990, have led to a dramatic increase in the once largest nesting population in the world. The number of olive ridley nests has increased from 50,000 in 1988 to over 700,000 in 1994 to over 1,000,000 nests in 2000 (Márquez et al. 2002). At-sea estimates of density and abundance of the olive ridley show a yearly estimate of over 1 million, which is consistent with the increase seen on the eastern Pacific nesting beaches as a result of protection programs that began in the 1990’s (Eguchi et al. 2007). This dramatic improvement gives hope that with strict protections the once depleted populations in Mexico have begun to stabilize.

Genetic Diversity

In the western Atlantic Ocean, Plot et al. (2012) found low genetic diversity in the French Guiana population. They felt the low diversity could be attributed to a recent (300,000 years ago) colonization of the western Atlantic by olive ridley turtles (Bowen et al. 1998), but was more likely indicative of a recent population collapse due to human over-exploitation (Plot et al. 2012).

Distribution

Olive ridleys are globally distributed in the tropical regions of the South Atlantic, Pacific, and Indian Oceans. In the South Atlantic Ocean, they are found along the Atlantic coasts of West Africa and South America. In the Eastern Pacific, they occur from Southern California to Northern Chile. Olive ridleys often migrate great distances between feeding and breeding grounds. Using satellite telemetry tags, scientists have documented both male and female olive ridleys leaving the breeding and nesting grounds off the Pacific coast of Costa Rica migrating out to the deep waters of the Pacific Ocean. Solitary nesting occurs extensively throughout this species' range, and nesting has been documented in approximately 40 countries worldwide. Arribadas, however, occur on only a few beaches worldwide, in the eastern Pacific and northern Indian oceans, in the countries of: Mexico, Nicaragua, Costa Rica, Panama, and India. In the eastern Pacific, arribadas occur from June to December on certain beaches on the coasts of Mexico, Nicaragua, and Costa Rica, and on a single beach in Panama. In the northern Indian Ocean, arribadas occur on three different beaches along the coast of India.

6.2.5.4 Status

The olive ridley sea turtle was listed July 28, 1978 as two populations: the breeding colony populations on Pacific coast of Mexico as endangered and all other populations as threatened (43 FR 32800).

6.2.5.5 Status Within the Action Area

In the Western Atlantic Ocean (Surinam, French Guiana, and Guyana), there has, since 1967, been an 80 percent reduction in certain nesting populations (USFWS 2002). In the Eastern Atlantic Ocean, lack of data and trends on specific nesting beaches make it difficult to estimate nesting populations. Along the entire west coast of Africa, nesting females and eggs are regularly taken for consumption, except where research stations have been established. This impact is likely extremely devastating to the entire Eastern Atlantic population (Plotkin 2007).

6.2.5.6 Critical Habitat

No critical habitat has been designated for olive ridley sea turtles.

6.2.5.7 Recovery Goals

There is currently no recovery plan for olive ridley populations other than the Pacific population. See the 1991 Recovery Plan for the U.S. Pacific population of olive ridley sea turtles for complete down-listing criteria for the following recovery goals:

1) All regional stocks that use U.S. waters have been identified to source beaches based on reasonable geographic parameters.

2) Foraging populations are statistically significantly increasing at several key foraging grounds within each stock region.

3) All females estimated to nest annually at "source beaches" are either stable or increasing for over 10 years.

4) A management plan based on maintaining sustained populations for turtles is in effect.

5) International agreements are in place to protect shared stocks.

6.2.6 Hawksbill Sea Turtles

Hawksbill sea turtles received protection on June 2, 1970, (35 FR 8491) under the Endangered Species Conservation Act and, since 1973, have been listed as endangered under the ESA (Table 18).

Table 18. Hawksbill sea turtle information bar.

Species	Common Name	Distinct Population Segment	ESA Status	Critical Habitat	Recovery Plan
Eretmochelys imbricata	Hawksbill sea turtle	N/A	Endangered 35 FR 8491 06/02/1970	63 FR 46693 Atlantic 09/02/1998	57 FR 38818 U.S. Caribbean, Atlantic and Gulf of Mexico 1992

6.2.6.1 Species Description

The hawksbill turtle has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical oceans. The hawksbill sea turtle has a sharp, curved, beak-like mouth and a "tortoiseshell" pattern on its carapace which has radiating streaks of brown, black, and amber (Figure 9).

Figure 9. Hawksbill sea turtle, *Eretmochelys imbricata*. Credit: Jordan Wilkerson.

6.2.6.2 Life History

Hawksbill sea turtles reach sexual maturity at 20 to 40 years of age. Females return to their natal beaches every 2 to 5 years to 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 in straight carapace length. As juveniles, they take up residency in coastal waters to forage and grow. As adults, hawksbills use their sharp beak-like mouths to feed on sponges and corals. Hawksbill sea turtles are highly migratory and use a wide range of habitats during their lifetimes (Musick and Limpus 1997; Plotkin 2003). Satellite tagged turtles have shown significant variation in movement and migration patterns. Distance traveled between nesting and foraging locations ranges from a few hundred to a few thousand kilometers (Miller et al. 1998; Horrocks et al. 2001).

6.2.6.3 Population Dynamics

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

Abundance

Surveys at 88 nesting sites worldwide indicate that 22,004 to 29,035 females nest annually (NMFS and USFWS 2013). In general, hawksbills are doing better in the Atlantic and Indian Ocean than in the Pacific Ocean, where despite greater overall abundance, a greater proportion of the nesting sites are declining.

Population Growth Rate

From 1980 to 2003, the number of nests at three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased 15 percent annually (Heppell et al. 2005); however, due to recent declines in nest counts, decreased survival at other life stages, and updated population modeling, this rate is not expected to continue (NMFS and USFWS 2015).

Genetic Diversity

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 sea turtles foraging off the Cape Verde Islands identified three 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; Monzón-Argüello et al. 2010). Hawksbills in the Caribbean seem to have dispersed into separate populations (rookeries) after a bottleneck roughly 100,000 to 300,000 years ago (Leroux et al. 2012).

Distribution

The hawksbill has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical waters of the Atlantic, Indian, and Pacific Oceans. In their oceanic phase, juvenile hawksbills can be found in Sargassum mats; post-oceanic hawksbills may occupy a range of habitats that include coral reefs or other hard-bottom habitats, sea grass, algal beds, mangrove bays and creeks (Musick and Limpus 1997; Bjorndal and Bolten 2010).

6.2.6.4 Status

Long-term data on the hawksbill sea turtle indicate that 63 sites have declined over the past 20 to 100 years (historic trends are unknown for the remaining 25 sites). Recently, 28 sites (68 percent) have experienced nesting declines, 10 have experienced increases, three have remained stable, and 47 have unknown trends. The greatest threats to hawksbill sea turtles are overharvesting of turtles and eggs, degradation of nesting habitat, and fisheries interactions. Adult hawksbills 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 percent 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.

6.2.6.5 Status Within the Action Area

In the Atlantic, hawksbill population increase has been greater in the Insular Caribbean than along the Western Caribbean Mainland or the eastern Atlantic (including Sao Tomé and Equatorial Guinea). Nesting populations of Puerto Rico appeared to be in decline until the early 1990's, but have universally increased during the survey periods. Mona Island now hosts 199-332 nesting females annually, and the other sites combined host 51-85 nesting females annually (NMFS and USFWS 2007a). The U.S. Virgin Islands have a long history of tortoiseshell trade (Schmidt 1916). At Buck Island Reef National Monument, protection has been in force since 1988, and during that time, hawksbill nesting has increased by 143 percent to 56 nesting females annually, with apparent spill over to beaches on adjacent St. Croix. However, St. John populations did not increase, perhaps due to the proximity of the legal turtle harvest in the British Virgin Islands.

6.2.6.6 Critical Habitat

On September 2, 1998, NMFS established critical habitat for hawksbill sea turtles around Mona and Monito Islands, Puerto Rico (63 FR 46693). Aspects of these areas that are important for hawksbill sea turtle survival and recovery include important natal development habitat, refuge from predation, shelter between foraging periods, and food for hawksbill sea turtle prey. The critical habitat for hawksbill does not occur in the action area for the proposed permit.

6.2.6.7 Recovery Goals

See the 1998 Recovery Plan for U.S. Pacific populations of hawksbill sea turtles for complete down-listing criteria for the following recover criteria:

1) All regional stocks that use U.S. waters have been identified to source beaches based on reasonable geographic parameters.

2) Each stock must average 1,000 females estimated to nest annually (or a biologically reasonable estimate based on the goal of maintaining a stable population in perpetuity) over six years.

3) All females estimated to nest annually at "source beaches" are either stable or increasing for 25 years.

4) Existing foraging areas are maintained as healthy environments.

5) Foraging populations are exhibiting statistically significant increases at several key foraging grounds within each stock region.

6) All Priority 1 tasks have been implemented.

7) A management plan designed to maintain sustained populations of turtles is in place.

8) Ensure formal cooperative relationship with regional sea turtle management program.

9) International agreements are in place to protect shared stocks.

6.2.7 Smalltooth Sawfish, United States Distinct Population Segment

The United States Distinct Population Segment of smalltooth sawfish was listed as endangered under the ESA effective May 1, 2003 (Table 19).

Table 19. Smalltooth sawfish information bar.

Species	Common Name	Distinct Population Segment	ESA Status	Critical Habitat	Recovery Plan
Pristis pectinata	Smalltooth Sawfish	United States Population	Endangered 68 FR 15674 04/01/2003	74 FR 45353 09/02/2009	74 FR 3566 U.S. Population 2009

6.2.7.1 Life History

Smalltooth sawfish size at sexual maturity has been reported as 360 centimeters total length (TL) by Simpfendorfer (2005). Carlson and Simpfendorfer (2015) estimated that sexual maturity for females occurs between 7 and 11 years of age. As in 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; Simpfendorfer 2005; Carlson and Simpfendorfer 2015).

Neonate smalltooth sawfish are born measuring 67 to 81 centimeters (TL) and spend the majority of their time in the shallow nearshore edges of sand and mud banks (Simpfendorfer et al. 2010; Poulakis et al. 2011). Once individuals reach 100 to 140 centimeters (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 to 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 centimeters (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)

6.2.7.2 Population Dynamics

The following is a discussion of the species' population and its variance over time. This section is broken down into: abundance, population growth rate, genetic diversity, and spatial distribution as it relates to the smalltooth sawfish.

Abundance

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 2014). 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 to 350 adults (95 percent C.I. 142-955). Simpfendorfer (2002) estimated that the U.S. population may number less than 5 percent of historic levels based on the contraction of the species' range.

Population Growth Rate

The abundance of juveniles encountered in recent studies (Seitz and Poulakis 2002; Simpfendorfer and Wiley 2004; Poulakis et al. 2014) 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 percent per year (Carlson et al. 2007; Carlson and Osborne 2012). Intrinsic rates of growth for smalltooth sawfish have been estimated at 1.08 to 1.14 per year and 1.237 to 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.

Genetic Diversity

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 percent of its current genetic diversity over the next century.

Distribution

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 (Seitz and Poulakis 2002; Poulakis and Seitz 2004). Water temperatures (no lower than 16 to 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 (Bigalow and Schroeder 1953).

6.2.7.3 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 2009; Simpfendorfer et al. 2011). These factors continue to threaten the smalltooth sawfish population.

6.2.7.4 Status Within the Action Area

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 (Seitz and Poulakis 2002; Poulakis and Seitz 2004; 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 2010i).

6.2.7.5 Critical Habitat

Critical habitat for smalltooth sawfish was designated in 2009 (74 FR 45353) and includes two major units: Charlotte Harbor (221,459 acres) and Ten Thousand Islands/Everglades (619,013 acres). These two 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, two features were identified as essential to the conservation of the species: red mangroves (*Rhizophora mangle*), and euryhaline habitats with water depths greater than or equal to 0.9 meters (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. 2011; Poulakis et al. 2014).

6.2.7.6 Recovery Goals

The 2009 Smalltooth Sawfish Recovery Plan contains complete downlisting/delisting criteria for each of the three following recovery goals (NMFS 2009).

1) Minimize human interactions and associated injury and mortality.

Specific criteria include: 1) educational programs; 2) handling and release guidelines; 3) injury and mortality regulations; and, 4) other State and/or Federal measures (not including those provided under the ESA).

2) Protect and/or restore smalltooth sawfish habitats.

Specific criteria include: 1) protection of existing mangrove shoreline habitat; 2) assurance of availability and accessibility of both mangrove and non-mangrove habitat sufficient to support subpopulations of juvenile sawfish; 3) appropriate freshwater flow regimes; and, 4) identification and protection of habitat areas utilized by adult smalltooth sawfish.

3) Ensure smalltooth sawfish abundance increases substantially and the species reoccupies areas from which it had been previously extirpated.

Specific criteria include: 1) annual increases in the relative abundance of juvenile smalltooth sawfish; 2) annual increases in the relative abundance of adult smalltooth sawfish; 3) verified records of adult smalltooth sawfish in outer regions of the species range.

6.2.8 Atlantic Sturgeon

Five separate DPSs of Atlantic sturgeon were listed under the ESA by NMFS effective April 6, 2012 (77 FR 5880 and 5914, February 6, 2012). The New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs were listed as endangered. The Gulf of Maine DPS was listed as threatened (Table 20).

Table 20. Atlantic Sturgeon information bar.

Species	Common Name	Distinct Population Segment	ESA Status	Critical Habitat	Recovery Plan
Acipenser oxyrinchus oxyrinchus	Atlantic Sturgeon	Gulf of Maine	Threatened 77 FR 5880 02/06/2012	81 FR 35701 (Proposed)	--
		Carolina	Endangered 77 FR 5914 02/06/2012	81 FR 36077 (Proposed)	--
		South Atlantic	Endangered 77 FR 5914 02/06/2012	81 FR 36077 (Proposed)	--
		New York Bight	Endangered 77 FR 5880 02/06/2012	81 FR 35701 (Proposed)	--
		Chesapeake Bay	Endangered 77 FR 5880 02/06/2012	81 FR 35701 (Proposed)	--

6.2.8.1 Life History

Atlantic sturgeon are long-lived, late-maturing, estuarine-dependent, anadromous fish distributed along the eastern coast of North America (Waldman and Wirgin 1998). Historically, sightings have been reported from Hamilton Inlet, Labrador, Canada, south to the St. Johns River, Florida (Murawski et al. 1977; Smith and Clugston 1997). Atlantic sturgeon may live up to 60 years, reach lengths up to 14 feet, and weigh over 800 pounds (Collette and Klein-MacPhee 2002; ASSRT 2007). They are distinguished by armor-like plates (called scutes) and a long protruding snout that has four barbels (slender, whisker-like feelers extending from the head used for touch and taste). Atlantic sturgeon spend the majority of their lives in nearshore marine waters, returning to the rivers where they were born (natal rivers) to spawn (Wirgin et al. 2002). Young sturgeon may spend the first few years of life in their natal river estuary before moving out to sea (Wirgin et al. 2002). Atlantic sturgeon are omnivorous benthic (bottom) feeders and filter quantities of mud along with their food. Adult diets include mollusks, gastropods, amphipods, isopods, and fish. Juvenile sturgeon feed on aquatic insects and other invertebrates (Smith 1985).

6.2.8.2 Population Dynamics

The following is a discussion of the species' population and its variance over time. This section is broken down into: abundance, population growth rate, genetic diversity, and spatial distribution as it relates to all of the Atlantic Sturgeon distinct population segments.

Abundance

Historically, the Gulf of Maine DPS likely supported more than 10,000 spawning adults, (Secor 2002; ASSRT 2007) suggesting the recent estimate of spawning adults within the DPS is 1 to 2 orders of magnitude smaller than historical levels (i.e., hundreds to low thousands).

Secor (2002) estimates that 8,000 adult females were present in South Carolina prior to 1890 for the Carolina DPS. Prior to the collapse of the fishery in the late 1800s, the sturgeon fishery was the third largest fishery in Georgia. Secor (2002) estimated from U.S. Fish Commission landing reports that approximately 11,000 spawning females were likely present in Georgia prior to 1890.

The Altamaha River population of Atlantic sturgeon, with an estimated 343 adults spawning annually, is believed to be the largest population in the Southeast, yet is estimated to be only 6 percent of its historical population size. The abundances of the remaining river populations within the South Atlantic DPS, each estimated to have fewer than 300 annually spawning adults, are estimated to be less than 1 percent of what they were historically (ASSRT 2007).

The New York Bight DPS only supports two spawning subpopulations, the Delaware and Hudson River. The number of Atlantic Sturgeon in this DPS are extremely low compared to historical levels and have remained so for the past one-hundred years. The spawning population of this DPS is thought to be one to two orders of magnitude below historical levels.

Historically, Atlantic sturgeon were common throughout the Chesapeake Bay and its tributaries. There is currently only one known spawning population (James River) with some evidence of spawning in the York River as well. The spawning population of this DPS is thought to be one to two orders of magnitude below historical levels.

Population Growth Rate

There are some positive signs for the Gulf of Maine distinct population segment, which include observations of Atlantic sturgeon in rivers from which sturgeon observations have not been reported for many years (Saco, Presumpscot, and Charles rivers) and potentially higher catch-per-unit-effort levels than in the past (Kennebec). These observations suggest that the abundance of the Gulf of Maine DPS is large enough that recolonization to rivers historically suitable for spawning may be occurring.

Precise estimates of population growth rate for the Carolina DPS are unknown due to lack of long-term abundance data. The status review team concluded that the subpopulations in the Roanoke, Tar/Pamlico, Neuse, Waccamaw, and Pee Dee river systems are at a moderate extinction risk the subpopulations in the Cape Fear and Santee-Cooper river systems are at a moderately high risk of extinction.

Low population numbers of every river population in the South Atlantic DPS put them in danger of extinction; none of the populations are large or stable enough to provide with any level of certainty for continued existence of Atlantic sturgeon in this part of its range. Although the largest impact that caused the precipitous decline of the species has been restricted (directed fishing), the population sizes within the South Atlantic DPS have remained relatively constant at greatly reduced levels (approximately 6 percent of historical population sizes in the Altamaha River, and 1 percent of historical population sizes in the remainder of the DPS) for 100 years.

The New Your Bight DPS currently supports only two spawning subpopulations, the Delaware and Hudson River. Population estimates based on mark and recapture of juvenile Atlantic sturgeon and voluntary logbook reporting indicate that the Delaware subpopulation has been declining rather rapidly over the last 20 years. In the U.S., the Hudson River currently supports the largest subpopulation of spawning adults (approximately 850 males and females) and approximately 8,000 subadults, although historically it supported 6,000 to 7,000 spawning females. Long-term surveys indicate that the Hudson River subpopulation has been stable since 1995 and/or slightly increasing in abundance.

The Chesapeake Bay once supported at least six historical spawning subpopulations; however, today the Bay is believed to support at the most, only two spawning subpopulations (James and York). Precise estimates of population growth rate (intrinsic rates) are unknown due to lack of long-term abundance data. The status review team concluded that the subpopulations in the James and York Rivers are at a moderate and moderately high risk of extinction.

Genetic Diversity

While adult Atlantic sturgeon from all DPSs mix extensively in marine waters, the majority of Atlantic sturgeon return to their natal rivers to spawn. Genetic studies show that fewer than two adults per generation spawn in rivers other than their natal river (Wirgin et al. 2000; King et al. 2001; Waldman et al. 2002). Young sturgeon spend the first few years of life in their natal river estuary before moving out to sea. We expect that all DPSs would be affected by the proposed action of Permit No. 20339 and the Carolina and South Atlantic DPSs would be affected by the proposed action of Permit No. 19621-01.

Distribution

The Atlantic sturgeon were once present in 38 river systems and, of these, spawned in 35 of them. Individuals are currently present in 36 rivers, and spawning occurs in at least 20 of these (ASSRT 2007). Atlantic sturgeon occupy ocean waters and associated bays, estuaries, and coastal river systems from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida.

6.2.8.3 Status

The viability of the Gulf of Maine, Carolina, South Atlantic, New York Bight, and Chesapeake Bay DPSs depends on having multiple self-sustaining riverine spawning populations and maintaining suitable habitat to support the various life functions (spawning, feeding, growth) of Atlantic sturgeon populations. Because a DPS is a group of populations, the stability, viability, and persistence of individual populations affects the persistence and viability of the larger DPS. The loss of any population within a DPS will result in (1) a long-term gap in the range of the DPS that is unlikely to be recolonized, (2) loss of reproducing individuals, (3) loss of genetic biodiversity, (4) potential loss of unique haplotypes, (5) potential loss of adaptive traits, (6) reduction in total number, and (7) potential for loss of population source of recruits. The loss of a population will negatively impact the persistence and viability of the DPS as a whole, as fewer than two individuals per generation spawn outside their natal rivers (Wirgin et al. 2000; King et al. 2001; Waldman et al. 2002). The persistence of individual populations, and in turn the DPS, depends on successful spawning and rearing within the freshwater habitat, the immigration into marine habitats to grow, and then the return of adults to natal rivers to spawn.

6.2.8.4 Status Within the Action Area

The Gulf of Maine DPS historically supported more than 10,000 spawning adults, and recent estimates suggest the number is one to two orders of magnitude smaller (Secor 2002; ASSRT 2007).

The Carolina DPS ranges from the Albemarle Sound to the Santee-Cooper River and consists of seven extant subpopulations; one subpopulation (Sampit) is believed to be extirpated. The current abundance of these subpopulations is likely less than three percent of their historical abundance based on 1890s commercial landings data (Secor 2002; ASSRT 2007).

The South Atlantic DPS historically supported eight spawning subpopulations but currently supports five extant spawning subpopulations (ASSRT 2007). The current abundance of these subpopulations are suspected to be less than 6 percent of their historical abundance, extrapolated from the 1890s commercial landings (Secor 2002; ASSRT 2007).

The New York Bight, ranging from the Delmarva Peninsula to Cape Cod, historically supported four or more spawning subpopulations. Currently, this DPS only supports two spawning subpopulations, the Delaware and Hudson River. The spawning population is thought to be one to two orders of magnitude below historic levels.

Historically, Atlantic sturgeon were common throughout the Chesapeake Bay and its tributaries. There is currently only one known spawning population (James River) for the Chesapeake DPS with some evidence of spawning in the York River as well.

6.2.8.5 Critical Habitat

NMFS proposed critical habitat for each ESA-listed DPS of Atlantic sturgeon in June of 2016.

The following physical and biological features were determined to be essential for Atlantic sturgeon reproduction and recruitment:

> 1. Suitable hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0 to 0.5 parts per thousand range) for settlement of fertilized eggs, refuge, growth, and development of early life stages
>
> 2. Transitional salinity zones inclusive of waters with a gradual downstream gradient of 0.5 to 30 parts per thousand and soft substrate (e.g., sand, mud) downstream of spawning sites for juvenile foraging and physiological development
>
> 3. Water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support (1) unimpeded movement of adults to and from spawning sites, (2) seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary, and (3) staging, resting, or holding of subadults or spawning condition adults. Water depths in the main river channels must also be deep enough (e.g., ≥1.2m) to ensure continuous flow in the main channel at all times when any sturgeon life stage would be in the river
>
> 4. Water quality conditions, especially in the bottom meter of the water column, with the temperature, salinity, and oxygen values that, combined, support (1) spawning, (2) annual and inter-annual adult, subadult, larval, and juvenile survival, and (3) larval, juvenile, and subadult growth, development, and recruitment (e.g., 13°C to 26°C for spawning habitat and no more than 30°C for juvenile rearing habitat, and 6 mg/L DO for juvenile rearing habitat.

6.2.8.6 Recovery Plan

No recovery plan exists for Atlantic Sturgeon.

6.2.9 Shortnose Sturgeon

Shortnose sturgeon were initially listed as endangered on March 11, 1967 under the Endangered Species Preservation Act of 1966 (Table 21). In 1994, the species was listed as endangered throughout its range under the ESA (38 FR 41370). Critical habitat has not been designated for shortnose sturgeon. Shortnose sturgeon occur along the Atlantic Coast of North America, from the St. John River in Canada to the St. Johns River in Florida.

Table 21. Shortnose sturgeon information bar.

Species	Common Name	Distinct Population Segment	ESA Status	Critical Habitat	Recovery Plan
Acipenser brevirostrum	Shortnose Sturgeon	N/A	Endangered 32 FR 4001 03/11/1967	--	63 FR 69613 Range-wide 1998

The shortnose sturgeon is the smallest of the three sturgeon species that occur in eastern North America; they grow up to 4.7 feet (1.4 meters) and weigh up to 50.7 pounds (23 kilograms). It has a short, conical snout with four barbells in front of its large underslung mouth. Five rows of bony plates (called scutes) occur along its body: one on the back, two on the belly, and one on each side. The body coloration is generally olive-yellow to gray or bluish on the back, and milky-white to dark yellow on the belly. The peritoneum (body cavity lining) is black.

6.2.9.1 Life History

Shortnose sturgeon populations show clinal variation, with a general trend of faster growth and earlier age at maturity in more southern systems. Fish in the southern portion of the range grow the fastest, but do not reach the larger size of fish in the northern part of the range that continue to grow throughout life. Male shortnose sturgeon mature at 2-3 years of age in Georgia, 3-5 years of age in South Carolina, and 10-11 years of age in the Saint John River, Canada. Females mature at 4-5 years of age in Georgia, 7-10 years of age in the Hudson River, and 12-18 years of age in the Saint John River, Canada. Males begin to spawn 1-2 years after reaching sexual maturity and spawn every 1-2 years (Dadswell 1979; Kieffer and Kynard 1996; NMFS 1998). Age at first spawning for females is about 5 years post-maturation with spawning occurring every 3-5 years (Dadswell 1979). Fecundity of shortnose sturgeon ranges between approximately 30,000-200,000 eggs per female (Gilbert 1989).

Adult shortnose sturgeon spawn in the rivers where they were born. Initiation of the upstream movement of shortnose sturgeon to spawn is likely triggered partially by water temperatures above 46°F [8°C (Dadswell 1979; Kynard 1997)]. This typically occurs during the late winter to early spring (December-March) in southern rivers (North Carolina and south) and the mid- to late spring in northern rivers. Southern populations of shortnose sturgeon usually spawn at least 125 miles (200 kilometers) upriver (Kynard 1997) or throughout the fall line zone if they are able to reach it. Substrate in spawning areas is usually composed of gravel, rubble, cobble, or large rocks (Dadswell 1979; Taubert and Dadswell 1980; Buckley and Kynard 1985; Kynard 1997), or timber, scoured clay, and gravel (Hall et al. 1991). Water depth and flow are also important parameters for spawning sites (Kieffer and Kynard 1996). Spawning sites are characterized by moderate river flows with average bottom velocities between 1 to 2.5 feet (0.4 to 0.8 meters) per second (Hall et al. 1991; Kieffer and Kynard 1996; NMFS 1998). Spawning in the southern rivers has been reported at water temperatures of 51°F (10.5°C) in the Altamaha River (Heidt and Gilbert 1978) and 48° to 54°F (9° to 12°C) in the Savannah River (Hall et al. 1991). In the southern portion of the range, adults typically spawn well upriver in the late winter to early spring and spend the rest of the year in the vicinity of the saltwater/freshwater interface (Collins and Smith 1993).

Little is known about young-of-the-year behavior and movements in the wild, but shortnose sturgeon at this age are believed to remain in channel areas within freshwater habitats upstream of the saltwater/freshwater interface for about 1 year, potentially due to their low tolerance for salinity (Dadswell et al. 1984; Kynard 1997). Residence of YOY in freshwater is supported by several studies on cultured shortnose sturgeon (Jenkins et al. 1993; Jarvis et al. 2001; Ziegeweid et al. 2008). In most rivers, juveniles aged 1 and older join adults and show similar patterns of habitat use (Kynard 1997). In the Southeast, juveniles aged 1 year and older make seasonal migrations like adults, moving upriver during warmer months where they shelter in deep holes, before returning to the fresh/saltwater interface when temperatures cool (Flournoy et al. 1992; Collins et al. 2002). Due to their low tolerance for high temperatures, warm summer temperatures (above 82°F) may severely limit available juvenile rearing habitat in some rivers in the southeastern United States. Juveniles in the Saint John, Hudson, and Savannah Rivers use deep channels over sand and mud substrate for foraging and resting (Pottle and Dadswell 1979; Hall et al. 1991; Dovel et al. 1992).

6.2.9.2 Population Dynamics

The following is a discussion of the species' population and its variance over time. This section is broken down into: abundance, population growth rate, genetic diversity, and spatial distribution as it relates to the shortnose sturgeon.

Abundance

No estimate of the historical population size of shortnose sturgeon is available. While the shortnose sturgeon was rarely the target of a commercial fishery, it often was taken incidentally in the commercial fishery for Atlantic sturgeon. In the 1950s, sturgeon fisheries declined on the east coast, which resulted in a lack of records of shortnose sturgeon. This led the Fish and

Wildlife Service (FWS) to conclude that the fish had been eliminated from the rivers in its historic range (except the Hudson River) and was in danger of extinction because of pollution and overfishing, both directly and incidentally.

Population Growth Rate

Annual variation in population estimates in many basins is due to changes in yearly capture rates, which are strongly correlated with weather conditions (river flow and water temperatures). In "dry years", fish move into deep holes upriver of the saltwater/freshwater interface, which can make them more susceptible to gillnet sampling. Consequently, rivers with limited data sets among years and limited sampling periods within a year may not offer a realistic representation of the size or trend of the shortnose sturgeon population in the basin. As a whole, the data on shortnose sturgeon populations is rather limited and some of the differences observed between years may be an artifact of the models and assumptions used by the various studies. Long-term data sets and an open population model would likely provide for more accurate population estimates across the species range, and could provide the opportunity to more closely link strong-year classes to habitat conditions.

The persistence of a species is dependent on the existence of metapopulations. As demonstrated there are 3 metapopulations of shortnose sturgeon. These 3 metapopulations of shortnose sturgeon should not be considered collectively but as individual units of management as each metapopulation is reproductively isolated from the other and therefore, constitutes an evolutionarily (and likely an adaptively) significant lineage. The loss of any metapopulation would result in the loss of evolutionarily significant biodiversity and would result in a significant gap(s) in the species' range. Loss of the southern shortnose sturgeon metapopulation would result in the loss of the southern half of the species' range (i.e., there is no known reproduction south of the Delaware River). Loss of the mid-Atlantic metapopulation (Virginian Province) would create a conspicuous discontinuity in the range of the species from the Hudson River to the northern extent of the Southern metapopulation. The northern metapopulation constitutes the northernmost portion of the U.S. range. Loss of this metapopulation would result in a significant gap in the range that would serve to isolate the shortnose sturgeon that reside in Canada from the remainder of the species' range in the United States. The loss of any metapopulation would result in a decrease in spatial range, biodiversity, unique haplotypes, adaptations to climate change, and gene plasticity. Loss of unique haplotypes that may carry geographic specific adaptations would lead to a loss of genetic plasticity and, in turn, decrease adaptability. The loss of any metapopulation would increase species' vulnerability to stochastic events.

Genetic Diversity

The 1998 shortnose sturgeon recovery plan identified 19 distinct shortnose sturgeon populations based on natal rivers. Since 1998, significantly more tagging/tracking data on straying rates to adjacent rivers has been collected, and several genetic studies have determined where coastal migrations and effective movement (i.e., movement with spawning) are occurring. New genetic analyses aided in identifying population structure across the range of shortnose sturgeon. Several studies (Wirgin et al. 2000; King et al. 2001; Waldman et al. 2002; Wirgin et al. 2005; Wirgin et al. 2009) indicate that most, if not all, shortnose sturgeon riverine populations are statistically different ($p < 0.05$), based on tests using both mitochondrial and nuclear DNA genetic markers. That is, while shortnose sturgeon tagged in one river may later be recaptured in another, it is likely that the individuals are not spawning in those non-natal rivers, as gene flow is known to be low between riverine populations. This is consistent with our knowledge that adult shortnose sturgeon are known to return to their natal rivers to spawn. However, Wirgin et al. (2009) provide evidence that greater mixing of riverine populations occurs in areas where the distance between adjacent river mouths is relatively close, such as in the Southeast.

Significant levels of genetic diversity are present in the shortnose sturgeon genome. Characterization of genetic differentiation (haplotype frequency) and estimates of gene flow (genetic distance) provide a quantitative measure to investigate population structure across the range of the shortnose sturgeon and determine their reproductive isolation or connection. Researchers have identified levels of genetic differentiation that indicate high degrees of reproductive isolation in at least three groupings (i.e., metapopulations) of shortnose sturgeon. Genetic analyses grouped shortnose sturgeon populations in the Southeast into one metapopulation. Wirgin et al. (2009) note that genetic differentiation among populations within the Carolinian Province was considerably less pronounced than among those in the other two provinces and contemporary genetic data suggest that reproductive isolation among these populations is less than elsewhere.

Distribution

Historically, shortnose sturgeon were found in the coastal rivers along the east coast of North America from the Saint John River, New Brunswick, Canada, to the St. Johns River, Florida, and perhaps as far south as the Indian River in Florida (Evermann and Bean 1898; Gilbert 1989). Currently, the distribution of shortnose sturgeon across their range is disjunctive, with northern populations separated from southern populations by a distance of about 250 miles (400 kilometers) near their geographic center in Virginia. In the southern portion of the range, they are currently found in the Cooper, Altamaha, Ogeechee, and Savannah Rivers in Georgia. While it had been concluded that shortnose sturgeon are extinct from the Satilla River in Georgia, the St. Marys River along the Florida and Georgia border, and the St. Johns River in Florida (Rogers and Weber; 1995, Kahnle et al.; 1998, and Collins et al. 2000), recent targeted surveys in both the Satilla and St. Mary's have captured shortnose sturgeon. A single specimen was found in the St. Johns River by the Florida Fish and Wildlife Conservation Commission during extensive sampling of the river in 2002 and 2003.

6.2.9.3 Status

Shortnose sturgeon continued to meet the listing criteria as "endangered" under subsequent definitions specified in the 1969 Endangered Species Conservation Act and remained on the list with the inauguration of the ESA in 1973. NMFS assumed jurisdiction for shortnose sturgeon from USFWS in 1974 (39 FR 41370). The shortnose sturgeon currently remains listed as an endangered species throughout all of its range along the east coast of the United States and Canada. A recovery plan for shortnose sturgeon was published by NMFS in 1998 (63 FR 69613).

6.2.9.4 Status Within the Action Area

The current status of the shortnose sturgeon in the Southeast is variable. Populations within the southern metapopulation are relatively small compared to their northern counterparts. Altamaha River supports the largest known shortnose sturgeon population in the Southeast with successful self-sustaining recruitment. Population estimates for shortnose sturgeon in the Altamaha have been calculated several times since 1993. Total population estimates in the Altamaha show large interannual variation is occurring; estimates have ranged from as low as 468 fish in 1993 to over 6,300 fish in 2006 (NMFS 1998; DeVries 2006). The Ogeechee River is the next most-studied river south of Chesapeake Bay, and abundance estimates indicate that the shortnose sturgeon population in this river is considerably smaller than that in the Altamaha River. The highest point estimate in 1993 using a modified Schnabel technique resulted in a total Ogeechee River population estimate of 361 shortnose sturgeon (95 percent confidence interval: 326 to 400). In contrast, the most recent survey resulted in an estimate of 147 shortnose sturgeon (95 percent confidence interval: 104-249), suggesting that the population may be declining. Spawning is also occurring in the Savannah River, the Cooper River, the Congaree River, and the Yadkin-Pee Dee River. The Savannah River shortnose sturgeon population, possibly the second largest in the Southeast with an estimated 1,000 to 3,000 adults, is facing many environmental stressors and spawning is likely occurring in only a very small area. While active spawning is occurring in South Carolina's Winyah Bay complex (Black, Sampit, Yadkin-Pee Dee, and Waccamaw Rivers) the population status there is unknown. Status of the other riverine populations supporting the southern metapopulation is unknown due to limited survey effort, with capture in some rivers limited to less than five specimens.

6.2.9.5 Critical Habitat

No critical habitat has been designated for shortnose sturgeon.

6.2.9.6 Recovery Plan

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.

6.2.10 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 U.S. Fish and Wildlife Service jointly manage Gulf sturgeon. In riverine habitats, the U.S. Fish and Wildlife Service is responsible for all consultations regarding Gulf sturgeon and critical habitat. In estuarine habitats, responsibility is divided based on the action agency involved. The U.S. Fish and Wildlife Service consults with the Department of Transportation, the Environmental Protection Agency, the U.S. Coast Guard, and the Federal Emergency Management Agency; NMFS consults with the Department of Defense, U.S. Army Corps of Engineers, the 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. In 2009, NMFS and the U.S. Fish and Wildlife Service conducted a five-year review and found Gulf sturgeon continued to meet the definition of a threatened species (USFWS and NMFS 2009).

Table 22. Gulf Sturgeon information bar.

Species	Common Name	Distinct Population Segment	ESA Status	Critical Habitat	Recovery Plan
Acipenser oxyrinchus desotoi	Gulf Sturgeon	Subspecies of Atlantic sturgeon	Threatened 56 FR 49653 09/30/1991	68 FR 13370 03/19/2003	FR Notice Not Available Range-wide 1995

6.2.10.1 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 to 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 3-5 years (Huff 1975; Fox et al. 2000).

Gulf sturgeon move from the Gulf of Mexico into coastal rivers in early spring (i.e., March through May). Fox et al. (2000) found water temperatures at time of river entry differed significantly by reproductive stage and sex. Individuals entered the river system when water temperatures ranged anywhere between 11.2°C and 27.1°C. Spawning occurs in the upper reaches of rivers in the spring when water temperature is around 15°C to 20°C. While Sulak and Clugston (1999) suggest that sturgeon spawning activity is related to moon phase, other researchers have found little evidence of spawning associated with lunar cycles (Slack et al. 1999; Fox et al. 2000). 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 (Vladykov and Greely 1963; Huff 1975). 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. Published research on the life history of younger Gulf sturgeon is limited. After hatching, young-of-year (YOY) 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 percent (860 of 4,100 fish) were later recaptured in the river of their initial collection, 8 fish (0.2 percent) moved between river systems, and the remaining fish (78.8 percent) have not yet been recaptured (USFWS and GSMFC 1995). There is no information documenting the presence of spawning adults in non-natal rivers. However, there is some evidence of movements by both male and female Gulf sturgeon (n = 22) from natal rivers into non-natal rivers (Wooley and Crateau 1985; Carr et al. 1996; Craft et al. 2001; Ross et al. 2001; Fox et al. 2002).

After spawning, Gulf sturgeon move downstream to areas referred to as “summer resting” or “holding” areas. Adults and subadults are not distributed uniformly throughout the river, but instead show a preference for these discrete holding areas usually located in the lower and middle river reaches (Hightower et al. 2002). While it was suggested these holding areas were sought for cooler water temperatures (Chapman and Carr 1995; Carr et al. 1996), Hightower et al. (2002) found that water temperatures in holding areas where Gulf sturgeon were repeatedly found in the Choctawhatchee River were similar to temperatures where sturgeon were only occasionally found elsewhere in the river.

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 (Huff 1975; Wooley and Crateau 1985; Foster and Clugston 1997). Because the adult and large subadult sturgeon have spent at least 6 months fasting or foraging sparingly on detritus (Mason Jr. and Clugston) 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. 2003; Edwards et al. 2007).

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 (Odenkirk 1989; Clugston et al. 1995; Fox et al. 2002). Tagged fish have been located in well-oxygenated shallow water (less than 7 meters) areas that support burrowing macro invertebrates (Fox and Hightower 1998; Craft et al. 2001; Parauka et al. 2001; Ross et al. 2001; Fox et al. 2002; Rogillio et al. 2007; Ross et al. 2009). These areas may include shallow shoals 5 to 7 feet (1.5 to 2.1 meters), deep holes near passes (Craft et al. 2001), unvegetated sand habitats such as sandbars, and intertidal and subtidal energy zones (Menzel 1971; Abele and Kim 1986; 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 to 6 feet (2 to 3 meters) (Parauka et al. 2001; Fox et al. 2002). 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 (Menzel 1971; Abele and Kim 1986; Williams et al. 1989). 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, mollusks, and crustaceans (Huff 1975; Mason Jr. and Clugston 1993; Carr et al. 1996; Fox et al. 2002). Generally, Gulf sturgeon prey are burrowing species that feed on detritus and/or suspended particles, and inhabit sandy substrate. In the river, YOY sturgeon eat aquatic invertebrates and detritus (Mason Jr. 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 Jr. and Clugston 1993). Adults forage sparingly in freshwater and depend almost entirely on estuarine and marine prey for their growth (Gu et al. 2001). Both adult and subadult Gulf sturgeon are known to lose up to 30 percent of their total body weight while in fresh water, and subsequently compensate the loss during winter feeding in marine areas (Carr 1983; Wooley and Crateau 1985; Clugston et al. 1995; Morrow et al. 1998; Heise et al. 1999; Sulak and Clugston 1999).

6.2.10.2 Population Dynamics

The following is a discussion of the species' population and its variance over time. This section is broken down into: abundance, population growth rate, genetic diversity, and spatial distribution as it relates to the Gulf sturgeon.

Abundance

Abundance of Gulf sturgeon is measured at the riverine scale. Currently, seven rivers are known to support reproducing populations of Gulf sturgeon: Pearl, Pascagoula, Escambia, Yellow, Choctawhatchee, Apalachicola, and Suwannee. Gulf sturgeon abundance estimates by river and year for the seven known reproducing populations. The number of individuals within each riverine population is variable across their range, but generally over the last decade (USFWS and NMFS 2009), populations in the eastern part of the range (Suwannee, Apalachicola Choctawhatchee) appear to be relatively stable in number or have a slightly increasing population trend. In the western portion of the range, populations in the Pearl and Pascagoula Rivers, have never been nearly as abundant as those to the east, and their current status, post-hurricanes Katrina and Rita, is unknown as comprehensive surveys have not occurred.

Population Growth Rate

Both acute and episodic events are known to impact individual populations of Gulf sturgeon that in turn, affect overall population numbers. For example, on August 9, 2011, an overflow of "black liquor" (an extremely alkaline waste byproduct of the paper industry) was accidentally released by a paper mill into the Pearl River near Bogalusa, Louisiana, that may have affected the status and abundance of the Pearl River population. While paper mills regularly use acid to balance the black liquor's pH before releasing the material, as permitted by the Louisiana Department of Environmental Quality, this material released was not treated. The untreated waste byproduct created a low oxygen ("hypoxic") environment lethal to aquatic life. These hypoxic conditions moved downstream of the release site killing fish and mussels in the Pearl River over several days. Within a week after the spill, the dissolved oxygen concentrations returned to normal in all areas of the Pearl River tested by Louisiana Department of Wildlife and Fisheries. The investigation of fish mortality began on August 13, 2011, several days after the spill occurred. Twenty-eight Gulf sturgeon carcasses (38 to 168 centimeters TL) were collected in the Pearl River after the spill (Sanzenbach 2011a, b) and anecdotal information suggests many other Gulf sturgeon carcasses were not collected. The smaller fish collected represent young-of-year and indicate spawning is likely occurring in the Pearl River. The spill occurred during the time when Gulf sturgeon were still occupying the freshwater habitat. Because the materials moved downriver after the spill, the entire Pearl River population of Gulf sturgeon was likely impacted.

Genetic Diversity

Gene flow is low in Gulf sturgeon stocks, with each stock exchanging less than one mature female per generation (Waldman and Wirgin 1998). Genetic studies confirm that Gulf sturgeon exhibit river-specific fidelity. Stabile et al. (1996) analyzed tissue taken from Gulf sturgeon in 8 drainages along the Gulf of Mexico for genetic diversity and noted significant differences among Gulf sturgeon stocks, which suggests region-specific affinities and likely river-specific fidelity. Five regional or river-specific stocks (from west to east) have been identified: (1) Lake Pontchartrain and Pearl River, (2) Pascagoula River, (3) Escambia and Yellow Rivers, (4) Choctawhatchee River, and (5) Apalachicola, Ochlockonee, and Suwannee Rivers (Stabile et al. 1996).

Distribution

Gulf sturgeon are found in river systems from Louisiana to Florida, in nearshore bays and estuaries, and in the Gulf of Mexico.

6.2.10.3 Status

The 1991 listing rule (56 FR 49653) for Gulf sturgeon cited the following impacts and threats: (1) Dams on the Pearl, Alabama, and Apalachicola Rivers; also on the North Bay arm of St. Andrew Bay; (2) Channel improvement and maintenance activities: dredging and de-snagging;

(3) Water quality degradation, and (4) Contaminants. In 2009, NMFS and USFWS conducted a five-year review of the Gulf sturgeon and identified several new threats to the Gulf sturgeon (USFWS and NMFS 2009).

6.2.10.4 Status Within the Action Area

The Gulf sturgeon population is estimated to number approximately 19,000 individuals. The number of individuals within each riverine population is variable across their range, but generally over the last decade (USFWS and NMFS 2009), populations in the eastern part of the range (Suwannee, Apalachicola Choctawhatchee) appear to be relatively stable in number or have a slightly increasing population trend. Recovery of depleted populations is an inherently slow process for a late-maturing species such as Gulf sturgeon. Their late age at maturity provides more opportunities for individuals to be removed from the population before reproducing. While a long life span also allows multiple opportunities to contribute to future generations, this is hampered within the species' range by habitat alteration, pollution, and bycatch.

6.2.10.5 Critical Habitat

In 2003, NMFS and the USFWS jointly designated Gulf sturgeon critical habitat in fourteen geographic areas from Florida to Louisiana, encompassing spawning rivers and adjacent estuarine areas.

6.2.10.6 Recovery Plan

On September 30, 1991, the Gulf sturgeon was listed as a threatened species under the Endangered Species Act (56 FR 49653). In 1995, a recovery/ management plan was published for the Gulf Sturgeon. In addition, all U.S. fisheries for the Gulf sturgeon have been closed. The following are priority-one recovery tasks:

1) Develop and implement standardized population sampling and monitoring techniques.
2) Develop and implement regulatory framework to eliminate introductions of nonindigenous stock or other sturgeon species.
3) Reduce or eliminate incidental mortality.
4) Restore the benefits of natural riverine habitats.
5) Utilize existing authorities to protect habitat and where inadequate, recommend new laws and regulations.

7 ENVIRONMENTAL BASELINE

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 (50 C.F.R. §402.02).

7.1 Climate Change

There is no question that our climate is changing. The globally-averaged combined land and ocean surface temperature data, as calculated by a linear trend, show a warming of approximately 0.85° Celsius over the period 1880 to 2012 (IPCC 2014). Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850 (IPCC 2014). Burning fossil fuels has increased atmospheric carbon dioxide concentrations by 35 percent with respect to pre-industrial levels, with consequent climatic disruptions that include a higher rate of global warming than occurred at the last global-scale state shift (the last glacial-interglacial transition, approximately 12,000 years ago) (Barnosky et al. 2012). Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90 percent of the energy accumulated between 1971 and 2010 (IPCC 2014). It is virtually certain that the upper ocean (zero to 700 meters) warmed from 1971 to 2010 and it likely warmed between the 1870s and 1971 (IPCC 2014). On a global scale, ocean warming is largest near the surface, and the upper 75 meters warmed by 0.11° Celsius per decade over the period 1971 to 2010 (IPCC 2014). There is high confidence, based on substantial evidence, that observed changes in marine systems are associated with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels, and circulation. Higher carbon dioxide concentrations have also caused the ocean rapidly to become more acidic, evident as a decrease in pH by 0.05 in the past two decades (Doney 2010).

This climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine ecosystems in the near future. It is most likely to have the most pronounced effects on species whose populations are already in tenuous positions (Isaac 2009). As such, we expect the extinction risk of ESA-listed species to rise with global warming. Primary effects of climate change on individual species include habitat loss or alteration, distribution changes, altered and/or reduced distribution and abundance of prey, changes in the abundance of competitors and/or predators, shifts in the timing of seasonal activities of species, and geographic isolation or extirpation of populations that are unable to adapt. Secondary effects include increased stress, disease susceptibility, and predation.

The Northern Hemisphere (where a greater proportion of ESA-listed species occur) is warming faster than the Southern Hemisphere, although land temperatures are rising more rapidly than over the oceans (Poloczanska et al. 2009). In the western North Atlantic, sea surface temperatures have been unusually warm in recent years (Blunden and Arndt 2016). A study by (Polyakov et al. 2010), suggests that the North Atlantic overall has been experiencing a general warming trend over the last 80 years of 0.031 ± 0.006 ºCelsius per decade in the upper 2,000 meters of the ocean. The ocean along the United States eastern seaboard is also much saltier than historical averages (Blunden and Arndt 2014). The direct effects of climate change will result in increases in atmospheric temperatures, changes in sea surface temperatures, patterns of precipitation, and sea level.

For sea turtles, temperature regimes generally lead toward female-biased nests (Hill et al. 2015). Acevedo-Whitehouse and Duffus (2009) proposed that the rapidity of environmental changes, such as those resulting from global warming, can harm immunocompetence and reproductive parameters in wildlife to the detriment of population viability and persistence. An example of this is the altered sex ratios observed in sea turtle populations worldwide (Mazaris et al. 2008; Reina et al. 2009; Robinson et al. 2009; Fuentes et al. 2010).

This does not appear to have yet affected population viabilities through reduced reproductive success, although nesting and emergence dates of days to weeks in some locations have changed over the past several decades (Poloczanska et al. 2009). Altered ranges can also result in the spread of novel diseases to new areas via shifts in host ranges (Simmonds and Eliott 2009; Schumann et al. 2013).

Changes in global climatic patterns will likely have profound effects on the coastlines of every continent by increasing sea levels and the intensity, if not the frequency, of hurricanes and tropical storms (Wilkinson and Souter 2008). A half-degree-Celsius increase in temperatures during hurricane season from 1965-2005 correlated with a 40 *percent* increase in cyclone activity in the Atlantic. Sea levels have risen an average of 1.7 mm/year over the 20th century due to glacial melting and thermal expansion of ocean water; this rate will likely increase. The current pace is nearly double this, with a 20-year trend of 3.2 mm/year (Blunden and Arndt 2014). This is largely due to thermal expansion of water, with minor contributions from melt water (Blunden and Arndt 2014). Based on computer models, these phenomena would inundate nesting beaches of sea turtles, change patterns of coastal erosion and sand accretion that are necessary to maintain those beaches, and would increase the number of turtle nests destroyed by tropical storms and hurricanes (Wilkinson and Souter 2008). Inundation itself reduces hatchling success by creating hypoxic conditions within inundated eggs (Pike et al. 2015). In addition, flatter beaches preferred by smaller sea turtle species would be inundated sooner than would steeper beaches preferred by larger species (Hawkes et al. 2014). The loss of nesting beaches, by itself, would have catastrophic effects on sea turtle populations globally if they are unable to colonize new beaches that form or if the beaches do not provide the habitat attributes (sand depth, temperature regimes, refuge) necessary for egg survival. In some areas, increases in sea level alone may be sufficient to inundate sea turtle nests and reduce hatching success (Caut et al. 2009). Storms may also cause direct harm to sea turtles, causing “mass” strandings and mortality (Poloczanska et al. 2009). Increasing temperatures in sea turtle nests alters sex ratios, reduces incubation times (producing smaller hatchling), and reduces nesting success due to exceeded thermal tolerances (Fuentes et al. 2009; Fuentes et al. 2010; Fuentes et al. 2011). Smaller individuals likely experience increased predation (Fuentes et al. 2011).

In addition to the anthropogenic effects, changes to the global climate are likely to be a threat to smalltooth sawfish and the habitats they use. The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts to coastal resources may be significant. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, changes in the amount and timing of precipitation, and changes in air and water temperatures (EPA 2012; NOAA 2012). The impacts to smalltooth sawfish cannot, for the most part, currently be predicted with any degree of certainty, but we can project some effects to the coastal habitats where they reside. We know that the coastal habitats that contain red mangroves and shallow, euryhaline waters will be directly impacted by climate change through sea level rise, which is expected to exceed 1 meter globally by 2100 according to Meehl et al. (2007), Pfeffer et al. (2008), and Vermeer and Rahmstorf (2009). Sea level rise will impact mangrove resources, as sediment surface elevations for mangroves will not keep pace with conservative projected rates of elevation in sea level (Gilman et al. 2008). Sea level increases will also affect the amount of shallow water available for juvenile smalltooth sawfish nursery habitat, especially in areas where there is shoreline armoring (e.g., seawalls). Further, the changes in precipitation coupled with sea level rise may also alter salinities of coastal habitats, reducing the amount of available smalltooth sawfish nursery habitat.

The South Atlantic and Carolina Atlantic Sturgeon DPSs, shortnose sturgeon, and Gulf sturgeon are all within a region the Intergovernmental Panel on Climate Change (IPCC) predicts will experience overall climatic drying (IPCC 2008). All sturgeon species are already susceptible to reduced water quality resulting from inputs of nutrients; contaminants from industrial activities and non-point sources; and interbasin transfers of water. The IPCC report projects with high confidence that higher water temperatures and changes in extremes in this region, including floods and droughts, will affect water quality and exacerbate many forms of water pollution—from sediments, nutrients, dissolved organic carbon, pathogens, pesticides, and salt, as well as thermal pollution—with possible negative impacts on ecosystems (IPCC 2008). In addition, sea level rise is projected to extend areas of salinization of groundwater and estuaries, resulting in a decrease of freshwater availability for humans and ecosystems in coastal areas. Some of the most populated areas of this region are low-lying, and the threat of salt water entering into its aquifers with projected sea level rise is a concern (USGRG 2004). Existing water allocation issues would be exacerbated, leading to an increase in reliance on interbasin water transfers to meet municipal water needs, further stressing water quality. Dams, dredging, and poor water quality have already modified and restricted the extent of suitable habitat for Atlantic sturgeon spawning and nursery habitat. Changes in water availability (depth and velocities) and water quality (temperature, salinity, DO, contaminants, etc.) in rivers and coastal waters inhabited by Atlantic sturgeon resulting from climate change will further modify and restrict the extent of suitable habitat for the South Atlantic and Carolina DPSs. Effects could be especially harmful since these populations have already been reduced to low numbers, potentially limiting their capacity for adaptation to changing environmental conditions (Salwasser et al. 1984; Belovsky 1987; Soulé 1987; Thomas 1990). The Southeast has experienced an ongoing period of drought since 2007.

During this time, South Carolina experienced drought conditions that ranged from moderate to extreme (SCSCO 2008). From 2006 until mid-2009, Georgia experienced the worst drought in its history. In September 2007, many of Georgia's rivers and streams were at their lowest levels ever recorded for the month, and new record low daily stream flows were recorded at 15 rivers with 20 or more years of data in Georgia (USGS 2007). The drought worsened in September 2008. All streams in Georgia except those originating in the extreme southern counties were extremely low. While Georgia has periodically undergone periods of drought—there have been 6 periods of drought lasting from 2-7 years since 1903 (USGS 2000)—drought frequency appears to be increasing (Ruhl 2003). Abnormally low stream flows can restrict access by sturgeon to habitat areas and exacerbate water quality issues such as water temperature, reduced DO, nutrient levels, and contaminants.

7.2 Fisheries

Globally, 6.4 million tons of fishing gear is lost in the oceans every year (Wilcox et al. 2015). Fishery interaction remains a major factor in sea turtle recovery and, frequently, the lack thereof. It is estimated that 62,000 loggerhead sea turtles have been killed as a result of incidental capture and drowning in shrimp trawl gear in 2001 (Epperly et al. 2002). Although turtle excluder devices and other bycatch reduction devices have significantly reduced the level of bycatch to sea turtles and other marine species in U.S. waters, mortality still occurs in Gulf of Mexico waters. In addition to commercial bycatch, recreational hook-and-line interaction also occurs. Cannon and Flanagan (1996) reported that from 1993 to 1995, at least 170 Kemp's ridley sea turtles were hooked or tangled by recreational hook-and-line gear in the northern Gulf of Mexico. Of these, 18 were dead stranded turtles, 51 were rehabilitated turtles, five died during rehabilitation, and 96 were reported as released by fishermen.

7.2.1 Federal Activities

Threatened and endangered sea turtles are adversely affected by several types of fishing gears used throughout the action area. Gillnet, longline, other types of hook-and-line gear, trawl gear, and pot fisheries have all been documented as interacting with sea turtles. Available information suggests sea turtles can be captured in any of these gear types when the operation of the gear overlaps with the distribution of sea turtles. For all fisheries for which there is a fishery management plan (FMP) or for which any federal action is taken to manage that fishery, impacts have been evaluated under section 7. Formal section 7 consultation have been conducted on the following fisheries, occurring at least in part within the action area, found likely to adversely affect threatened and endangered sea turtles: Atlantic bluefish, Atlantic herring, Atlantic mackerel/squid/butterfish, Atlantic sea scallop, Atlantic swordfish/tuna/shark/billfish, coastal migratory pelagic, dolphin-wahoo, Gulf of Mexico reef fish, monkfish, Northeast multispecies, South Atlantic snapper-grouper, Southeast shrimp trawl, spiny dogfish, red crab, skate, commercial directed shark, summer flounder/scup/black sea bass fisheries, tilefish, Atlantic highly migratory species fishery, Gulf of Mexico /South Atlantic spiny lobster, and Gulf of

Mexico stone crab. An Incidental Take Statement has been issued for the take of sea turtles in each of the fisheries. A brief summary of each consultation is provided below but more detailed information can be found in the respective biological opinions.

NMFS found the operation of the Atlantic bluefish fishery was likely to adversely affect Kemp's ridley and loggerhead sea turtles, but not likely to jeopardize their continued existence (NMFS 2010a). The majority of commercial fishing activity in the North and Mid-Atlantic occurs in the late spring to early fall, when bluefish (and sea turtles) are most abundant in these areas (NMFS 2005).

NMFS' consultation on the Atlantic Herring fishery FMP concluded that the federal herring fishery may adversely affect loggerhead, leatherback, Kemp's ridley, and green sea turtles as a result of capture in gear used in the fishery, but not jeopardize their continued existence. NMFS currently authorizes the use of trawl, purse seine, and gillnet gear in the commercial herring fishery (64 FR 4030). There is no direct evidence of takes of ESA-listed species in the herring fishery from the NMFS sea sampling program. However, observer coverage of this fishery has been minimal. Sea turtles have been captured in comparable gear used in other fisheries that occur in the same area as the herring fishery. Consultation on the Atlantic herring fishery was reinitiated on March 23, 2005, due to new information on the effects of the fishery on the Gulf of Maine DPS of Atlantic salmon and sea turtles. That consultation was completed in February 2010 and determined that the herring fishery is not likely to adversely affect any ESA-listed species, including sea turtles. Murray (2006) estimated zero sea turtle takes in trawl gear by the Atlantic herring fishery. In addition, over the five-year period from 2004 to 2008, higher than normal observer coverage occurred in the herring fishery, without any observed takes of sea turtles.

The Atlantic mackerel/squid/butterfish fisheries are managed under a single FMP that includes both the short-finned squid and long-finned squid fisheries. The most recent biological opinion concluded that the continued authorization of the FMP was likely to adversely affect sea turtles, but not jeopardize their continued existence (NMFS 2010g). Trawl gear is the primary fishing gear for these fisheries, but several other types of gear may also be used, including hook-and-line, pot/trap, dredge, pound net, and bandit gear. Entanglements or entrapments of sea turtles have been recorded in one or more of these gear types.

It was previously believed that the Atlantic sea scallop fishery was unlikely to take sea turtles given differences in depth and temperature preferences for sea turtles and the optimal areas where the fishery occurs. However, after the reopening of a closed area in the mid-Atlantic, and the accumulation of more extensive observer effort, NMFS conducted a formal section 7 consultation on the fishery. NMFS concluded that operation of the fishery may adversely affect loggerhead, Kemp's ridley, green, and leatherback sea turtles as a result of capture in scallop dredge and/or trawl gear.

The Atlantic highly migratory species (HMS) pelagic fisheries for swordfish, tuna, and billfish are known to incidentally capture large numbers of sea turtles, particularly in the pelagic longline component. Pelagic longline, pelagic driftnet, bottom longline, and/or purse seine gear have all been documented taking sea turtles. A permanent prohibition on the use of driftnet gear in the swordfish fishery was published in 1999.

NMFS completed a consultation on the continued authorization of the coastal migratory pelagic fishery in the Gulf of Mexico and South Atlantic (NMFS 2007a). In the Gulf of Mexico, hook-and-line, gillnet, and cast net gears are used. Gillnets are the primary gear type used by commercial fishermen in the South Atlantic regions as well, while the recreational sector uses hook-and-line gear. The hook-and-line effort is primarily trolling. The biological opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by operation of the fishery. However, the proposed action was not expected to jeopardize the continued existence of any of these species.

The South Atlantic FMP for the dolphin-wahoo fishery was approved in December 2003. NMFS's consultation concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by the longline component of the fishery, but it was not expected to jeopardize their continued existence (NMFS 2003). In addition, pelagic longline vessels can no longer target dolphin-wahoo with smaller hooks because of hook size requirements in the pelagic longline fishery.

The incidental take for sea turtles specified in the February 2005 biological opinion on the Gulf of Mexico reef fish fishery was substantially exceeded in 2008 by the bottom longline component of the fishery. In May 2009, NMFS published an emergency rule, which was intended to reduce the number of sea turtle takes by the reef fish fishery in the short-term while the Gulf of Mexico Fishery Management Council develops long-term measures in Amendment 31 to the Reef Fish Fishery Management Plan. The new biological opinion, which considered the continued authorization of reef fish fishing under the Reef Fish Fishery Management Plan, including any measures proposed in Amendment 31, was completed October 2009.

The federal monkfish fishery occurs from Maine to the North Carolina/South Carolina border and is jointly managed by the New England Fishery Management Council and Mid-Atlantic Fishery Management Council, under the Monkfish FMP (NMFS 2010b). The current commercial fishery operates primarily in the deeper waters of the Gulf of Maine, Georges Bank, and southern New England, and effort has recently increased dramatically in the mid-Atlantic. The monkfish fishery uses several gear types that may entangle sea turtles, including gillnet, trawl gear and scallop dredges, which are the principal gear types that have historically landed monkfish. Monkfish (also known as "goosefish" or "angler") are found in inshore and offshore waters from the northern Gulf of St. Lawrence to Florida, although primarily distributed north of Cape Hatteras. As fishing effort moves further south, there is a greater potential for interactions with sea turtles.

Following an event in which over 200 sea turtle carcasses washed ashore in an area where large mesh gillnetting had been occurring, NMFS published new restrictions for the use of gill nets with larger than 8-inch stretched mesh, in the exclusive economic zone off of North Carolina and Virginia (67 FR 71895, December 3, 2002). This rule was in response to a direct need to reduce the impact of this fishery on sea turtles. The rule was subsequently modified on April 26, 2006, by modifying the restrictions to the use of gillnets with greater than or equal to 7-inch stretched mesh when fished in federal waters from the North Carolina/South Carolina border to Chincoteague, Virginia.

Multiple gear types are used in the Northeast Multispecies fishery FMP, which manages 15 different commercial fisheries. Data indicated that gear type of greatest concern is the sink gillnet gear, which has taken loggerhead and leatherback sea turtles (i.e., in buoy lines and/or net panels). The Northeast multi species sink gillnet fishery has historically occurred from the periphery of the Gulf of Maine to Rhode Island in water as deep as 360 feet. In recent years, more of the effort in the fishery has occurred in offshore waters and into the Mid-Atlantic. Participation in this fishery has declined because extensive groundfish conservation measures have been implemented; the latest of these occurring under Amendment 13 to the Multispecies FMP. Consultation on the Northeast Multispecies fishery was reinitiated on April 2, 2008, based on new information on the capture of loggerhead sea turtles in this fishery (NMFS 2010c).

The South Atlantic snapper-grouper fishery uses spear and powerhead, black sea bass pot, and hook-and-line gear. Hook-and-line gear used in the fishery includes commercial bottom longline gear and commercial and recreational vertical line gear (e.g., handline, bandit gear, and rod-and-reel). The consultation found only hook-and-line gear likely to adversely affect, green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles.

The Southeast shrimp trawl fishery affects more sea turtles than all other activities combined (NRC 1990). Revisions to the turtle exclusion device (TED) regulations (68 FR 8456, February 21, 2003), requiring larger openings in TEDs enhanced the TED effectiveness in reducing sea turtle mortality resulting from trawling. This determination was based, in part, on the opinion's analysis that shows the revised TED regulations are expected to reduce shrimp trawl related mortality by 94 percent for loggerheads and 97 percent for leatherbacks. Interactions between sea turtles and the shrimp fishery may also be declining because of reductions of fishing effort unrelated to fisheries management actions. In recent years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of recent hurricanes in the Gulf of Mexico have all impacting the shrimp fleets; in some cases reducing fishing effort by as much as 50 percent for offshore waters of the Gulf of Mexico (GMFMC 2007).

Indirect effects of shrimp trawling on sea turtles would include the disturbance of the benthic habitat by the trawl gear. The effect bottom trawls have on the seabed is mainly a function of bottom type. In areas where repeated trawling occurs, fundamental shifts in the structure of the benthic community have been documented (Auster et al. 1996) which may affect the availability of prey items for foraging turtles. The overall effect to benthic communities that may result from long-term and chronic disturbance from shrimp fishing is not understood and needs further evaluation.

The primary gear types for the spiny dogfish fishery are sink gillnets, otter trawls, bottom long line, and driftnet gear (NMFS 2010d). Spiny dogfish are landed in every state from Maine to North Carolina, throughout a broad area with the distribution of landings varying by area and season. During the fall and winter months, spiny dogfish are captured principally in Mid-Atlantic waters from New Jersey to North Carolina. During the spring and summer months, spiny dogfish are landed mainly in northern waters from NY to ME. Sea turtles can be incidentally captured in all gear sectors of this fishery. Although there have been delays in implementing the FMP, quota allocations are expected to be substantially reduced over the four and a half year rebuilding schedule; this should result in a substantial decrease in effort directed at spiny dogfish. The reduction in effort should be of benefit to protected turtle species by reducing the number of gear interactions that occur.

The red crab fishery is a pot/trap fishery that occurs in deep waters along the continental slope. There have been no recorded takes of ESA-listed species in the red crab fishery. However, given the type of gear used in the fishery, takes of loggerhead and leatherback sea turtles may be possible where gear overlaps with the distribution of ESA-listed species. The red crab commercial fishery has traditionally been composed of less than six vessels fishing trap gear. The fishery appears to have remained small (approximately two vessels) through the mid-1990's. But between 1995 and 2000 there were as many as five vessels with the capacity to land an average of approximately 78,000 pounds of red crab per trip. Following concerns that red crab could be overfished, an FMP was developed and became effective on October 21, 2002.

Traditionally, the main gear types used in the skate fishery (NMFS 2010h) include mobile otter trawls, gillnet gear, hook and line, and scallop dredges, although bottom trawling is by far the most common gear type with gillnet gear is the next most common gear type. The Northeast skate complex is comprised of seven different skate species. The seven species of skate are distributed along the coast of the northeast United States from the tide line to depths exceeding 700m (383 fathoms). There have been no recorded takes of ESA-listed species in the skate fishery. However, given that sea turtles interactions with trawl and gillnet gear have been observed in other fisheries, sea turtle takes in gear used in the skate fishery may be possible where the gear and sea turtle distribution overlap.

The commercial HMS Atlantic shark fisheries (NMFS 2008a) uses bottom longline and gillnet gear. The recreational sector of the fishery uses only hook-and-line gear. To protect declining shark stocks the proposed action seeks to greatly reduce the fishing effort in the commercial component of the fishery. These reductions are likely to greatly reduce the interactions between the commercial component of the fishery and sea turtles.

The Summer Flounder, Scup and Black Sea Bass fisheries (NMFS 2010e) are known to interact with sea turtles. Otter trawl gear is used in the commercial fisheries for all three species. Floating traps and pots/traps are used in the scup and black sea bass fisheries, respectively. Significant measures have been developed to reduce the take of sea turtles in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which would include fisheries for other species like scup and black sea bass). TEDs are required throughout the year for trawl nets fished from the North Carolina/South Carolina border to Oregon Inlet, North Carolina, and seasonally (March 16-January 14) for trawl vessels fishing between Oregon Inlet, North Carolina, and Cape Charles, Virginia.

The North Carolina inshore fall southern flounder gillnet fishery was identified as a source of large numbers of sea turtle mortalities in 1999 and 2000, especially loggerhead sea turtles. In 2001, NMFS issued an ESA section 10 permit to North Carolina with mitigated measures for the southern flounder fishery. Subsequently, the sea turtle mortalities in these fisheries were drastically reduced. The reduction of sea turtle mortalities in these fisheries reduces the negative effects these fisheries have on the environmental baseline.

The management unit for the tilefish fishery management plan is all golden tilefish under United States jurisdiction in the Atlantic Ocean north of the Virginia/North Carolina border. Tilefish have some unique habitat characteristics, and are found in a warm water band (8 to 18° C) approximately 250 to 1200 feet deep on the outer continental shelf and upper slope of the U. S. Atlantic coast. Because of their restricted habitat and low biomass, the tilefish fishery in recent years has occurred in a relatively small area in the Mid-Atlantic Bight, south of New England and west of New Jersey.

The Atlantic HMS and Associated Fisheries are known to take sea turtles via pelagic longline, pelagic driftnet, bottom longline, hand line (including bait nets), and/or purse seine gear. The opinion analyzed the effects of proposed regulatory modifications to the HMS fishery management plan that address the impacts of the HMS pelagic longline fishery on endangered green, hawksbill, Kemp's ridley, and leatherback sea turtles and on threatened loggerhead sea turtles. However, the proposed action was not expected to jeopardize the continued existence of any of these.

Based on limited observer data available, NMFS also anticipates that continued operation of the U.S. shark drift gillnet portion of the fishery would result in the capture of loggerhead sea turtles, leatherbacks, Kemp's ridley sea turtles, and hawksbill sea turtles. NMFS anticipates that continued operation of the bottom longline fishery component would result in the capture of loggerhead sea turtles, leatherback, Kemp's ridley, green, and hawksbill sea turtles. Since potential for take in other HMS fisheries is low, NMFS anticipated that the proposed action was not expected to jeopardize the continued existence of any of these.

The American lobster trap fishery has been identified as a source of gear causing injuries and mortality of loggerhead and leatherback sea turtles as a result of entanglement in buoy lines of the pot/trap gear (NMFS 2010f). Loggerhead or leatherback sea turtles caught/wrapped in the buoy lines of lobster pot/trap gear can die as a result of forced submergence or incur injuries leading to death as a result of severe constriction of a flipper from the entanglement. Given the seasonal distribution of loggerhead sea turtles in Mid-Atlantic and New England waters and the operation of the lobster fishery, loggerhead sea turtles are expected to overlap with the placement of lobster pot/trap gear in the fishery during the months of May through October in waters off of New Jersey through Massachusetts. Compared to loggerheads, leatherback sea turtles have a similar seasonal distribution in Mid-Atlantic and New England waters, but with a more extensive distribution in the Gulf of Maine. Therefore, leatherback sea turtles are expected to overlap with the placement of lobster pot/trap gear in the fishery during the months of May through October in waters off of New Jersey through Maine.

The commercial Gulf of Mexico/South Atlantic spiny lobster fishery (NMFS 2013b) consists of diving, bully net and trapping sectors; recreational fishers are authorized to use bully net and hand-harvest gears. The consultation determined that, although evidence that the commercial trap sector of the fishery adversely affects these species, the continued authorization of the fishery would not jeopardize the continued existence of green, hawks bill, Kemp's ridley leatherback, and loggerhead sea turtles.

The Gulf of Mexico stone crab fishery (NMFS 2013b) is unique in that only the claws of the crab are harvested (Muller et al. 2006). The fishery operates primarily nearshore and fishing techniques have changed little since the implementation of the federal Stone Crab Fishery Management Plan. The commercial and recreational fishery consists of trap/pot, and recreational hand harvest. Stone crab traps are known to adversely affect sea turtles via entanglement and forced submergence. The fishery is currently management through spatial-temporal closures, effort limitations, harvest limitations, permit requirements, trap construction requirements, and a passive trap limitation program managed by the State of Florida. Recreational fishers must follow the same guidelines as commercial fishers unless otherwise noted. The consultation determined the continued authorization of the fishery would not jeopardize the continued existence of green, hawksbill, Kemp's ridley leatherback, and loggerhead sea turtles.

Bycatch mortality is cited as the primary cause for the decline in smalltooth sawfish in the United States (NMFS 2010i). While there has never been a large-scale directed fishery, smalltooth sawfish easily become entangled in fishing gears (gill nets, otter trawls, trammel nets, and seines) directed at other commercial species, often resulting in serious injury or death (NMFS 2009). This has historically been reported in Florida (Snelson and Williams 1981), Louisiana (Simpfendorfer 2002) and Texas (Baughman 1943). For instance, one fisherman interviewed by Evermann and Bean (1897) reported taking an estimated 300 smalltooth sawfish in just one netting season in the Indian River Lagoon, Florida. In another example, smalltooth sawfish landings data gathered by Louisiana shrimp trawlers from 1945-1978, which contained both landings data and crude information on effort (number of vessels, vessel tonnage, number of gear units), indicated declines in smalltooth sawfish landings from a high of 34,900 pounds in

1949 to less than 1,500 pounds in most years after 1967. The Florida net ban passed in 1995 has led to a reduction in the number of smalltooth sawfish incidentally captured, "…by prohibiting the use of gill and other entangling nets in all Florida waters, and prohibiting the use of other nets larger than 500 square feet in mesh area in nearshore and inshore Florida waters" (FLA. CONST. art. X, §16). However, the threat of bycatch currently remains in commercial fisheries (e.g., South Atlantic shrimp fishery, Gulf of Mexico shrimp fishery, federal shark fisheries of the South Atlantic, and the Gulf of Mexico reef fish fishery), though anecdotal information collected by NMFS port agents suggest smalltooth sawfish captures are now rare.

Overutilization of Atlantic sturgeon, including Gulf and shortnose sturgeon, from directed fishing caused initial severe declines in Atlantic sturgeon populations in the Southeast, from which they have never rebounded. Further, continued overutilization of Atlantic sturgeon as bycatch in commercial fisheries is an ongoing impact to the South Atlantic and Carolina DPSs, as well as the shortnose and Gulf subpopulations. All sturgeon species are more sensitive to bycatch mortality because they are a long-lived species, have an older age at maturity, have lower maximum reproductive rates, and a large percentage of egg production occurs later in life. Based on these life history traits, Boreman (1997) calculated that Atlantic sturgeon can only withstand the annual loss of up to 5 percent of their population to bycatch mortality without suffering population declines. Mortality rates of Atlantic sturgeon taken as bycatch in various types of fishing gear range between 0 and 51 percent, with the greatest mortality occurring in sturgeon caught by sink gillnets. Atlantic sturgeon are particularly vulnerable to being caught in sink gillnets; therefore, fisheries using this type of gear account for a high percentage of Atlantic sturgeon bycatch. Little data exists on bycatch in the Southeast and high levels of bycatch underreporting are suspected. Further, a total population abundance for the DPSs are not available and it is therefore not possible to calculate the percentage of the DPSs subject to bycatch mortality based on the available bycatch mortality rates for individual fisheries. However, fisheries known to incidentally catch Atlantic sturgeon occur throughout the marine range of the species and in some riverine waters as well. Because Atlantic sturgeon mix extensively in marine waters and may access multiple river systems, they are subject to being caught in multiple fisheries throughout their range. In addition, stress or injury to Atlantic sturgeon taken as bycatch but released alive may result in increased susceptibility to other threats, such as poor water quality (e.g., exposure to toxins and low dissolved oxygen). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality.

7.2.2 State or Private Activities

Various fishing methods used in state fisheries, including trawling, pot fisheries, fly nets, and gillnets are known to incidentally take listed species, but information on these fisheries is sparse (NMFS SEFSC 2001). Although few of these state regulated fisheries are currently authorized to incidentally take listed species, several state agencies have approached NMFS to discuss applications for a section 10(a)(1)(B) incidental take permit. Since the NMFS issuance of a section 10(a)(1)(B) permit requires formal consultation under section 7 of the ESA, the effects of these activities are considered in section 7 consultation. Any fisheries that come under a section 10(a)(1)(B) permit in the future will likewise be subject to section 7 consultation. Although the past and current effects of these fisheries on listed species is currently not determinable, NMFS believes that ongoing state fishing activities may be responsible for seasonally high levels of observed stranding of sea turtles on both the Atlantic and Gulf of Mexico coasts. Most of the state data are based on extremely low observer coverage or sea turtles were not part of data collection; thus, these data provide insight into gear interactions that could occur but are not indicative of the magnitude of the overall problem. In addition to the lack of interaction data, there is another issue that complicates the analysis of impacts to sea turtles from these fisheries. Certain gear types may have high levels of sea turtle takes, but very low rates of serious injury or mortality. For example, the hook and line takes rarely result in death, but trawls and gillnets frequently do. Leatherbacks seem to be susceptible to a more restricted list of fisheries, while the hard shelled turtles, particularly loggerheads, seem to appear in data on almost all of the state fisheries.

Other state bottom trawl fisheries that are suspected of incidentally capturing sea turtles are the horseshoe crab fishery in Delaware and the whelk trawl fishery in South Carolina and Georgia. In South Carolina, the whelk trawling season opens in late winter and early spring when offshore bottom waters are greater than 55°F. One criterion for closure of this fishery is water temperature: whelk trawling closes for the season and does not reopen throughout the state until six days after water temperatures first reach 64°F in the Fort Johnson boat slip. Based on the South Carolina Department of Natural Resources Office of Fisheries Management data, approximately six days will usually lapse before water temperatures reach 68°F, the temperature at which sea turtles move into state waters. From 1996-1997, observers onboard whelk trawlers in Georgia reported a total of three Kemp's ridley, two green, and two loggerhead sea turtles captured in 28 tows for a catch per unit effort of 0.3097 turtles/100 ft. net hour. As of December 2000, turtle exclusion devices are required in Georgia state waters when trawling for whelk. Trawls for cannonball jellyfish and Florida try nets may also be a source of interactions.

A detailed summary of the gillnet fisheries currently operating along the mid-and southeast U.S. Atlantic coastline, which are known to incidentally capture loggerheads, can be found in the turtle expert working group report (2000). Although all or most nearshore gillnetting is prohibited by state regulations in state waters of South Carolina, Georgia, Florida, Louisiana, and Texas, gillnetting in other states' waters and in federal waters does occur. Of particular concern are the nearshore and inshore gillnet fisheries of the mid-Atlantic operating in Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, and North Carolina state waters and/or federal waters. Incidental captures in these gillnet fisheries (both lethal and non-lethal) of loggerhead, leatherback, green and Kemp's ridley sea turtles have been reported. In addition, illegal gillnet incidental captures have been reported in South Carolina, Florida, Louisiana and Texas (NMFS SEFSC 2001).

Georgia and South Carolina prohibit gillnets for all but the shad fishery. This fishery was observed in South Carolina for one season by the NMFS Southeast Fishery Science Center (McFee et al. 1996). No takes of protected species were observed. Florida banned all but very small nets in state waters, as has the state of Texas. Louisiana, Mississippi and Alabama have also placed restrictions on gillnet fisheries within state waters such that very little commercial gillnetting takes place in southeast waters, with the exception of North Carolina. Gillnetting activities in North Carolina associated with the southern flounder fishery had been implicated in large numbers of sea turtle mortalities. The Pamlico Sound portion of that fishery was closed and has subsequently been reopened under a section 10(a)(1)(B) permit.

Pound nets are a passive, stationary gear that are known to incidentally capture loggerhead sea turtles in Massachusetts, Rhode Island, New Jersey, Maryland, New York (Morreale and Standora 1998), Virginia (Bellmund et al. 1987) and North Carolina (Epperly et al. 2000). Although pound nets are not a significant source of mortality for loggerheads in New York (Morreale and Standora 1998) and North Carolina (Epperly et al. 2000), they have been implicated in the stranding deaths of loggerheads in the Chesapeake Bay from mid-May through early June (Bellmund et al. 1987). Pound net leaders with greater than or equal to 12 inches (30.5 cm) stretched mesh and leaders with stringers have been documented to incidentally take sea turtles (Bellmund et al. 1987; NMFS SEFSC 2001).

Incidental captures of loggerheads in fish traps set in Massachusetts, Rhode Island, New York, and Florida have been reported. Although no incidental captures have been documented from fish traps set in North Carolina and Delaware, they are another potential anthropogenic impact to loggerheads and other sea turtles. Lobster pot fisheries are prosecuted in Massachusetts (Prescott 1988), Rhode Island, Connecticut and New York. Although they are more likely to entangle leatherback sea turtles, lobster pots set in New York are also known to entangle loggerhead sea turtles. No incidental capture data exist for the other states. Long haul seines and channel nets in North Carolina are known to incidentally capture loggerhead and other sea turtles in the sounds and other inshore waters. No lethal takes have been reported (NMFS SEFSC 2001).

Recreational fishermen have reported hooking turtles when fishing from boats, piers, and beach, banks, and jetties. Commercial fishermen fishing for reef fish and for sharks with both single rigs and bottom longlines have also reported hooked turtles. A detailed summary of the known impacts of hook and line incidental captures to loggerhead sea turtles can be found in the Turtle Expert Working Group reports (TEWG 1998, 2000, 2007).

In addition to incidental bycatch in commercial fisheries, smalltooth sawfish have historically been and continue to be captured by recreational fishers. Encounter data (ISED 2014) and past research (Caldwell 1990) document that rostrums are sometimes removed from smalltooth sawfish caught by recreational fishers, thereby reducing their chances of survival. While the current threat of mortality associated with recreational fisheries is expected to be low given that possession of the species in Florida has been prohibited since 1992, bycatch in recreational fisheries remains a potential threat to the species.

7.3 Vessel Strikes

Potential sources of adverse effects from federal vessel operations in the action area and throughout the range of sea turtles include operations of the U.S. Navy and the U.S. Coast Guard, which maintain the largest Federal vessel fleets, the Environmental Protection Agency, NOAA, and the Army Corps of Engineers. NMFS has conducted formal consultations with the U.S. Navy and the U.S. Coast Guard, and NOAA on some, but not all their vessel operations. Through the ESA section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to ESA-listed species. At the present time, however, they present the potential for some level of interaction.

Vessel strikes are a poorly-studied threat, but have the potential to be an important source of mortality to sea turtle populations (Work et al. 2010). All sea turtles must surface to breathe, and several species are known to bask at the surface for long periods. Although sea turtles can move rapidly, sea turtles apparently are not able to avoid vessels moving at more than 4 kilometers/hour; most vessels move faster than this in open water (Hazel et al. 2007; Work et al. 2010).

Given the high level of vessel traffic in the Gulf of Mexico and along the Atlantic coast, frequent injury and mortality could affect sea turtles in the region. Hazel et al. (2007) suggested that green sea turtles may use auditory cues to react to approaching vessels rather than visual cues, making them more susceptible to strike as vessel speed increases. Each state along the east coast of the U.S. and the Gulf of Mexico has several hundred thousand recreational vessels registered, including Florida with nearly one million which is the highest number of registered boats in the United States (USCG 2003, 2005; NMMA 2007). Private and commercial vessel operations also have the potential to interact with sea turtles. For example, shipping traffic in Massachusetts Bay is estimated at 1,200 ship crossings per year with an average of three per day. Vessels servicing the offshore oil and gas industry are estimated to make 115,675 to 147,175 trips annually, and many commercial vessels travel to and from some of the largest ports in the United States (MMS 2007; USN 2008).

Sea turtles may also be harassed by the high level of helicopter activity over Gulf of Mexico waters. It is estimated that between roughly 900,000 and 1.5 million helicopter take-offs and landings are undertaken in association with oil and gas activities in the Gulf of Mexico annually (NRC 1990; USN 2008). This likely includes numerous overflights of sea turtles, an activity which has been observed to startle and at least temporarily displace sea turtles (USN 2009).

7.4 United States Military Activities

Naval activities conducted during training exercises in designated naval operating areas and training ranges have the potential to adversely affect sea turtles and sturgeon. Species occurring in the action area could experience stressors from several naval training ranges or facilities listed below. Listed individuals travel widely in the North Atlantic and could be exposed to naval activities in several ranges.

- The Virginia Capes, Cherry Point, and Jacksonville-Charleston Operating Areas, which are situated consecutively along the migratory corridor for sea turtles, and
- The Key West, Gulf of Mexico, Bermuda, and Puerto Rican Complexes have the potential to overlap the range of sea turtles species.

Naval activities to which individuals could be exposed include, among others, vessel and aircraft transects, munition detonations, and sonar use.

Anticipated impacts from harassment include changes from foraging, resting, and other behavioral states that require lower energy expenditures to traveling, avoidance, and behavioral states that require higher energy expenditures and, therefore, would represent significant disruptions of the normal behavioral patterns of the animals that have been exposed. Behavioral responses that result from stressors associated with these training activities are expected to be temporary and would not affect the reproduction, survival, or recovery of these species.

From 2009-2012, NMFS issued a series of biological opinions to the U.S. Navy for training activities occurring within their Virginia Capes, Cherry Point, and Jacksonville Range Complexes that anticipated annual levels of take of listed species incidental to those training activities through 2014. During the proposed activities 344 hardshell sea turtles (any combination of green, hawksbill, Kemp's ridley, olive ridley, or northwest Atlantic loggerhead sea turtles) per year were expected to be harassed as a result of their behavioral responses to mid- and high-frequency active sonar transmissions.

In 2013, NMFS issued a biological opinion to the U.S. Navy on all testing and training activities in the Atlantic basin and Gulf of Mexico (Table 19) (NMFS 2013a). These actions would include the same behavioral and hearing loss effects as described above, but would also include other sub-lethal injuries that lead to fitness consequences and mortality that can lead to the loss of individuals from their populations.

Table 23. Annual total of model-predicted impacts on sea turtles for training activities using sonar and other active non-implusive acoustic sources for United States Navy testing activities in the North Atlantic.

Sea turtle species	Harassment Temporary threshold shift	Injury Permanent threshold shift
Hardshell sea turtles	12,131	11
Kemp's ridley	263	0
Leatherback	8,806	9
Loggerhead	16,624	16

7.5 Dredging and Dams

Marine dredging vessels are common within U.S. coastal waters. Construction and maintenance of federal navigation channels and dredging in sand mining sites have been identified as sources of sea turtle mortality and are currently being undertaken along the U.S. East Coast, such as in Port Everglades, Florida. Hopper dredges in the dredging mode are capable of moving relatively quickly compared to sea turtle swimming speed and can thus overtake, entrain, and kill sea turtles as the suction draghead(s) of the advancing dredge catch up to resting or swimming turtles. Entrained sea turtles rarely survive. Relocation trawling frequently occurs in association with dredging projects to reduce the potential for dredging to injure or kill sea turtles (Dickerson et al. 2007). Dredging has been documented to capture or kill 168 sea turtles from 1995 to 2009 in the Gulf of Mexico, including 97 loggerheads, 35 Kemp's ridleys, 32 greens, and three unidentified sea turtles (USACE 2010).

Dams, dredging, poor water quality, and accidental catch (bycatch) by fisherman continue to threaten Atlantic sturgeon. Riverine, nearshore, and offshore areas are often dredged to support commercial shipping and recreational boating, construction of infrastructure, and marine mining. Environmental impacts of dredging include the direct removal/burial of organisms; turbidity/siltation effects; contaminant resuspension; noise/disturbance; alterations to hydrodynamic regime and physical habitat; and actual loss of riparian habitat (Chytalo 1996; Winger et al. 2000). According to Smith and Clugston (1997), dredging and filling impact important habitat features of Atlantic sturgeon as they disturb benthic fauna, eliminate deep holes, and alter rock substrates. Maintenance dredging is currently modifying Atlantic sturgeon nursery habitat in the Savannah River and modeling indicates that the proposed deepening of the navigation channel will result in reduced dissolved oxygen (DO) and upriver movement of the salt wedge, restricting spawning habitat. Dredging is also modifying nursery and foraging habitat in the Saint Johns River. Dredging in spawning and nursery grounds modifies the quality of the habitat and is further restricting the extent of available habitat in the Cape Fear and Cooper Rivers, where Atlantic sturgeon habitat has already been modified and restricted by the presence of dams.

Dams for hydropower generation, flood control, and navigation adversely affect shortnose sturgeon habitat by impeding access to spawning, developmental, and foraging habitat, modifying free-flowing rivers to reservoirs, physically damaging fish on upstream and downstream migrations, and altering water quality in the remaining downstream portions of spawning and nursery habitat. Fish passage has not proven very successful in minimizing the impacts of dams on shortnose sturgeon, as they do not regularly use existing fish passage devices, which are generally designed to pass pelagic fish (i.e., those living in the water column) rather than bottom-dwelling species like sturgeon. Dams have separated the shortnose sturgeon population in the Cooper River, trapping some above the structure while blocking access upstream to sturgeon below the dam. Telemetry studies indicate that shortnose sturgeon do not pass upriver through the vessel lock in the Pinopolis Dam on the Cooper River. Shortnose sturgeon have been documented entering the lock, but they have never passed into the reservoir, probably because there is a 40 foot (12 meter) vertical wall at the upstream end. Shortnose sturgeon inhabit only Lake Marion, the upper of the 2 reservoirs. There is currently no estimate for the portion of the population that inhabits the reservoirs and rivers above the dam. Riverine, nearshore, and offshore areas are often dredged to support commercial shipping and recreational boating, construction of infrastructure, and marine mining. Environmental impacts of dredging include the direct removal/burial of prey species; turbidity/siltation effects; contaminant resuspension; noise/disturbance; alterations to hydrodynamic regime and physical habitat; and actual loss of riparian habitat (Chytalo 1996; Winger et al. 2000). Dredging in spawning and nursery grounds modifies the quality of the habitat and further restricts the extent of available habitat in the Cooper and Savannah Rivers, where shortnose sturgeon habitat has already been modified and restricted by the presence of dams.

7.6 Entrainment, Entrapment, and Impingement in Power Plants

There are dozens of power plants in coastal areas of the action area, from South Carolina to Texas (Muyskens et al. 2015). Sea turtles have been affected by operation of cooling-water systems of electrical generating plants. We do not have data for many of these, but have reason to believe that impacts to particularly loggerhead and green sea turtles may be important. For example, in over 40 years of operation at the St. Lucie Nuclear Power Plant in Florida, 16,600 sea turtles have been captured to avoid being drawn into cooling structures (which likely would kill sea turtles that enter), and 297 have died (NMFS 2016a). These included: 9,552 loggerheads (including 180 mortalities), 6,886 green (including 112 mortalities), 42 leatherback (no mortalities), 67 Kemp’s ridley (including four mortalities), and 65 hawksbill sea turtles (including one mortality) (NMFS 2016a). Only since 2001 have the mortalities been classified as causally (or non-causally) related to operation of St. Lucie Nuclear Power Plant, and not all mortalities were causal to St. Lucie Nuclear Power Plant operations: 59 percent of dead loggerheads were causal to St. Lucie Nuclear Power Plant operation, 46 percent of greens, and none of hawksbills (no leatherback or Kemp’s ridley mortalities occurred since 2001) (NMFS 2016a).

Effects from cooling system operations generally involve stress, injury, and mortality from being captured, entrained, or impinged by cooling water intake systems. Cooling water discharge (which is warmer than the surrounding water temperature) can alter habitat around the outflow pipe. This can present advantages (such as shelter from cold water temperatures that may stun sea turtles and allow for unseasonal growth of marine plants that green sea turtles may forage upon) and disadvantages (such as altering normal ecology sea turtles and sturgeon rely upon and result in individuals depending on unnatural conditions that can be problematic if a plant is decommissioned or goes offline) for ESA-listed species.

7.7 Oil and Gas Exploration

The Army Corps of Engineers and the Minerals Management Service authorize oil and gas exploration, well development, production, and abandonment/rig removal activities that may adversely affect sea turtles. Both of these agencies have consulted numerously with the NMFS on these types of activities. These activities include the use of seismic arrays for oil and gas exploration in the Gulf of Mexico, the impacts have been analyzed during consultations for individual and multi-lease sales. NMFS anticipates incidental takes of sea turtles from vessel strikes, noise, marine debris, and the use of explosives to remove oil and gas structures.

The northern Gulf of Mexico is the location of massive industrial activity associated with oil and gas extraction and processing. Over 4,000 oil and gas structures are located outside of state waters in the northern Gulf of Mexico; 90 percent of these occur off Louisiana and Texas (USN 2009). This is both detrimental and beneficial for sea turtles. These structures appreciably increase the amount of hard substrate in the marine environment and provide shelter and foraging opportunities for species like loggerhead sea turtles (Parker Jr. et al. 1983; Stanley and Wilson 1989). However, the Bureau of Ocean Energy Management requires that structures must be removed within one year of lease termination. Many of these structures are removed by explosively severing the underwater supportive elements, which produces a shock wave that kills, injures, or disrupts marine life in the blast radius (Gitschlag et al. 1997).

For sea turtles, this means death or serious injury for individuals within a few hundred meters of the structure and overt behavioral (potentially physiological) impacts for individuals further away from the structure (Duronslet et al. 1986; Klima et al. 1988). Although observers and procedures are in place to mitigate impacts to sea turtles (i.e., not blasting when sea turtles are present), not all sea turtles are observed all the time, and low-level sea turtle injury and mortality still occurs (Gitschlag and Herczeg 1994; Gitschlag et al. 1997). Two loggerheads were killed in August 2010, and one Kemp’s ridley was killed in July 2013, along with several additional stunning or sub-lethal injuries reported over the past five years. In an August 28, 2006 opinion, NMFS issued incidental take for Bureau of Ocean Energy Management-permitted explosive structure removals (NMFS 2006a). These levels were far surpassed by the *Deepwater Horizon* incident.

7.8 Habitat Degradation

A number of factors may be directly or indirectly affecting ESA-listed species in the action area by degrading habitat. In-water construction activities (e.g., pile driving associated with shoreline projects) in both inland waters as well as coastal waters in the action area can produce sound levels sufficient to disturb sea turtles under some conditions. Pressure levels from 190-220 decibels re 1 micropascal were reported for piles of different sizes in a number of studies (NMFS 2006c). The majority of the sound energy associated with pile driving is in the low frequency range (less than 1,000 Hertz) (Reyff 2003; Illingworth Rodkin Inc. 2004), which is the frequency range at which sea turtles hear best. Dredging operations also have the potential to emit sounds at levels that could disturb sea turtles. Depending on the type of dredge, peak sound pressure levels from 100 to 140 dB re 1 micropascal were reported in one study (Clarke et al. 2003). As with pile driving, most of the sound energy associated with dredging is in the low-frequency range, less than 1,000 Hertz (Clarke et al. 2003).

Several measures have been adopted to reduce the sound pressure levels associated with in-water construction activities or prevent exposure of sea turtles to sound. For example, a six-inch block of wood placed between the pile and the impact hammer used in combination with a bubble curtain can reduce sound pressure levels by about 20 decibels (NMFS 2008b). Alternatively, pile driving with vibratory hammers produces peak pressures that are about 17 dB lower than those generated by impact hammers (Nedwell and Edwards 2002). Other measures used in the action area to reduce the risk of disturbance from these activities include avoidance of in-water construction activities during times of year when sea turtles may be present; monitoring for sea turtles during construction activities; and maintenance of a buffer zone around the project area, within which sound-producing activities would be halted when sea turtles enter the zone (NMFS 2008b).

Marine debris is a significant concern for listed species and their habitats. Marine debris accumulates in gyres throughout the oceans. The input of plastics into the marine environment also constitutes a significant degradation to the marine environment. In 2010, an estimated 4.8-12.7 million metric tons of plastic entered the ocean globally (Baulch and Simmonds 2015).

For sea turtles, marine debris is a problem due primarily to individuals ingesting debris and blocking the digestive tract, causing death or serious injury (Lutcavage et al. 1997; Laist et al. 1999). Schuyler et al. (2015) estimated that, globally, 52 percent of individual sea turtles have ingested marine debris. Gulko and Eckert (2003) estimated that between one-third and one-half of all sea turtles ingest plastic at some point in their lives; this figure is supported by data from Lazar and Gracan (2011), who found 35 percent of loggerheads had plastic in their gut. A Brazilian study found that 60 percent of stranded green sea turtles had ingested marine debris (Bugoni et al. 2001). Loggerhead sea turtles had a lesser frequency of marine debris ingestion. Plastic is possibly ingested out of curiosity or due to confusion with prey items. Marine debris consumption has been shown to depress growth rates in post-hatchling loggerhead sea turtles, elongating the time required to reach sexual maturity and increasing predation risk (McCauley and Bjorndal 1999). Sea turtles can also become entangled and die in marine debris, such as discarded nets and monofilament line (NRC 1990; Lutcavage et al. 1997; Laist et al. 1999).

Although beach nourishment, or placing sand on beaches, may provide more sand, the quality of that sand, and hence the nesting beach, may be less suitable than pre-existing natural beaches. Sub-optimal nesting habitat may cause decreased nesting success, place an increased energy burden on nesting females, result in abnormal nest construction, and reduce the survivorship of eggs and hatchlings (Mann 1978; Ackerman 1980; Mortimer 1990).

Beach armoring (e.g., bulkheads, seawalls, soil retaining walls, rock revetments, sandbags, and geotextile tubes) can impede a turtle's access to upper regions of the beach/dune system, thereby limiting the amount of available nesting habitat (Mazaris et al. 2009). Impacts also can occur if structures are installed during the nesting season. For example, unmarked nests can be crushed or uncovered by heavy equipment, nesting turtles and hatchlings can get caught in construction debris or excavations, and hatchlings can get trapped in holes or crevices of exposed riprap and geotextile tubes. In many areas of the world, sand mining (removal of beach sand for upland construction) seriously reduce or degrade/destroy sea turtle nesting habitats or interfere with hatchling movement to sea (NMFS 2003).

Modification and loss of smalltooth sawfish habitat, especially nursery habitat, is another contributing factor in the decline of the species. Activities such as agricultural and urban development, commercial activities, dredge-and-fill operations, boating, erosion, and diversions of freshwater runoff contribute to these losses (SAFMC 1998). Large areas of coastal habitat were modified or lost between the mid-1970s and mid-1980s within the United States (Dahl and Johnson 1991). Since then, rates of loss have decreased, but habitat loss continues. From 1998-2004, approximately 64,560 acres of coastal wetlands were lost along the Atlantic and Gulf coasts of the United States, of which approximately 2,450 acres were intertidal wetlands consisting of mangroves or other estuarine shrubs (Stedman and Dahl 2008). Further, Orlando Jr. et al. (1994) analyzed 18 major southeastern estuaries and recorded over 703 mi of navigation channels and 9,844 mi of shoreline with modifications. In Florida, coastal development often involves the removal of mangroves and the armoring of shorelines through seawall construction. Changes to the natural freshwater flows into estuarine and marine waters through construction of canals and other water control devices have had other impacts: altered the temperature, salinity, and nutrient regimes; reduced both wetlands and submerged aquatic vegetation; and degraded vast areas of coastal habitat utilized by smalltooth sawfish (Reddering 1988; Whitfield and Bruton 1989; Gilmore 1995). While these modifications of habitat are not the primary reason for the decline of smalltooth sawfish abundance, it is likely a contributing factor and almost certainly hampers the recovery of the species. Juvenile sawfish and their nursery habitats are particularly likely to be affected by these kinds of habitat losses or alternations, due to their affinity for shallow, estuarine systems. Although many forms of habitat modification are currently regulated, some permitted direct and/or indirect damage to habitat from increased urbanization still occurs and is expected to continue to threaten survival and recovery of the species in the future.

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

Low dissolved oxygen is modifying sturgeon habitat in the Savannah due to dredging, and nonpoint source inputs are causing low dissolved oxygen in the Ogeechee River and in the Saint Marys River, which completely eliminates juvenile nursery habitat in summer. Low dissolved oxygen has also been observed in the Saint Johns River in the summer. Reductions in water quality from terrestrial activities have modified habitat utilized by the Carolina DPS. In the Pamlico and Neuse systems, nutrient loading and seasonal anoxia are occurring, associated in part with concentrated animal feeding operations. Heavy industrial development and concentrated animal feeding operations have degraded water quality in the Cape Fear River. Water quality in the Waccamaw and Yadkin-Pee Dee Rivers has been affected by industrialization and riverine sediment samples contain high levels of various toxins, including dioxins.

Water allocation issues are a growing threat in the Southeast and exacerbate existing water quality problems. Taking water from one basin and transferring it to another fundamentally and irreversibly alters natural water flows in both the originating and receiving basins. This transfer can affect dissolved oxygen levels, temperature, and the ability of the basin of origin to assimilate pollutants (GWC 2006). Water quality within the river systems in the range of the shortnose sturgeon is negatively affected by large water withdrawals. Known water withdrawals of over 240 million gallons per day are permitted from the Savannah River for power generation and municipal uses. However, permits for users withdrawing less than 100,000 gallons per day are not required, so actual water withdrawals from the Savannah River and other rivers within the range of the shortnose sturgeon are likely much higher. The removal of large amounts of water from the system alters flows, temperature, and dissolved oxygen. Water shortages and “water wars” are already occurring in the rivers occupied by the shortnose sturgeon and will likely be compounded in the future by human population growth and potentially by climate change.

7.9 Pollutants

Coastal runoff, marina and dock construction, dredging, aquaculture, oil and gas exploration and extraction, increased under water noise and boat traffic can degrade marine habitats used by sea turtles (Colborn et al. 1996). The development of marinas and docks in inshore waters can negatively impact nearshore habitats. An increase in the number of docks built increases boat and vessel traffic. Fueling facilities at marinas can sometimes discharge oil, gas, and sewage into sensitive estuarine and coastal habitats. Although these contaminant concentrations do not likely affect the more pelagic waters, the species of turtles analyzed in this biological opinion travel between near shore and offshore habitats and may be exposed to and accumulate these contaminants during their life cycles.

There are studies on organic contaminants and trace metal accumulation in green and leatherback sea turtles (Aguirre et al. 1994; Corsolini et al. 2000). Mckenzie et al. McKenzie et al. (1999) measured concentrations of chlorobiphenyls and organochlorine pesticides in sea turtles tissues collected from the Mediterranean (Cyprus, Greece) and European Atlantic waters (Scotland) between 1994 and 1996. Omnivorous loggerhead turtles had the highest organochlorine contaminant concentrations in all the tissues sampled, including those from green and leatherback turtles (Storelli et al. 2008). It is thought that dietary preferences were likely to be the main differentiating factor among species. Decreasing lipid contaminant burdens with turtle size were observed in green turtles, most likely attributable to a change in diet with age.

Sakai et al (1995) found the presence of metal residues occurring in loggerhead turtle organs and eggs. Storelli et al. (1998) analyzed tissues from twelve loggerhead sea turtles stranded along the Adriatic Sea (Italy) and found that characteristically, mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals and porpoises (Law et al. 1991). No information on detrimental threshold concentrations are available, and little is known about the consequences of exposure of organochlorine compounds to sea turtles. Research is needed on the short- and long-term health and fecundity effects of chlorobiphenyl, organochlorine, and heavy metal accumulation in sea turtles.

The Gulf of Mexico is a sink for massive levels of pollution from a variety of marine and terrestrial sources, which ultimately can interfere with ecosystem health and particularly that of sea turtles. Sources include the petrochemical industry in and along the Gulf of Mexico, wastewater treatment plants, septic systems, industrial facilities, agriculture, animal feeding operations, and improper refuse disposal. The Mississippi River drains 80 percent of United States cropland (including the fertilizers, pesticides, herbicides, and other contaminants that are applied to it) and discharges into the Gulf of Mexico (MMS 1998). Agricultural discharges and discharges from large urban centers (e.g., Tampa) contribute contaminants as well as coliform bacteria to Gulf of Mexico habitats (Garbarino et al. 1995). These contaminants can be carried long distances from terrestrial or nearshore sources and ultimately accumulate in offshore pelagic environments (USCOP 2004). The ultimate impacts of this pollution are poorly understood.

Significant attention has been paid to nutrient enrichment of Gulf of Mexico waters, which leads to algal blooms (including harmful algal blooms), oxygen depletion, loss of seagrass and coral reef habitat, and the formation of a hypoxic “dead zone” (USCOP 2004). This hypoxic event occurs annually from as early as February to as late as October, spanning roughly 12,700 square kilometers (although in 2005 the “dead zone” grew to a record size of 22,000 square kilometers) from the Mississippi River Delta to Galveston, Texas (MMS 1998; Rabalais et al. 2002; LUMCON 2005). Although sea turtles do not extract oxygen from sea water, numerous staple prey items of sea turtles, such as fish, shrimp, and crabs, do and are killed by the hypoxic conditions (Craig et al. 2001). More generally, the “dead zone” decreases biodiversity, alters marine food webs, and destroys habitat (Craig et al. 2001; Rabalais et al. 2002). High nitrogen loads entering the Gulf of Mexico from the Mississippi River is the likely culprit; nitrogen concentrations entering the Gulf of Mexico have increased three fold over within 60 years (Rabalais et al. 2002).

7.10 Disease and Non-native Species Introductions

A disease known as fibropapilloma is a major threat to green turtles in some areas of the world. Fibropapilloma is characterized by tumorous growths, which can range in size from very small to extremely large, and are found both internally and externally. Large tumors can interfere with feeding and essential behaviors, and tumors on the eyes can cause permanent blindness (Foley et al. 2005). Fibropapilloma was first described in green turtles in the Florida Keys in the 1930s. Since then it has been recorded in many green turtle populations around the world, most notably present in green turtles of Hawaii, Florida, and the Caribbean. In Florida, up to 50 percent of the immature green turtles captured in the Indian River Lagoon are infected, and there are similar reports from other sites in Florida, including Florida Bay, as well as from Puerto Rico and the U.S. Virgin Islands. In addition, scientists have documented fibropapilloma in populations of loggerhead, olive ridley, and flatback turtles (Huerta et al. 2000). The effects of fibropapilloma at the population level are not well understood and could be a serious threat to their recovery. The cause of the disease remains unknown. Research to determine the cause of this disease is a high priority and is underway.

An increased human presence at some nesting beaches or close to nesting beaches has lead to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs and an increased presence of native species (e.g. raccoons, armadillos, and opossums) which raid and feed on turtle eggs. Non-native vegetation has invaded many coastal areas and often outcompetes native species. Non-native vegetation is usually less-stabilizing and can lead to increased erosion and degradation of suitable nesting habitat. Non-native vegetation may also form impenetrable root mats that can prevent proper nest cavity excavation, invade and desiccate eggs, or trap hatchlings. In light of these issues, conservation and long-term protection of sea turtle nesting and foraging habitats is an urgent and high priority need.

7.11 Scientific Research and Permits

Scientific research similar to that which would be conducted under Permit Nos. 20339 and 19621-01 has and will continue to impact ESA-listed sea turtles within the action area. Authorized research on ESA-listed sea turtles includes: capturing/handling; satellite, sonic or PIT tagging; blood/tissue collecting, ultrasound, laparoscopy, and imaging. Annual takes of ESA-listed species resulting from research activities that are currently permitted by NMFS within the action area can be seen in Tables 24-29 for green, Kemp's ridley, loggerhead, leatherback, olive ridley and hawksbill sea turtles from 2009 to 2016. The actual number of individual sea turtles affected by scientific research is not known. However, for all species, the number affected is assumed to be less than the total number authorized. This is because, if researchers meets or exceed the number of turtle takes allowed in their permit, they must stop the activity and notify the Permits Division. A permit modification or new permit and a new or re-initiated ESA section 7 consultation would be done prior to the continuation of the research activity. Additional take of sea turtles permitted would be reflected in new or modified permits and hence also reflected in the tables below.

Table 24. Green sea turtle takes in the Atlantic Ocean.

Year	Capture/ Handling/ Restraint	Satellite, sonic or PIT tagging	Blood/ tissue collection	Lavage	Ultrasound	Laparoscopy	Imaging	Mortality
2009	3,093	3,093	3,009	1,860	555	74	72	6
2010	3,753	3,753	3,669	2,480	555	74	72	6
2011	4,255	4,255	3,505	2,990	564	74	72	20
2012	3,354	3,354	2,622	2,210	704	74	72	18.2
2013	5,001	5,001	4,325	3,654	1,903	398	396	4.2
2014	4,336	3,686	3,660	3,044	1,408	324	324	4.2
2015	4,280	3,630	3,610	3,044	1,408	324	324	4.2
2016	2,960	2,960	2,940	1,734	1,408	324	324	4.2
Total	**31,032**	**29,732**	**27,340**	**21,016**	**8,505**	**1,666**	**1,656**	**67**

Permit Nos.: 1450, 1462, 1501, 1506, 1507, 1518, 1522, 1526, 1527, 1540, 1544, 1551, 1552, 1570, 1571, 1576, 10014, 10022, 13306, 13307, 13543, 13544, 13573, 14506, 14508,14622, 14655, 14726, 14949, 15112, 15135, 15552, 15556, 15575, 15606, 15802, 16134, 16146, 16174, 16194, 16253, 16556, 16598, 16733, 17183, 17304, 17355, 17381, 17506, and 18069. All DPSs included, but numbers are mostly the Atlantic Ocean DPS.

Table 25. Kemp's ridley sea turtle takes in the Atlantic Ocean.

Year	Capture/ Handling/ Restraint	Satellite, sonic or PIT tagging	Blood/ tissue collection	Lavage	Ultrasound	Laparoscopy	Imaging	Mortality
2009	1,394	1,394	1,195	425	371	53	53	5
2010	1,402	1,402	1,203	426	371	53	53	5
2011	2,210	2,210	1,368	976	400	53	53	9
2012	2,229	2,219	1,561	972	450	53	53	7.2
2013	2,836	2,852	2,190	1,627	990	213	218	3.2
2014	2,010	2,026	1,964	706	619	160	165	3.2
2015	1,833	1,849	1,819	706	619	160	165	3.2
2016	1,420	1,436	1,406	300	264	125	125	3.2
Total	**15,334**	**15,388**	**12,706**	**6,138**	**4,084**	**870**	**885**	**39**

Permit Nos.: 1462, 1501, 1506, 1507, 1526, 1527, 1540, 1544, 1551, 1552, 1570, 1571, 1576, 10014, 10022, 13306, 13543, 13544, 14508, 14726, 14506, 14622, 14655, 14726, 15112, 15135, 15552, 15566, 15575, 15606, 15802, 16134, 16194, 16253, 16556, 16598, 16733, 17183, 17304, 17355, 17381, 17506, and 18069.

Table 26. Loggerhead sea turtle takes in the North Atlantic Ocean.

Year	Capture/ Handling/ Restraint	Satellite, sonic or PIT tagging	Blood/ tissue collection	Lavage	Ultrasound	Laparoscopy	Imaging	Mortality
2009	5,462	5,462	5,044	1,165	1,322	109	123	111
2010	5,464	5,464	5,046	1,205	1,322	109	116	111
2011	7,165	7,165	6,097	1,420	1,667	148	114	122.2
2012	4,791	4,791	3,741	1,370	1,429	161	114	29.8
2013	5,909	5,909	4,859	2,609	2,519	401	354	24.8
2014	4,052	3,912	3,862	1,460	1,543	292	240	24.8
2015	3,935	3,795	3,795	1,470	1,543	292	240	7.8
2016	3,510	3,510	3,510	1,255	1,543	292	240	7.8
Total	**40,288**	**40,008**	**35,954**	**11,954**	**12,888**	**1,804**	**1,541**	**439.2**

Permit Nos.: 1450, 1462, 1501, 1506, 1507, 1522, 1526, 1527, 1540, 1544, 1551, 1552, 1570, 1571, 1576, 1599, 10014, 10022, 13306, 13307, 13543, 13544, 14249, 14622, 14506, 14508, 14622, 14655, 14726, 15112, 15552, 15566, 15575, 15606, 15802, 16134, 16146, 16194, 16253, 16556, 16598, 16733, 17183, 17304, 17355, 17381, 17506, and 18069. All DPSs are included, but numbers are mostly the Northwest Atlantic Ocean DPS.

Table 27. Leatherback sea turtle takes in the North Atlantic Ocean.

Year	Capture/ Handling/ Restraint	Satellite, sonic or PIT tagging	Blood/ tissue collection	Lavage	Ultrasound	Laparoscopy	Imaging	Mortality
2009	1,357	1,357	1,331	197	188	0	0	2
2010	1,421	1,421	1,394	197	188	0	0	1
2011	1,709	1,709	1,682	197	189	0	0	3.4
2012	736	736	709	187	189	0	0	2.6
2013	842	835	808	312	254	65	65	1.6
2014	653	646	620	135	66	65	65	1.6
2015	647	640	620	135	66	65	65	1.6
2016	634	627	617	125	66	65	65	1.6
Total	**7,999**	**7,971**	**7,781**	**1,485**	**1,206**	**260**	**260**	**15.4**

Permit Nos.: 1506, 1527, 1540, 1544, 1551, 1552, 1557, 1570, 1571, 1576, 10014, 13543, 14506, 14586, 14655, 14726, 15112, 15552, 15556, 15575, 15672, 15802, 16109, 16194, 16253, 16556, 16733, 17355, and 17506.

Table 28. Olive ridley sea turtle takes in the Atlantic Ocean.

Year	Capture/ Handling/ Restraint	Satellite, sonic or PIT tagging	Blood/ tissue collection	Lavage	Ultrasound	Laparoscopy	Imaging	Mortality
2009	187	187	187	34	34	0	0	1
2010	98	247	247	34	34	0	0	1
2011	108	312	312	34	34	0	0	1.4
2012	92	196	196	34	34	0	0	0.8
2013	138	205	205	44	44	0	0	0.8
2014	67	171	171	10	10	0	0	0.8
2015	37	171	171	10	10	0	0	0.8
2016	67	171	171	10	10	0	0	0.8
Total	**794**	**1,660**	**1,660**	**210**	**210**	**0**	**0**	**7.4**

Permit Nos.: 1551, 15112, 1570, 1571, 1576, 16194, 16253, 16733, and 15552.

Table 29. Hawksbill sea turtle takes in the Atlantic Ocean.

Year	Capture/ Handling/ Restraint	Satellite, sonic or PIT tagging	Blood/ tissue collection	Lavage	Ultrasound	Mortality
2009	1,088	1,088	1,081	464	254	0
2010	1,424	1,424	1,417	534	254	0
2011	1,959	1,959	1,955	914	255	0
2012	1,462	1,456	1,452	904	255	0
2013	1,423	1,417	1,415	844	320	39
2014	1,114	1,108	1,106	550	66	39
2015	1,032	1,026	1,026	550	66	39
2016	1,106	1,050	1,013	500	66	39
Total	**10,608**	**10,528**	**10,465**	**5,260**	**1,536**	**156**

Permit Nos.: 1462, 1501, 1506, 1507, 1518, 1526, 1527, 1540, 1544, 1551, 1552, 1570, 1571, 1576, 1599, 10014, 10022, 13306, 13307, 13543, 13544, 14272, 14508, 14726, 14506, 14508, 14622, 14655, 14726, 14949, 15112, 15135, 15552, 15566, 15575, 15606, 15802, 16134, 16146, 16194, 16253, 16598, 16733, 17183, 17304, 17355, 17381, and 17506

8 Effects of the Action

Section 7 regulations define "effects of the action" as the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 C.F.R. §402.02). Indirect effects are those that are caused by the proposed action and are later in time, but are reasonably certain to occur. This effects analyses section is organized following the stressor, exposure, response, risk assessment framework.

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 survival and recovery of the species.

The destruction and adverse modification analysis considers whether the action produces "a direct or indirect alteration that appreciably diminished the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features." 50 C.F.R. 402.02.

8.1 Stressors Associated with the Proposed Action

Stressors are any physical, chemical, or biological entity that may induce an adverse response either in an ESA-listed species or their designated critical habitat. The issuance of Permit Nos. 20339 and 19621-01 would authorize several research activities that may expose sea turtles to a variety of stressors. Each research activity presents a unique set of stressors. The potential stressors we expect to result from the proposed action are:

1) capture with handling and restraint following capture;

2) morphometrics;

3) tissue, blood sampling and cloacal swabbing;

5) ultrasonic examination;

6) tumor removal;

7) application of flipper tags, PIT tags, and satellite transponders; and

8) laparoscopy.

8.2 Mitigation to Minimize or Avoid Exposure

Several aspects of the proposed action are designed to minimize ESA-listed species' exposure to the potential stressors associated with the proposed research activities. These include the experience and measures taken by the researchers themselves and the terms and conditions specified in the permit, as proposed by the Permits Division for Permit No. 20339 (Appendix 1) and Permit No. 19621-01 (Appendix 2). In addition to these mitigation measures taken by the applicants, the Permits Division will include mitigation measures as part of the terms and conditions (Section B5) of each permit.

To minimize the effects of the actions proposed for Permit No. 20339, the applicant will perform a number of mitigation measures found starting on page 13 of their application. A summary of these is as follows:

During trawl sets in which a TED is not installed in the trawl (i.e., tows to assess target catch rates without a TED), one of two methods to ensure a non-lethal turtle interaction will be employed. The first method will involve a tow time limitation as described below, while the second will involve the use of a real time video monitoring system that will allow the researchers to know when a turtle enters the codend section of the trawl. In state waters with contracted vessels, trawl gear without turtle excluder devices will be towed for no longer than 30 minutes unless specific fisheries regulations exist requiring tow time limits in lieu of turtle excluder devices. During skimmer trawl operations, a minimum of two staff, one on each side (port/starboard) of the vessel, will inspect the gear every five minutes to monitor for the presence of marine mammals. Prior to retrieving skimmer trawl tail bags, the vessel will be slowed from the active towing speed to 0.5 to 1.0 knots to allow animals that may be in the net to escape. If a sturgeon is observed in the net, researchers will immediately haul the gear and carefully release the fish as quickly as possible to avoid injury, following sturgeon careful handling guidelines.

Leatherbacks will only be boated if they can be easily and safely brought on board the vessel. Leatherback turtles will be handled by at least two people, one on either side of the turtle, and precautions will be taken to ensure that animals are supported from underneath and not turned on their back.

Only minor stress, discomfort, and pain are expected during sample collection. The effect of each proposed procedure is described in detail in the attached SEFSC Sea Turtle Research Techniques Manual. All equipment that comes into contact with sea turtle body fluids, cuts or lesions will be disinfected between the processing of each turtle using a 1:10 solution of 5 to 6 percent bleach or other appropriate disinfectant. A separate set of sampling equipment for handling animals displaying fibropapilloma tumors will be maintained and thoroughly disinfected if ever used. Tagging and biopsy sites will be disinfected using a 10 percent povidone-iodine swab, an isopropyl alcohol swab, another povidone-iodine swab, and a second alcohol swab.

No research will be conducted over, on, or adjacent to any listed seagrass, live bottom, or coral habitat. The applicant has no intention of approaching non-targeted listed species during research efforts and will avoid them if seen.

To minimize the effects of the actions proposed for Permit No. 19621-01, the applicant will perform a number of mitigation measures found starting on page 18 of their application for their current Permit No. 19621. A summary of these is as follows:

The trawl gear consists of two wooden doors that plane away from each other as the vessel makes headway, which spreads out a modified shrimp net attached to the posterior of the inside and outside doors. One set of doors and one trawl net are deployed on each of the port and starboard sides of the trawler/research vessels. Trawl net modifications include the absence of a turtle excluder device and large-mesh webbing to minimize fisheries by-catch. During randomized sampling in coastal waters, tow time is restricted to 42 minutes between the doors entering the water and returning to the water surface, with a target bottom tow time of 30 minutes.

Captured marine life will be brought on board and removed from the net; large-hoop dip nets will be available for boarding and subduing larger specimens such as stingrays, sharks, and sea turtles. When non-sea turtle species are encountered they will be removed from the nets and either released immediately or transferred to a second vessel (of similar dimensions/design as the primary net boat, approximately 6.4 m in length) to briefly record basic biological data before release. All captured sea turtles will also be transferred to this second vessel for processing as described in detail in Part 2 of this Project Description. Captured sea turtles will be placed in padded containers to keep them safely restrained until they can be processed, as well as during epoxy curing for the sub-set of sea turtles that receive telemetry transmitters.

No research will be conducted over, on, or adjacent to any listed seagrass, live bottom, or coral habitat. The applicant has no intention of approaching non-targeted listed species during research efforts and will avoid them if seen.

The Permits Division will require individuals conducting the research activities to possess qualifications commensurate with their roles and responsibilities. In accordance, the only personnel authorized to conduct the research would be the Primary Investigator Jeff Gearhart for Permit No. 20339 and Mike Arendt for Permit No. 19621-01, listed Co-Investigator's, and research assistants. We anticipate that requiring that the research be conducted by experienced personnel will further minimize impacts to the ESA-listed species that may be exposed to the stressors, as these individuals should be able to recognize adverse responses and cease or modify their research activities accordingly.

8.3 Exposure Analysis

Exposure analyses identify the ESA-listed species that are likely to co-occur with the actions' effects on the environment in space and time, and identify the nature of that co-occurrence. The exposure analysis also identifies, as possible, the number, age or life stage, and gender of the individuals likely to be exposed to the actions' effects and the population(s) or subpopulation(s) those individuals represent. The issuance of Permit Nos. 20339 and 19621-01 will authorize research activities that have been ongoing for several years and NMFS includes research effort and subsequent exposure and response data in its assessment of exposure where data are available.

Permit Nos. 20339 and 19621-01 both have previous annual reports and supplementary data available to help NMFS estimate the likely future levels of exposure. Research permits have required the applicants to report activities every year. 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 believe this is the best tool available to us to estimate the exposure, response, and take that ESA-listed species will be exposed to under the following proposed permits. As we have no indication of how many of these individuals would actually be exposed to each research procedure, we expect most or all will (based upon the stated goals and rationale for the research activities), we assume that all captured individuals will also be exposed to these other activities.

8.3.1 Permit No. 20339

For Permit No. 20339, applicant data always reported individuals to species (no difficulty in identification was documented), but the Permit Division proposes to issue unidentified sea turtle take based upon the possibility of identification difficulties (such as through video monitoring). Our analysis does not include an unidentified sea turtle category, but assumes that if an individual cannot be identified, its species and the cumulative amount of exposure that species would experience falls within the bounds of the exposure analysis presented (i.e., true exposure would not be underestimated).

We expect that an individual would be exposed to these stressors 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. An individual of any life stage except hatchling could be exposed to the proposed activities; 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 longline or trawl activities (hatchlings appear to stay in relatively shallow areas of the water column; trawl and longline activities deploy in relatively deep water depths).

The applicant's bycatch data for the past ten years shows that no interactions have occurred with smalltooth sawfish. However, smalltooth sawfish were a significant bycatch component in trawl fisheries in the southeastern U.S. prior to their listing and were probably the leading factor in the species' decline. Additional captures occurred in pelagic longlines (particularly the bottom shark longline fishery, which the applicant proposes to experiment in abundantly under the proposed permit). To quantify the expected level of exposure, we extracted data from observer data of the shrimp trawling fishery in the Gulf of Mexico (NMFS 2011a, b). These data indicated that five smalltooth sawfish captures occurred over 5,559 trawls (averaging 7.75 hours each). Of the five captures indicated from shrimp trawling data, at least two and possibly three of the individuals died as a result of capture (NMFS 2011b). Shrimp trawling mortalities likely resulted from individuals being intentionally killed so that removal from nets would be made easier and safer. Because of the rarity of smalltooth sawfish capture, we used a Poisson distribution to calculate the probability of smalltooth sawfish capture given the expected level of effort provided by the applicant. Based upon this, we expect one smalltooth sawfish is reasonably likely to be captured during trawling operations over the life of the proposed permit. However, we do not expect mortality as a result of capture under the proposed permit. This is because we expect that NOAA personnel onboard research vessels will remove entangled sawfish using procedures outlined in NMFS (2011a) and NMFS (2007b). We cannot calculate how many smalltooth sawfish would likely be captured as a result of longline activities. This is because we do not know how much effort, either in sets or hooks per set, applicants are likely to undertake and how much effort was associated with bycatch in the smalltooth encounter database. Records from the sawfish encounter database indicate that longline captures are much more common than trawl captures (35 captures in 438 observed bottom shark longline sets; (Richards 2007), but mortality rarely occurs (NMFS 2011b). The applicants have never caught a sawfish despite years of research effort. Thus, although it is certainly possible to capture sawfish under the proposed research, it is not likely to occur with even moderate frequency or intensity. We therefore expect researchers may capture one or two sawfish during the course of the permit's lifespan via longline activities. Captured individuals would be disentangled according to NMFS approved guidelines (NMFS 2007b) and, as a result, we do not expect mortality to result from incidental sawfish capture on longlines. We accept the Permits Division's estimate that up to three smalltooth sawfish may be captured over the life of Permit No. 20339.

Although the proposed permit would authorize sea turtle bycatch during TED testing, there also exists the possibility of interactions with Atlantic sturgeon. To evaluate the potential for Atlantic sturgeon bycatch, we analyzed bycatch data from the applicant from 2001 to present. To date, we know of three instances of Atlantic sturgeon bycatch under the applicant's current or previous permits for similar actions, all of which were in the vicinity of Duck Pier, Duck, North Carolina using flynets. The applicant has expended significant effort throughout a broad geographic range and, with the exception of this location, has not bycaught any sturgeon elsewhere. From 2001-2007, no sturgeon were caught, nor were any caught in 2010. However, in 2008, 80 Atlantic sturgeon were captured, of which 25 percent died. An additional 15 individuals were bycaught in 2009 in two trawls on a single day, with an unknown level of mortality. Bycatch and mortality data from 2001-present were analyzed and the mean and standard deviation calculated. As with the sea turtle exposure analysis, four standard deviations were added to the mean, resulting in 106 reasonably likely annual captures and 28 mortalities. Our calculations processed data on an annual basis instead of over the life of the permit because effort and bycatch data were reported annually and clumping data for longer periods would have reduced the accuracy of our calculations. According to unpublished genetic data, roughly 52 percent of Atlantic sturgeon in the area where bycatch occurred are from the York River, 14 percent from the Hudson River, 12 percent from the Savannah River, and 17 percent from the Ogeechee River. All individuals were of subadult size (a life stage with very low mortality and in which a large majority of individuals recruit in sexually mature adult age classes). With no further effective mitigation measures in place, we would expect the Chesapeake Bay DPS would likely experience up to 56 captures and 15 mortalities annually, the South Atlantic DPS up to 31 captures and 9 mortalities annually, and the New York Bight DPS up to 15 captures and four mortalities annually. However, the applicant will be including mitigation measures (particularly 100 percent video monitoring of trawls and cessation of trawling upon sturgeon detection off Duck, North Carolina) that we expect will bring these numbers down dramatically.

The proposed permit contains conditions, limitations, and new methodology that were not present in prior permits that significantly reduce this level of capture. The applicant expects effort under the proposed permit would be equivalent overall to that which has occurred in the past, although trawls would be shorter (30 to 55 minutes versus trawl times of 75 to 167 minutes when Atlantic sturgeon were bycaught under the applicant's current permit), there would be more of them. Therefore, the opportunity to capture sturgeon would likely remain the same without additional limitations.

Much more significant to reducing the likelihood of Atlantic sturgeon bycatch would result from the use of video monitoring systems on trawl nets. The applicant has and still does use video monitoring to observe sea turtles moving out through TEDs and to account for this "take," although the applicant indicates that sturgeon have been observed exiting through TEDs as well. Under the proposed permit, the applicant has agreed that a trawl will be stopped if Atlantic sturgeon are observed entering the trawl net. Video monitoring would be used on 40 to 70 percent of trawls overall and would be employed on all trawls in the vicinity of Duck, North Carolina (where all Atlantic sturgeon bycatch has occurred). 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) would be observed. If detected, the proposed permit requires that trawls be immediately hauled back and Atlantic sturgeon released using NMFS-recommended safe handling protocols. This would mean that the trawl would pass through only a small part of an Atlantic sturgeon refuge and that most individuals that would otherwise be captured without this measure would not be (i.e., the opening of the trawl net would pass over the refuge not through it). As it is not standard practice for commercial trawls to repeat fishing effort over areas they have just fished, we do not expect the trawl would be redeployed over the same location and capture remaining individuals (a fishing vessel's inertia would carry the vessel over and past a refuge before the vessel could redeploy trawl nets).

In determining the total number of Atlantic sturgeon captures, we assume that up to two individuals may be captured during a single trawl (one individual may be missed during video monitoring, but not a second) and that up to two trawling events per year may capture Atlantic sturgeon (the maximum number of trawls per year that have captured Atlantic sturgeon according to data over the past decade). We accept the Permits Division's estimate that up to four Atlantic sturgeon, two Gulf sturgeon, and two shortnose sturgeon may be captured annually under Permit No. 20339.

No mortality has occurred in the applicant's prior performance. However, due to the frequency of trawl capture and incidence of mortality in commercial trawling in the action area as well as research trawling under more restrictive conditions, the Permits Division is proposing to allow: three mortalities over the life of the permit for loggerhead, two mortalities for Kemp's ridley, two for green, one for leatherback, one for hawksbill, and one for olive ridley sea turtles. We accept these mortalities as being reasonably likely due to the history of life-threatening captures, an instance of death, and the additional risk of undertaking new (for the researcher), potentially life-threatening activities in new areas. We expect that data on mortality (or lack thereof) under Permit No. 20339 will help inform future actions by the researcher and potentially change conclusions as to how much, if any mortality is reasonably likely to occur in future permits the researcher obtains for similar actions.

8.3.2 Permit No. 19621-01

For Permit No. 19621-01, since 2000, no turtles have died aboard the applicant's research vessels due to forced submergence, and only five sea turtles (of more than 1,600 captured with a 30-minute tow time) have required intubation and resuscitation at sea. Post-release, only 15 sea turtles have been reported stranded dead after release in our study three weeks to 12 years later (mean of three years), also suggesting minimal negative impacts. Despite increases in allowable annual take, annual mortality take, a subset of all turtles collected for each species, remain virtually unchanged or are more conservative than permitted for the previous three Section 10 permits. Because there is a very low inherent risk of incidental mortality during trawl surveys, we have included a minimal request for lethal take.

We do not expect that individuals will be exposed to these stressors more than once in a given year. The applicant has indicated over 19 years and over 250 taggings that no recaptures have yet occurred. An individual of any life stage except hatchling could be exposed to the proposed activities.

Permit No. 19621-01 will allow trawling in areas frequented by shortnose and Atlantic sturgeon (Post et al. 2014) and in areas where smalltooth sawfish potentially occur (NMFS 2006d). The applicant captured five Atlantic sturgeons out of 70 trawling events in Charleston, South Carolina in 2005. We do not have enough data on Atlantic sturgeon (and no data on shortnose sturgeon) bycatch to support an anticipated capture number. However, we accept the Permits Division's rational for up to ten Atlantic sturgeons and five shortnose sturgeons as being reasonably likely to be captured over the life of the permit. This is based upon the capture history to date, as well as life history parameters of sturgeon tending to gather in small, poorly-known nearshore marine areas, as well as the ephemeral nature of particularly shortnose sturgeon in marine waters.

Smalltooth sawfish are found less frequently north of Florida than along the Florida coast, but occur regularly in Florida waters with decreasing latitude. Smalltooth sawfish may be found throughout the action area, particularly in its southern portion. We do not have past-performance data to inform us on the likelihood of a capture occurring, but believe it is reasonably likely. We accept the Permits Division's estimate that up to two smalltooth sawfish may be captured over the life of Permit No. 19621-01.

Mortality has also been requested by the applicants in association with their capture methods. A single loggerhead sea turtle was reported as dead in 2007 by the applicants, but no other instances have been documented since then. Out of more than 1,600 sea turtles (mostly loggerheads) captured with a 30-minute tow time, only five loggerheads have required intubation and resuscitation at sea. Post-release, 15 sea turtles captured by the researchers have been reported stranded dead after release three weeks to 12 years later (mean of 3 years). The cause of these deaths was not directly or indirectly linked to procedures undertaken by the applicant. However, the applicant is engaging in capture in new areas and tangle netting. Because of this, the Permits Division is proposing to allow a single mortality each of green, Kemp's, and leatherback sea turtles, and two for loggerhead sea turtles over the life of Permit No. 19621-01. We accept these mortalities as being reasonably likely due to the history of life-threatening captures, an instance of death, and the additional risk of undertaking new (for the researcher), potentially life-threatening activities in new areas. We expect that data on mortality (or lack thereof) under Permit No. 19621-01 will help inform future actions by the researcher and potentially change conclusions as to how much, if any mortality is reasonably likely to occur in future permits the researcher obtains for similar actions.

Table 30. Number of exposures to activities expected under Permit No. 20339 over the permit's lifespan.

Sea turtle species	Life Stage	Procedures	Takes per Individual Animal[1]	No. of Animals Authorized per Year	Cumulative No. Animals Over Five Years	Cumulative Takes per Animal Over Five Years[2]
Green	All except hatchling	Mark: carapace; Tag: flipper, PIT; Measure; Sample: tissue; Weigh; Salvage (carcass, tissue, parts); Unintentional mortality[3]; Import/export/receive, parts; Photograph/Video	1	62	310	5
Kemp's ridley	All except hatchling	Mark: carapace; Tag: flipper, PIT; Measure; Sample: tissue; Weigh; Salvage (carcass, tissue, parts); Unintentional mortality[3]; Import/export/receive, parts; Photograph/Video	1	117	585	5
Loggerhead	All except hatchling	Mark: carapace; Tag: flipper, PIT; Measure; Sample: tissue; Weigh; Salvage (carcass, tissue, parts); Unintentional mortality[3]; Import/export/receive, parts; Photograph/Video	1	253	1,265	5
Leatherback	All except hatchling	Mark: carapace; Tag: flipper, PIT; Measure; Sample: tissue; Weigh; Salvage (carcass, tissue, parts); Unintentional mortality[3]; Import/export/receive, parts; Photograph/Video	1	116	580	5
Olive ridley	All except hatchling	Mark: carapace; Tag: flipper, PIT; Measure; Sample: tissue; Weigh; Salvage (carcass, tissue, parts); Unintentional mortality[3]; Import/export/receive, parts; Photograph/Video	1	41	205	5
Hawksbill	All except hatchling	Mark: carapace; Tag: flipper, PIT; Measure; Sample: tissue; Weigh; Salvage (carcass, tissue, parts); Unintentional mortality[3]; Import/export/receive, parts; Photograph/Video	1	41	205	5
Unidentified	All except hatchling	Mark: carapace; Tag: flipper, PIT; Measure; Sample: tissue; Weigh; Salvage (carcass, tissue, parts); Unintentional mortality[3]; Import/export/receive, parts; Photograph/Video	1	85	425	5

[1] Individual turtles are subjected to procedures one time per year. [2] Total number of times an individual turtle can be captured and handled over the lifespan of the permit. [3] Unintentional mortality numbers are added into the total animals authorized.

Table 31. Number of exposures to activities expected under Permit No. 19621-01 over the permit's lifespan.

Sea turtle species	Life Stage	Procedures	Takes per Individual Animal[1]	No. of Animals Authorized per Year	Cumulative No. Animals Over Five Years	Cumulative Takes per Animal Over Five Years[2]
Green	All except hatchling	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, scute scraping, cloacal swab; Ultrasound; Weigh; Unintentional mortality[3]	1	112	560	5
Kemp's ridley	All except hatchling	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, scute scraping, cloacal swab; Ultrasound; Weigh; Unintentional mortality[3]	1	210	1,050	5
Loggerhead	All except hatchling	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, scute scraping, cloacal swab; Ultrasound; Weigh; Unintentional mortality[3]	1	984	4,920	5
Leatherback	All except hatchling	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, scute scraping, cloacal swab; Ultrasound; Weigh; Unintentional mortality[3]	1	7	35	5
Olive ridley	All except hatchling	Collect: tumors, Epibiota removal; Mark: carapace; Tag: flipper, PIT; Measure; Photograph/Video; Sample: blood, fecal, scute scraping, cloacal swab; Ultrasound; Weigh; Unintentional mortality[3]	1	5	25	5

[1] Individual turtles are subjected to procedures one time per year. [2] Total number of times an individual turtle can be captured and handled over the lifespan of the permit. [3] Unintentional mortality numbers are added into the total animals authorized.

The North Atlantic DPS of green turtles has an estimated 30,058 to 64,396 female nesters in 2010 with an increasing population (Seminoff et al. 2015). The Northwest Atlantic DPS of loggerhead is estimated at 32,000 to 56,000 nesting females with populations in decline or not enough information to make a trend (TEWG 1998; NMFS 2001). Gallaway et al. (2013) estimated that nearly 189,000 female Kemp's ridley sea turtles over the age of two years were alive in 2012. Extrapolating based on sex bias, the authors estimated that nearly a quarter million age-two or older Kemp's ridleys alive now with counts show that the population trend is increasing towards recovery. North Atlantic leatherbacks likely number 34,000 to 94,000 individuals, with females numbering 18,800 and the eastern Atlantic segment numbering 4,700 (TEWG 2007) and populations in the Caribbean and Atlantic Ocean are generally stable or increasing. Although no historical records of abundance are known, hawksbill sea turtles are considered to be severely depleted due to the fragmentation and low use of current nesting beaches (NMFS and USFWS 2007a). Worldwide, an estimated 21,212 to 28,138 hawksbills nest each year among 83 sites. Among the sites with historic trends, all show a decline during the past 20 to 100 years. The olive ridley is considered the most abundant sea turtle in the world, with an estimated 800,000 nesting females annually, however some nesting populations are depleting while others are stable or slightly increasing (Márquez et al. 2002; Eguchi et al. 2007). Based on these current population estimates, the proposed exposure to research activities represents a small portion of the population for each species of sea turtle. Based on these current population estimates, the proposed exposure to research activities represents a small portion of the population for each species of sea turtle.

8.4 Response Analysis

Given the exposure estimated above, in this section we describe the range of responses among ESA-listed sea turtles that may result from the stressors associated with the research activities that would be authorized under Permit Nos. 20339 and 19621-01. These include stressors associated the following activities: capture with handing and restraint following capture; measuring, photographing, weighing; tissue, blood, scute, and cloacal sampling; ultrasonic examination; tumor removal, and application of flipper tags, PIT tags, and satellite transponders. For the purposes of consultation, our assessment tries to detect potential lethal, sub-lethal (or physiological), or behavioral responses that might reduce the fitness of individuals. Our response analysis considers and weighs evidence of adverse consequences, as well as evidence suggesting the absence of such consequences.

There is mounting evidence that wild animals respond to human disturbance in the same way that they respond to predators (Harrington and Veitch 1992; Lima 1998; Gill et al. 2001; Frid 2003; Beale and Monaghan 2004; Romero 2004). These responses manifest themselves as stress responses (in which an animal perceives human activity as a potential threat and undergoes physiological changes to prepare for a flight or fight response), interruptions of essential behavioral or physiological events, alteration of an animal's time budget, or some combinations of these responses (Sapolsky et al. 2000; Frid and Dill 2002; Romero 2004; Walker et al. 2005). These responses have been associated with abandonment of sites (Sutherland and Crockford 1993), reduced reproductive success (Giese 1996; Müllner et al. 2004), and the death of individual animals (Feare 1976; Daan 1996; Bearzi 2000).

Stress is an adaptive response and does not normally place an animal at risk. However, distress involves a stress response resulting in a biological consequence to the individual. The stress response of fish and reptiles involves the hypothalamic-pituitary-adrenal axis being stimulated by a stressor, causing a cascade of physiological responses, such as the release of the stress hormones cortisol, adrenaline (epinephrine), glucocorticosteroids, and others (Barton 2002; Bayunova et al. 2002; Wagner et al. 2002; Lankford et al. 2005; Busch and Hayward 2009; McConnachie et al. 2012; Atkinson et al. 2015). These hormones subsequently can cause short-term weight loss, the release of glucose into the blood stream, impairment of the immune and nervous systems, elevated heart rate, body temperature, blood pressure, fatigue, cardiovascular damage, and alertness, and other responses (Aguilera and Rabadan-Diehl 2000; Guyton and Hall 2000; Dierauf and Gulland 2001; Wagner et al. 2002; Romero 2004; NMFS 2006b; Busch and Hayward 2009; Omsjoe et al. 2009; Queisser and Schupp 2012), particularly over long periods of continued stress (Sapolsky et al. 2000; Desantis et al. 2013).

In some species, stress can also increase an individual's susceptibility to gastrointestinal parasitism (Greer 2008). In highly-stressful circumstances, or in species prone to strong "fight-or-flight" responses, more extreme consequences can result, including muscle damage and death (Curry and Edwards 1998; Cowan and Curry 2002; Herraez et al. 2007; Cowan and Curry 2008). The most widely-recognized indicator of vertebrate stress, cortisol, normally takes hours to days to return to baseline levels following a significantly stressful event, but other hormones of the hypothalamic-pituitary-adrenal axis may persist for weeks.

Several studies have suggested that stress can adversely impact female reproduction through alterations in the estrus cycle (Herrenkohl and Politch 1979; Moberg 1991; Rivier and Rivest 1991; Mourlon et al. 2011). This is likely due to changes in sex steroids and growth hormone levels associated with the stress response (Sapolsky et al. 2000). Komesaroff et al. (1998) found that estrus may inhibit the stress response to some extent, although several studies suggest estrus and the follicular stage may be susceptible to stress-induced disruption (see Rivier (1991) and Moberg (1991) for reviews). Most of these studies were conducted with single or multiple invasive methodologies or chronic stress; we do not expect stressors associated with the proposed research to be nearly as stressful.

The common underling stressor of a human disturbance caused by the research activities that would be authorized under Permit Nos. 20339 and 19621-01 may lead to a variety of different stress related responses which we discuss below.

8.4.1 Capture, Handling and Restraint

Sea turtles that are forcibly submerged undergo respiratory and metabolic stress that can lead to severe disturbance of their acid-base balance. While most voluntary dives by sea turtles appear to be aerobic, showing little if any increases in blood lactate and only minor changes in acid-base status (pH level of the blood) (Lutz and Bentley 1985), sea turtles that are stressed as a result of being forcibly submerged through entanglement consume oxygen stores, triggering an activation of anaerobic glycolysis, and subsequently disturbing their acid-base balance, sometimes to lethal levels. It is likely that the rapidity and extent of the physiological changes that occur during forced submergence are functions of the intensity of struggling as well as the length of submergence (Lutcavage and Lutz 1997). Other factors to consider in the effects of forced submergence include the size of the turtle, ambient water temperature, and multiple submergences. Larger sea turtles are capable of longer voluntary dives than small turtles, so juveniles may be more vulnerable to the stress due to handling. During the warmer months, routine metabolic rates are higher, so the impacts of the stress may be magnified. With each forced submergence, lactate levels increase and require a long (even as much as 20 hours) time to recover to normal levels. Turtles are probably more susceptible to lethal metabolic acidosis if they experience multiple captures in a short period of time, because they would not have had time to process lactic acid loads (Lutcavage and Lutz 1997).

Capture and handling activities may markedly affect metabolic rate (St. Aubin and Geraci 1988), reproduction (Mahmoud and Licht 1997), and hormone levels (Gregory et al. 1996). Handling has been shown to result in progressive changes in blood chemistry indicative of a continued stress response (Hoopes et al. 2000; Gregory and Schmid 2001). The additional on-board holding time imposes an additional stressor on these already acidotic turtles (Hoopes et al. 2000). It has been suggested that the muscles used by sea turtles for swimming might also be used during lung ventilation (Butler et al. 1984). Thus, an increase in breathing effort in negatively buoyant animals may have heightened lactate production. Understanding the physiological effects of capture methodology is essential to conducting research on endangered sea turtles, since safe return to their natural habitat is required. However, literature pertaining to the physiological effects of capture on sea turtles is scarce.

Smalltooth sawfish entangled in nets used in Permit Nos. 18926, 19528, or 19621 would likely experience stress in association with the event and some lacerations associated netting. However, they should be capable of continued respiration (in the case of trawls, the rostrum tangling in the net should keep individuals away from being crushed or immobilized by bycatch). If disentangled according to NOAA-approved protocols no further injury should occur (NMFS 2009). Bycatch in the past does not appear to be fatal due to distress and we do not expect distress that would impede fitness for any interactions with trawls under the proposed permits.

We also expect that activity budgets of captured individuals will be altered after release, with more time spent actively swimming for several hours to a day after release (Thomson and Heithaus 2014). After this period, we expect that individuals will engage in resting and feeding activities to a greater extent (Thomson and Heithaus 2014).

We expect capture, handling, and restraint of Atlantic and shortnose sturgeon during trawling to cause short-term stress (Kahn and Mohead 2010). This can be exacerbated by less than ideal environmental conditions, such as relatively high water temperature (higher than 28° C), high salinity, or low dissolved oxygen, potentially resulting in mortality or failure to breed (Hastings et al. 1987; Jenkins et al. 1993; Moser and Ross 1995; Secor and Gunderson 1998; Niklitschek 2001; Secor and Niklitschek 2001; Secor and Niklitschek 2002; Kynard et al. 2007; Niklitschek and Secor 2009).

Although sturgeon may be captured during warm-water periods, the action areas generally encompass areas where water movement is good (generally providing good oxygenation and moderating salinity) and would not occur in breeding areas. We do not expect the additional stress associated with brief capture, handling, and restraint to result in more than short-term stress if the researchers under Permit No. 19621 follow guidelines outlined in Kahn and Mohead (2010) and best practice guidelines established by the Smalltooth Sawfish Recovery Team (NMFS 2009).

8.4.2 Morphometrics

Once sea turtles have been captured, individuals will be handled and exposed to various activities of greater or lesser degrees of invasiveness. Each sea turtle will be exposed to morphometric measurement, including carapace size and individual weight. Although these activities are not considered invasive, we expect individual sea turtles to experience a continued stress response due to the handling and restraint necessary to conduct these activities.

8.4.3 Tissue, Blood Sampling and Cloacal Swabbing

Sea turtles are also expected to experience a short-term stress response in association with the handling, restraint, and pain associated with blood sampling. Taking a blood sample from the sinuses in the dorsal side of the neck is a routine procedure (Owens 1999), although it requires knowledgeable and experienced staff to do correctly and requires the animal to be restrained (Wallace and George 2007; DiBello et al. 2010). According to Owens (1999) with practice, it is possible to obtain a blood sample 95 percent of the time, and the sample collection time should be about 30 seconds in duration. The applicants have experience in blood sampling, some of them with hundreds of individuals over decades. No sea turtle mortalities have occurred during the applicant's blood sampling activities, which we are aware of, nor are we aware of any meaningful pathological consequences by sampled individuals on the part of the applicants. Sample collection sites are always sterilized prior to needle insertions, which would be limited to two on either side of the neck. Bjorndal et al. (2010) found that repeated scute, blood, and skin sampling of the same individual loggerhead sea turtles did not alter growth, result in scarring, or impact other physiological or health parameters.

Sea turtles will also be biopsied during the course of the research. We expect that this will involve stress associated with pain stimuli (Balazs 1999). Although the skin will be breached and tissue exposed, we expect disinfection protocols to make the risk of infection minimal from the small hole that will be produced by the biopsy punch. Disinfection of biopsy punches and surgical equipment will also reduce the risk of pathogen spread between individuals. Swabbing is minimally invasive or opportunistic and not expected to adversely affect sea turtles. Any discomfort experienced by the turtle would be temporary and would not have any lasting effects.

8.4.4 Ultrasonic Examination

Ultrasonography is a noninvasive technique (Owens 1999) commonly used in human medicine, that assists in determining the presence of fibropapillomatosis tumors or other abnormal features using a portable ultrasound machine on board the research vessel and takes a maximum of ten minutes per turtle. Turtles remain largely impassive while inverted. A clear, water-based gel would be applied to the inguinal area of the turtle and smooth-ended transducer would then be pushed up against the skin and used to visualize the area.

Ultrasonography is used to evaluate gonadal development of juvenile loggerheads greater than seventy-five centimeters straight carapace length minimum as well as adult loggerheads (reproductively active vs. in-active in males, follicles vs. eggs in females). Although tail lengths greater than forty percent of straight-line carapace length are useful for identifying adult male loggerheads, not all large loggerheads with short tail lengths are females; thus, ultrasound enables the collection of additional data for determining the sex of pubescent loggerheads.

This procedure is a noninvasive technique commonly used in human medicine that allows the imaging of gonadal tissue and has been successfully used with loggerheads. Ultrasonography will occur at sea using a portable Sonosite 180Plus and imaging will occur with the turtle in supine position while resting on a foam-filled rubber tire. Imaging may also occur with turtles in an upright position while resting on a rubber tire, but such that a rear flipper is draped over the tire to provide a suitable space for the ultrasound probe to work in the inguinal region cranial to the hind leg. A coupling gel is used to insure transmission of the ultrasonic signal. Imaging data are electronically stored for future review, reducing this procedure time to approximately 10 min.

Like the procedures discussed above, the researcher has done ultrasonic examination of sea turtles under previous permits. It is a short-duration, non-invasive procedure, with no evidence of harm to turtles under previous permits.

8.4.5 Tumor Removal

The removal of tumors is invasive and potentially hazardous to the turtle. Familiarization with sea turtle anatomy is essential prior to doing surgery. It is also important to use aseptic techniques at all times to prevent infections. Tumor(s) would be removed with the use of electrosurgery, which allows coagulation of the blood vessels as the tissue is dissected, resulting in minimal blood loss. Effects of surgery could include pain, handling discomfort, possible hemorrhage at the site with a risk of infection. Particular caution is necessary to avoid an entry that is too deep; striking vital organs during surgery has the potential of inducing severe bleeding and mortality. It is currently common practice to avoid the use of general anesthetics (with veterinary approval) whenever possible, since a local anesthetic incurs less risk of mortality, is adequate for reducing apparent pain, and allows a much shorter post-operative observation period (Wibbels et al. 1990). Turtles will be held for 24 hours following recovery from anesthesia and closely monitored to evaluate breathing and diving capability and released once normal buoyancy has been confirmed.

Unusual growths or lesions on soft or hard tissues will be photographed and a portion of the growth/lesion gently removed by appropriately trained personnel using a 6mm biopsy tool as appropriate. Samples will be stored in 95 percent ethanol and transferred to the University of Florida College of Veterinary Medicine for identification. This procedure will only be performed opportunistically and in situations where collecting the biopsy sample can be done without causing injury to the animal; however, because there is no way to predict a priori which animals this procedure will need to be performed with, it is included as a standard sampling procedure. To date, only five biopsies have been collected for more than 2,700 sea turtles captured across the various Section 10 permits since 2000 for the researchers under Permit No. 19621-01.

8.4.6 Application of Tags and Satellite Transponders

All sea turtles will also be scanned or visually inspected for PIT and flipper tags, respectively. If either of these is absent, then individuals will be tagged with them. Both procedures involve the implantation of tags in or through skin and/or muscle of the flippers. The PIT tags remain internal while flipper tags have both internal and external components. For both, internal tag parts are expected to be biologically inert. In addition to the stress sea turtles are expected to experience by handling and restraint associated with inspection and tagging, we expect an additional stress response associated with the short-term pain experienced during tag implantation (Balazs 1999), although this will be reduced by a standard injection of an anesthetic. We expect disinfection methods proposed by the applicant should mitigate infection risks from tagging. Wounds are expected to heal without infection. Researchers applying for all permits have routinely applied tags over many years. Those that have recaptured individuals report never seeing evidence of infection resulting from tagging or blood sampling. Tags are designed to be small, physiologically inert, and not hinder movement or cause chafing; we do not expect the tags themselves to negatively impact sea turtles (Balazs 1999). Flipper tags occasionally come off of turtle flippers, which may cause tissue ripping and subsequent trauma and infection risk; an observation reported occasionally be researchers under the proposed permits considered here. However, individuals who have lost flipper tags have not been observed to be in any different body condition than turtles lacking tags or those who still retain their tags. Based upon these experiences, behavioral responses may or may not be evident during tag implantation; when evident, behavioral responses will be fleeting, and lasting effects resulting in pathological consequences are not expected.

Transmitters, as well as biofouling of the tag, attached to the carapace of turtles increase hydrodynamic drag and affect lift and pitch. For example, Watson and Granger (1998) performed wind tunnel tests on a full-scale juvenile green turtle and found that, at small flow angles representative of straight-line swimming, a transmitter mounted on the carapace increased drag by 27 to 30 percent, reduced lift by less than 10 percent, and increased pitch moment by 11 to 42 percent. It is likely that this type of transmitter attachment would negatively affect the swimming energetics of the turtle. Based on the results of hardshell sea turtles equipped with this tag setup, NMFS is unaware of transmitters resulting in any serious injury to these species. These tags are unlikely to become entangled due to their streamlined profile and will typically be shed after about one year, posing no long-term risks to the turtle. The permit would require the researchers streamline the attachment materials so that neither buoyancy nor drag would affect the turtle's swimming ability, in addition to reducing the risk of entanglement. There would be no gap allowed between the transmitter and the turtle. All transmitters would be attached in the most hydrodynamic manner possible, minimizing the epoxy footprint. Removal of the transmitters at the end of the experiment is a non-invasive procedure and is not expected to result in any significant stress above that which has occurred during recapture. The transmitter attachment (ties) will break away and release the sonic tag after its life is finished in case, for some unexpected reason, the researchers are unable to recapture an animal to remove it.

Sonic tags/transponders emit a moderate to high frequency sonic pulse detectable using an underwater directional hydrophone (Yano and Tanaka 1991). Triangulation of the acoustic signal allows researchers to determine turtle locations. The sonic transmitters would have a frequency of approximately 50 to 80 kilohertz. This frequency level is not expected to adversely affect turtles. Sea turtles have low-frequency hearing sensitivity and are potentially affected by sound energy in the band below 1,000 Hertz (Lenhardt 2003). Bartol et al. (1999) found the effective bandpass of the loggerhead sea turtle to be between at least 250 and 1,000 hertz. Ridgeway et al. (1969) found the maximum sensitivity of green sea turtle hearing to fall within 300 to 500 hertz with a sharp decline at 750 hertz. Since the sonic tags authorized for sea turtle tracking research would be well above this hearing threshold, these tags would not be heard by the turtles. NMFS would not expect the transmitters to interfere with turtles' normal activities after they are released. Another important consideration is whether the sounds emitted by the sonic transmitters would attract potential predators, primarily sharks. Unfortunately, hearing data on sharks is limited. Casper and Mann (2004) examined the hearing abilities of the nurse shark and results showed that this species detects low-frequency sounds from 100 to 1,000 hertz, with best sensitivity from 100 to 400 hertz. Myrberg (2001) explained that audiograms have been published on elasmobranchs. Although we do not have hearing information for all the sharks that could potentially prey on sea turtles, estimates for hearing sensitivity in available studies provided ranges of 25 to 1,000 hertz. In general, these studies found that shark hearing is not as sensitive as in other tested fishes, and that sharks are most sensitive to low-frequency sounds (Casper et al. 2003). Thus, it appears that the sonic transmitters would not attract potential shark predators to the turtles, because the frequency of the sonic tags is well above the 1,000 hertz threshold.

The transmitters will be affixed to the central section of the turtles' carapace using epoxy and/or resined fiberglass using the method further described following Balazs et al. (1996) and Van Dam et al. (2008). However, whenever possible, transmitters will not be placed at the peak height of the carapace to make attachments as hydrodynamic as possible (Jones et al. 2011). Turtles are held for 1 to 2 hours after attaching the transmitters to allow adhesives to set. From the time of capture until release, procedures (e.g., satellite tag attachment) may take up to 3 hours for each turtle. No mortalities have resulted from the application of tags and transmitters under either applicant's prior and current permits. The researchers have successfully recaptured tagged turtles and have found them to be in good health.

8.4.7 Laproscopy

Laparoscopy is a form of surgery that involves a small incision being made allowing access by a miniature camera and sampling equipment into the body cavity. This procedure allows direct viewing of organs and tissues (such as reproductive tracts to confirm sex) as well as sampling (such as biopsies of internal organs). However, as with any surgical procedure, laparoscopy introduces the risk of infection not only at the surgical site, but also within the body cavity. The procedure also requires veterinary staff experienced in the procedure and sea turtle anatomy in order to be performed safely. The procedure is likely to be very stressful for subjects, as it involves restraining the individual in a head-down position for an extended period. Although anaesthesia (local and/or systemic) is also involved, a degree of pain can be expected at least with the sutured surgical site after the procedure is complete and anaesthesia has worn off.

Even though laparoscopy has the potential to cause lethal or major sub-lethal injury, few studies have been conducted evaluating the effects of laparoscopy on sea turtles. Perhaps the best study on the long-term effects of laparoscopy was conducted over 30 years ago when sea turtles were being farmed for commercial use. Wood et al. (1983) performed laparoscopy on over 50 sea turtles in an aquaculture facility where all individuals were retained and monitored. No individual died or appeared to suffer long-term injury as a result of procedures conducted in less aseptic conditions and using less-refined methods than proposed by the applicant for proposed Permit No. 19621. Because gas is introduced into the body cavity without a way to escape, there is the possibility that excessive gas may remain in the body cavity following the procedure. However, individuals will be checked for buoyancy issues prior to release. If buoyancy is not correct, sea turtles will remain under care until corrected.

More recently, Dobbs et al. (2007) reported findings after conducting laparoscopy on 225 free-ranging adult nesting hawksbill sea turtles in Australia. Individuals were released following the procedure. The researchers found stitches were gone in individuals returning to lay additional nests, but those individuals that returned to lay additional nests took on average one day longer to return than individuals that did not undergo laparoscopy (Dobbs et al. 2007). Some individuals were resighted in subsequent nesting seasons (Dobbs et al. 2007). Of the 225 hawksbill sea turtles, 27 were injured during laparoscopy, which included (24 of 27 received lung punctures and the other three injuries were blood vessel punctures of egg yolks or ovaries; Dobbs et al. 2007). This may be a unique feature of hawksbill sea turtles, as researchers noted that hawksbill lungs extended around the gut when the turtle was inverted for laparoscopy; a condition that was not found in green or loggerhead sea turtles (Dobbs et al. 2007). The researchers modified their methods so as to reduce the potential for injury (Dobbs et al. 2007). One sea turtle with lung puncture was seen to nest again the same season, and five were seen nesting in subsequent seasons (Dobbs et al. 2007).

8.5 Risk Analysis

In this section we assess the consequences of the responses to the individuals that have been exposed, the populations those individuals represent, and the species those populations comprise. Whereas the Response Analysis identified the potential responses of ESA-listed species to the proposed action, this section summarizes our analysis of the expected risk to individuals, populations, and species given the expected exposure to those stressors and the expected responses to those stressors.

We measure risks to individuals of endangered or threatened species using changes in the individuals' fitness, which may be indicated by changes the individual's growth, survival, annual reproductive success, and lifetime reproductive success. When we do not expect ESA-listed animals exposed to an action's effects to experience reductions in fitness, we would not expect the action to have adverse consequences on the viability of the populations those individuals represent or the species those populations comprise.

Tissue and blood sampling, and flipper/PIT tagging are all activities that will break the integument and create the potential for infection or other physiological disruptions. The applicant and co-investigators have procedures in place to reduce the potential for infection or disease transmission. To date, the applicants have not documented a case of infection or mortality in sea turtles, which were exposed to these research activities. Based on this past performance and the rigor of aseptic conditions, we do not expect any individuals to develop infections or experience other pathological conditions associated with these activities.

Flipper- and satellite-tagged sea turtles will experience a greater degree of drag through the water than they otherwise would. This drag would be experienced continually over years after flipper tags are applied and over shorter periods of months to a year for tags applied to the carapace. However, we expect the amount of drag to be minimal. To date, many thousands of sea turtles have been flipper tagged in relatively standard ways, and we are unaware of flipper tagging leading to reduced growth, impaired mobility or altered migration, deteriorated body condition, or other outcomes that could impair the survival, growth, or reproductive potential of any individual sea turtle.

Any time a turtle is removed from its natural habitat and handled, it undoubtedly experiences stress. However, based on observations over decades of research, the applicant's proposed procedures have had minor, if any, adverse effects on the captured turtles. This is evidenced by the subsequent recapture of previously encountered sea turtles as well as telemetry data that do not indicate abnormalities in turtle movement or behavior post-encounter. Many turtles have been recaptured from the applicant's in-water netting programs have later been observed on nesting beaches as adults; some turtles captured inshore and exhibiting fibropapillomas have later been recaptured with regressed or no tumors. Negative impacts on the turtles will be minimized by covering turtles with wet towels and keeping them in the shade while being held, disinfecting tagging equipment, disinfecting holding areas and tubs, following antiseptic protocol when drawing blood or taking biopsies, reducing hydrodynamic drag from transmitters via transmitter profile, placement, and attachment method, and releasing the turtles as soon as possible.

We expect up to three Northwest Atlantic Ocean DPS loggerheads and two North Atlantic DPS greens, two Kemp's ridley, one leatherback, one hawksbill, and one olive ridley sea turtles to die over the life of Permit No. 20339. We expect up to two Northwest Atlantic Ocean DPS loggerheads and one each of North Atlantic DPS green, Kemp's ridley, and leatherback sea turtles to die over the life of Permit No. 19621-01.

Any mortalities are likely to come from the Florida nesting population for loggerhead, the Rancho Nuevo population for Kemp's ridleys, one of several small Caribbean nesting populations for leatherback, or one of three Gulf of Mexico nesting populations for green sea turtles. Green sea turtle populations are generally growing, as are leatherback sea turtles in the Caribbean. Based upon this, the loss of one North Atlantic DPS green or a leatherback sea turtle is not likely to sizably decrease the survival rate or recovery potential of a given population. Kemp's ridley sea turtle population recovery over the past two decades has been robust, with greater than ten percent annual increases in nesting from year-to-year in many cases, with several thousand females nesting annually and range expansions onto Texas beaches becoming more common. However, the past couple of years have showed declines (Caillouet Jr. 2014). For purposes of this consultation, given the long-term increase and recent decline, we expect the population trajectory to be stable over the long term. Considering the tens to hundreds of thousands of individuals (Caillouet Jr. 2014) that are currently a part of the population, the loss of a single individual (even an adult female) as a result of the proposed research is not expected to alter the survival or recovery trajectory of the Kemp's ridley population. Loggerhead sea turtle nesting along the Florida coast has been increasing over the past couple of decades, but has declined in 2013 and has been stable in 2014 and 2015 (FFWCC 2016). Overall, we expect the nesting trend to be roughly stable. This population is expected to number many thousands of individuals (FFWCC 2016). Overall, we do not expect the loss of two individuals from this population to alter the survival or recovery trajectory of Florida population of the Northwest Atlantic Ocean DPS of loggerhead sea turtles.

NMFS does expect some individual sea turtles will die, appreciably reducing the survival, growth, and reproductive potential of these individuals, as a result of the proposed actions. However, at the population level, NMFS does not expect the proposed research activities to appreciably reduce the North Atlantic DPS green, Kemp's ridley, hawksbill, leatherback, olive ridley or Northwest Atlantic Ocean DPS loggerhead sea turtles' likelihood of survival and recovery in the wild by adversely affecting their birth rates, death rates, growth rates, or recruitment rates. Otherwise, for a majority of sea turtles, the proposed action is not expected to have more than short-term stress effects and some longer-term effects associated with wound healing from biopsy, blood sampling, laparoscopy, and tagging. The data generated by the applicants regarding these populations over the duration of these involved study will provide beneficial information that will be important to the management and recovery of threatened and endangered species. The information collected as a direct result of permit issuance will be used to implement the goals identified in the recovery plans for all listed sea turtle species.

9 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 areas of the Federal actions subject to consultation (50 CFR 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 (non-Federal) actions reasonably certain to occur in the action area. We did not find any information about non-Federal actions other than what has already been described in the Environmental Baseline, which we expect will continue in the future. Anthropogenic effects include climate change, ship strikes, sound, military activities, fisheries, pollution, and scientific research, although some of these activities would involve a federal nexus and thus, but subject to future ESA section 7 consultation. An increase in these activities could result in an increased effect on ESA-listed species; however, the magnitude and significance of any anticipated effects remain unknown at this time. The best scientific and commercial data available provide little specific information on any long-term effects of these potential sources of disturbance on sea turtle populations.

10 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. In this section, we add the *Effects of the Action* (Section 8) to the *Environmental Baseline* (Section 7) and the *Cumulative Effects* (Section 9) to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) 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; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the *Status of the Species and Critical Habitat* (Section 6).

The following discussions separately summarize the probable risks the proposed action poses to threatened and endangered species and critical habitat that are likely to be exposed. These summaries integrate the exposure profiles presented previously with the results of our response analyses for each of the actions considered in this opinion.

We expect all targeted sea turtles to experience some degree of stress response to handling and restraint following capture, blood and tissue sampling, tumor removal, and PIT/flipper tagging and satellite transponder attachment. We also expect many of these individuals to respond behaviorally by attempting to fight when initially captured, startle when blood sampled, biopsied, or tagged, and strongly swim away when released. We do not expect more than temporary displacement or removal of individuals for a period of hours from small areas as a result of the proposed actions. Individuals responding in such ways may temporarily cease feeding, breeding, resting, or otherwise disrupt vital activities. However, we do not expect that these disruptions will cause a measureable impact to any individual's growth or reproduction.

We expect all tagged individuals to experience additional physiological reactions associated with foreign body penetration into the muscle, including inflammation, scar tissue development, and/or a small amount of drag associated with the applied tags. We also do not expect any pathological responses to procedures that breach the skin. A small metabolic cost to individuals held for several hours will also occur. Responses here should be limited to wound healing that should not impair the survival, growth, or reproduction of any individual.

We expect up to three Northwest Atlantic Ocean DPS loggerheads and two North Atlantic DPS green, two Kemp's ridley, one leatherback, one hawksbill, and one olive ridley sea turtles to die over the life of Permit No. 20339. We expect up to two Northwest Atlantic Ocean DPS loggerheads and one each of North Atlantic DPS green, Kemp's ridley, and leatherback sea turtles to die over the life of Permit No. 19621-01. These individuals will cease to contribute to their respective populations. However, at the population level, NMFS does not expect the proposed research activities to appreciably reduce the North Atlantic DPS green, Kemp's ridley, hawksbill, leatherback, olive ridley or Northwest Atlantic Ocean DPS loggerhead sea turtles' likelihoods of survival and recovery in the wild by adversely affecting their birth rates, death rates, growth rates, or recruitment rates. Overall, we do not expect any population to experience a fitness consequence as a result of the proposed actions and, by extension, do not expect species-level effects.

A few Carolina and South Atlantic DPS sturgeon, shortnose sturgeon, Gulf sturgeon, or smalltooth sawfish may be captured incidental to research activities. We expect these individuals will experience a brief stress response during capture, handling, and release. No individual is expected to experience longer-term effects that would impair any individual's fitness.

Overall, we do not expect any population to experience a fitness consequence as a result of the proposed actions and, by extension, do not expect species-level effects.

11 Conclusion

After reviewing the current status of the ESA-listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS' biological opinion that the proposed actions are not likely to jeopardize the continued existence or recovery of the North Atlantic green turtle DPS, Kemp's ridley, Northwest Atlantic DPS loggerhead, leatherback, olive ridley or hawksbill sea turtles; or the Atlantic, Gulf, or shortnose surgeon; or U.S. DPS of smalltooth sawfish. Further, we do not expect the issuance of Permit Nos. 20339 or 19621-01 to destroy or adversely modify any designated critical habitat.

12 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.

Harass is further defined as an act that “creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering” (NMFSPD 02-110-19).

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 incidental take statement.

We do not expect incidental take of threatened or endangered sea turtle species as a result of the proposed actions because all actions that may affect ESA-listed species would be undertaken in a directed manner as authorized by the permits. 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, which does have regulatory provisions in place requiring exemption for incidental take (78 FR 69310).

12.1 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).

The NMFS anticipates the proposed permits along the southeastern U.S. are likely to result in the incidental take of ESA-listed species by capture and harassment.

For Permit No. 20339, we expect two shortnose sturgeon annually, four Atlantic sturgeon annually (Gulf of Maine, Carolina, South Atlantic, New York Bight, or Chesapeake Bay DPS), two Gulf sturgeon annually, and three smalltooth sawfish over the life of the permit.

For Permit No. 19621-01, we expect five shortnose sturgeon, ten Atlantic sturgeon (Carolina or South Atlantic DPS), and two smalltooth sawfish over the life of the permit.

These species would be captured by trawl or tangle net during sea turtle research, which will elicit a behavioral and stress response that would constitute harassment. Capture durations are sufficiently short that we do not expect more severe pathological effects, including mortality, to occur. Individuals will be released according to NMFS guidelines (Kahn and Mohead 2010) and permit conditions for the capture of these species.

12.2 Effects of the Take

In this opinion, NMFS 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 or destruction or adverse modification of designated critical habitat.

12.3 Reasonable and Prudent Measures

The measures described below are nondiscretionary, and must be undertaken by NMFS Permits and Conservation 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 measures described below are necessary and appropriate to minimize the impacts of incidental take on threatened and endangered species:

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

12.4 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the Permits and Conservation Division must comply with the following terms and conditions, which implement 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)). These terms and conditions are non-discretionary. If the researchers or Permits and Conservation Division fail to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

To implement the reasonable and prudent measure, the NMFS' Permits and Conservation Division shall report to the ESA Interagency Coordination Division the number of incidental takes for each species that occurs under any permit upon expiration of the permit. Any take exceedance must be reported immediately.

13 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 CFR §402.02).

The ESA Interagency Cooperation Division recommends that annual reports submitted to the Permits Division require detail on the exposure and response of listed individuals to permitted activities. The specific activities that each sea turtle is exposed should be identified. A minimum of general comments on response can be informative regarding methodological, population, researcher-based responses in future consultations. The number and types of responses observed should be summarized and include responses of both target and non-target individuals. This will greatly aid in analyses of likely impacts of future activities.

The Permits Division should work with the sea turtle recovery team and the research community to develop protocols that would have sufficient power to determine the cumulative impacts (that is, includes the cumulative lethal, sub-lethal, and behavioral consequences) of existing levels of research on individuals populations of sea turtles. The Permits Division should review the annual reports and final reports submitted by researchers that have conducted research on sea turtles as well as any data and results that can be obtained from the permit holders. This should be used to estimate the numbers of sea turtles killed and harassed by these investigations, and how the harassment affects the life history of individual animals.

In order for the Office of Protected Resources, ESA Interagency Cooperation Division to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, ESA-listed species or their designated critical habitat, the Permits Division should notify the ESA Interagency Cooperation Division of any conservation recommendations they implement in their final action.

14 REINITIATION OF CONSULTATION

This concludes formal consultation for the Permits Division proposed issuance of Permit Nos. 20339 and 19621-01. As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect ESA-listed species or designated critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the ESA-listed species or designated critical habitat that was not considered in this opinion, or (4) a new species is ESA-listed or designated critical habitat designated that may be affected by the action.

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16 APPENDICES

16.1 Appendix A, Permit No. 20339 Terms and Conditions

Section 10(a)(1) of the ESA requires the prescription of terms and conditions as part of the scientific research permit. The Permits Division proposes to include the following terms and conditions in Permit No. 20339. The text below was taken directly from the proposed permit provided to us in the consultation initiation package.

The activities authorized herein must occur by the means, in the areas, and for the purposes set forth in the permit application, and as limited by the Terms and Conditions specified in this permit, including attachments and appendices. Permit noncompliance constitutes a violation and is grounds for permit modification, suspension, or revocation, and for enforcement action.

A. Duration of Permit

1. Personnel listed in Condition C.1 of this permit (hereinafter "Researchers") may conduct activities authorized by this permit through XXXX, 2022. This permit expires on the date indicated and is non-renewable. This permit may be extended by the Director, NMFS Office of Protected Resources, pursuant to applicable regulations and the requirements of the ESA.

2. Researchers must immediately stop permitted activities and the Permit Holder must contact the Chief, NMFS Permits and Conservation Division (hereinafter "Permits Division") for written permission to resume

   a. If serious injury or mortality[1] of protected species occurs.

   b. If authorized take[2] is exceeded in any of the following ways:

      i. More animals are taken than allowed in Appendix 1.

      ii. Animals are taken in a manner not authorized by this permit.

[1] This permit does allow for unintentional serious injury and mortality caused by the presence or actions of researchers as specified in Appendix 1. This includes, but is not limited to: deaths resulting from infections related to sampling procedures; and deaths or injuries sustained by animals during capture and handling, or while attempting to avoid researchers or escape capture.

[2] Under the ESA, a take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to do any of the preceding.

iii. Protected species other than those authorized by this permit are taken.

c. Following incident reporting requirements at Condition E.2.

B. Number and Kind(s) of Protected Species, Location(s) and Manner of Taking

1. The tables in Appendix 1 outline the number of protected species, by species, authorized to be taken, and the locations, manner, and time period in which they may be taken.

2. Researchers working under this permit may collect visual images (e.g., photographs, video) in addition to the photo-identification authorized in Appendix 1 as needed to document the permitted activities, provided the collection of such images does not result in takes.

3. The Permit Holder may use visual images and audio recordings collected under this permit, including those authorized in Appendix 1, in printed materials (including commercial or scientific publications) and presentations provided the images and recordings are accompanied by a statement indicating that the activity was conducted pursuant to NMFS ESA Permit No. 20339. This statement must accompany the images and recordings in all subsequent uses or sales.

4. The Chief, Permits Division may grant written approval for personnel performing activities not essential to achieving the research objectives (e.g., a documentary film crew) to be present, provided

a. The Permit Holder submits a request to the Permits Division specifying the purpose and nature of the activity, location, approximate dates, and number and roles of individuals for which permission is sought.

b. Non-essential personnel/activities will not influence the conduct of permitted activities or result in takes of protected species.

c. Persons authorized to accompany the Researchers for the purpose of such non-essential activities will not be allowed to participate in the permitted activities.

d. The Permit Holder and Researchers do not require compensation from the individuals in return for allowing them to accompany Researchers.

5. Researchers must comply with the following conditions related to the manner of taking:

Turtles Captured Under Another Authority Prior to Research Activities

a. Research activities may be performed on sea turtles from other sources only if the Permit Holder can demonstrate that the sea turtles were taken legally (e.g., covered by the incidental take statement [ITS] of an ESA section 7 biological opinion with a "no jeopardy" conclusion or an ESA section 10 permit incidental take permit or scientific research permit).

b. If the capture authority reduces the take level for a species during the life of the permit, researchers may only conduct procedures on the reduced take limit for that capture source.

c. Researchers must only use turtles that appear in good health and are active, and if there is no chance that further stress from the research may compromise the animal.

General Handling, Resuscitation, and Release

d. Researchers must

i. Handle turtles according to procedures specified in 50 CFR 223.206(d)(1)(i). Use care when handling live animals to minimize any possible injury.

ii. Use appropriate resuscitation techniques on any comatose turtle prior to returning it to the water.

iii. When possible, transfer injured, compromised, or comatose animals to rehabilitation facilities and allow them an appropriate period of recovery before return to the wild.

iv. Have an experienced veterinarian, veterinary technician, or rehabilitation facility (i.e., medical personnel) on call for emergencies.

e. If an animal becomes highly stressed, injured, or comatose during capture or handling or is found to be compromised upon capture, Researchers must forego or cease activities that will further significantly stress the animal (erring on the side of caution) and contact the on call medical personnel as soon as possible. Compromised turtles include animals that are obviously weak, lethargic, positively buoyant, emaciated, or that have severe injuries or other abnormalities resulting in debilitation. One of the following options must be implemented (in order of preference):

i. Based on the instructions of the veterinarian, if necessary, immediately transfer the animal to the veterinarian or to a rehabilitation facility to receive veterinary care.

ii. If medical personnel cannot be reached at sea, the Permit Holder should err on the side of caution and bring the animal to shore for medical evaluation and rehabilitation as soon as possible.

iii. If the animal cannot be taken to a rehabilitation center due to logistical or safety constraints, allow it to recuperate as conditions dictate, and return the animal to the sea.

f. In addition to Condition A.2, the Permit Holder is responsible for following the status of any sea turtle transported to rehab as a result of permitted activities and reporting the final disposition (death, permanent injury, recovery and return to wild, etc.) of the animal to the Chief, Permits Division.

g. In the event an animal dies as a result of research activities, the Permit Holder must, within two weeks, submit an incident report as described in Condition E.2. A necropsy should be performed, except where not feasible such as in remote areas with limited personnel. Gross necropsy findings should be included as part of an incident report. Final necropsy findings (e.g., histology and other analyses) must be submitted when complete.

h. While holding sea turtles, Researchers must:

i. Protect sea turtles from temperature extremes (ideal air temperature range is between 70°F and 80°F).

ii. Provide adequate air flow.

iii. Keep sea turtles moist when the temperature is ≥ 75°F.

iv. Keep the area surrounding the turtle free of materials that could be accidentally ingested.

i. During release, turtles must be lowered as close to the water's surface as possible to prevent injury.

j. For research activities occurring aboard commercial fishing vessels or in conjunction with other NMFS research, NMFS researchers must carefully observe newly released turtles and record observations on the turtle's apparent ability to swim and dive in a normal manner.

k. Extra care must be exercised when handling, sampling and releasing leatherbacks. Field and laboratory observations indicate that leatherbacks have more friable skin and softer bones than hardshell turtles which tend to be hardier and less susceptible to trauma. Researchers must:

i. only board leatherbacks if they can be safely brought on board the vessel.

ii. handle and support leatherbacks from underneath, with one person on either side of the turtle.

iii. not turn leatherbacks on their backs.

Handling, Measuring, Weighing, PIT and Flipper Tagging

l. Refer to Attachment 1 for more information on the requirements for handling and sampling sea turtles.

m. Researchers must:

i. Clean and disinfect all equipment (tagging equipment, tape measures, etc.) and surfaces that comes in contact with sea turtles between the processing of each turtle.

ii. Maintain a designated set of instruments and other items should be used on turtles with fibropapillomatosis. Items that come into contact with sea turtles with fibropapillomas should not be used on turtles without tumors. All measures possible should be exercised to minimize exposure and cross-contamination between affected turtles and those without apparent disease, including use of disposable gloves and thorough disinfection of equipment and surfaces. Appropriate disinfectants include 10% bleach and other viricidal solutions with proven efficacy against herpes viruses.

iii. Examine turtles for existing flipper and PIT tags before attaching or inserting new ones. If existing tags are found, the tag identification numbers must be recorded. Researchers must have PIT tag readers capable of reading 125, 128, 134.2, and 400 kHz tags.

iv. Clean and disinfect

A. flipper tags (*e.g.*, to remove oil residue) before use;

B. tag applicators, including the tag injector handle, between sea turtles; and

C. the application site before the tag pierces the animal’s skin.

n. Passive Integrated Transponder Tagging

i. Use new, sterile tag applicators (needles) each time.

ii. The application site must be cleaned and then scrubbed with two replicates of a medical disinfectant solution (e.g., Betadine, Chlorhexidine) followed by 70% isopropyl alcohol before the applicator pierces the animal’s skin. If it has been exposed to fluids from another animal, the injector handle must be disinfected between animals.

o. Marking the Carapace

i. Researchers must use non-toxic paints or markers that do not generate heat or contain xylene or toluene.

ii. Markings should be easily legible using the least amount of paint or media necessary to re-identify the animal.

Sampling

p. Biopsy Sampling

i. A new biopsy punch must be used on each turtle.

ii. Turtles brought on-board the vessel for sampling:

Aseptic techniques must be used at all times. Samples must be collected from the trailing edge of a flipper if possible and practical (preference should be given to a rear flipper if practical). At a minimum, the tissue surface must be thoroughly swabbed with a medical disinfectant solution (e.g., Betadine, Chlorhexidine) followed by alcohol before sampling. The procedure area and Researchers' hands must be clean.

iii. Turtles not boarded for sampling:

A. Turtles must be sampled using a biopsy pole in the location most safely and easily accessed by the researcher and released.

B. Samples may be collected from anywhere on the limbs or neck, avoiding the head.

iv. If it can be easily determined (through markings, tag number, etc.) that a sea turtle has been recaptured by the fisheries and has been already sampled under this permit, no additional biopsy samples may be collected from the animal during the same permit year.

Non-Target Species

q. Bycatch: All incidentally captured species (e.g., fishes) must be released alive as soon as possible.

r. North Atlantic Right Whale: If a right whale is seen, Researchers must maintain a distance of at least 460 meters (500 yards) from the animal. Please report all right whale sightings to NMFS Sighting Advisory System:

- in any location to the U.S. Coast Guard on channel 16
- from VA to ME to 978-585-8473
- from NC to FL to 904-237-4220.

s. Manatees: Attachment 2 includes mitigation measures required by the U.S. Fish and Wildlife Service to minimize impacts to manatees.

t. Shortnose//Gulf/Atlantic Sturgeon Handling Requirements [placeholder as a result of consultation if needed]

u. Smalltooth Sawfish [placeholder as a result of consultation if needed]

v. Submerged Aquatic Vegetation (SAV; e.g., seagrass) Coral Communities, Hard and Live Bottom Habitat

i. Researchers must take all practicable steps including the use of charts, GIS, sonar, fish finders, or other electronic devices to determine characteristics and suitability of bottom habitat prior to using gear to identify SAV, coral communities, and live/hard bottom habitats and avoid setting gear in such areas.

ii. No gear may be set, anchored on, or pulled across SAV, coral or hard/live bottom habitats.

iii. If research gear is lost, diligent efforts would be made to recover the lost gear to avoid further damage to benthic habitat and impacts related to “ghost fishing.”

iv. Johnson’s sea grass and critical habitat. No research activities may be conducted over, on, or immediately adjacent to Johnson’s sea grass or in Johnson’s sea grass critical habitat.

v. *Other sea grass species*. Researchers must avoid conducting research over, on, or immediately adjacent to any non-listed sea grass species. If these non-listed species cannot be avoided, then the following avoidance/minimization measures must be implemented:

A. To reduce the potential for sea grass damage, anchors must be set by hand when water visibility is acceptable. Anchors must be placed in unvegetated areas within sea grass meadows or areas having relatively sparse vegetation coverage. Anchor removal must be conducted in a manner that would avoid the dragging of anchors and anchor chains.

B. Researchers must take great care to avoid damaging any sea grass species and if the potential for anchor or net drag is evident researchers must suspend research activities immediately.

C. Researchers must be careful not to tread or trample on sea grass and coral reef habitat.

6. <u>Transfer of Sea Turtle Biological Samples</u>

a. Samples may be sent to the Authorized Recipients listed in Appendix 2 provided that

i. The analysis or curation is related to the research objectives of this permit.

ii. A copy of this permit accompanies the samples during transport and remains on site during analysis or curation.

b. Samples remain in the legal custody of the Permit Holder while in the possession of Authorized Recipients.

c. The transfer of biological samples to anyone other than the Authorized Recipients in Appendix 2 requires written approval from the Chief, Permits Division.

d. Samples cannot be bought or sold.

C. Qualifications, Responsibilities, and Designation of Personnel

1. At the discretion of the Permit Holder, the following Researchers may participate in the conduct of the permitted activities in accordance with their qualifications and the limitations specified herein:

   a. Principal Investigator – Jeff Gearhart

   b. Co-Investigator(s) –See Appendix 2 for list of names and corresponding activities.

   c. Research Assistants – personnel identified by the Permit Holder or Principal Investigator and qualified to act pursuant to Conditions C.2, C.3, and C.4 of this permit.

2. Individuals conducting permitted activities must possess qualifications commensurate with their roles and responsibilities. The roles and responsibilities of personnel operating under this permit are as follows:

   a. The Permit Holder is ultimately responsible for activities of individuals operating under the authority of this permit. The Responsible Party is the person at the institution/facility who is responsible for the supervision of the Principal Investigator.

   b. The Principal Investigator (PI) is the individual primarily responsible for the taking, import, export and related activities conducted under the permit. The PI must be on site during activities conducted under this permit unless a Co-Investigator named in Condition C.1 is present to act in place of the PI.

c. Co-Investigators (CIs) are individuals who are qualified to conduct activities authorized by the permit, for the objectives described in the application, without the on-site supervision of the PI. CIs assume the role and responsibility of the PI in the PI's absence.

d. Research Assistants (RAs) are individuals who work under the direct and on-site supervision of the PI or a CI. RAs cannot conduct permitted activities in the absence of the PI or a CI.

3. Personnel involved in permitted activities must be reasonable in number and essential to conduct of the permitted activities. Essential personnel are limited to

a. individuals who perform a function directly supportive of and necessary to the permitted activity (including operation of vessels or aircraft essential to conduct of the activity),

b. individuals included as backup for those personnel essential to the conduct of the permitted activity, and

c. individuals included for training purposes.

4. Persons who require state or Federal licenses or authorizations (e.g., veterinarians) to conduct activities under the permit must be duly licensed/authorized and follow all applicable requirements when undertaking such activities.

5. Permitted activities may be conducted aboard vessels or aircraft, or in cooperation with individuals or organizations, engaged in commercial activities, provided the commercial activities are not conducted simultaneously with the permitted activities, except as specifically provided for in an Incidental Take Statement or Incidental Take Permit for the specific commercial activity.

6. The Permit Holder cannot require or receive direct or indirect compensation from a person approved to act as PI, CI, or RA under this permit in return for requesting such approval from the Permits Division.

7. The Permit Holder or PI may designate additional CIs without prior approval from the Chief, Permits Division provided

    a. A copy of the letter designating the individual and specifying their duties under the permit is forwarded to the Permits Division by facsimile or email on the day of designation.

    b. The copy of the letter is accompanied by a summary of the individual's qualifications to conduct and supervise the permitted activities.

    c. The Permit Holder acknowledges that the designation is subject to review and revocation by the Chief, Permits Division.

8. The Responsible Party may request a change of PI by submitting a request to the Chief, Permits Division that includes a description of the individual's qualifications to conduct and oversee the activities authorized under this permit.

9. Submit requests to add CIs or change the PI by one of the following:

    a. the online system at https://apps.nmfs.noaa.gov;
    b. an email attachment to the permit analyst for this permit; or
    c. a hard copy mailed or faxed to the Chief, Permits Division, Office of Protected Resources, NMFS, 1315 East-West Highway, Room 13705, Silver Spring, MD 20910; phone (301)427-8401; fax (301)713-0376.

D. Possession of Permit

1. This permit cannot be transferred or assigned to any other person.

2. The Permit Holder and persons operating under the authority of this permit must possess a copy of this permit when

a. Engaged in a permitted activity.

b. A protected species is in transit incidental to a permitted activity.

c. A protected species taken under the permit is in the possession of such persons.

3. A duplicate copy of this permit must accompany or be attached to the container, package, enclosure, or other means of containment in which a protected species or protected species part is placed for purposes of storage, transit, supervision or care.

E. Reporting

1. The Permit Holder must submit incident, annual, and final reports containing the information and in the format specified by the Permits Division.

a. Reports must be submitted to the Permits Division by one of the following:

i. the online system at https://apps.nmfs.noaa.gov;

ii. an email attachment to the permit analyst for this permit; or

iii. a hard copy mailed or faxed to the Chief, Permits Division.

b. You must contact your permit analyst for a reporting form if you do not submit reports through the online system.

2. Incident Reporting

a. If the total number of mortalities is reached, or authorized takes have been exceeded as specified in Conditions A.2 and B.5.g, the Permit Holder must

i. Contact the Permits Division by phone (301-427-8401) as soon as possible, but no later than 2 business days of the incident;

ii. Submit a written report within 2 weeks of the incident as specified below; and

iii. Receive approval from the Permits Division before resuming work. The Permits Division may grant authorization to resume permitted activities based on review of the incident report and in consideration of the Terms and Conditions of this permit.

b. Any time a serious injury or mortality of a protected species occurs, a written report must be submitted within two weeks.

c. The incident report must include (1) a complete description of the events and (2) identification of steps that will be taken to reduce the potential for additional serious injury and research-related mortality or exceeding authorized take.

3. Annual reports describing activities conducted during the previous permit year (from February 15 to February 14) must

a. be submitted by May 15 each year for which the permit is valid, and

b. include a tabular accounting of takes and a narrative description of activities and effects.

4. A final report summarizing activities over the life of the permit must be submitted by (August 15), or, if the research concludes prior to permit expiration, within 180 days of completion of the research.

5. Research results must be published or otherwise made available to the scientific community in a reasonable period of time. Copies of technical reports, conference abstracts, papers, or publications resulting from permitted research must be submitted the Permits Division.

F. Notification and Coordination

1. NMFS Regional Offices are responsible for ensuring coordination of the timing and location of all research activities in their areas to minimize unnecessary duplication, harassment, or other adverse impacts from multiple researchers.

2. The Permit Holder must provide written notification of planned field work to the applicable NMFS Region at least two weeks prior to initiation of each field trip/season. If there will be multiple field trips/seasons in a permit year, a single summary notification may be submitted per year.

   a. Notification must include the

      i. locations of the intended field study and/or survey routes;

      ii. estimated dates of activities; and

      iii. number and roles of participants (for example: PI, CI, veterinarian, boat driver, safety diver, animal restrainer, Research Assistant "in training").

   b. Notification must be sent to the Southeast or Greater Atlantic Assistant Regional Administrators for Protected Resources as applicable to the location of your activity:

      For activities in NC, SC, GA, FL, AL, MS, LA, TX, PR, and USVI:

      Southeast Region, NMFS, 263 13th Ave South, St. Petersburg, FL 33701; phone (727)824-5312; fax (727)824-5309

      Email (*preferred*): nmfs.ser.research.notification@noaa.gov; and

      For activities in ME, VT, NH, MA, NY, CT, NJ, DE, RI, MD, and VA: Greater Atlantic Region, NMFS, 55 Great Republic Drive, Gloucester, MA 01930; phone (978)281-9328; fax (978)281-9394

      Email (*preferred*): NMFS.GAR.permit.notification@noaa.gov

3. To the maximum extent practical, the Permit Holder must coordinate permitted activities with activities of other Permit Holders conducting the same or similar activities on the same species, in the same locations, or at the same times of year to avoid unnecessary disturbance of animals. Contact the applicable Regional Offices listed above for information about coordinating with other Permit Holders.

G. Observers and Inspections

1. NMFS may review activities conducted under this permit. At the request of NMFS, the Permit Holder must cooperate with any such review by

   a. allowing an employee of NOAA or other person designated by the Director, NMFS Office of Protected Resources to observe permitted activities; and

   b. providing all documents or other information relating to the permitted activities.

H. Modification, Suspension, and Revocation

1. Permits are subject to suspension, revocation, modification, and denial in accordance with the provisions of subpart D [Permit Sanctions and Denials] of 15 CFR part 904.

2. The Director, NMFS Office of Protected Resources may modify, suspend, or revoke this permit in whole or in part

   a. in order to make the permit consistent with a change made after the date of permit issuance with respect to applicable regulations prescribed under section 4 of the ESA;

   b. in a case in which a violation of the terms and conditions of the permit is found;

   c. in response to a written request[3] from the Permit Holder;

[3] The Permit Holder may request changes to the permit related to: the objectives or purposes of the permitted activities; the species or number of animals taken; and the location, time, or manner of taking or importing protected species. Such requests must be submitted in writing to the Permits Division in the format specified in the application instructions.

d. if NMFS determines that the application or other information pertaining to the permitted activities (including, but not limited to, reports pursuant to Section E of this permit and information provided to NOAA personnel pursuant to Section G of this permit) includes false information; and

e. if NMFS determines that the authorized activities will operate to the disadvantage of threatened or endangered species or are otherwise no longer consistent with the purposes and policy in Section 2 of the ESA.

3. Issuance of this permit does not guarantee or imply that NMFS will issue or approve subsequent permits or modifications for the same or similar activities requested by the Permit Holder, including those of a continuing nature.

I. Penalties and Permit Sanctions

1. A person who violates a provision of this permit, the ESA, or the regulations at 50 CFR 222-226 is subject to civil and criminal penalties, permit sanctions, and forfeiture as authorized under the, ESA, and 15 CFR part 904.

2. The NMFS Office of Protected Resources shall be the sole arbiter of whether a given activity is within the scope and bounds of the authorization granted in this permit.

a. The Permit Holder must contact the Permits Division for verification before conducting the activity if they are unsure whether an activity is within the scope of the permit.

b. Failure to verify, where the NMFS Office of Protected Resources subsequently determines that an activity was outside the scope of the permit, may be used as evidence of a violation of the permit, the ESA, and applicable regulations in any enforcement actions.

J. Acceptance of Permit

1. In signing this permit, the Permit Holder

a. agrees to abide by all terms and conditions set forth in the permit, all restrictions and relevant regulations under 50 CFR Part 222-226, and all restrictions and requirements under the ESA;

b. acknowledges that the authority to conduct certain activities specified in the permit is conditional and subject to authorization by the Office Director; and

c. acknowledges that this permit does not relieve the Permit Holder of the responsibility to obtain any other permits, or comply with any other Federal, State, local, or international laws or regulations.

Appendix 1: Tables Specifying the Kind(s) of Protected Species, Location(s), and Manner of Taking

Table 1: Authorized Take of Sea Turtles of All Life Stages except Hatchlings in the Atlantic Ocean, Gulf of Mexico, Caribbean Sea, and their estuarine and coastal environments. Takes are annual except for mortalities as noted in the Details.

Project A: Turtle Excluder Device Evaluations. Where capture is not authorized, sea turtles may only be processed that were legally captured incidentally in a Federal fishery under section 7 of the ESA. If the ITS for the fishery increases, and only if a no jeopardy conclusion was made on the new consultation, researchers may take additional turtles up to the amount of the new ITS but not to exceed the limits of this permit. If the ITS decreases, researchers may take only the number authorized in the lower ITS.

Species	Listing Unit	No. Animals	Take Action	Collect Method	Procedures	Details
Turtle, loggerhead sea	Range-wide (NMFS Threatened)	150	Handle/Release	Capture under other authority	Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh	Annual takes
		70	Capture/Handle/Release	Net, trawl		
Turtle, Kemp's ridley sea	Range-wide (NMFS Endangered)	80	Handle/Release	Capture under other authority		
		25	Capture/Handle/Release	Net, trawl		
Turtle, leatherback sea	Range-wide (NMFS Endangered)	65	Handle/Release	Capture under other authority		
		20	Capture/Handle/Release	Net, trawl		
Turtle, green sea	North Atlantic DPS (Threatened)	35	Handle/Release	Capture under other authority		

Table 1: Authorized Take of Sea Turtles of All Life Stages except Hatchlings in the Atlantic Ocean, Gulf of Mexico, Caribbean Sea, and their estuarine and coastal environments. Takes are annual except for mortalities as noted in the Details.

Project A: Turtle Excluder Device Evaluations. Where capture is not authorized, sea turtles may only be processed that were legally captured incidentally in a Federal fishery under section 7 of the ESA. If the ITS for the fishery increases, and only if a no jeopardy conclusion was made on the new consultation, researchers may take additional turtles up to the amount of the new ITS but not to exceed the limits of this permit. If the ITS decreases, researchers may take only the number authorized in the lower ITS.

Species	Listing Unit	No. Animals	Take Action	Collect Method	Procedures	Details
		15	Capture/Handle/Release	Net, trawl		
Turtle, hawksbill sea	Range-wide (NMFS Endangered)	20	Handle/Release	Capture under other authority		
		10	Capture/Handle/Release	Net, trawl		
Turtle, olive ridley sea	Range-wide (NMFS Threatened)	20	Handle/Release	Capture under other authority	Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh	Annual takes
		10	Capture/Handle/Release	Net, trawl		
Turtle, unidentified sea	N/A	50	Handle/Release	Capture under other authority		
		25	Capture/Handle/Release	Net, trawl		
Turtle, loggerhead sea	Range-wide (NMFS Threatened)	3	Unintentional mortality	Net, trawl	Salvage (carcass, tissue, parts); Unintentional mortality	Mortalities due to trawl authorized over life of
Turtle, Kemp's ridley sea	Range-wide (NMFS Endangered)	2				

Table 1: Authorized Take of Sea Turtles of All Life Stages except Hatchlings in the Atlantic Ocean, Gulf of Mexico, Caribbean Sea, and their estuarine and coastal environments. Takes are annual except for mortalities as noted in the Details.

Project A: Turtle Excluder Device Evaluations. Where capture is not authorized, sea turtles may only be processed that were legally captured incidentally in a Federal fishery under section 7 of the ESA. If the ITS for the fishery increases, and only if a no jeopardy conclusion was made on the new consultation, researchers may take additional turtles up to the amount of the new ITS but not to exceed the limits of this permit. If the ITS decreases, researchers may take only the number authorized in the lower ITS.

Species	Listing Unit	No. Animals	Take Action	Collect Method	Procedures	Details
Turtle, green sea	North Atlantic DPS (Threatened)	2				permit, not annual.
Turtle, leatherback sea	Range-wide (NMFS Endangered)	1				
Turtle, hawksbill sea	Range-wide (NMFS Endangered)	1				
Turtle, olive ridley sea	Range-wide (NMFS Threatened)	1				

Table 2: Authorized Annual Take of Sea Turtles in Atlantic Ocean, Gulf of Mexico, Caribbean Sea and their estuarine and coastal environments.

Turtle, loggerhead sea	Range-wide (NMFS Threatened)	30	Capture under other authority	Import/export/receive, parts; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh
Turtle, Kemp's ridley sea	Range-wide (NMFS Endangered)	10		
Turtle, leatherback sea	Range-wide (NMFS Endangered)	30		
Turtle, green sea	North Atlantic DPS (Threatened)	10		
Turtle, hawksbill sea	Range-wide (NMFS Endangered)	10		
Turtle, olive ridley sea	Range-wide (NMFS Threatened)	10		
Turtle, unidentified sea	N/A	10		

Table 3. Takes Authorized by the Incidental Take Statement of the Biological Opinion prepared for ESA Section 7 Consultation on Permit No. 20339 Associated with Project A in Table 1.

Species	Listing Unit	No. of Animals	Take Action	Details
Shortnose Sturgeon	Range-wide	2	Incidental Take	Annually; Due to trawl or tangle net capture; fish must be released alive
Atlantic Sturgeon	Gulf of Maine, Carolina, South Atlantic, New York Bight, and Chesapeake Bay DPS	4	Incidental Take	Annually; Due to trawl or tangle net capture; fish must be released alive
Gulf Sturgeon	Range-wide	2	Incidental Take	Annually; Due to trawl or tangle net capture; fish must be released alive
Smalltooth Sawfish	U.S. DPS	3	Incidental Take	Over entire lifespan of permit (5-years); Due to trawl or tangle net capture; fish must be released alive

Appendix 2: NMFS-Approved Personnel and Authorized Recipients for Permit No. 20339.

The following individuals are approved to act as Co-Investigators pursuant to the terms and conditions under Section C (Qualifications, Responsibilities, and Designation of Personnel) of this permit.

Name of Co-Investigator	**Activities**
Daniel Foster	All research activities
Bret Hataway	
John Mitchell	

Biological samples authorized for collection or acquisition in Tables 1 and 2 of Appendix 1 may be transferred to the following Authorized Recipients for the specified disposition, consistent with Condition B.6 of the permit:

Authorized Recipient	**Sample Type**	**Disposition**
Peter Dutton, NMFS Southwest Fisheries Science Center La Jolla, CA	Tissue	Analysis

Attachment 1: Requirements for Handling and Sampling Sea Turtles

Conditions have been included in the permit for research procedures that involve the handling and sampling of sea turtles. These conditions include requirements provided by a suite of expert veterinarians to minimize and mitigate potential impacts to the study animals. This information is being provided to help understand the permit requirements and standard veterinary protocols for sea turtles.

I. Permit requirements for antiseptic practices and research techniques

Measures required to minimize risk of infection and cross-contamination between individuals generally fall under the categories of clean, aseptic, and sterile techniques. Clean technique applies to noninvasive procedures that result in contact with skin or mucous membranes. Aseptic technique is used for brief, invasive procedures that result in any degree of internal contact, e.g. drawing blood. Sterile technique applies to longer invasive procedures, such as laparoscopy or surgery. Reusable instruments for procedures requiring aseptic or sterile technique should be sterilized by standard autoclave or cold sterilization procedures. Instruments that do not have internal contact, e.g. tagging pliers and PIT tag applicators, should be disinfected using a broadcidal solution and the product-recommended contact time between individuals.

<u>Clean technique:</u>

1. Routine hand washing or use of non-sterile disposable gloves.
2. Cleaning and disinfection of equipment between individuals.

<u>Aseptic technique:</u>

1. Disinfection of hands or use of new non-sterile disposable gloves (preferred)
2. Disinfection of the turtle's skin using a surgical scrub (e.g. betadine scrub or chlorhexidine gluconate)† followed by application of 70% alcohol (isopropyl or ethanol) (minimum requirement).*
3. Clean work area.
4. Use of sterile instruments or new disposable items (e.g. needles and punch biopsies) between individuals.

† Alcohol alone may be used in lieu of surgical scrub if necessary to avoid interference with research objectives, e.g. isotopic analysis.

* Multiple applications and scrubbing should be used to achieve thorough cleansing of the procedure site as necessary. A <u>minimum of two</u> alternating applications of surgical scrub and alcohol are to be used for PIT tag application sites and drilling into the carapace, due to potential increased risk of infection.

<u>Sterile technique:</u>

1. To be conducted in accordance with approved veterinary protocol that considers analgesia/anesthesia, use of antimicrobials, anticipated risks and response measures, and exclusionary criteria for animal candidacy.
2. Direct veterinary attendance
3. Disinfection of hands and use of sterile disposable gloves
4. Dedicated site (surgery room) or work area modified to reduce contamination
5. Surgical preparation of skin
6. Sterile instruments

Research Procedure	
Handling, gastric lavage, and cloacal lavage	Clean technique
Tissue sampling (biopsy punch or comparable)	Aseptic technique
Blood sampling	Aseptic technique
PIT tagging	Aseptic technique; 2 applications of surgical scrub and alcohol
Flipper tagging	Aseptic technique
Carapace drilling for instrument attachment or bone biopsy	Aseptic technique; 2 applications of surgical scrub and alcohol
Bone biopsy (other than carapace)	Sterile
Laparoscopy (+/- biopsy)	Sterile
Large skin, muscle, fat biopsy, other tissue biopsy	Sterile

II. Minimum requirements for pain management and field techniques

Procedures used for sea turtle research include those anticipated to cause short term pain or distress, such as tagging, as well more invasive procedures where relatively longer periods of pain or discomfort may result. The minimum requirements below consider animal welfare and relative benefits and risks of different modes of pain management under field and laboratory conditions. Additional measures are encouraged whenever possible, including sedation or anesthesia for invasive procedures, e.g. laparoscopy, when release does not immediately follow the procedure and full recovery can be assessed.

Research Procedure	**Minimum Requirement**
Tissue sampling (biopsy punch or comparable)	None
Blood sampling	None
PIT tagging	Local anesthetic if <30 cm SCL
Flipper tagging	None
Carapace drilling for instrument attachment or bone biopsy	Systemic analgesic
Bone biopsy (other than carapace)	Local anesthetic and systemic analgesic
Laparoscopy	Local anesthetic and systemic analgesic
Laparoscopy biopsy	Local anesthetic, sedation, and systemic analgesic
Large skin, muscle, fat biopsy, other tissue biopsy	Local anesthetic and systemic analgesic

16.2 Appendix B, Permit No. 19621-01 Terms and Conditions

Section 10(a)(1) of the ESA requires the prescription of terms and conditions as part of the scientific research permit. The Permits Division proposes to include the following terms and conditions in Permit No. 19621-01. The text below was taken directly from the proposed permit provided to us in the consultation initiation package.

The activities authorized herein must occur by the means, in the areas, and for the purposes set forth in the permit application, and as limited by the Terms and Conditions specified in this permit, including attachments and appendices. Permit noncompliance constitutes a violation and is grounds for permit modification, suspension, or revocation, and for enforcement action.

A. Duration of Permit

1. Personnel listed in Condition C.1 of this permit (hereinafter "Researchers") may conduct activities authorized by this permit through June 15, 2021. This permit expires on the date indicated and is non-renewable. This permit may be extended by the Director, NMFS Office of Protected Resources, pursuant to applicable regulations and the requirements of the ESA.

2. Researchers must immediately stop permitted activities and the Permit Holder must contact the Chief, NMFS Permits and Conservation Division (hereinafter "Permits Division") for written permission to resume

   b. if serious injury or mortality[4] of protected species reaches that specified in Table 6 of Appendix 1.

   d. if authorized take[5] is exceeded in any of the following ways:

[4] This permit allows for unintentional serious injury and mortality caused by the presence or actions of researchers up to the limit in Table 6 of Appendix 1. This includes, but is not limited to: deaths resulting from infections related to sampling procedures; and deaths or injuries sustained by animals during capture and handling, or while attempting to avoid researchers or escape capture.

[5] Under the ESA, a take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to do any of the preceding. By regulation, a take under the Marine Mammal Protection Act means to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal. This includes, without limitation, any of the following: The collection of dead animals, or parts thereof; the restraint or detention of a marine mammal, no matter how temporary; tagging a marine mammal; the negligent or intentional operation of an aircraft or vessel, or the doing of any other negligent or intentional act which results in disturbing or molesting a marine mammal; and feeding or attempting to feed a marine mammal in the wild.

i. More animals are taken than allowed in Tables 1- 6 of Appendix 1.

ii. Animals are taken in a manner not authorized by this permit.

iii. Protected species other than those authorized by this permit are taken.

e. following reporting requirements at Condition E.2.

3. The Permit Holder may continue to possess biological samples acquired[6] under this permit after permit expiration without additional written authorization, provided the samples are maintained as specified in this permit.

B. Number and Kind(s) of Protected Species, Location(s) and Manner of Taking

1. The tables in Appendix 1 outline the number of protected species authorized to be taken, and the locations, manner, and time period in which they may be taken.

2. Researchers working under this permit may collect images (e.g., photographs, video) in addition to the photo-identification or behavioral photo-documentation authorized in Appendix 1 as needed to document the permitted activities, provided the collection of such images does not result in takes.

3. The Permit Holder may use images and audio recordings collected under this permit, including those authorized in Tables 1-6 of Appendix 1, in printed materials (including commercial or scientific publications) and presentations provided the images and recordings are accompanied by a statement indicating that the activity was conducted pursuant to a NMFS Permit. This statement must accompany the images and recordings in all subsequent uses or sales.

4. The Chief, Permits Division may grant written approval for personnel performing activities not essential to achieving the research objectives (e.g., a documentary film crew) to be present, provided

d. The Permit Holder submits a request to the Permits Division specifying the purpose and nature of the activity, location, approximate dates, and number and roles of individuals for which permission is sought.

[6] Authorized methods of sample acquisition are specified in Appendix 1.

e. Non-essential personnel/activities will not influence the conduct of permitted activities or result in takes of protected species.

f. Persons authorized to accompany the Researchers for the purpose of such non-essential activities will not be allowed to participate in the permitted activities.

d. The Permit Holder and Researchers do not require compensation from the individuals in return for allowing them to accompany Researchers.

5. Researchers must comply with the following conditions related to the manner of taking:

<u>Capture Methods</u>

a. Entanglement Netting

i. Highly visible buoys must be attached to the float line of each net and spaced at intervals of every 10 yards or less.

ii. Nets must be checked at intervals of less than 30 minutes, and more frequently whenever turtles or other organisms are observed in the net. If water temperatures are $\leq 10^{o}C$ or $\geq 30^{o}C$, nets must be checked at less than 20-minute intervals. "Net checking" is defined as a thorough check of the net either by snorkeling in clear water or by pulling up on the top line such that the full depth of the net is viewed along the entire length.

iii. The float line of all nets must be observed at all times for movements that indicate an animal has encountered the net. When this occurs the net must be immediately checked.

iv. Researchers must plan for unexpected circumstances or demands of the research activities and have the ability and resources to meet net checking requirements at all times (e.g. if one animal is very entangled and requires extra time and effort to remove from the net, researchers must have sufficient staff and resources to continue checking the rest of the net at the same time).

c. Trawling: Tow times must not exceed 42 minutes (doors in to doors out) with a 30 minute bottom time.

d. Marine Mammals:

i. Researchers must make every effort to prevent interactions with marine mammals. Researchers must be aware of the presence and location of these animals at all times as they conduct activities.

ii. Except for the presence of dolphins or porpoises when trawling, netting must not be deployed if marine mammals are observed within the vicinity. Marine mammals must be allowed to either leave or pass through the area safely before trawling or tangle netting is initiated.

iii. Should marine mammals enter the research area after tangle nets have been set, the lead line must be raised and dropped in an attempt to make marine mammals in the vicinity aware of the net.

iv. If marine mammals remain within the vicinity of the research area, tangle nets must be removed.

v. If a marine mammal enters the net, becomes entangled, or dies, Researchers must:

A. stop netting activities and immediately free the animal;

B. notify the NMFS Southeast Regional Stranding Coordinator as soon as possible (www.nmfs.noaa.gov/pr/health/coordinators.htm);

C. report the incident as specified in Condition E.2; and

D. suspend permitted activities until the Permits Division has granted approval to continue research per Condition E.2.

Permitted activities will be suspended until the Permits Division has granted approval to continue research per Condition E.2.

General Handling, Resuscitation, and Release

e. Researchers must

   i. Handle turtles according to procedures specified in 50 CFR 223.206(d)(1)(i). Use care when handling live animals to minimize any possible injury.

   ii. Use appropriate resuscitation techniques on any comatose turtle prior to returning it to the water.

   iii. When possible, transfer injured, compromised, or comatose animals to rehabilitation facilities and allow them an appropriate period of recovery before return to the wild.

   iv. Have an experienced veterinarian, veterinary technician, or rehabilitation facility (i.e., medical personnel) on call for emergencies.

f. If an animal becomes highly stressed, injured, or comatose during capture or handling or is found to be compromised upon capture, Researchers must forego or cease activities that will further significantly stress the animal (erring on the side of caution) and contact the on call medical personnel as soon as possible. Compromised turtles include animals that are obviously weak, lethargic, positively buoyant, emaciated, or that have severe injuries or other abnormalities resulting in debilitation. One of the following options must be implemented (in order of preference):

   i. Based on the instructions of the veterinarian, if necessary, immediately transfer the animal to the veterinarian or to a rehabilitation facility to receive veterinary care.

   ii. If medical personnel cannot be reached at sea, the Permit Holder should err on the side of caution and bring the animal to shore for medical evaluation and rehabilitation as soon as possible.

   iii. If the animal cannot be taken to a rehabilitation center due to logistical or safety constraints, allow it to recuperate as conditions dictate, and return the animal to the sea.

g. In addition to Condition A.2, the Permit Holder is responsible for following the status of any sea turtle transported to rehab as a result of permitted activities and reporting the final disposition (death, permanent injury, recovery and return to wild, etc.) of the animal to the Chief, Permits Division.

h. While holding sea turtles, Researchers must

   i. Protect sea turtles from temperature extremes.
   ii. Provide adequate air flow.
   iii. Keep sea turtles moist when the temperature is ≥ 75°F.
   iv. Keep the area surrounding the turtle free of materials that could be accidentally ingested.

i. During release, turtles must be lowered as close to the water's surface as possible to prevent injury.

j. Researchers must carefully monitor newly released turtles' apparent ability to swim and dive in a normal manner. If a turtle is not behaving normally within one hour of release, the turtle must be recaptured and taken to a rehabilitation facility.

k. Extra care must be exercised when handling, sampling and releasing leatherbacks. Field and laboratory observations indicate that leatherbacks have more friable skin and softer bones than hardshell turtles which tend to be hardier and less susceptible to trauma. Researchers must

   i. only board leatherbacks if they can be safely brought on board the vessel.
   ii. handle and support leatherbacks from underneath, with one person on either side of the turtle.
   iii. not turn leatherbacks on their backs.

Handling, Measuring, Weighing, PIT and Flipper Tagging

l. Refer to Appendix 2 for more information on the requirements for handling and sampling sea turtles.

m. Researchers must

   i. Clean and disinfect all equipment (tagging equipment, tape measures, etc.) and surfaces that comes in contact with sea turtles between the processing of each turtle.

ii. Maintain a designated set of instruments for use on turtles with fibropapillomatosis (FP). Items that come into contact with sea turtles with FP should not be used on turtles without tumors. All measures possible should be exercised to minimize exposure and cross-contamination between affected turtles and those without apparent disease, including use of disposable gloves and thorough disinfection of equipment and surfaces. Appropriate disinfectants include 10% bleach and other viricidal solutions with proven efficacy against herpes viruses.

iii. Examine turtles for existing flipper and PIT tags before attaching or inserting new ones. If existing tags are found, the tag identification numbers must be recorded. Researchers must have PIT tag readers capable of reading 125, 128, 134.2, and 400 kHz tags.

iv. Clean and disinfect

A. flipper tags (e.g., to remove oil residue) before use;

B. tag applicators, including the tag injector handle, between sea turtles; and

C. the application site before the tag pierces the animal's skin.

n. Passive Integrated Transponder (PIT) Tagging

i. Use new, sterile tag applicators (needles) each time.

ii. The application site must be cleaned and then scrubbed with two replicates of a medical disinfectant solution (e.g., Betadine, Chlorhexidine) followed by 70% isopropyl alcohol before the applicator pierces the animal's skin. If it has been exposed to fluids from another animal, the injector handle must be disinfected between animals.

iii. <u>Turtles < 30 cm SCL</u>

1. Researchers must have specialized experience to tag turtles < 30 cm SCL.

2. PIT tags should be inserted into the thickest part of the triceps superficialis muscle*. The tag must occupy no

more than an estimated 20% of the muscle's total volume and length. To determine eligibility, pinch the muscle forward and assess the tag size relative to the muscle size. Alternative sites may be used provided: 1) there is sufficient mass to accommodate the tag ($\leq$ 20%) and 2) there is minimal risk of injury to vital structures or other anatomical features.

3. Local anesthetic (e.g., lidocaine) must be used.

*The preferable site for Kemp's ridleys is the left triceps superficialis muscle to maximize the chances of tag detection, as the nesting project in Rancho Nuevo scans the left front flipper.

o. Marking the Carapace

i. Researchers must use non-toxic paints or markers that do not generate heat or contain xylene or toluene.

ii. Markings should be easily legible using the least amount of paint or media necessary to re-identify the animal.

<u>Sampling</u>

p. Blood Sampling

i. Blood samples must be directly taken by or supervised by experienced personnel.

ii. New disposable needles must be used on each animal.

iii. Collection sites must be thoroughly cleaned prior to sampling using Chlorhexidine-alcohol solution or betadine followed by 70% alcohol. Two (2) applications of alcohol may be used if disinfectant solutions may affect intended analyses.

iv. Samples must not be taken if an animal cannot be adequately immobilized for blood sampling or conditions on the boat preclude the safety and health of the turtle.

v. Attempts (needle insertions) to extract blood from the neck must be limited to a total of four, two on either side. Best practices must be followed, including retraction of the needle to the level of the subcutis prior to redirection to avoid lacerating vessels and causing other unnecessary soft tissue injury.

q. Blood Volume Limits

i. *Sample volume.* The volume of blood withdrawn must be the minimal volume necessary to complete permitted activities. A single sample must not exceed 3 ml per 1 kg of animal.

ii. *Sampling period.* Cumulative blood volume taken from a single turtle must not exceed the maximum safe limit described above within a 45-day period. If more than 50% of the maximum safe limit is taken, in a single event or cumulatively from repeat sampling events, from a single turtle within a 45-day period that turtle must not be re-sampled for 3 months from the last blood sampling event.

iii. *Research coordination.* Researchers must, to the maximum extent practicable, attempt to determine if any of the turtles they blood sample may have been sampled within the past 3 months or will be sampled within the next 3 months by other researchers. The Permit Holder must make efforts to contact other researchers working in the area that could capture the same turtles to ensure that none of the above limits are exceeded.

r. Tumor **and Skin** Biopsy Sampling

i. A new biopsy punch must be used on each turtle.

ii. Aseptic techniques must be used at all times. At a minimum, the tissue surface must be thoroughly swabbed with a medical disinfectant solution (e.g., Betadine, Chlorhexidine) followed by alcohol before sampling. The procedure area and Researchers' hands must be clean.

s. Laparoscopy

i. Compromised animals must not be subjected to this type of surgery.

ii. This procedure must be directly performed or overseen by a licensed veterinarian.

iii. A veterinary-approved pain management protocol must be followed.

Instrument Attachments: Acoustic and Satellite Tags

t. No more than one transmitter may be attached to an animal at one time.

u. Total combined weight of all transmitter attachments and media must not exceed 5% of the animal's body mass.

v. Each attachment must be made so that there is minimal risk of entanglement. The transmitter attachment must contain a weak link (where appropriate) or have no gap between the transmitter and the turtle that could result in entanglement. The lanyard length (if used) must be less than half of the turtle's carapace length. It must include a corrosive, breakaway link that will release the unit after its battery life.

w. Transmitters must not be placed at the peak height of the carapace whenever possible.

x. Researchers must make attachments as hydrodynamic as possible.

y. Adequate ventilation around the head of the turtle must be provided during the attachment of transmitters if attachment materials produce fumes.

Turtles must not be held in water during application to prevent skin or eye contact with harmful chemicals.

Holding

z. Turtles held in a facility must be maintained and cared for under the "Standard Permit Conditions for Care and Maintenance of Captive Sea Turtles," issued by the U.S. Fish and Wildlife Service.

Non-Target Species

aa. Bycatch: All incidentally captured species (e.g., sturgeon) must be released alive as soon as possible.

bb. Atlantic Sturgeon, Shortnose Sturgeon, and Sawfish:

  i. If a sturgeon is incidentally caught during trawling, efforts must be made to return it to neutral buoyancy prior to and during release. Sturgeon tend to inflate their swim bladder when stressed and in air. If the fish has air in its bladder, it will float and be susceptible to sunburn or bird attacks. Air must be released by gently applying ventral pressure in a posterior to anterior direction. The specimen must then be propelled rapidly downward during release.

  ii. All efforts must be made to release the animal as soon as possible while minimizing potential harm. This includes keeping the fish in the water to the maximum extent possible and, for sawfish, cutting the net from the rostrum and body of the animal. Do not attempt to disentangle the rostrum from the net.

  iii. When tangle netting, Researchers must have equipment (e.g., large hoop net) to safely support and board the fish on the vessel for disentanglement if it cannot be done in-water.

cc. Manatees: See Appendix 3 for requirements provided by the U.S. Fish and Wildlife Service.

dd. Submerged Aquatic Vegetation (SAV; e.g., seagrass) Coral Communities, Hard and Live Bottom Habitat

i. Researchers must take all practicable steps including the use of charts, GIS, sonar, fish finders, or other electronic devices to determine characteristics and suitability of bottom habitat prior to using gear to identify SAV, coral communities, and live/hard bottom habitats and avoid setting gear in such areas.

ii. No gear may be set, anchored on, or pulled across SAV, coral or hard/live bottom habitats.

iii. If research gear is lost, diligent efforts would be made to recover the lost gear to avoid further damage to benthic habitat and impacts related to "ghost fishing."

iv. *Seagrass*. Researchers must avoid conducting research over, on, or immediately adjacent to any seagrass species. If these species cannot be avoided, the following avoidance/minimization measures must be implemented:

A. To reduce the potential for sea grass damage, anchors must be set by hand when water visibility is acceptable. Anchors must be placed in unvegetated areas within seagrass meadows or areas having relatively sparse vegetation coverage. Anchor removal must be conducted in a manner that would avoid the dragging of anchors and anchor chains.

B. Researchers must take great care to avoid damaging any sea grass species and if the potential for anchor or net drag is evident researchers must suspend research activities immediately.

C. Researchers must be careful not to tread or trample on seagrass and coral reef habitat.

ee. North Atlantic Right Whale: If a right whale is seen, Researchers must maintain a distance of at least 460 meters (500 yards) from the animal. Report all right whale sightings to NMFS Sighting Advisory System:

- in any location to the U.S. Coast Guard on channel 16
- from VA to ME to 978-585-8473
- from NC to FL to 904-237-4220.

6. Transfer of Sea Turtle Biological Samples

e. Samples may be sent to the Authorized Recipients listed in Appendix 4 provided that

iii. The analysis or curation is related to the research objectives of this permit.

iv. A copy of this permit accompanies the samples during transport and remains on site during analysis or curation.

f. Samples remain in the legal custody of the Permit Holder while in the possession of Authorized Recipients.

g. The transfer of biological samples to anyone other than the Authorized Recipients in Appendix 4 requires written approval from the Chief, Permits Division.

h. Samples cannot be bought or sold.

C. Qualifications, Responsibilities, and Designation of Personnel

1. At the discretion of the Permit Holder, the following Researchers may participate in the conduct of the permitted activities in accordance with their qualifications and the limitations specified herein:

a. Principal Investigator – Michael Arendt--all activities except laparoscopy.

b. Co-Investigators – See Appendix 4 for list of names and corresponding activities.

c. Research Assistants – personnel identified by the Permit Holder or Principal Investigator and qualified to act pursuant to Conditions C.2, C.3, and C.4 of this permit.

2. Individuals conducting permitted activities must possess qualifications commensurate with their roles and responsibilities. The roles and responsibilities of personnel operating under this permit are as follows:

   a. The Permit Holder is ultimately responsible for activities of individuals operating under the authority of this permit. Where the Permit Holder is an institution/facility, the Responsible Party is the person at the institution/facility who is responsible for the supervision of the Principal Investigator.

   b. The Principal Investigator (PI) is the individual primarily responsible for the taking, import, export and related activities conducted under the permit. The PI must be on site during activities conducted under this permit unless a Co-Investigator named in Condition C.1 is present to act in place of the PI.

   c. Co-Investigators (CIs) are individuals who are qualified to conduct activities authorized by the permit, for the objectives described in the application, without the on-site supervision of the PI. CIs assume the role and responsibility of the PI in the PI’s absence.

   d. Research Assistants (RAs) are individuals who work under the direct and on-site supervision of the PI or a CI. RAs cannot conduct permitted activities in the absence of the PI or a CI.

3. Personnel involved in permitted activities must be reasonable in number and essential to conduct of the permitted activities. Essential personnel are limited to

   a. individuals who perform a function directly supportive of and necessary to the permitted activity (including operation of vessels or aircraft essential to conduct of the activity),

   b. individuals included as backup for those personnel essential to the conduct of the permitted activity, and

c. individuals included for training purposes.

4. Persons who require state or Federal licenses to conduct activities authorized under the permit (e.g., veterinarians, pilots) must be duly licensed when undertaking such activities.

5. Permitted activities may be conducted aboard vessels or aircraft, or in cooperation with individuals or organizations, engaged in commercial activities, provided the commercial activities are not conducted simultaneously with the permitted activities.

7. The Permit Holder cannot require or receive direct or indirect compensation from a person approved to act as PI, CI, or RA under this permit in return for requesting such approval from the Permits Division.

8. The Permit Holder or PI may add CIs by submitting a request to the Chief, Permits Division that includes a description of the individual's qualifications to conduct and oversee the activities authorized under this permit. If a CI will only be responsible for a subset of permitted activities, the request must also specify the activities for which they would provide oversight.

9. Submit requests to add CIs by one of the following:

   a. the online system at https://apps.nmfs.noaa.gov;
   b. an email attachment to the permit analyst for this permit; or
   c. a hard copy mailed or faxed to the Chief, Permits Division, Office of Protected Resources, NMFS, 1315 East-West Highway, Room 13705, Silver Spring, MD 20910; phone (301)427-8401; fax (301)713-0376.

D. Possession of Permit

1. This permit cannot be transferred or assigned to any other person.

2. The Permit Holder and persons operating under the authority of this permit must possess a copy of this permit when

d. Engaged in a permitted activity.

e. A protected species is in transit incidental to a permitted activity.

f. A protected species taken under the permit is in the possession of such persons.

3. A duplicate copy of this permit must accompany or be attached to the container, package, enclosure, or other means of containment in which a protected species or protected species part is placed for purposes of storage, transit, supervision or care.

E. Reports

4. The Permit Holder must submit annual, final, and incident reports containing the information and in the format specified by the Permits Division.

a. Reports must be submitted to the Permits Division by one of the following:

iv. the online system at https://apps.nmfs.noaa.gov;

v. an email attachment to the permit analyst for this permit; or

vi. a hard copy mailed or faxed to the Chief, Permits Division.

c. You must contact your permit analyst for a reporting form if you do not submit reports through the online system.

2. Incident reports: must be submitted within two weeks of exceeding authorized takes, as specified in Conditions A.2 and B.5.c.

d. The incident report must include a complete description of the events and identification of steps that will be taken to reduce the potential for additional exceeding authorized take.

e. In addition to the written report, the Permit Holder must contact the Permits Division by phone (301-427-8401) as soon as possible, but no later than within two business days of the incident.

f. The Permits Division may grant authorization to resume permitted activities based on review of the incident report and in consideration of the Terms and Conditions of this permit.

3. Annual reports describing activities conducted during the previous permit year (from January 1 to December 31st) must

a. be submitted by March 31st each year for which the permit is valid, and

b. include a tabular accounting of takes and a narrative description of activities and effects.

4. A final report summarizing activities over the life of the permit must be submitted by December 15, 2021, or, if the research concludes prior to permit expiration, within 180 days of completion of the research.

5. Research results must be published or otherwise made available to the scientific community in a reasonable period of time. Copies of technical reports, conference abstracts, papers, or publications resulting from permitted research must be submitted the Permits Division.

F. Notification and Coordination

1. The Permit Holder must provide written notification of planned field work to the applicable NMFS Region at least two weeks prior to initiation of each field trip/season. If there will be multiple field trips/seasons in a permit year, a single summary notification may be submitted per year.

c. Notification must include the
   i. locations of the intended field study and/or survey routes;
   ii. estimated dates of activities; and
   iii. number and roles of participants (for example: PI, CI, veterinarian, boat driver, safety diver, animal restrainer, Research Assistant “in training”).

d. Notification must be sent to the following Assistant Regional Administrator for Protected Resources:

Southeast Region, NMFS, 263 13th Ave South, St. Petersburg, FL 33701; phone (727)824-5312; fax (727)824-5309

Email (*preferred*): nmfs.ser.research.notification@noaa.gov

5. To the maximum extent practical, the Permit Holder must coordinate permitted activities with activities of other Permit Holders conducting the same or similar activities on the same species, in the same locations, or at the same times of year to avoid unnecessary disturbance of animals. Contact the Regional Office listed above for information about coordinating with other Permit Holders.

G. Observers and Inspections

1. NMFS may review activities conducted under this permit. At the request of NMFS, the Permit Holder must cooperate with any such review by

a. allowing an employee of NOAA or other person designated by the Director, NMFS Office of Protected Resources to observe permitted activities; and

b. providing all documents or other information relating to the permitted activities.

H. Modification, Suspension, and Revocation

1. Permits are subject to suspension, revocation, modification, and denial in accordance with the provisions of subpart D [Permit Sanctions and Denials] of 15 CFR part 904.

2. The Director, NMFS Office of Protected Resources may modify, suspend, or revoke this permit in whole or in part

a. in order to make the permit consistent with a change made after the date of permit issuance with respect to applicable regulations prescribed under section 4 of the ESA;

b. in a case in which a violation of the terms and conditions of the permit is found;

c. in response to a written request[7] from the Permit Holder;

d. if NMFS determines that the application or other information pertaining to the permitted activities (including, but not limited to, reports pursuant to Section E of this permit and information provided to NOAA personnel pursuant to Section G of this permit) includes false information; and

e. if NMFS determines that the authorized activities will operate to the disadvantage of threatened or endangered species or are otherwise no longer consistent with the purposes and policy in Section 2 of the ESA.

3. Issuance of this permit does not guarantee or imply that NMFS will issue or approve subsequent permits or modifications for the same or similar activities requested by the Permit Holder, including those of a continuing nature.

I. Penalties and Permit Sanctions

1. A person who violates a provision of this permit, the MMPA, ESA, or the regulations at 50 CFR 222-226 is subject to civil and criminal penalties, permit sanctions, and forfeiture as authorized under the ESA, and 15 CFR part 904.

2. The NMFS Office of Protected Resources shall be the sole arbiter of whether a given activity is within the scope and bounds of the authorization granted in this permit.

c. The Permit Holder must contact the Permits Division for verification before conducting the activity if they are unsure whether an activity is within the scope of the permit.

[7] The Permit Holder may request changes to the permit related to: the objectives or purposes of the permitted activities; the species or number of animals taken; and the location, time, or manner of taking or importing protected species. Such requests must be submitted in writing to the Permits Division in the format specified in the application instructions.

d. Failure to verify, where the NMFS Office of Protected Resources subsequently determines that an activity was outside the scope of the permit, may be used as evidence of a violation of the permit, the MMPA, the ESA, and applicable regulations in any enforcement actions.

J. Acceptance of Permit

1. In signing this permit, the Permit Holder

a. agrees to abide by all terms and conditions set forth in the permit, all restrictions and relevant regulations under 50 CFR Parts 222-226, and all restrictions and requirements under the ESA;

b. acknowledges that the authority to conduct certain activities specified in the permit is conditional and subject to authorization by the Office Director; and

c. acknowledges that this permit does not relieve the Permit Holder of the responsibility to obtain any other permits, or comply with any other Federal, State, local, or international laws or regulations.

Appendix 1: Tables Specifying the Kinds of Protected Species, Locations, and Manner of Taking

Table 1: Study 1 Authorized Annual Take of Adult, Subadult and Juvenile Sea Turtles by Trawl in Charleston, South Carolina Shipping Channel Entrance from June 2016 to July 15, 2017.

Species	Listing Unit	No. Animals	Collect Method	Procedures	Details
Turtle, loggerhead sea	Northwest Atlantic Ocean DPS (NMFS Threatened)	70	Net, trawl	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, loggerhead sea	Northwest Atlantic Ocean DPS (NMFS Threatened)	40	Net, trawl	Collect, tumors; Epibiota removal; Instrument, epoxy attachment (e.g., satellite tag, VHF tag); Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, cloacal swab; Sample, fecal; Sample, scute scraping; Ultrasound; Weigh	Standard plus acoustic tags, keratin (scute) and cloacal sampling
Turtle, Kemp's ridley sea	Range-wide (NMFS Endangered)	5	Net, trawl	Collect, tumors; Epibiota removal; Instrument, epoxy attachment (e.g., satellite tag, VHF tag); Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Sample, scute scraping; Ultrasound; Weigh	Standard plus acoustic tags and keratin sampling
Turtle, green sea	North Atlantic DPS (NMFS Threatened)	3	Net, trawl	Collect, tumors; Epibiota removal; Instrument, epoxy attachment (e.g., satellite tag, VHF tag); Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Sample, scute scraping; Ultrasound; Weigh	Standard plus acoustic tags and keratin sampling
Turtle, leatherback sea	Range-wide (NMFS Endangered)	1	Net, trawl	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Reduced standard processing
Turtle, olive ridley	**Range-wide (NMFS Threatened)**	**1**	**Net, trawl**	**Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh**	**Standard processing**

Table 2. Study 2 Authorized Annual Take of Adult, Subadult, and Juvenile Sea Turtles in Coastal and Estuarine Waters near Brunswick, Georgia including St. Simons Sound from June 2016 to August 31, 2017.

Species	Listing Unit	No. Animals	Collect Method	Procedures	Details
Turtle, Kemp's ridley sea	Range-wide (NMFS Endangered)	44	Net, trawl	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, Kemp's ridley sea	Range-wide (NMFS Endangered)	20	Net, trawl	Collect, tumors; Epibiota removal; Instrument, epoxy attachment (e.g., satellite tag, VHF tag); Laparoscopy; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Sample, scute scraping; Transport; Ultrasound; Weigh	Standard plus telemetry, keratin, laparoscopy
Turtle, Kemp's ridley sea	Range-wide (NMFS Endangered)	4	Net, Tangle	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, Kemp's ridley sea	Range-wide (NMFS Endangered)	20	Net, Tangle	Collect, tumors; Epibiota removal; Instrument, epoxy attachment (e.g., satellite tag, VHF tag); Laparoscopy; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Sample, scute scraping; Transport; Ultrasound; Weigh	Standard plus telemetry, keratin, laparoscopy
Turtle, loggerhead sea	Northwest Atlantic Ocean DPS (NMFS Threatened)	48	Net, trawl	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing

Turtle, loggerhead sea	Northwest Atlantic Ocean DPS (NMFS Threatened)	12	Net, Tangle	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, green sea	North Atlantic DPS (NMFS Threatened)	16	Net, trawl	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, cloacal swab; Sample, fecal; Sample, scute scraping; Ultrasound; Weigh	Standard plus keratin and cloacal swab
Turtle, green sea	North Atlantic DPS (NMFS Threatened)	24	Net, Tangle	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, cloacal swab; Sample, fecal; Sample, scute scraping; Ultrasound; Weigh	Standard plus keratin and cloacal swab
Turtle, leatherback sea	Range-wide (NMFS Endangered)	1	Net, trawl	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, leatherback sea	Range-wide (NMFS Endangered)	1	Net, Tangle	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, olive ridley	**Range-wide (NMFS Threatened)**	**1**	**Net, trawl**	**Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh**	**Standard processing**

Table 3. Study 3 Authorized Annual Take of Sea Turtles by Trawl in Port Canaveral, Florida Shipping Channel Entrance, **including neighboring shoals** from February 1, 2017 to **October 31, 2020**.

Species	Listing Unit	Life Stage	Sex	No. Animals	Procedures	Details
Turtle, green sea	North Atlantic DPS (NMFS Threatened)	Adult/ Subadult/ Juvenile	Male and Female	**9**	Collect, tumors; Epibiota removal; **Instrument, epoxy attachment (e.g., satellite tag, VHF tag)**;Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; **Sample, tissue;** Ultrasound; Weigh	**Standard processing plus telemetry**; **Up to 2 tag attachments at a time.**
Turtle, Kemp's ridley sea	Range-wide (NMFS Endangered)			15	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Measure; Photograph/Video; Sample, blood; Sample, cloacal swab; Sample, fecal; Sample, scute scraping; Ultrasound; Weigh	Standard plus keratin and cloacal swab
Turtle, leatherback sea	Range-wide (NMFS Endangered)			1	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, loggerhead sea	Northwest Atlantic Ocean DPS (NMFS Threatened)	Adult	Female	35	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing

Table 3. Study 3 Authorized Annual Take of Sea Turtles by Trawl in Port Canaveral, Florida Shipping Channel Entrance, **including neighboring shoals** from February 1, 2017 to **October 31, 2020**.

Species	Listing Unit	Life Stage	Sex	No. Animals	Procedures	Details
Turtle, loggerhead sea	Northwest Atlantic Ocean DPS (NMFS Threatened)	Juvenile/ Subadult	Male and Female	455	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, loggerhead sea	Northwest Atlantic Ocean DPS (NMFS Threatened)	Adult	Male	85	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, cloacal swab; Sample, fecal; Ultrasound; Weigh	Standard plus keratin and cloacal swab
Turtle, loggerhead sea	Northwest Atlantic Ocean DPS (NMFS Threatened)	Adult	Male	40	Collect, tumors; Epibiota removal; Instrument, epoxy attachment (e.g., satellite tag, VHF tag); Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, cloacal swab; Sample, fecal; Sample, scute scraping; Ultrasound; Weigh	Standard plus keratin, cloacal, and telemetry
Turtle, olive ridley	**Range-wide (NMFS Threatened)**	**Adult/ Subadult/ Juvenile**	**Male and Female**	**1**	**Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh**	**Standard processing**
Turtle, loggerhead sea	**Northwest Atlantic Ocean DPS (NMFS Threatened)**	**Adult/ Subadult/ Juvenile**	**Male and Female**	**9**	**Collect, tumors; Epibiota removal; Instrument, epoxy attachment (e.g., satellite tag, VHF tag); Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, tissue; Ultrasound; Weigh**	**Standard plus keratin, and telemetry; Up to 2 tag attachments at a time.**

Table 4. Study 4 Authorized Annual Take of Sea Turtles by Trawl in Atlantic waters from Winyah Bay, South Carolina to St. Augustine, Florida from May 1, 2018 to June 15, 2021.

Species	Listing Unit	Life Stage	Sex	No. Animals	Procedures	Details
Turtle, loggerhead sea	Northwest Atlantic Ocean DPS (NMFS Threatened)	Adult/ Subadult/ Juvenile	Male and Female	135	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, loggerhead sea	Northwest Atlantic Ocean DPS (NMFS Threatened)	Juvenile/ Subadult	Male and Female	20	Collect, tumors; Epibiota removal; Instrument, epoxy attachment (e.g., satellite tag, VHF tag); Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, cloacal swab; Sample, fecal; Sample, scute scraping; Ultrasound; Weigh	Standard plus cloacal, keratin, and telemetry
Turtle, loggerhead sea	Northwest Atlantic Ocean DPS (NMFS Threatened)	Adult	Male	5	Collect, tumors; Epibiota removal; Instrument, epoxy attachment (e.g., satellite tag, VHF tag); Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, cloacal swab; Sample, fecal; Sample, scute scraping; Ultrasound; Weigh	Standard plus cloacal, keratin, and telemetry
Turtle, Kemp's ridley sea	Range-wide (NMFS Endangered)	Adult/ Subadult/ Juvenile	Male and Female	35	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, Kemp's ridley sea	Range-wide (NMFS Endangered)	Adult/ Subadult/ Juvenile	Male and Female	10	Collect, tumors; Epibiota removal; Instrument, epoxy attachment (e.g., satellite tag, VHF tag); Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure;	Standard plus cloacal, keratin, and

Table 4. Study 4 Authorized Annual Take of Sea Turtles by Trawl in Atlantic waters from Winyah Bay, South Carolina to St. Augustine, Florida from May 1, 2018 to June 15, 2021.

Species	Listing Unit	Life Stage	Sex	No. Animals	Procedures	Details
					Photograph/Video; Sample, blood; Sample, cloacal swab; Sample, fecal; Sample, scute scraping; Ultrasound; Weigh	telemetry
Turtle, green sea	North Atlantic DPS (NMFS Threatened)	Adult/ Subadult/ Juvenile	Male and Female	3	Collect, tumors; Epibiota removal; Instrument, epoxy attachment (e.g., satellite tag, VHF tag); Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, cloacal swab; Sample, fecal; Sample, scute scraping; Ultrasound; Weigh	Standard plus cloacal, keratin, and telemetry
Turtle, leatherback sea	Range-wide (NMFS Endangered)	Adult/ Subadult/ Juvenile	Male and Female	1	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, olive ridley	**Range-wide (NMFS Threatened)**	**Adult/ Subadult/ Juvenile**	**Male and Female**	**1**	**Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh**	**Standard processing**

Table 5. Study 5 Authorized Annual Takes of Adult, Subadult, Juvenile Sea Turtles by Tangle Net in Estuarine and Near-shore Coastal South Carolina Waters from April 1, 2018 to June 15, 2021

Turtle, loggerhead sea	Northwest Atlantic Ocean DPS (NMFS Threatened)	18	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, loggerhead sea	Northwest Atlantic Ocean DPS (NMFS Threatened)	10	Collect, tumors; Epibiota removal; Instrument, epoxy attachment (e.g., satellite tag, VHF tag); Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Photograph/Video; Sample, blood; Sample, cloacal swab; Sample, fecal; Sample, scute scraping; Ultrasound; Weigh	Standard plus cloacal, keratin, and telemetry
Turtle, Kemp's ridley sea	Range-wide (NMFS Endangered)	46	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, Kemp's ridley sea	Range-wide (NMFS Endangered)	10	Collect, tumors; Epibiota removal; Instrument, epoxy attachment (e.g., satellite tag, VHF tag); Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, cloacal swab; Sample, fecal; Sample, scute scraping; Ultrasound; Weigh	Standard plus cloacal, keratin, and telemetry
Turtle, green sea	North Atlantic DPS (NMFS Threatened)	46	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, green sea	North Atlantic DPS (NMFS Threatened)	10	Collect, tumors; Epibiota removal; Instrument, epoxy attachment (e.g., satellite tag, VHF tag); Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Photograph/Video; Sample, blood; Sample, cloacal swab; Sample, fecal; Sample, scute scraping; Ultrasound; Weigh	Standard plus cloacal, keratin, and telemetry
Turtle, leatherback sea	Range-wide (NMFS Endangered)	1	Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh	Standard processing
Turtle, olive ridley	**Range-wide (NMFS Threatened)**	1	**Collect, tumors; Epibiota removal; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, blood; Sample, fecal; Ultrasound; Weigh**	**Standard processing**

Table 6: Authorized Mortality of Adult, Subadult, and Juvenile Sea Turtles Captured in all Projects over the Life of the Permit.				
Species	Listing Unit	No. Animals	Procedures	Details
Turtle, loggerhead sea	Northwest Atlantic Ocean DPS (NMFS Threatened)	2	Unintentional mortality	Due to trawl or tangle net capture over the course of the permit
Turtle, Kemp's ridley sea	Range-wide (NMFS Endangered)	1		
Turtle, green sea	North Atlantic DPS (NMFS Threatened)	1		
Turtle, leatherback sea	Range-wide (NMFS Endangered)	1		

Table 7: Incidental Take of Non-target Species Over the Life of the Permit Authorized by the ESA Section 7 Biological Opinion prepared for this permit.				
Species				
Sawfish, smalltooth	U.S. DPS (NMFS Endangered)	2	Incidental Take	Due to trawl or tangle net capture over the course of the permit; fish must be released alive
Sturgeon, Atlantic	Carolina and South Atlantic DPS (NMFS Endangered)	10		
Sturgeon, shortnose	Range-wide (NMFS Endangered)	5		

Appendix 2: Requirements for Handling and Sampling Sea Turtles

Conditions have been included in the permit for research procedures that involve the handling and sampling of sea turtles. These conditions include requirements provided by a suite of expert veterinarians to minimize and mitigate potential impacts to the study animals. This information is being provided to help understand the permit requirements and standard veterinary protocols for sea turtles.

III. Permit requirements for antiseptic practices and research techniques

Measures required to minimize risk of infection and cross-contamination between individuals generally fall under the categories of clean, aseptic, and sterile techniques. Clean technique applies to noninvasive procedures that result in contact with skin or mucous membranes. Aseptic technique is used for brief, invasive procedures that result in any degree of internal contact, e.g. drawing blood. Sterile technique applies to longer invasive procedures, such as laparoscopy or surgery. Reusable instruments for procedures requiring aseptic or sterile technique should be sterilized by standard autoclave or cold sterilization procedures. Instruments that do not have internal contact, e.g. tagging pliers and PIT tag applicators, should be disinfected using a broadcidal solution and the product-recommended contact time between individuals.

Clean technique:

1. Routine hand washing or use of non-sterile disposable gloves.
2. Cleaning and disinfection of equipment between individuals.

Aseptic technique:

1. Disinfection of hands or use of new non-sterile disposable gloves (preferred)
2. Disinfection of the turtle's skin using a surgical scrub (e.g. betadine scrub or chlorhexidine gluconate)† followed by application of 70% alcohol (isopropyl or ethanol) (minimum requirement).*
3. Clean work area.
4. Use of sterile instruments or new disposable items (e.g. needles and punch biopsies) between individuals.

† Alcohol alone may be used in lieu of surgical scrub if necessary to avoid interference with research objectives, e.g. isotopic analysis.

* Multiple applications and scrubbing should be used to achieve thorough cleansing of the procedure site as necessary. A minimum of two alternating applications of surgical scrub and alcohol are to be used for PIT tag application sites and drilling into the carapace, due to potential increased risk of infection.

Sterile technique:

1. To be conducted in accordance with approved veterinary protocol that considers analgesia/anesthesia, use of antimicrobials, anticipated risks and response measures, and exclusionary criteria for animal candidacy.
2. Direct veterinary attendance
3. Disinfection of hands and use of sterile disposable gloves
4. Dedicated site (surgery room) or work area modified to reduce contamination
5. Surgical preparation of skin
6. Sterile instruments

Research Procedure	Required Technique
Handling, gastric lavage, and cloacal lavage	Clean technique
Tissue sampling (biopsy punch or comparable)	Aseptic technique
Blood sampling	Aseptic technique
PIT tagging	Aseptic technique; 2 applications of surgical scrub and alcohol
Flipper tagging	Aseptic technique
Carapace drilling for instrument attachment or bone biopsy	Aseptic technique; 2 applications of surgical scrub and alcohol
Bone biopsy (other than carapace)	Sterile
Laparoscopy (+/- biopsy)	Sterile
Large skin, muscle, fat biopsy, other tissue biopsy	Sterile

IV. Minimum requirements for pain management and field techniques

Procedures used for sea turtle research include those anticipated to cause short term pain or distress, such as tagging, as well more invasive procedures where relatively longer periods of pain or discomfort may result. The minimum requirements below consider animal welfare and relative benefits and risks of different modes of pain management under field and laboratory conditions. Additional measures are encouraged whenever possible, including sedation or anesthesia for invasive procedures, e.g. laparoscopy, when release does not immediately follow the procedure and full recovery can be assessed.

Research Procedure	Minimum Requirement
Tissue sampling (biopsy punch or comparable)	None
Blood sampling	None

PIT tagging	Local anesthetic if <30 cm SCL
Flipper tagging	None
Carapace drilling for instrument attachment or bone biopsy	Systemic analgesic
Bone biopsy (other than carapace)	Local anesthetic and systemic analgesic
Laparoscopy	Local anesthetic and systemic analgesic
Laparoscopy biopsy	Local anesthetic, sedation, and systemic analgesic
Large skin, muscle, fat biopsy, other tissue biopsy	Local anesthetic and systemic analgesic

Appendix 3: Standard Conditions for Netting in Manatee Habitat

Permittees engaged in netting activities in manatee habitat shall comply with the following conditions provided by the U.S. Fish and Wildlife Service to protect manatees during project-related activities:

1. All project personnel shall be informed that manatees may be found in the project area and that there are civil and criminal penalties for harming, harassing, and/or killing manatees which are protected under the Federal MMPA, ESA, and other Federal, State, and Commonwealth laws and regulations.

2. Boat operators must avoid collisions with manatees through prudent seamanship and by adhering to Federal, State, and Commonwealth measures to prevent collisions with manatees, including Permit Conditions 3.(c) and 4.(a) below. In Florida, information about Federal and State manatee speed zones can be found at:
   http://myfwc.com/wildlifehabitats/managed/manatee/protection-zones/

3. Project personnel shall take steps to avoid the accidental capture of manatees in nets and associated gear. These steps shall include:

   a. Restricting netting activities to between one-half hour after sunrise and one-half hour before sunset.

   b. Monitoring netting sites for at least 15 minutes before deploying gear to ensure that manatees are not in the action area. Manatees must be allowed to leave or pass through the area safely before setting any nets. Animals must not be herded away or harassed into leaving.

   c. Having at least one experienced, dedicated observer watching for manatees during project-related activities and ensuring that all personnel are alert to the presence of manatees. Personnel should be encouraged to use sunglasses with polarized lenses to improve the likelihood of seeing manatees on and below the water's surface.

d. Monitoring nets and float lines constantly. Stopping all active netting, including vessel movements, when a manatee(s) comes within 100 feet of the action area. Activities may resume when the manatee(s) has moved 100 feet from the area or when it's been 30 minutes since the animal(s) was last seen.

e. Maintaining gear to minimize the likelihood of entangling manatees. Gear-related lines and ropes must be kept taut and free of kinks and knots. Stiff line or cable should be strung across the mouths of hoop and funnel nets at a perpendicular angle (to form an "X") to prevent manatees from entering these nets.

4. If a manatee is accidentally captured:

a. Immediately discontinue netting operations and turn off or idle boat motors.

b. Verify that the animal is entangled in your gear. Manatees occasionally appear in netting operations but are not entangled; they may also test or push against nets without entanglement.

c. For manatees entangled in gear, these animals are under duress and are known to injure people and damage nets and other gear. Project personnel should exercise extreme caution when in the presence of captured animals.

d. Monitor the manatee's breathing and behavior to assess its condition. Healthy animals surface to breathe about once every four minutes. Entangling nets, float lines, and other gear should be kept loose enough to allow animals to surface and breathe.

e. If a manatee's breathing pattern or behavior suggests that the animal is unduly stressed, stop any activities causing or contributing to the animal's distress.

f. All options for safely and expeditiously removing an animal from entangling gear shall be identified and considered. If it is determined that the animal can be removed without significant risk to human safety, detailed plans, including safety measures, shall be described to project personnel prior to rescuing the animal.

g. When handling an entangled manatee, the animal's powerful tail should be avoided. Personnel handling entangling gear should avoid getting fingers, arms, legs, etc., caught in gear. Personal belongings that could entangle in gear (loose clothing, wrist watches, jewelry, etc.) should be removed prior to handling entangled animals and gear.

h. In the case of animals that are not seriously entangled, plans should consider releasing tension on entangling gear to enable an animal to free itself. For more seriously entangled manatees, plans will likely include pulling, unwrapping, cutting, etc., entangling gear from the animal's head, trunk, tail, and/or flippers.

i. If a manatee is entangled in a seine net, the best course of action is to stop and open the set, creating as large a window as possible for the manatee to swim out of. If the net set has been completed, one end of the net should be released and a window in the net circumference should be opened to allow the manatee to swim out.

j. If in the opinion of project personnel the manatee cannot be rescued without significant risk to human safety, authorized stranding responders shall be contacted for assistance. In Florida, the Florida Fish and Wildlife Conservation Commission's Wildlife Alert dispatcher shall be called for assistance. (See "To Report Accidental Manatee Captures" for contact information).

k. In the event that stranding responders assist with a rescue, project personnel shall aid and support responders as directed to safely and expeditiously rescue the animal.

l. All accidental manatee captures shall be reported immediately to State or Commonwealth wildlife officials. In Florida, the Florida Fish and Wildlife Conservation Commission's Wildlife Alert dispatcher must be notified. Within 24 hours of an accidental manatee capture, captures must also be reported to manatee staff at the USFWS's North Florida Ecological Services Office, the local USFWS ecological services office (if different), and to the NMFS Chief, Permits Division. (See "To Report Accidental Manatee Captures" for contact information.)

m. Within 30-days of an accidental capture, the permittee shall submit a written report to manatee staff at the USFWS's North Florida Ecological Services Office, the local USFWS ecological services office (if different), and to the NMFS Chief, Permits Division describing the circumstances and gear that led to the capture of the manatee, the condition of the animal, steps taken to rescue the animal, and any recommendations to prevent and minimize any future entanglements.

5. In the event an accidental capture results in injury to or the death of a manatee:

   a. Project activities must stop and State or Commonwealth wildlife officials must be contacted immediately. In Florida, the Florida Fish and Wildlife Conservation Commission's Wildlife Alert dispatcher must be notified. (See "To Report Accidental Manatee Captures" for contact information).

   b. Authorized stranding responders shall be asked to provide aid to injured animals and, in the event of a death, to salvage the carcass.

   c. Injured animals shall be treated by a licensed and experienced veterinarian or by experienced animal care staff working in consultation with a licensed and experienced veterinarian.

   d. In the event of a death, a necropsy should be performed by a qualified veterinarian or by persons experienced in marine mammal necropsies to evaluate the cause of death. In Florida, manatee necropsies are conducted by the State's Marine Mammal Pathobiology Laboratory.

e. Within 24 hours of a manatee injury or death, the event must be reported to manatee staff at the USFWS's North Florida Ecological Services Office, the local USFWS ecological services office (if different), and to the NMFS Chief, Permits Division.

f. Within 30-days of an injury or death, the permittee shall submit a written report to the USFWS and NMFS describing the circumstances and gear that led to the injury or death of the manatee and the steps taken to rescue the animal. The report shall include information from attending responders, veterinarian(s) and/or staff and shall include descriptions of injuries and trauma, likely causes of injuries, trauma, or death, and any recommendations to minimize future injuries or death.

6. USFWS, in consultation with NMFS and other appropriate authorities (including State or Commonwealth officials) and individuals, will review all event-related information and will recommend to NMFS if, in USFWS' opinion, the project should be authorized to continue as permitted, continue with modifications necessary to prevent additional injuries or deaths from occurring, or if permit revocation procedures should be initiated.

To Report Accidental Manatee Captures, Including Injured and Dead Manatees

NMFS Permitting Office

Chief of Permits

National Marine Fisheries Service (NMFS), Permits and Conservation Division

PHONE: 301 427-8401

Florida Fish and Wildlife Conservation Commission, Wildlife Alert,

PHONE: 888 404-3922

U.S Fish and Wildlife Service (USFWS), North Florida Ecological Services Office

PHONE: 904 731-3336 and FAX: 904 731-3045

U.S Fish and Wildlife Service (USFWS), Georgia Ecological Services Office

PHONE: 912 832-8739

U.S Fish and Wildlife Service (USFWS), South Carolina Ecological Services Office

PHONE: 843 727-4707

For Florida manatees outside of Florida, contact respective state wildlife officials:

Georgia (Georgia Department of Natural Resources)

PHONE: 800 TO SAVE ME (272-8363)

South Carolina (South Carolina Department of Natural Resources)

PHONE: 800 922-5431

Appendix 4: NMFS-Approved Personnel and Authorized Recipients for Permit No. 19621.

The following individuals are approved to act as Co-Investigators pursuant to the terms and conditions under Section C (Qualifications, Responsibilities, and Designation of Personnel) of this permit.

Name of Co-Investigator	Activities
Al Segars	All activities except laparoscopy
J. David Whitaker	
Julia Byrd	
Lindsey Parker	
Susan Michelle Pate	
Jeff Schwenter	
Terry Norton, DVM	Laparoscopy

Biological samples authorized for collection or acquisition in Tables 1-6 of Appendix 1 may be transferred to the following Authorized Recipients for the specified disposition, consistent with Condition B.6 of the permit:

Sample Type	Disposition	Authorized Recipient	Affiliation
Blood	Analysis	Dr. David Owens,	College of Charleston Charleston, SC
Blood	Analysis	Dr. David Rostal	GA Southern University Statesboro, GA

Sample Type	Disposition	Authorized Recipient	Affiliation
Blood	Analysis	Dr. Roldán Valverde	SE Louisiana University Hammond, LA
Blood	Analysis	Dr. Terry Norton, D.V.M.	GA Sea Turtle Center Jekyll Island, GA
Blood	Analysis	New Bolton Diagnostic Center	University of Pennsylvania Kennet Square, PA
Blood	Analysis	Dr. Lisa Mazzaro	Mystic Aquarium Mystic, CT
Blood	Analysis	Dr. Carolyn Cray	U. of Miami Miami, FL
Blood	Analysis	Dr. Tai Chen	Boston University Boston, MA
Blood	Analysis	Dr. Shane Boylan, D.V.M.	SC Aquarium Charleston, SC
Blood	Analysis	Dr. Duncan McKenzie, D.V.M.	Texas A&M Veterinary Diagnostic Medical Laboratory College Station, TX
Blood, keratin, **tissue**	Analysis	Dr. Simona Ceriani	Florida Fish and Wildlife Conservation Commission St. Petersburg, FL
Blood, keratin	Analysis	Dr. Karen Bjorndal	University of Florida Gainesville, FL
Blood	Analysis	Sandy Jones (regional rep)	Antech Memphis, TN
Blood	Analysis	Dr. Jennifer Lynch	National Institute of Standards and Technology Charleston, SC
Blood	Analysis	Dr. Nicole Stacy, D.V.M.	University of Florida Gainesville, FL

Sample Type	Disposition	Authorized Recipient	Affiliation
Blood	Analysis	Dr. Joe Quattro	University of South Carolina Columbia, SC
Blood	Analysis	Brian Shamblin	University of Georgia Athens, GA
Blood	Analysis	Dr. Andrew Shedlock	College of Charleston Charleston, SC
Tissue (growth/lesion)	Analysis	Dr. Brian Stacy, D.V.M.	University of Florida Gainesville, FL
Feces	Analysis	Dr. Ellis Greiner, D.V.M.	University of Florida Gainesville, FL
Blood	Analysis	Dr. Charles Rice	Clemson University Clemson, SC