NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7
BIOLOGICAL OPINION

Title: Biological Opinion on the Issuance of Permit No. 22281 for Scientific Research on Sea Turtles in the Gulf of Mexico

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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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 a scientific research permit (Appendix A) pursuant to section 10(a)(1)(A) of the ESA. Permit No. 22281 authorizes the capture of green (North Atlantic distinct population segment (DPS)), hawksbill, Kemp's ridley, and loggerhead (Northwest Atlantic DPS) sea turtles in the Gulf of Mexico off the coast of Florida, Alabama, Mississippi, Louisiana, and Texas.

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. 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 the NMFS opinion on the effects of these actions on ESA-listed species and designated critical habitat. A complete record of this consultation is on file at the NMFS Office of Protected Resources in Silver Spring, Maryland.

1.1 Background

This ongoing research is the continuation of a project that began in 2013 under Permit No. 17304. The original permit authorized the capture via hand/rodeo, tangle net, dip net, strike net, and trawl with marking, biological sampling, tagging and recapture of green (North Atlantic DPS), hawksbill, Kemp's ridley, and loggerhead (Northwest Atlantic) sea turtles in the Gulf of Mexico from the Florida/Alabama border to the Louisiana/Texas border. Permit 17304 was modified three times. Permit modification No. 17304-01 authorized an increase to the number of permitted animals that could receive tracking devices. Permit modification No. 17304-02 authorized an additional capture technique of trawling within the action area of the Florida/Alabama border to the Louisiana/Texas border in the Gulf of Mexico. Permit modification No. 17304-03 expanded the action area to authorize capture from the Louisiana/Texas border to the Texas/Mexico border in the Gulf of Mexico into the Bureau of Ocean Energy Management's central and western planning areas. In addition, one-hundred more green (North Atlantic DPS) sea turtles were authorized for capture and research.

Permit No. 22281 would authorize the same species and procedures authorized in Permit No. 17304-03 with one exception, the applicant is requesting to perform trawls for 24 hours a day, instead of only during daylight hours.

1.2 Consultation History

The following dates are important to the history of the consultation:

- The permit application to NMFS Permits Division and early technical assistance/review of the permit was requested of the ESA Interagency Cooperation Division on April 9, 2019.
- On May 8, 2019, the NMFS Permits Division deemed the application complete.
- On September 25, 2019, the completed initiation package was sent from the NMFS Permits Division to the ESA Interagency Cooperation Division.
- On September 25, 2019, the ESA Interagency Cooperation Division initialized formal consultation on Permit No. 22281.

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) and *Action Area* (Section 4) where we describe the proposed action, identify the stressors that may lead to consequences to ESA-listed resources, and describe the action area with the spatial extent of those stressors.

Status of Endangered Species Act Protected Resources (Section 5): We identify the ESA-listed species and designated critical habitat that are likely to co-occur with those stressors in space and time and evaluate the status of those species and habitat. In this Section, we identify those *Species and Designated Critical Habitat Not Likely to be Adversely Affected* (Section 5.1), and those *Species and Designated Critical Habitat Likely to be Adversely Affected* (Section 5.2).

Environmental Baseline (Section 6): 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 7): 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 8): 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 9): 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 10); 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 11) 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 12) 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 13). 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 action is the issuance of the scientific research Permit No. 22281 to Kristen Hart, U.S. Geological Survey, Wetland and Aquatic Research Center, pursuant to section 10(a)(1)(a) of the ESA, to conduct research on green (North Atlantic DPS), hawksbill, Kemp's ridley, and loggerhead (Northwest Atlantic DPS) sea turtles.

The purpose of the proposed permit is the continuation of a long-term project studying green (North Atlantic DPS), hawksbill, Kemp's ridley, and loggerhead (Northwest Atlantic DPS) sea turtles. Turtles will be captured via hand/rodeo, tangle net, dip net, strike net, and trawl for marking, biological sampling, and recapture to study their ecology, genetic origin, and habitat use patterns. The proposed annual take of each sea turtle species under Permit No. 22281 is found in Table 1. Each action is summarized below. Detail as to procedures within the proposed action can be found within the biological opinion for Permit No. 17304-03 (NMFS 2017b). Permit No. 22281 would be issued for a five year duration.

Table 1. Proposed annual takes under Permit No. 22281.

Species	Listing Unit	No. of Animals Annually	Take Action	Collect Method	Procedures
Green Sea Turtle	North Atlantic DPS[1]	250	Capture/ Handle/ Release	Hand, Trawl, Tangle/Dip/Strike/ Cast Net or Captured under another authority[2]	Epibiota removal; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, passive integrated transponder (PIT) tag; Measure; Carapace swabs; Photograph/Video; Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Tracking; Weigh
Green Sea Turtle	North Atlantic DPS[1]	50	Capture/ Handle/ Release	Hand, Trawl, Tangle/Dip/Strike/ Cast Net or Captured under another authority[2]	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Carapace swabs; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Tracking; Weigh; Up to 3 tags[3]: acoustic data logger (ADL), acoustic, & satellite tags.
Hawksbill Sea Turtle	Range-wide	20	Capture/ Handle/ Release	Hand, Trawl, Tangle/Dip/Strike/ Cast Net or Captured under another authority[2]	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Carapace swabs; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Tracking; Weigh; Up to 3 tags[3]: ADL, acoustic, & satellite tags.
Loggerhead Sea Turtle	Northwest Atlantic DPS[1]	100	Capture/ Handle/ Release	Hand, Trawl, Tangle/Dip/Strike/ Cast Net or Captured under another authority[2]	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Carapace swabs; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Tracking; Weigh; Up to 3 tags[3]: ADL, acoustic, & satellite tags.
Loggerhead Sea Turtle	Northwest Atlantic DPS[1]	200	Capture/ Handle/ Release	Hand, Trawl, Tangle/Dip/Strike/ Cast Net or Captured under another authority[2]	Epibiota removal; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Carapace swabs; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Weigh; Up to 3 tags[3]: ADL, acoustic, & satellite tags.
Kemp's Ridley Sea Turtle	Range-wide	90	Capture/ Handle/ Release	Hand, Trawl, Tangle/Dip/Strike/ Cast Net or Captured under another authority[2]	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Carapace swabs; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Tracking; Weigh; Up to 3 tags[3]: ADL, acoustic, & satellite tags.
Kemp's Ridley Sea Turtle	Range-wide	210	Capture/ Handle/ Release	Hand, Trawl, Tangle/Dip/Strike/ Cast Net or Captured under another authority[2]	Epibiota removal; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Other; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Weigh; Up to 3 tags[3]: ADL, acoustic, & satellite tags.

[1]DPS=distinct population segment; [2]Capture under another authority from relocation trawling; [3]No more than three external tags on an animal at one time: acoustic data logger (ADL), acoustic, and satellite.

3.1 Capture

Capture fleet will consist of three to four U.S. Geological Survey boats (i.e., capture boat(s), work-up boat): a 26 foot center-console Dorado with a tuna tower, and a 300 horsepower engine.; a 20 foot Carolina Skiff with a 150 horsepower engine and a smaller 'kicker' motor attached; a 16 foot Whaler with a 50 horsepower engine.; a 19 foot Boston Whaler with a 115 horsepower engine. Contracted trawling vessels range in length from 65 feet to 95 feet.

Capture methods will include dip-netting, strike-netting, tangle-netting, cast-netting, hand capture and trawling, including turtles legally obtained for study that are opportunistically captured by permitted relocation trawling vessels that are working in the study area (dredging, nourishment, etc.; Dena Dickerson, U.S. Army Corps of Engineers (NMFS 2015a)). Turtles taken by U.S. Army Corps of Engineers relocation trawling is authorized by an ESA section 7 biological opinion (NMFS 2015a). Researchers will only sample turtles captured on trawling vessels that are operating with approved authority under the ESA. If the researchers trawl, they will contract only trawling operators that have worked approved relocation trawling projects (i.e., sole-source contract with Bosarge Boats).

3.1.1 Trawling

The fleet of trawling vessels provided by the contracted company (Bosarge Boats) will range in length from 65 feet to 95 feet depending upon the number of researchers and crew members required to complete the research objectives and vessel availability. All vessels work the same net design, one which Bosarge boats developed working with the Bureau of Safety and Environmental Enforcement and the Bureau of Ocean Energy Management to rewrite net configuration requirements. Net design consists of four seam, four legged, three bridal trawl net with bib attached. Webbing is made up of a 4-inch bar, 8-inch stretch, with top (60 gauge twisted nylon, dipped), side (60 gauge twisted nylon, dipped) and bottom (96 gauge braided nylon, dipped). Net length is 73.5 feet overall from wing rope to cod end, with body taper of four bars to one point and wing height of 8 feet. The cod end has a length of approximately 50 meshes x 4 inches which equals 16.7 feet. Webbing is 2-inch bar, 4-inch stretch, 84 or 96-gauge braided nylon, dipped and 60 meshes around. Head rope is 60 feet of half inch combination cable and foot rope is 72 feet of 9/16 inch combination rope. Floats consist of six tuna floats (football style) with a 7-inch diameter and a length of 9 inches spaced on 12-foot centers across head rope. Door size is 7 feet by 40 inches to 9 feet by 40 inches, with a shoe of 1 inch by 6 inch and bridle of half inch stainless steel chain. Standard limits of 30 minutes bottom time will be used, and no deeper than 20 meters. Nets will be brought on-board using winches and turtles will be removed from nets and immediately checked for health status and existing tags. Trawling is the only capture method that would occur at night (non-daylight hours).

The research boats will travel at low or idle speed almost 100 percent of the time, and the motor will not be engaged near sea turtles. While trawling at night the vessel runs bright halogen lights. These lights shine on the back deck where the nets are operated from and when the turtles will be held and worked up, making the deck as bright as a sports stadium at night. The lighting allows for working of the nets (deploying and retrieving), processing of the nets and turtles the same as if it were daylight. Turtles will be released at night the same as during daylight, lowered to the water and observed for normal swimming. If a turtle is observed to be swimming abnormally, or cannot dive, the net on that side of the vessel can be lowered and used to recapture the turtle if needed. If a turtle is observed at the water's surface directly in front of the vessel, the vessel will be turned, or speed varied to avoid hitting the turtle.

3.1.2 Dip Net

Capture by dip-netting is a simple and non-invasive capture method. Turtles are briefly pursued at a safe distance (usually about 25 feet, or one boat-length) from a motorboat traveling at 4 to 6 miles per hour and then when the turtle is within reach, the boat is slowed, the dip-netter scoops into the water, often near the surface, to catch the turtle. The technique uses a standard fishing dip-net with an approximately 15 foot long handle and an approximately one meter by one meter net.

3.1.3 Cast/Throw Net

Capture by cast net is a simple and non-invasive capture method. Cast nets will measure 3 feet to 8 feet diameter, 2.5 to 4 pound weight and 3/8 inch to 1 foot mesh. When using a cast net, turtles will be captured at the surface from a jetty or a boat. When cast netting from a jetty, capture will occur while standing on the jetty, casting the net over the turtle and pulling the purse mechanism of the net. Members of the field team will help to carefully move the turtle to the top of the jetty and remove it from the net as quickly as possible. Researchers will ensure that turtles do not hit the jetty or drag across rocks. Sea turtles captured at jetties will be placed in the shade (using a portable canopy) and worked up on location. When cast netting from a boat, turtles are briefly pursued at a safe distance (usually about 25 feet, or one boat-length) from a motorboat traveling at 4 to 6 miles per hour. When the turtle is within reach, the cast net is thrown into the water, the boat is slowed or put in neutral and the turtle is caught. The captured turtle will immediately be brought onboard the boat where it will be worked up and then released at the capture location.

3.1.4 Strike Net

The strike net would be 100 to 250 meters in length and composed of 20 centimeter stretch-mesh multi-filament nylon. The net would have large bullet floats attached every 3 to 4 meters at the surface and a weighted line along the bottom. Strike netting involves quick deployment of the net around an observed turtle. Once the area is encircled, the net is either: 1) left to soak for fifteen minutes and then retrieved or 2) personnel jump from the boat into the encircled area and check the net visually; then remove the turtle from the net.

3.1.5 Tangle Net

Tangle netting will not be the researcher’s primary form of capture. Sea turtles would be captured by a large-mesh tangle net fished at a depth of 4 to 5 meters deep between two anchored buoys. This net would be 100 to 250 meters in length, 12 to 15 meters in depth, and has 20 centimeters stretch-mesh multi-filament nylon. The net would have large bullet floats attached every 3 to 4 meters at the surface and a weighted line along the bottom. The net will be deployed from the boat and closely monitored throughout the soak time of 1 to 6 hours and physically checked by hand-over-hand from floats to weighted line along the entire length at a minimum of every 20 to 30 minutes. When a turtle is caught in the net it will immediately be pulled in the boat and freed of the net. Researchers tend the net 100 percent of the time. Only one net will ever be set at a time. While on board the boat, turtles will be kept shaded.

Before deployment of the net, a careful visual inspection of the area will be made to ensure there are no marine mammals in the area. In the case where marine mammals are sighted, the net will not be deployed; if the net is already in the water when marine mammals are spotted, it will immediately be pulled into the boat and netting activity will cease until the area is clear of marine mammals.

3.1.6 Hand/Snorkel

Hand capture will take place by researchers leaning over the work boat's edge, holding a post for balance, to scout for turtles. The boat driver will follow the turtle which may be swimming at 5 miles per hour. When the turtle comes up for air, two divers wearing snorkels and gloves jump into the water. The first diver usually grabs the turtle at the nuchal and rear of the carapace, and then gets the turtle pointed skyward; together they come to the surface, and usually the second diver grabs onto one limb of the turtle to help control the animal. All three surface and make their location known to the boat driver, who observes the capture with engines in neutral. They then swim slowly over to the boat and two additional scientists on the boat then lift the turtle, which can weigh up to 400 pounds (181 kilograms), onto a foam pad on the boat's deck. The research team will then take measurements and blood samples, affix tags, and release the turtle.

When hand capturing turtles while snorkeling, researchers snorkel in the water spotting for turtles. Once a turtle is spotted the researcher swims towards the turtle and grabs the turtle at the nuchal and rear of the carapace. With the turtle pointed upwards, the swimmer ascends slowly. They then swim to the boat and additional scientists on the boat then lift the turtle onto a foam pad on the boat's deck. The research team will then take measurements and blood samples, affix tags, and release the turtle.

3.2 Handling, Restraint, and Release

Capture and sampling protocols will follow techniques used in Dr. Hart’s previously approved procedures (Permit Nos. 17304 and 20315). All captured turtles will receive a standard workup that includes morphometric measurements (i.e. length, width, weight), flipper and passive integrated transponder (PIT) tags, and collection of two skin biopsies, two carapace biopsies, cloacal, nasal and oral swabs, and blood. All turtles will be scanned for previous tags and marked (with internal PIT tags and external flipper tags) if no tags are detected. A subset of turtles will be fitted with acoustic, accelerometer, or satellite tracking tags. In ideal weather conditions, turtles receiving a transmitter attachment will be collected and held for no more than two hours each. This is due to the prep and drying time required for attaching these tags. Turtles not receiving tracking tags will be released within thirty minutes of capture.

Upon capture, each turtle will be placed on foam mats on the deck of the boat, in shady conditions. Further, during warm conditions, the turtle's carapace and head will be covered with a wet towel to avoid desiccation. During cooler weather, the towel will not be wet to avoid hypothermia. The deck of the main research boat has Seadeck foam padding, permanently installed. So, turtles will always be on foam padded surfaces. If a turtle becomes stressed during the sampling process, researchers will cover the eyes with a wet towel; this often has a calming effect on the turtle. If for some reason (i.e., weather) turtles need to be transported back to the dock, they will hold the turtles by hand during travel and navigate slowly and safely to the destination. Upon arrival, researchers will carefully transfer the turtles to a covered area on or near the dock. Under the covered area, the turtles will remain cool and will not become overheated. Researchers will continue with tag attachment on land and once the epoxy has set completely researchers return turtles to their original tagging location if possible. If it is not possible to go back onto the water and it does not appear they will be able to return within the hour, they will release the turtle at the dock location. After a normal workup without weather concerns, turtles are lowered carefully into the water for release at their original capture location, unless release at a different location is required per study design (this refers to trawling related captures only). A small subset of turtles will also undergo oral lavage to assess foraging habits. Researchers expect to capture turtles ranging from 20 centimeters to greater than 100 centimeters curved carapace length.

Turtles will be tagged with either an Argos tag or a Fastloc GPS tag (Wildlife Computers) and an electronic "accelerometer" logger, both of which will be applied just posterior to the highest point of the carapace. Tags will be affixed to turtles with cool-setting epoxy. Satellite-tags and satellite-linked GPS tags will be configured to transmit during prime satellite coverage periods which should allow for tracking periods of up to a year or more, depending on battery configurations. Researchers will deploy small electronic data loggers (accelerometers, CEFAS technology, UK or Wildlife Computers, USA) to log turtle behavior at depths and in each of the three-dimensions, yielding pitch, yaw, and roll data for each tagged turtle's body position. Turtles receiving tracking tags will also undergo gastric lavage to collect diet samples if they are juveniles or subadults; researchers will also collect lavage samples from other turtles not receiving tags to aim for thirty samples per species/year.

At most, five individual turtles will be worked up simultaneously by three to seven personnel on-board the main research vessel. Turtles are separated while on the vessel by being placed individually in plastic totes or placed on foam mats and separated by boxes/coolers if the turtle is too large to fit in a tote. For trawler-related sampling space is not limited on deck and so we can work up as many turtles as are caught during a single trawl. If multiple turtles are captured during a single trawl, researchers will cease operations as necessary based on crew size to workup and release turtles and avoid capturing additional animals.

3.3 General Physical Examination

All sea turtles will be examined for general physical condition, with emphasis on 1) examining the shell, skin and flippers for trauma, epibiota, tumors, bites, missing or defective anatomical features, foreign bodies, sloughing of tissues, oil and tar; 2) examining the eyes, nares and oral cavity for discharge, signs of dehydration or illness, corneal lesions, tumors or foreign bodies; 3) overall body condition for signs of illness and/or fitness.

3.4 Flipper and Passive Integrated Transponder Tagging

All turtles shall be examined for existing tags (conventional and PIT tags) before attaching new ones. If existing tags are found, the tag identification numbers shall be recorded and submitted to the Cooperative Marine Turtle Tagging Program (CMTTP) at the Archie Carr Center for Sea Turtle Research (http://accstr.ufl.edu/cmttp.html).

All turtles will receive two uniquely numbered flipper tags. Double tagging minimizes the probability of complete tag loss. All captured turtles greater than 30 centimeters straight carapace length will receive Inconel flipper tags (3/16 inch by 15/16 inch) at the trailing edge of the front flippers and a PIT tag (12.5 millimeter tag using a 12 gauge needle) placed just under the skin in the front right shoulder. Triple tagging increases the probability that a project turtle can be identified if recaptured. Turtles less than 30 centimeters (but greater than 16 centimeters) straight carapace length will receive a smaller PIT tag (10 millimeter PIT tag injected with a 16 gauge needle); and turtles measuring between 20 to 30 centimeters straight carapace length will receive a smaller set of flipper tags (measure 3/16 inch by 7/16 inch). Any turtles captured that measure less than 16 centimeters straight carapace length will receive no tags whatsoever.

Flipper tags and the pliers used to insert them are cleaned prior to application, scrubbed with a medical disinfectant followed by 70 percent isopropyl alcohol. PIT tags are sterile packed. The sites of application for all tags are first cleaned, then scrubbed with a medical disinfectant followed and wiped with 70 percent alcohol, repeated twice, before tags are applied. In addition, turtles less than 30 centimeters straight carapace length may receive an injection of carbocaine prior to PIT tagging for pain management, however this is not required. The protocol for carbocaine utilization is as follows: a two percent injectable carbocaine solution (20 milligrams per milliliter) will be used. It will be injected into the turtle using a 25 gauge needle and one cubic centimeter syringe. First, the stopper of the carbocaine bottle will be cleaned with 70 percent isopropanol prior to inserting the needle. They will withdraw 0.075 milliliter of carbocaine into the syringe; thoroughly clean and disinfect the injection site as described above and then insert the needle into the PIT tag site as normal. To avoid injecting into a blood vessel, they will slightly draw back on the plunger before injecting. If blood comes into the syringe, they will withdraw slightly before injecting. Researchers will inject the solution into the muscle mass and slowly back the needle out as we inject. The last amount of the volume will be injected immediately beneath the skin (subcutaneously). Finally, they will allow at least two minutes for the carbocaine to take effect before injecting the PIT tag.

3.5 Tracking Tags

Researchers intend to deploy up to three tracking tags per individual (satellite tag/acoustic tag or satellite tag/acoustic tag/acoustic data logger [ADL]). Tag deployment per individual will depend on the objectives of the project and size of the turtle. Green and hawksbill sea turtles greater than 60 centimeters straight carapace length and loggerheads and Kemp's ridleys greater than 50 centimeters straight carapace length may receive a satellite tag and an ADL or a satellite tag and an acoustic transmitter.

3.5.1 Acoustic Tags

This project will use coded high-powered acoustic transmitters (V13 or V16 from Vemco, Nova Scotia, Canada; 66-84 kHz). These small tags (i.e., approximately the size of a AA battery) weigh 10 grams in water. Researchers use both coded and continuous tags depending on tracking method. Turtles will be tracked via stationary acoustic receivers secured to the sea floor. A turtle is detected when the tag approaches within the vicinity of the receiver during the turtle's natural behavior. Researchers will attach tags to the right, rear ventral side of the carapace using stainless-steel wire or zip ties placed through two small holes drilled in the very edge of the marginal scutes of animals at least 30 centimeters straight carapace length. For each individual turtle, a new, sterile drill bit will be used. The site of drilling will be disinfected following similar protocols as tagging (alcohol applied twice) with use of a systemic analgesic, recommended by NMFS.

Epibionts (barnacles, algae, etc.) will be carefully removed from the carapace at the site of transmitter attachment using a paint scraper. The site of drilling will be disinfected following similar protocols as PIT tagging. Only turtles in good condition (i.e., not emaciated or sluggish or with large fibropapillomas [FP]) and those that do not need any rehabilitation will be tagged. The entire tagging procedure will take less than two hours. All tagged turtles will go through the standard workup procedure for data collection prior to tag application. Researchers have used these tracking techniques successfully in the past to document fine-scale movements and habitat use. They expect tags to remain attached to turtles between six to seven months for green turtles and up to two years for hawksbills and loggerheads (battery life is estimated at six months to two plus years per tag).

Acoustic tags are programmed at the factory with a unique code for each tag. Each tag transmits at 69 kilohertz and will have a predetermined minimum and maximum time between transmissions. A randomized interval between transmissions prevents any two tags from continuously interfering with the other tag. If possible, they will use 5H Lithium tags so as to get the highest decibel rating Vemco offers with an average 60 seconds between transmissions. This pause time will extend battery life to approximately 16 months (minimum). Vemco provides this information on decibels (see http://www.vemco.com/education/faqs.php#q1).

Active tracking efforts will serve as a critical verification of movements recorded by the anchored passive acoustic receivers and provide more detailed daily movement trajectories for finer scale home range estimation. Researchers anticipate using a Vemco VR100 manual receiver equipped with both a directional hydrophone and an omni-directional hydrophone to track turtle movements of tagged turtles. They intend to manually track turtles by vessel intensively for one-week time periods throughout summer and winter to define foraging habitat. Turtles will be manually tracked during periods separate from the main capture periods because of the intense nature of acoustic tracking (often twelve hours per day). During acoustic tracking, one of the objectives is to verify habitat use of tagged turtles therefore once the location of an acoustic tagged turtle is identified we will confirm the turtle's presence and describe the habitat it is using.

The carapace of all acoustic tagged turtles will be marked with white paint pen. This will allow them to observe turtles from a distance greater than 50 meters, however when conditions are murky or choppy researchers may need to approach the turtle within 50 meters. When doing so researchers will turn off the boat motor to reduce potential impacts to the turtles. Once visual confirmation has been made and the habitat described, they will cease observations. Researchers expect to observe turtles for less than five minutes.

3.5.2 Satellite Tags

Attachment of satellite tags with epoxy is a commonly used and permitted technique (Figure 1). Numerous researchers have used the technique with no apparent effect on survival or movement. Researchers anticipate that tags used in this project will be from Wildlife Computers (Redmond, Washington) and will include location-only SPOT (smart position and temperature) tags and depth capable SPLASH (depth, temperature, and light) tags; if project funding allows, they will use GPS tags for precise location questions. Two or more different SPOT tag models will be used based on the objectives of the project and the size of the turtle (smaller lighter tags on smaller turtles): current model SPOT 375A (99x55x22 millimeters), current model SPOT 287 (72x54x24 millimeters and weighs 72 grams) and model SPOT293 (70x41x23 millimeters and weighs 119 grams) are appropriate and specs can be found at the following link: https://wildlifecomputers.com/wp-content/uploads/mds/SPOT_Backmount_Suite.pdf.

Two or more different SPLASH tag models will be used depending upon the objectives of the project and the size of the turtle captured (smaller, lighter tags will be placed on smaller turtles): current model SPLASH10-F-296 (86x85x29 millimeters and weighs 192 grams) and model SPLASH 10-F-297 (86x55x26 millimeters and weighs 130 grams) are appropriate and specs can be found at the following link: https://wildlifecomputers.com/wp-content/uploads/mds/SPLASH10_FastlocGPSBackmountSuite.pdf.

For small turtles, researchers will use the SPOT 311 tag (51x27x19 millimeters; specs can be found at the link above for SPOT tags) to minimize drag in line with Jones et al. (2013) as follows by species. Green and hawksbill sea turtles 40 to 60 centimeters straight carapace length will only carry the SPOT 311 tag (no more than 1 tag). Likewise, loggerheads and Kemp's 40 to 50 centimeters straight carapace length will only carry the SPOT 311 tag. Epoxy for all tags will be formed into a tear-drop shape to reduce drag. Care must be given to avoid high temperatures of some fast setting epoxies but this can be controlled by proper selection of epoxy and mixing reagents in the proper proportions. Researchers will use a two-part cool-setting epoxy (Superbond™) to secure the transmitter on to the carapace. Satellite tags are attached directly to the carapace to keep any potential drag to a minimum on animals of at least 40 centimeters straight carapace length. In addition, the total weight of transmitter attachments for a turtle will not exceed five percent of the body mass of the animal.

Figure 1. A MK-10 satellite tag being deployed on a juvenile Kemp's ridley in St. Joseph Bay, Florida, with the antenna facing the posterior of the animal (photo credit M. Lamont).

No compromised or sick turtles will be satellite-tagged. The tag will be placed just posterior to the highest part of the carapace. The site of attachment will be lightly cleaned with a paint scraper and sandpaper to remove dirt and epibionts. The area will then be wiped with 91 percent isopropyl alcohol to remove oils and water. A small amount (i.e. golf ball sized) of epoxy will be placed at the site of attachment to serve as a base for the satellite tag. Once that epoxy becomes tacky, the tag will be 'seated' into the epoxy and additional epoxy will be smoothed around the edges and over the top of the tag (avoiding all tag ports and sensors). Turtles receiving satellite tags will be restrained for no longer than two hours. Tags are expected to stay on the turtle for no more than 18 months and/or battery life of 18 months (SPOT) or 12 months (SPLASH). This estimate does not factor in the time it takes for scutes to shed. However, researchers have recaptured turtles over two years later with the tags still attached in some cases and therefore would like to use the current models to maximize data collected. Switching to a smaller tag could cause them to be unable to collect the required data.

In summary, transmitters will not exceed five percent of the turtle's body weight, and attachment materials will be streamlined so that neither buoyancy nor drag will affect the turtle's swimming ability. Based on tag models and battery life, they anticipate that tags will remain attached to turtles for approximately one year's time.

Transmitters will be programmed and activated in the lab prior to entering the field. During attachment, saltwater switches will be covered with electrical or masking tape to prevent fouling during the attachment procedure; tape will be removed prior to turtle release. Tags will be attached to the carapace using a two-part epoxy. A two-part cool setting epoxy (Superbond) will be used to secure the transmitter on to the carapace. Superbond epoxy is a low/no odor, high strength epoxy which produces minimal thermic reactions (i.e. becomes warm to the touch during activation but not super-heated and is never too hot to hold in your hand) and has a proven track record in two of Dr. Hart's permitted sea turtle tagging projects (Permit No. 13307 and Permit No. 16146), as well as in her Alabama, Dry Tortugas, and US Virgin Islands work on nesting sea turtles. The epoxy components (A and B) are mixed in equal amounts in a separate cup for three minutes. The mixture is quickly spread on the bottom of the tag and on a cleaned section of the carapace and press the two epoxied areas together. Additional epoxy that gets squeezed out when the tag is secured to the carapace is molded around the outside of the tag, making a more hydrodynamic shape. Attachment media will be tapered to prevent it from catching on rocks or woody debris. There will be no gap between the tag and the carapace. Drying time is usually 45 minutes but varies slightly depending on ambient temperatures and humidity and can vary between 20 to 60 minutes. The entire volume of epoxy is equivalent to about the size of a golf ball and a half.

Once completely dry, the turtle will then be released at or near the exact point of capture. Ideally turtles will be tagged on the boat and held no longer than two hours, however, weather or logistical events may lead us to bring turtles back to shore to avoid injury to people and turtles. In that event turtles will be released when tagging is complete, as near to the site of capture as possible. Researchers expect average satellite tag retentions of six months on juvenile turtles (max one year) and one-year on adult turtles (max three years) (based on tag retentions of the applicants K. Hart and M. Lamont [U.S. Geological Survey]), which can vary by species. Researchers expect tag retentions of several years for acoustic tags.

3.5.3 Accelerometers

Tagging turtles with Accelerometers (ADLs) (current model from Wildlife Computers, approximately 50x40x23 millimeters; 70 in air) will follow the same protocol used for affixing satellite tags, including turtle size (40 centimeters straight carapace length), location for tag placement. All care taken during satellite tagging will also be taken during deployment of accelerometers. Often, accelerometers are deployed simultaneous with satellite tags (both tags on one turtle, one placed posterior to the other) and when this occurs the tags will be attached to the turtle at the same time so as not to prolong the time the turtle is out of the water and restrained. No compromised turtles will be tagged with accelerometers.

Together, the transmitter(s) and attachment materials will not exceed five percent of the turtle's body weight, and attachment materials (i.e., cool-setting epoxy) will be streamlined so that neither buoyancy nor drag will affect turtle's swimming ability. The entire tagging procedure should take approximately two hours.

In addition, in partnership with Dr. Margaret Lamont (USGS) and Dr. Nick Whitney (New England Aquarium), researchers will be attaching ADLs to turtles using a pop-off package. Unlike satellite tags, ADLs typically require recapture for tag and data retrieval. Using a pop-off package will allow attachment of ADLs on individuals that are difficult to recapture (i.e., males). Dr. Whitney is a world-expert in development and use of pop-off packages on marine vertebrates including many different shark species. The pop-off package will be attached to the turtle via the same methods used to attach the ADL (Superbond epoxy). The size of the package will be similar to a Wildlife Computers SPLASH tag in size and weigh less than five percent the body weight of the turtle. These tags would be secured in a hydrodynamic, custom-made syntactic foam float. The ADL package will be secured to a nylon mesh base using monofilament or plastic cable ties and a galvanic timed release. After a set period of time (days to weeks), the galvanic release will dissolve in seawater, releasing the ADL package and allowing it to float to the surface for recovery. Released tags will be detected using a hand-held VHF receiver and a PTT-finder via vessel or from aircraft as necessary, and then retrieved by vessel. All that would remain on the turtle after release is a two millimeter thin mesh base, which would remain for a time frame similar to that of a satellite tag.

3.6 Skin Biopsy

For genetic and stable isotope sampling, sterile, disposable 6 millimeter AcuPunch or Sklar biopsy tools will be used to sample skin following standard procedures (Dutton et al. 1996), removing a small biopsy about 6 millimeters in diameter from the trailing edge of one rear flipper. Samples will be stored in ethanol or in a 20 percent Dimethyl sulfoxide buffer saturated in salt (Amos and Hoelzel 1991). This procedure will be conducted using a new, sterile biopsy punch. The tissue surface will be thoroughly swabbed with a medical disinfectant solution (e.g., Betadine, Chlorhexidine) followed by 70 percent alcohol before sampling. Researchers may use two applications of alcohol if disinfectants may interfere with analyses or is at a remote field site where a medical disinfectant is not available. Any bleeding will be stopped with Clotisol© drops or by applying pressure at the site of the biopsy while holding a new sterile alcohol wipe in place. Samples will be transported back to land in a cooler and stored in a regular freezer in the USGS lab until time of analysis. Please see blood sampling for details on use and analyses of skin biopsies. This procedure will not be performed on any compromised or injured animals. The minimum size turtle we will collect a biopsy sample from is 16 centimeters straight carapace length.

3.7 Carapace Biopsy

For long-term stable isotope sampling, researchers will take two biopsy punches of carapace scutes using a sterile, disposable 6 mm AcuPunch or Sklar tools on turtles greater than 30 centimeters curved carapace length. They will follow procedures in Vander Zanden et al. (2010). They will collect two samples from the third lateral scute: the right side is preferable, but if there are abnormalities or epibionts, the left side will be used. The area will be cleaned with alcohol swabs prior to sample collection. One sterile 6-milimeter biopsy will be placed at the sampling location on the posterior medial region of the third right lateral scute applying a little pressure.

The first application of pressure will make an outline in the scute, followed by applying more pressure with a twist, which allows the punch to remain at that sample site without moving. They will press the punch in to about 1/4 of its depth to get all the layers of the scute. A small cracking sound indicates the biopsy punch has reached the bottom of the scute. At that point, they will rock the punch from right to left to sever the sample completely. They will use clean forceps to remove the sample from the biopsy punch or from the carapace if it remains on the turtle. The sample will be placed into a 2 milliliter cryovial. A new biopsy punch will be used to take a second scute sample adjacent to the first, following the previous steps. They will place the samples in the same cryovial and label that cryovial. They will thoroughly clean forceps between turtles with alcohol swabs and we will place the cryovials in air-conditioned room for at least 48 hours with the lid loose, but not completely off, to allow the sample to dry. After 48 hours, they will tighten the lid and store. This procedure will be conducted using a new, sterile biopsy punch (which takes out one 6 millimeter plug of the top section of the carapace for each turtle) along with thoroughly disinfecting the sampling area prior to and after the procedure with 91 percent isopropyl alcohol. Samples will be transported back to land in a cooler and stored in a regular freezer in the USGS lab until time of analysis.

3.8 Blood Sampling

Blood samples will be obtained for multiple purposes including genetic analyses, stable isotopes and health. Researchers will use a new sterile syringe for each individual along with disinfecting the sampling area with a medical disinfectant solution (e.g. betadine, chlorhexidine) followed by 70 percent alcohol, or two applications of alcohol if disinfectant solutions affect analyses or a medical disinfectant isn't available due to remoteness of field location. Approximately 15 to 20 milliliters of blood will be collected from the dorso-cervical sinus (not to exceed 3 milliliters per kilogram body weight). Blood sampling will involve standard sampling practices that include measures to prevent cross-contamination of samples (Owens and Ruiz 1980). Bleeding will only be conducted on turtles over 5 kilograms in weight as described in Owens and Ruiz (1980). Blood samples consisting of a maximum of 20 milliliters total volume will be collected from adult turtles and will not exceed the total recommended volume (10 percent of total blood volume) based upon total weight as described by Jacobson (1999) who estimated that total blood volume in reptiles was 5 to 8 percent of total body weight. Areas of blood collection will be treated with a medical disinfectant followed by 70 percent isopropanol (alcohol) before the sample is collected. Samples from smaller turtles (less than 30 centimeters straight carapace length) can be obtained using a smaller (approximately 23 and 25 gauge ½ inch) needle. For all juvenile to adult turtles we will use a 21 gauge 1 to 1.5 inch needle and syringe (Owens and Ruiz 1980); we regularly carry a range of needle sizes in our equipment box and will select the smallest needle necessary. We also anticipate using additive-free (for whole blood) and heparin-containing (for the separation of plasma and red blood cell components) Vacutainer tubes

(Beckman Inc., Fullerton, California). To facilitate bleeding of the cervical sinus, turtles will be positioned so that their head is lower than the body. Attempts will be limited to a total of four, two on either side.

3.9 Gastric Lavage

Dietary samples will be carefully extracted from the captured sea turtles using gastric lavage or stomach flushing as described in Forbes (1999). The feeding habits of wild turtles can be determined by a variety of methods, but the preferred technique is gastric lavage or stomach flushing. Sample food components for the dietary component of our study will be collected using gastric lavage. Using gastric lavage, researchers will collect, identify, and characterize prey items and sediment that are consumed by turtles. Stomach contents will be sampled and analyzed for petroleum-associated hydrocarbons and food item-specific isotopic signatures. Food items collected using this technique are important because they will serve as complementary independent measurements to substantiate or further constrain interpretations of the isotopic evidence. Researchers will identify each specimen to the species-level in the U.S. Geological Survey lab.

Only juvenile and subadult turtles at least 25 centimeters straight carapace length will be lavaged. For each oral lavage attempt, the turtle will be placed on their carapace so that their head is positioned lower than the dome of the carapace. This placement facilitates optimal drainage of the food contents. Small turtles will be hand-held in the lap of the researcher. A thin stainless steel pry bar, cleaned prior to insertion with ethanol, will be used to separate the maxilla and mandible. Pry bars will be rounded and smooth in shape to avoid damaging the mouth cavity. The pry bar will then be pressed downward towards the palate in an attempt to provide an irritating pressure, which will cause the turtle to voluntarily open its mouth. A standard veterinary mouth gag is then inserted at the anterior end of the mouth. Care will be taken not to over-expand the gag so as to avoid damaging the soft dermal tissues of the mouth. One flexible clear plastic tube (one with a 2 millimeter wall thickness) will be inserted into the esophagus, on one side of the gag. The ends of the tube will be rounded to reduce damage to the esophagus. The tube will serve as the water injection point; it has a wall thickness of 1.0 to 2.0 millimeters and is approximately 3 meters in length. A smaller tube (3.5 to 4.0 millimeters in diameter) will be used for turtles 25 to 30 centimeters curved carapace length. Researchers will clean and disinfect all tubes and lavage equipment with ethanol and water between animals and use a separate tube for any turtles with fibropapillomas.

Before insertion, the selected tube will be thoroughly cleaned with ethanol and water. Next, markings will be made on the tube at 10 centimeter intervals; this is done so that researchers can monitor the length of tubing that has been inserted into the esophagus. For example, the distance from the mouth to the junction of the humeral and pectoral scutes typically represents the length of tube necessary to reach the internal location of a food bolus, and will assist researchers in knowing how much tube to insert. After the tip of the tube has been lubricated with vegetable oil, it is gently inserted into the esophagus. Obstruction of entry to the esophagus by the glottis can be overcome by using the pry bar to gently depress the glottis. At this point in the insertion process, extreme care will be made as the tube is further inserted in order to avoid damaging the delicate dermal tissues of the esophagus. External manipulation of the trachea may facilitate passage of the tube.

After successful insertion of tube, it passes the esophageal muscle groups. The tube will then be slowly advanced down the esophagus until resistance is felt from either the food bolus or the junction of the esophagus and stomach. Researchers will then begin to pump water into the turtle using a hand operated bilge pump. Care is taken not to deliver water at pressures or volumes greater than what is easily expelled by the turtle. Return flow should begin within seconds of water entering the turtle. If no water is retrieved, the tube will be withdrawn slightly to allow free entry of water into the tube to be unobstructed. If water continues not to exit for more than 15 to 20 seconds, the gastric lavage will be halted and the tube will be removed and reinserted. Gastric lavage is deemed successful once food particles are seen traveling into the collection bucket. The lavage (water pumping/tube inside turtle) will not exceed three minutes to reduce the chance of the turtle inhaling during the process. After food samples are collected, the use of the hand operated bilge pump will be ceased and water and food are then allowed to drain until all flow has stopped. To assist with drainage, the anterior end of the turtle will be placed lower than the rest of the body. Complete drainage is important to prevent aspiration from water used during lavage. The injection tube will be removed carefully/slowly. The gag will be removed rapidly after removing the tube; the head should be elevated to allow for drainage of any remaining water towards the esophagus. Food samples from gastric lavage will be stored frozen for later sorting and identification and possibly chemical and isotopic analyses. No compromised or sick turtles will be lavaged.

3.10 Fecal Collection

Scat samples will be collected from the turtle using digital extraction from animals over 50 centimeters straight carapace length, or opportunistically from the water when observed floating or voided while onboard the vessel. A sub-sample will be stored frozen or in ten percent formalin until analysis. For dietary analysis, scat samples will be analyzed and used as complementary independent measurements to substantiate or further constrain interpretations of the isotopic evidence. Scats collected from recaptured individuals on different days will be considered separate samples. Prior to examination the scats will be emulsified for 12 to 24 hours in a mixture of ten parts ethyl alcohol (95 percent), three parts water, and one part general detergent and then sorted manually. Prey items in each scat are then identified using a dissecting microscope.

3.11 Carapace Marking

Marking the carapace is a non-invasive activity that allows individual turtles to be identified from a boat without being captured. Carapace marking has been used extensively to identify individual turtles. It is a non-invasive, temporary way of identifying individuals and eliminates the need for recapture, or alternatively, can alert researchers to specific turtles that need to be recaptured (i.e., those that carry ADLs that require recapture for removal and data downloading). Prior to marking, the carapace of the turtle will be dried with a standard bath towel. Once dry, researchers will use commercially-available white paint pens from West Marine or DiversDirect to mark an area of the carapace that is approximately six inches by six inches.

The paint will be applied in the shape of a number to help individually identify each turtle. The first turtle will be painted with a 01, the second with a 02, etc. The paint dries within 10 minutes, therefore turtles will not need to be held more than 10 minutes. During this time, the turtle will be held by hand to allow the paint to dry and to prevent the turtle from getting paint on its flippers. During the short paint-applying process, the turtle will be held in the shade to prevent over-heating. As soon as the paint is dry to the touch and is non-tacky, the turtle will be released at the location it was captured. All activities related to this request will occur on the boat at the site of capture. No turtles will be captured if there are any risks (bad weather, etc.) that the full work-up cannot be conducted. Following similar studies, researchers expect the paint to remain on the carapace for a maximum of one-month which will provide sufficient time for observation of foraging behaviors, habitat use and movement patterns. The turtle will be released at the point of capture once the paint is dry.

3.12 Cloacal Swabs

This technique is minimally invasive (Lanci et al. 2012) yet provides a great deal of information. Herbivorous reptiles rely on microbial fermentation in the large intestine to degrade plant cell walls. In green turtles, differences in relative amounts of volatile fatty acids between individuals that forage on algae versus those that feed on seagrasses (Bjorndal 1997). Analysis of cloacal swabs collected from juvenile turtles that forage primarily on algae and those that forage primarily on seagrasses will provide a better understanding of sea turtle foraging behavior and habitat use. Methods for sample collection are as follows. The exterior of the cloaca is disinfected by swabbing area around cloacal opening with ethanol before interior cloacal swab. Insert swab at a depth of approximately ten percent of body length, but no more than five centimeters into cloaca and rotate to obtain a sample of cloacal microbes. Two cloacal swabs are collected per individual (minimum size 25 centimeters straight carapace length). While researchers not yet have funding to support microbiome sampling, we may work with collaborators who have funding and so are including this in their project methods.

3.13 Nasal and Oral Swabs

Analysis of nasal swabs collected from turtles may provide insight into the interaction between microbes and behavior. Increasingly, emphasis is placed on the holobiome in which an organism should be viewed as whole and not disparate systems. In analyzing the nasal microbiome we hope to learn more about the microbiome-gut-brain axis (Bienenstock et al. 2015). Researchers plan on investigating if certain bacterial communities are present in the nasal cavities of turtles which may play a part in recognizing other species and initiating certain cues such as feeding or mating. They adapted protocols (addition of different fixing agent) for swabbing nasal cavities as cloacas (Price et al. 2017). The swab is inserted no farther than the tip of the swab and rotate to obtain a sample of nasal microbes. For oral swabs, the tip of the swab is rotated along the jaw line.

3.14 Carapace/Skin Swab

Swabbing the carapace and skin will allow us to analyze the bacterial communities present on turtles in our study sites. These colonies would be representative of the environment they live in and potential indicators of shifts in water quality and overall turtle health. Swabbing and analyzing fibropapilloma turtles and non- fibropapilloma turtles would allow us to determine if there is a threshold of certain bacterial communities which prevents or induces an outbreak in the turtle. Also, analysis of carapace microbiome swabs of turtles would provide researchers a better understanding in the mechanism they use to keep their carapace clear of epibionts. Methods for this collection would not use isopropyl alcohol on the site and the skin or carapace would be swabbed directly and then placed in the RNAlater solution (aqueous, nontoxic tissue storage reagent) or equivalent.

4 ACTION AREA

Action area means all areas affected directly, or indirectly, by the Federal action, and not just the immediate area involved in the action (50 C.F.R. §402.02). The proposed action would occur in the northern Gulf of Mexico from the Florida to the Texas/Mexico border (Figure 2). The red polygon represents the area where the researchers are requesting direct captures and via trawling. This request does not include sampling in the Flower Gardens Bank National Marine Sanctuary or any other protected area (except Padre Island National Seashore).

Figure 2. Action area for Permit No. 22281 in the Gulf of Mexico (red shading).

5 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 No. 22281. It then summarizes the biology and ecology of those species and what is known about their life histories in the action area. The species and designated critical habitat potentially occurring within the action area are ESA-listed in Table 2 with their regulatory status.

Table 2. Endangered Species Act-listed species and designated critical habitat that may be affected by the issuance of Permit No. 22281.

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 the Action Area	FR Notice Not Available U.S. Atlantic 1991
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered 35 FR 8491 06/02/1970	Designated; Not in the Action Area	57 FR 38818 U.S. Caribbean, Atlantic, and Gulf of Mexico 1992
Loggerhead sea turtle (*Caretta caretta*) Northwest Atlantic DPS	Threatened 76 FR 58868 09/22/2011	79 FR 39856 2014	74 FR 2995 Northwest Atlantic 2009
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered 35 FR 18319 12/02/1970	Not Designated	75 FR 12496 U.S. Caribbean, Atlantic, and Gulf of Mexico (2nd) 2011
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered 35 FR 8491 06/02/1970	Designated; Not in the Action Area	63 FR 28359 U.S. Caribbean, Atlantic, and Gulf of Mexico 1991
Olive Ridley Turtle (*Lepidochelys olivacea*)	Threatened 43 FR 32800 07/28/1978	Not Designated	63 FR 28359 U.S. Pacific 1998
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)	Threatened 56 FR 49653 09/30/1991	68 FR 13370 2003	FR N/A 1995
Giant Manta Ray (*Manta birostris*)	Threatened 83 FR 2916 01/22/2018	None Designated	N/A
Gulf of Mexico Bryde's Whale (*Balaenoptera edeni*)	Endangered 84 FR 15446 05/15/2019	None Designated	N/A
Nassau Grouper (*Epinephelus striatus*)	Threatened 81 FR 42268 06/29/2016	None Designated	N/A
Scalloped Hammerhead Shark (*Sphyrna lewini*) Central and Southwest Atlantic DPS	Threatened 79 FR 38213 07/03/2014	None Designated	N/A
Sperm Whale (*Physeter macrocephalus*)	Endangered 35 FR 18319 12/2/1970	None Designated	74 FR 81584 2010

5.1 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 consequences of 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 species ESA-listed in Table 2, 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 an ESA-listed species), but it is very unlikely to occur.

The species and designated critical habitats that are not likely to be adversely affected are found in Table 3 and Table 4.

5.1.1 Non-target Species

Encounters of non-target ESA-listed species are expected to be infrequent to rare occurrences. Although the applicant acknowledges that Gulf sturgeon could be incidentally captured, they have reported no take of this species or any other listed non-target species under the current Permit No. 17304-03. Dr. Hart expects any encounter with Gulf sturgeon to be infrequent. Researchers will mainly use selective capture gear (versus non-selective trawl and tangle nets) for the majority of their work reducing the potential for incidental capture. Should a capture of

Gulf sturgeon occur, we do not expect it to result in mortality because researchers are trained in handling sturgeon. The effects to Gulf sturgeon are further analyzed in this biological opinion.

Risk of impacts to other non-target protected species, including marine mammals, are expected to be extremely low and discountable. Based on the known range and habitat use patterns of sperm whales and Gulf of Mexico Bryde's whales, the likelihood of researchers encountering these species is discountable. They are expected to have minimal spatial overlap with the study area given the species' preference for deeper waters, mainly off the continental shelf. Further, Dr. Hart has not reported encountering these species during her permitted research in this area under Permit No. 17304-03. The applicant's vessels operate within the known hearing range of marine mammals that could be found in the study area. Odontocetes have the added ability to echolocate and avoid the vessel. Hence, we expect any risk of vessel strike to any marine mammal to be discountable. In the rare event that researchers encounter a marine mammal, for the reasons outlined here, we expect effects to be limited to short-lived, minimal behavioral harassment. Such responses would not likely lead to mortality, serious injury, or disruption of essential behaviors such as feeding, mating, or nursing to a degree that the individual's likelihood of successful reproduction or survival would be substantially reduced. Thus, any impacts to non-target marine mammals would be insignificant or discountable.

5.1.2 Designated Critical Habitat

In 2014, NMFS designated critical habitat for loggerhead (Northwest Atlantic DPS) sea turtles. The specific areas identified by NMFS were included because they provide protection to loggerhead sea turtles which include Neritic (nearshore reproductive, foraging, winter, breeding, and migratory) and *Sargassum* habitat.

In 2003, NMFS designated critical habitat for Gulf sturgeon. The essential features include abundant prey items, riverine habitat, water quality, sediment quality, and unobstructed pathways to habitat.

The study area may overlap with designated critical habitat for loggerhead sea turtles and Gulf sturgeon. The research area will not affect more than what was previously analyzed in the biological opinion for the original Permit No. 17304 and subsequent modifications Permit No. 17304-02 and 17304-03 (NMFS 2013, 2016b, 2017b). The manner of work will not change and permit conditions mitigate the effect of research on aquatic vegetation. Trawling will occur over sand and silt bottom. Netting will have little effect on the habitat, and the weights on the bottom of the net will remain on the edge of seagrass beds and not on top of them. Anchors will sit on sand, and the prop of the motorboat will be elevated to not scar the bottom or uproot algae or seagrass. No anthropogenic noise from the proposed research will significantly impair the habitat for protected species.

The proposed activities will not alter the physical or biological environment including any designated critical habitat. None of the activities are likely to affect water characteristics (temperature, quality, salinity, etc.) or prey resources for these species that may be identified as primary constituent elements or identified essential physical or biological features.

It is extremely unlikely that the research activities will affect this designated critical habitat, therefore, the actions are discountable. We concur with the Permits Division that the issuance of Permit No. 22281 is not likely to adversely affect the designated critical habitat for loggerhead (Northwest Atlantic DPS) sea turtles and Gulf sturgeon.

Table 3. Species in the action area that will not likely be adversely affected by Permit No. 22281.

Species	ESA Status	Critical Habitat
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered 35 FR 8491 06/02/1970	Designated; Not in the Action Area
Olive Ridley Turtle (*Lepidochelys olivacea*)	Threatened 43 FR 32800 07/28/1978	Not Designated
Giant Manta Ray (*Manta birostris*)	Threatened 83 FR 2916 01/22/2018	Designated; Not in the Action Area
Gulf of Mexico Bryde's Whale (*Balaenoptera edeni*)	Endangered 84 FR 15446 05/15/2019	None Designated
Nassau Grouper (*Epinephelus striatus*)	Threatened 81 FR 42268 06/29/2016	None Designated
Scalloped Hammerhead Shark (*Sphyrna lewini*) Central and Southwest Atlantic DPS	Threatened 79 FR 38213 07/03/2014	None Designated
Sperm Whale (*Physeter macrocephalus*)	Endangered 35 FR 18319 12/2/1970	None Designated

Table 4. Designated critical habitat in the action area that will not likely be adversely affected by Permit No. 22281.

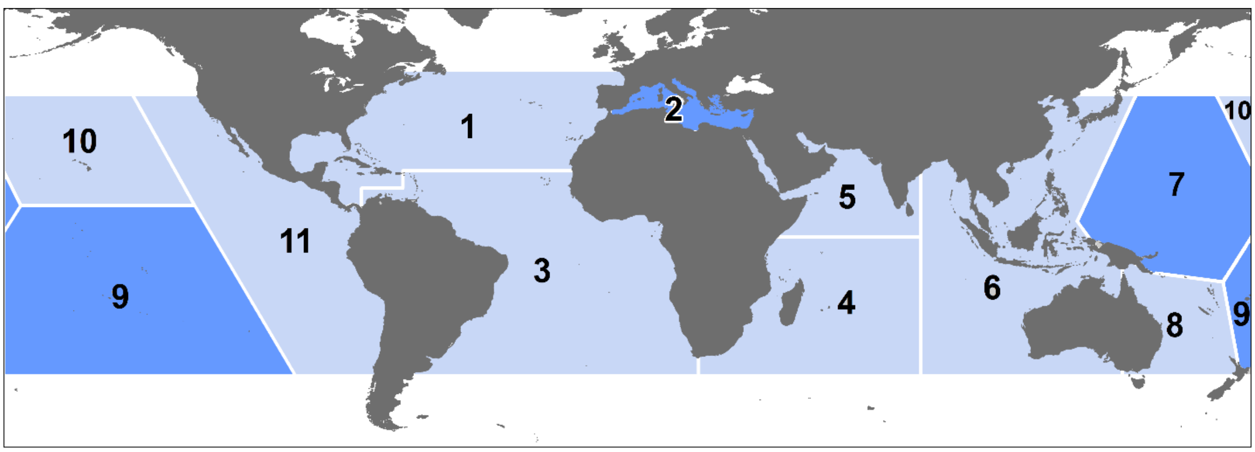
Species	ESA Status	Critical Habitat
Loggerhead sea turtle (*Caretta caretta*) Northwest Atlantic DPS	Threatened 76 FR 58868 09/22/2011	79 FR 39856 2014
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)	Threatened 56 FR 49653 09/30/1991	68 FR 13370 2003

5.2 Species and Critical Habitat Likely to be Adversely Affected

During consultation we examined 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 informs 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.

5.2.1 Green Sea Turtle, North Atlantic Distinct Population Segment

The green sea turtle is globally distributed and commonly inhabits nearshore and inshore waters, occurring throughout tropical, subtropical and, to a lesser extent, temperate waters (Figure 2). The North Atlantic DPS green turtle is found in the North Atlantic Ocean and Gulf of Mexico (Figure 4).



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 range and distinct population segment boundaries for green turtles.

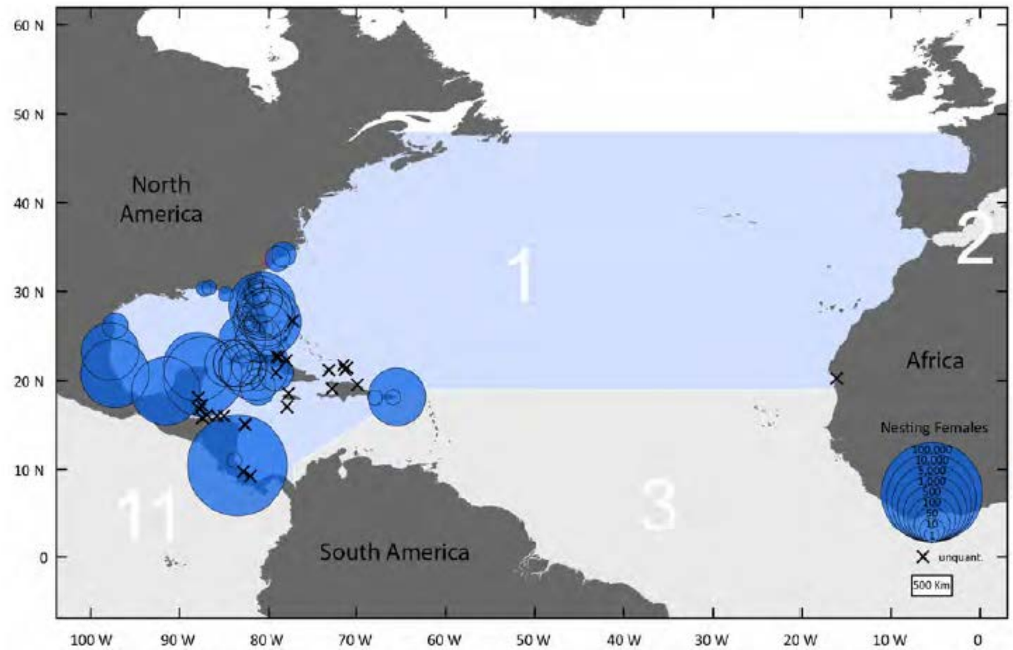


Figure 4. Geographic range of the North Atlantic distinct population segment green turtle, with location and abundance of nesting females (Seminoff et al. 2015).

The green sea turtle 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) (Figure 4).

Figure 5. Green sea turtle. Credit: Mark Sullivan, National Oceanic and Atmospheric Administration.

The species was listed under the ESA on July 28, 1978 (Table 5). 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. The North Atlantic DPS is listed as threatened.

Table 5. Summary of North Atlantic distinct population segment green sea turtle listing and recovery plan information.

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

We used information available in the 2007 Five Year Review (NMFS and USFWS 2007a) and 2015 Status Review (Seminoff et al. 2015) to summarize the life history, population dynamics and status of the species, as follows.

Life History

Age at first reproduction for females is twenty to forty 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 two to five 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.

Population Dynamics

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

Worldwide, nesting data at 464 sites indicate that 563,826 to 564,464 females nest each year. 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). 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.

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).

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. Nesting occurs primarily in Costa Rica, Mexico, Florida and Cuba.

Status

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 fifty 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.

Status in 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); U.S. (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 U.S., green turtles nest primarily along the central and southeast coast of Florida where an estimated 8,426 females nest annually.

Critical Habitat

On September 2, 1998, NMFS designated critical habitat for green sea turtles, 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. The designated critical habitat is not found in the action area of this proposed permit.

Recovery Goals

See the 1998 and 1991 recovery plans for the Pacific, East Pacific and Atlantic populations of green turtles for complete down-listing/delisting criteria for recovery goals for the species (NMFS and USFWS 1991a, 1998). Broadly, recovery plan goals emphasize the need to protect and manage nesting and marine habitat, protect and manage populations on nesting beaches and in the marine environment, increase public education, and promote international cooperation on sea turtle conservation topics.

5.2.2 Hawksbill Sea Turtle

The hawksbill turtle has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical oceans (Figure 5).

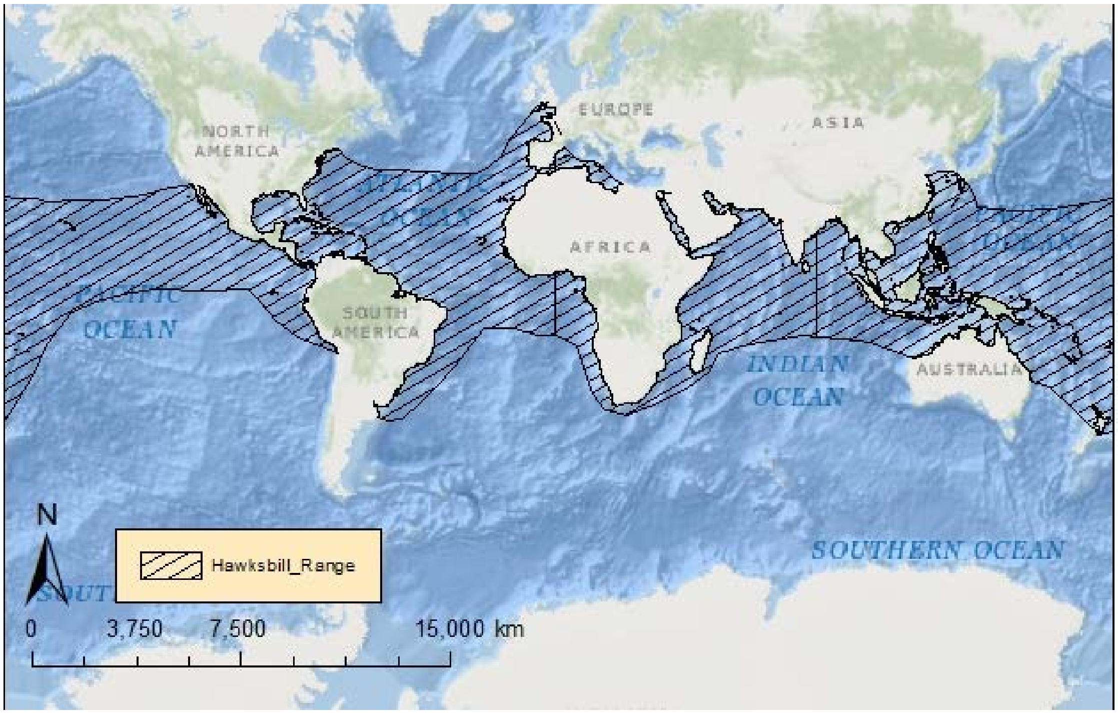


Figure 6. Map identifying the range of the endangered hawksbill sea turtle.

The hawksbill sea turtle has a sharp, curved, beak-like mouth and a "tortoiseshell" pattern on its carapace, with radiating streaks of brown, black, and amber (Figure 6).

Figure 7. Hawksbill sea turtle. Credit: Jordan Wilkerson.

The species was first listed under the Endangered Species Conservation Act and listed as endangered under the ESA since 1973 (Table 6).

Table 6. Summary of hawksbill sea turtle listing and recovery information.

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 1998	57 FR 38818 U.S. Caribbean, Atlantic and Gulf of Mexico 1992

We used information available in the five year reviews (NMFS and USFWS 2007b, 2013) to summarize the life history, population dynamics and status of the species, as follows.

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).

Population Dynamics

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

Surveys at eighty eight 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.

From 1980 to 2003, the number of nests at three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased fifteen 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 2013).

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).

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).

Status

Long-term data on the hawksbill sea turtle indicate that sixty-three sites have declined over the past twenty to one-hundred years (historic trends are unknown for the remaining twenty-five sites). Recently, twenty-eight sites (68 percent) have experienced nesting declines, ten have experienced increases, three have remained stable, and forty-seven 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 one-hundred 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.

Status in 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 to 332 nesting females annually, and the other sites combined host 51 to 85 nesting females annually (NMFS and USFWS 2007b). Within the U.S., hawksbills are most common in Puerto Rico and its associated islands and in the U.S. Virgin Islands. In the continental U.S., hawksbills are found primarily in Florida and Texas, though they have been recorded in all the Gulf States and along the east coast as far north as Massachusetts. In Florida, hawksbills are observed on the reefs off Palm Beach, Broward, Miami-Dade, and Monroe Counties. Most sightings involve post-hatchlings and juveniles. These small turtles are believed to originate from nesting beaches in Mexico.

Critical Habitat

On September 2, 1998, NMFS established critical habitat for hawksbill sea turtles around Mona and Monito Islands, Puerto Rico. 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 designated critical habitat for hawksbill does not occur in the action area for the proposed permit.

Recovery Goals

See the 1992 and 1998 Recovery Plans for the U.S. Caribbean, Atlantic and Gulf of Mexico and U.S. Pacific populations of hawksbill sea turtles, respectively, for complete down listing/delisting criteria for each of their respective recovery goals. The following items were the top recovery actions identified to support in the Recovery Plans:

1. Identify important nesting beaches
2. Ensure long-term protection and management of important nesting beaches
3. Protect and manage nesting habitat; prevent the degradation of nesting habitat caused by seawalls, revetments, sand bags, other erosion-control measures, jetties and breakwaters
4. Identify important marine habitats; protect and manage populations in marine habitat
5. Protect and manage marine habitat; prevent the degradation or destruction of important [marine] habitats caused by upland and coastal erosion
6. Prevent the degradation of reef habitat caused by sewage and other pollutants
7. Monitor nesting activity on important nesting beaches with standardized index surveys
8. Evaluate nest success and implement appropriate nest-protection on important nesting beaches
9. Ensure that law-enforcement activities prevent the illegal exploitation and harassment of sea turtles and increase law-enforcement efforts to reduce illegal exploitation
10. Determine nesting beach origins for juveniles and subadult populations

5.2.3 Loggerhead Sea Turtle, Northwest Atlantic Distinct Population Segment

Loggerhead sea turtles are circumglobal, and are found in the temperate and tropical regions of the Indian, Pacific and Atlantic Oceans. Northwest Atlantic Ocean DPS loggerheads are found along eastern North America, Central America, and northern South America (Figure 8).

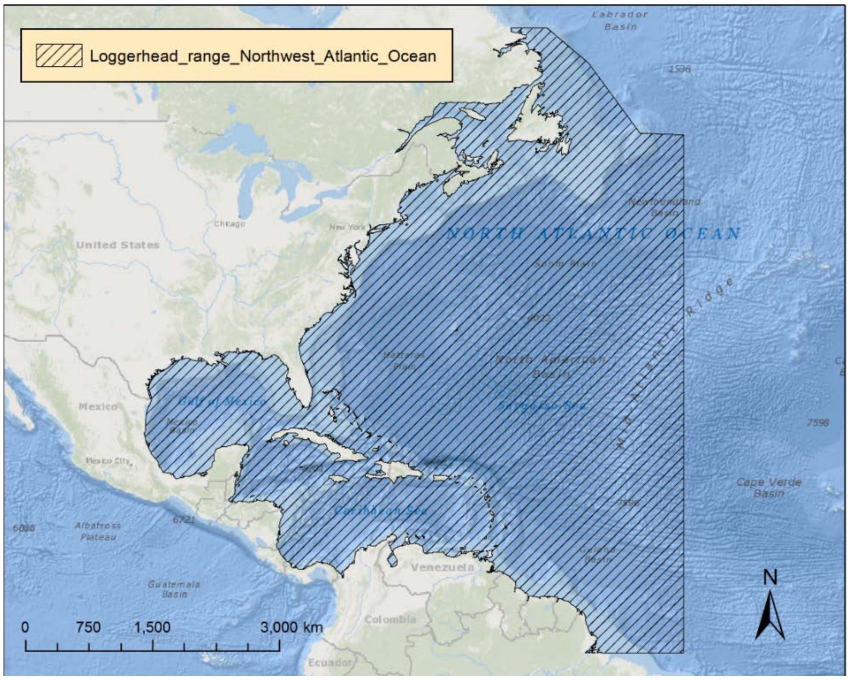


Figure 8. Map identifying the range of the Northwest Atlantic loggerhead sea turtle.

The loggerhead sea turtle is distinguished from other turtles by its reddish-brown carapace, large head and powerful jaws (Figure 9). The species was first listed as threatened under the ESA in 1978.

Figure 9. Loggerhead sea turtle. Credit: National Oceanic and Atmospheric Administration.

On September 22, 2011, the NMFS designated nine distinct population segments of loggerhead sea turtles, with the Northwest Atlantic Ocean DPS listed as threatened (Table 7).

Table 7. Summary of Northwest Atlantic Ocean distinct population segment loggerhead turtle listing and recovery information.

Species	Common Name	Distinct Population Segment	ESA Status	Critical Habitat	Recovery Plan
Caretta caretta	Loggerhead sea turtle	Northwest Atlantic	Threatened 76 FR 58868 09/22/2011 43 FR 32800 07/28/1978	79 FR 39856 Atlantic and GOM 2014	74 FR 2995 Notice Northwest Atlantic 2009

We used information available in the 2009 Status Review (Conant et al. 2009) and the final listing rule to summarize the life history, population dynamics and status of the species, as follows.

Life History

Mean age at first reproduction for female loggerhead sea turtles is thirty years. 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.

Population Dynamics

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

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. Adult nesting females often account for less than one percent of total population numbers (Bjorndal et al. 2005).

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.

The Northern Recovery Unit, from North Carolina to northeastern Florida, and is the second largest nesting aggregation in the DPS, with an average of 5,215 nests from 1989 to 2008, and approximately 1,272 nesting females (NMFS and USFWS 2008).

The Peninsular Florida Recovery Unit hosts more than 10,000 females nesting annually, which constitutes eighty-seven percent of all nesting effort in the DPS (Ehrhart et al. 2003).

The Greater Caribbean Recovery Unit encompasses nesting subpopulations in Mexico to French Guiana, the Bahamas, and the Lesser and Greater Antilles. The majority of nesting for this recovery unit occurs on the Yucatán peninsula, in Quintana Roo, Mexico, with 903 to 2,331 nests annually (Zurita et al. 2003). Other significant nesting sites are found throughout the Caribbean, and including Cuba, with approximately 250 to 300 nests annually (Ehrhart et al. 2003), and over one hundred nests annually in Cay Sal in the Bahamas (NMFS and USFWS 2008).

The Dry Tortugas Recovery Unit includes all islands west of Key West, Florida. The only available data for the nesting subpopulation on Key West comes from a census conducted from 1995 to 2004 (excluding 2002), which provided a mean of 246 nests per year, or about sixty nesting females (NMFS and USFWS 2007d).

The Gulf of Mexico Recovery Unit has between one hundred to 999 nesting females annually, and a mean of 910 nests per year.

The population growth rate for each of the 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 to 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 2007d).

The nesting subpopulation in the Florida panhandle has exhibited a significant declining trend from 1995 to 2005 (NMFS and USFWS 2007d; Conant et al. 2009). Recent model estimates predict an overall population decline of seventeen percent for the St. Joseph Peninsula, Florida subpopulation of the Northern Gulf of Mexico recovery unit (Lamont et al. 2014).

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).

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 (seventy-one to eighty-eight 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).

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).

Status in 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 US 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 South 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 south 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 1991b). The South Florida recovery unit increased at about 5.3 percent per year from 1978 to 1990, and was initially increasing at 3.9-4.2 percent after 1990. An analysis of nesting data from 1989 to 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).

Critical Habitat

NMFS has designated critical habitat for the Northwest Atlantic Ocean DPS loggerhead sea turtles. On July 10, 2014, NMFS and the U.S. Fish and Wildlife Service 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 (Figure 10). These areas contain one or a combination of nearshore reproductive habitat, winter area, breeding areas, and migratory corridors. The critical habitat is categorized into thirty-eight 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.

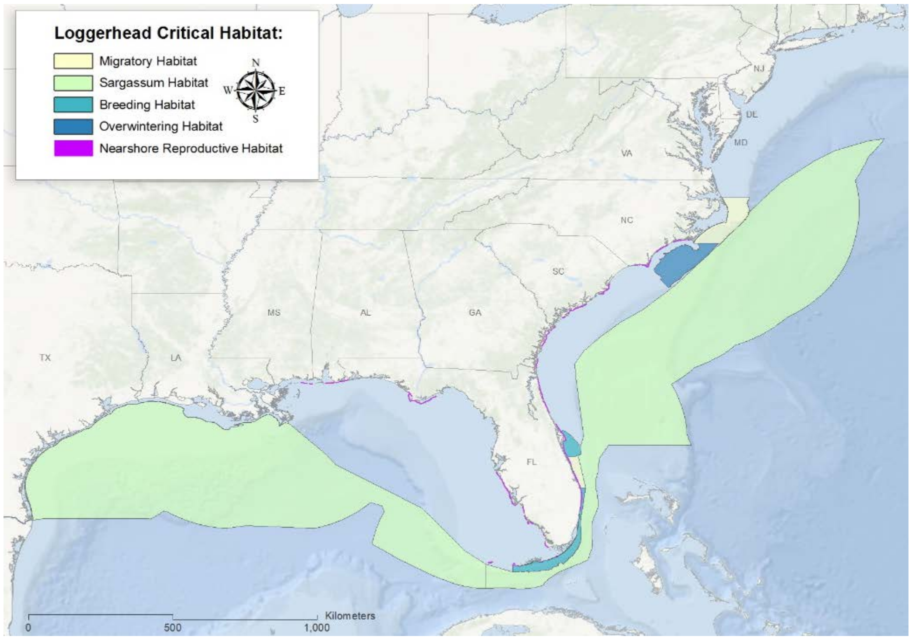


Figure 10. Map identifying designated critical habitat for the Northwest Atlantic distinct population segment loggerhead sea turtles.

Recovery Goals

See the 2009 Final Recovery Plan for the Northwest Atlantic Population of Loggerheads for complete down listing/delisting criteria for each of the following recovery objectives.

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.

5.2.4 Kemp's Ridley Sea Turtle

The Kemp's ridley turtle 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 (Figure 11).

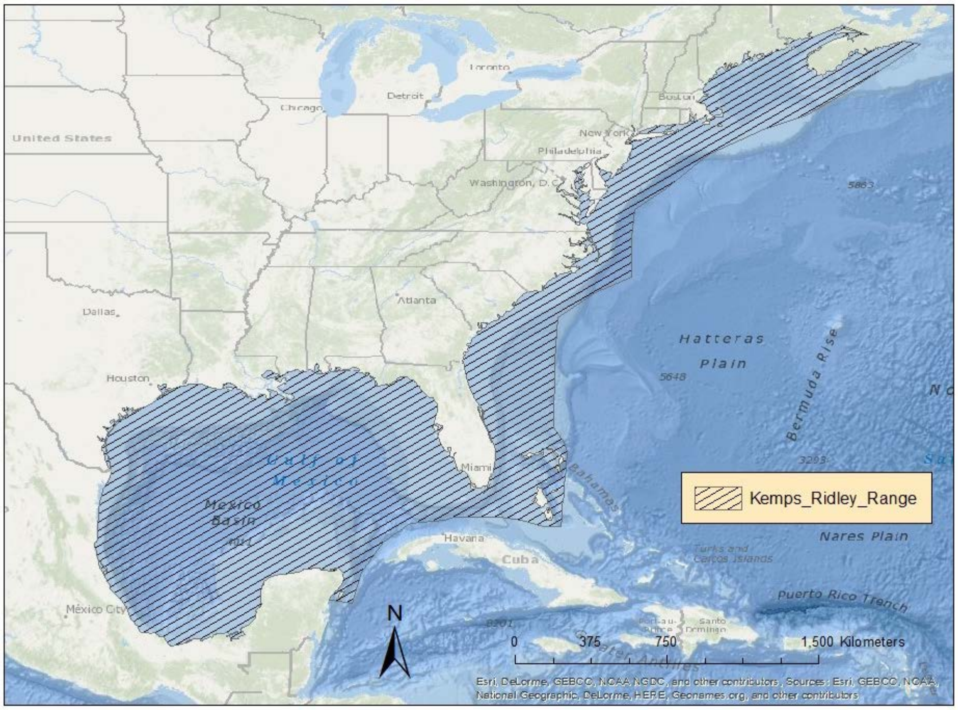


Figure 11. Map identifying the range of the Kemp's ridley sea turtle.

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 12).

Figure 12. Kemp's ridley sea turtle. Credit: National Oceanic and Atmospheric Administration.

The species was first listed under the Endangered Species Conservation Act and listed as endangered under the ESA since 1970 (Table 8).

Table 8. Summary of Kemp's ridley sea turtle listing and recovery information.

Species	Common Name	Distinct Population Segment	ESA Status	Critical Habitat	Recovery Plan
Lepidochelys kempii	Kemp's ridley sea turtle	Range-wide	Endangered 35 FR 18319 12/02/1970	Not Designated	75 FR 12496 U.S. Caribbean, Atlantic, and Gulf of Mexico (2nd) 2011

We used information available in the revised recovery plan (NMFS and USFWS 2011) and the Five-Year Review (NMFS and USFWS 2015) to summarize the life history, population dynamics and status of the species, as follows.

Life History

Females mature at twelve years of age. The average remigration is two 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 ninety-seven to one hundred 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 two 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, Kemp's ridleys forage on swimming crabs, fish, jellyfish, mollusks, and tunicates (NMFS and USFWS 2011).

Population Dynamics

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

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, fifty in 2005, 197 in 2009, and 119 in 2014 (NMFS and USFWS 2015).

From 1980 to 2003, the number of nests at three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased fifteen 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 2015b).

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).

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 (Tomás 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).

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.

Status in 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 2007c). 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.

Critical Habitat

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

Recovery Goals

See the 2011 Final Bi-National (U.S. and Mexico) Revised Recovery Plan for Kemp's ridley sea turtles for complete down listing/delisting criteria for each of their respective recovery goals. The following items were identified as priorities to recover Kemp's ridley sea turtles:

1) Protect and manage nesting and marine habitats.

2) Protect and manage populations on the nesting beaches and in the marine environment.

3) Maintain a stranding network.

4) Manage captive stocks.

5) Sustain education and partnership programs.

6) Maintain, promote awareness of and expand U.S. and Mexican laws.

7) Implement international agreements.

8) Enforce laws.

5.2.5 Gulf Sturgeon

The Gulf sturgeon was listed as threatened on September 30, 1991 (Table 9). NMFS and the USFWS jointly manage Gulf sturgeon under the ESA. NMFS is responsible for consultations on actions affecting Gulf sturgeon and their critical habitat in marine habitats. USFWS is responsible for Gulf sturgeon consultations in riverine habitats. In estuarine habitats, responsibility is divided based on the action agency involved: USFWS consults with the Department of Transportation, the USEPA, 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 2009, NMFS and USFWS conducted a 5-year review and found Gulf sturgeon continued to meet the definition of a threatened species (USFWS and NMFS 2009).

The current range of the Gulf sturgeon extends from Lake Pontchartrain in Louisiana east to the Suwannee river system in Florida (Figure 13). Within that range, seven major rivers are known to support reproducing populations: Pearl, Pascagoula, Escambia, Yellow, Choctawhatchee, Apalachicola, and Suwannee (USFWS and NMFS 2009).

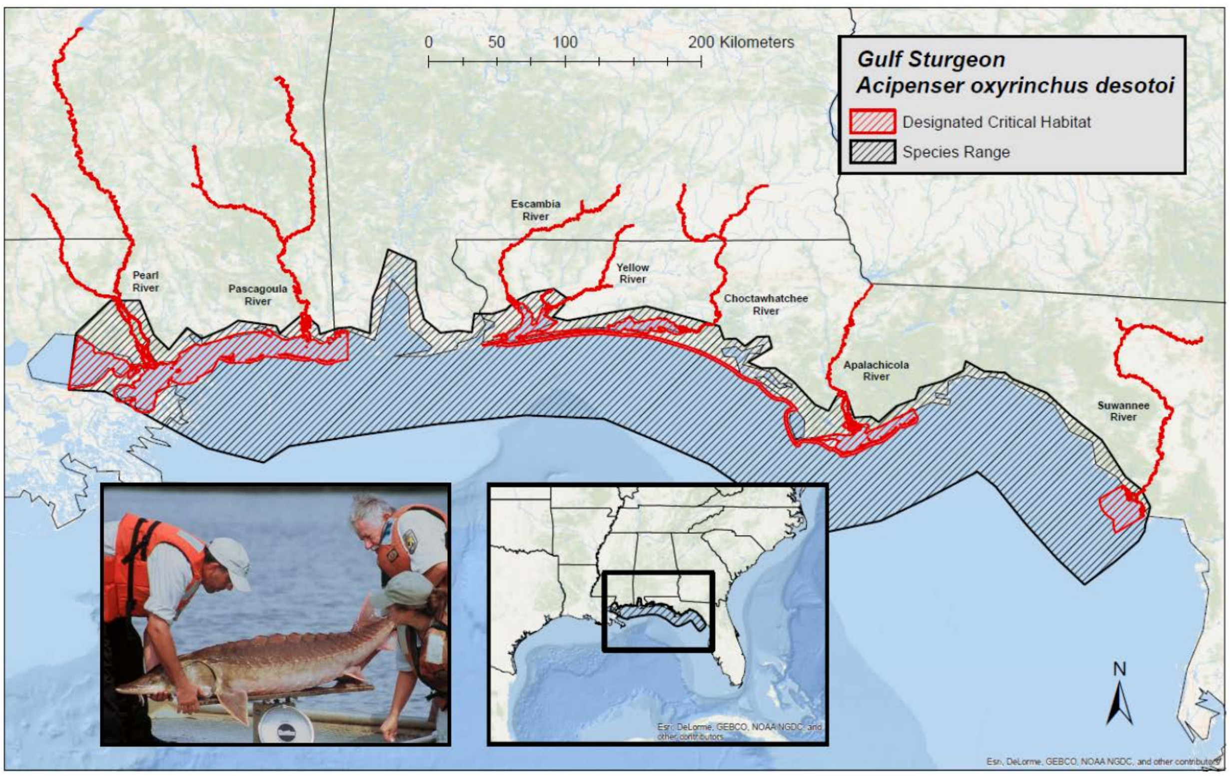


Figure 13. Geographic range and designated critical habitat of the Gulf sturgeon.

Gulf sturgeon are benthic fusiform fish with an extended snout, vertical mouth, five rows of scutes (bony plates surrounding the body), four barbels (slender, whisker-like feelers anterior to the mouth used for touch and taste), and a heterocercal (upper lobe is longer than lower) caudal fin. Adults range from 6 to 8 feet in length and weigh up to 200 pounds; females grow larger than males (USFWS and NMFS 2009).

Table 9. Summary of Gulf sturgeon listing and recovery plan information.

Species	Common Name	Distinct Population Segment	ESA Status	Recent Review Year	Listing	Recovery Plan	Critical Habitat
Acipenser oxyrinchus desotoi	Gulf sturgeon	None	Threatened	2009	56 FR 49653 09/30/1991	FR N/A 1995	68 FR 13370 Gulf of Mexico 2003

Life history

Gulf sturgeon are long-lived, with some individuals reaching at least 42 years in age. Surveys in the Suwannee River suggest that a more common maximum age may be around 25 years (Sulak and Clugston 1999). Age at sexual maturity for females ranges from 8 to 17 years, and for males from 7 to 21 years (Huff 1975). In general, gulf sturgeon spawn up-river in spring, spend winter months in near-shore marine environments, and utilize pre- and post-spawn staging and nursery areas in the lower rivers and estuaries (Heise et al. 2004; Heise et al. 2005). There is some evidence of autumn spawning in the Suwannee River, however there is uncertainty as to whether this spawning is due to environmental conditions or represents a genetically distinct population (Randall and Sulak 2012). Gulf sturgeon spawn at intervals ranging from 3 to 5 years for females and 1 to 5 years for males (Smith 1985; Fox et al. 2000). The spring migration to up-river spawning sites begins in mid-February and continues through May. Fertilization is external; females deposit their eggs in the upper reaches of and show preference for hard, clean substrate (e.g., bedrock covered in gravel and small cobble).

Upon hatching from their eggs, gulf sturgeon larvae spend the first few days of life sheltered in interstitial spaces at the spawning site (Kynard and Parker 2004). At the onset of feeding, age-0 gulf sturgeon disperse and are often found on shallow sandbars and rippled sand shoals (less than 4 meters depth) (Sulak and Clugston 1998). Young-of-the-year spend 6 to 10 months slowing working their way downstream feeding on aquatic insects (e.g., mayflies and caddisflies), worms (oligochaetes), and bivalve mollusks, and arrive in estuaries and river mouths by mid-winter (Sulak and Clugston 1999) where they will spend their next 6 years developing. After spawning, adult gulf sturgeon migrate downstream to summer resting and holding areas in the mid to lower reaches of the rivers where they may hold until November (Wooley and Crateau 1985). While in freshwater adults lose a substantial amount of their weight, but regain it upon entering the estuaries. Sub adult and non-spawning adults also spend late spring through fall in these holding areas (Foster and Clugston 1997). By early December all adult and sub-adult gulf sturgeon return to the marine environment to forage on benthic (bottom dwelling) invertebrates along the shallow nearshore (2 to 4 meters depth), barrier island passes, and in unknown off-shore locations in the gulf (Huff 1975; Carr et al. 1996; Fox et al. 2002; Ross et al. 2009). Juvenile gulf sturgeon overwinter in estuaries, river mouths, and bays; juveniles do not enter the nearshore/offshore marine environments until around age 6 (Sulak and Clugston 1999). Gulf sturgeon show a high degree of river-specific fidelity (Rudd et al. 2014). Adult and sub-adult gulf sturgeon fast while in freshwater environments and are almost entirely dependent on the estuarine/marine environment for food (Wooley and Crateau 1985; Gu et al. 2001). Some juveniles (ages 1 to 6) will also fast in the freshwater summer holding areas, but the majority feed year round in the estuaries, river mouths, and bays (Sulak et al. 2009).

Population Dynamics

Currently, seven rivers are known to support reproducing populations of Gulf sturgeon. The most recent abundance estimates were reported in the 5-Year Status Review conducted in 2009 (USFWS and NMFS 2009). The largest estimated populations of Gulf sturgeon are found in the Suwannee (14,000), the Choctawhatchee (3,314), and the Yellow (911) rivers (USFWS and NMFS 2009). The most recent population estimates for the other four rivers with known reproducing populations are all below 500.

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

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

Status

The decline in the abundance of gulf sturgeon has been attributed to targeted fisheries in the late 19th and early 20th centuries, habitat loss associated with dams and sills, habitat degradation associated with dredging, de-snagging, and contamination by pesticides, heavy metals, and other industrial contaminants, and certain life history characteristics (e.g., slow growth and late maturation) (56 FR 49653). Effects of climate change (warmer water, sea level rise and higher salinity levels) could lead to accelerated changes in habitats utilized by Gulf sturgeon. The rate that climate change and corollary impacts are occurring may outpace the ability of the Gulf sturgeon to adapt given its limited geographic distribution and low dispersal rate. In general, gulf sturgeon populations in the eastern portion of the range appear to be stable or slightly increasing, while populations in the western portion are associated with lower abundances and higher uncertainty (USFWS and NMFS 2009).

Designated Critical Habitat

Designated critical habitat for gulf sturgeon was established in 2003 and consists of 14 geographic units encompassing 2,783 river kilometers as well as 6,042 square kilometers of estuarine and marine habitat. Primary constituent elements for the conservation of Gulf Sturgeon are abundant food items, riverine spawning sites with substrates suitable for egg deposition and development, riverine aggregation areas, a flow regime necessary for normal behavior, growth, and survival, water and sediment quality necessary for normal behavior, growth, and viability of all life stages, and safe and unobstructed migratory pathways.

Recovery Goals

The 1995 Recovery Plan outlined three recovery objectives: (1) to prevent further reduction of existing wild populations of Gulf sturgeon within the range of the subspecies; (2) to establish population levels that would allow delisting of the Gulf sturgeon by management units (management units could be delisted by 2023 if required criteria are met); (3) to establish, following delisting, a self-sustaining population that could withstand directed fishing pressure within management units (USFWS and GSMFC 1995). The most recent Gulf sturgeon 5-year review recommended that criteria be developed in a revised recovery plan (USFWS and NMFS 2009).

6 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).

6.1 Climate Change

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

In order to evaluate the implications of different climate outcomes and associated impacts throughout the 21st century, many factors have to be considered. The amount of future greenhouse gas emissions is a key variable. Developments in technology, changes in energy generation and land use, global and regional economic circumstances, and population growth must also be considered.

Global annually averaged surface air temperature has increased by about 1.8 degrees Fahrenheit (1.0 degrees Celsius) over the last 115 years (1901 to 2016) (Wuebbles et al. 2017). The globally-averaged combined land and ocean surface temperature data, as calculated by a linear trend, show a warming of approximately 1.0°C from 1901 through 2016 (Hayhoe 2018). This period is now the warmest in the history of modern civilization. These global trends are expected to continue over climate timescales. The magnitude of climate change beyond the next few decades will depend primarily on the amount of greenhouse gases (especially carbon dioxide) emitted globally. A set of four scenarios was developed by the Intergovernmental Panel on Climate Change (IPCC) to ensure that starting conditions, historical data, and projections are employed consistently across the various branches of climate science. The scenarios are referred to as representative concentration pathways (RCPs), which capture a range of potential greenhouse gas emissions pathways and associated atmospheric concentration levels through 2100 (IPCC 2014). The RCP scenarios drive climate model projections for temperature, precipitation, sea level, and other variables: RCP2.6 is a stringent mitigation scenario; RCP4.5 and RCP6.0 are intermediate scenarios; and RCP8.5 is a scenario with no mitigation or reduction in the use of fossil fuels. IPCC future global climate predictions and national and regional climate predictions included in the Fourth National Climate Assessment for U.S. states and territories (USGCRP 2018) use the RCP scenarios. The increase of global mean surface temperature change by 2100 is projected to be 0.3 to 1.7°C under RCP2.6, 1.1 to 2.6°C under

RCP4.5, 1.4 to 3.1°C under RCP6.0, and 2.6 to 4.8°C under RCP8.5 with the Arctic region warming more rapidly than the global mean under all scenarios (IPCC 2014).

Changes in surface, atmospheric, and oceanic temperatures and other climatic changes have resulted in melting glaciers, diminishing snow cover, shrinking sea ice, rising sea levels, ocean acidification, and increasing atmospheric water vapor. Global average sea level has risen by about seven to eight inches since 1900, with almost half (about three inches) of that rise occurring since 1993. Human-caused climate change has made a substantial contribution to this rise since 1900, contributing to a rate of rise that is greater than during any preceding century in at least 2,800 years (Wuebbles et al. 2017). Global sea level rise has already affected the U.S.; the incidence of daily tidal flooding is accelerating in more than 25 Atlantic and Gulf Coast cities. Global average sea levels are expected to continue to rise by at least several inches in the next 15 years and by one to four feet by 2100. Sea level rise will be higher than the global average on the East and Gulf Coasts of the U.S. (Wuebbles et al. 2017). Climate change has been linked to changing ocean currents as well. Rising carbon dioxide levels have been identified as a reason for a poleward shift in the Eastern Australian Current, shifting warm waters into the Tasman Sea and altering biotic features of the area (Poloczanska et al. 2009). Similarly, the Kuroshio Current in the western North Pacific (an important foraging area for juvenile sea turtles) has shifted southward as a result of altered long-term wind patterns over the Pacific Ocean (Poloczanska et al. 2009).

Changes in air and sea surface temperatures can affect marine ecosystems in several ways. Direct effects decreases in sea ice and changes in ocean acidity, precipitation patterns, and sea level. Indirect effects of climate change include altered reproductive seasons/locations, shifts in migration patterns, reduced distribution and abundance of prey, and changes in the abundance of competitors and/or predators. Variations in sea surface temperature can affect an ecological community’s composition and structure, alter migration and breeding patterns of fauna and flora and change the frequency and intensity of extreme weather events. For species that undergo long migrations, individual movements are usually associated with prey availability or habitat suitability. If either is disrupted, the timing of migration can change or negatively impact population sustainability (Simmonds and Eliott. 2009). Over the long term, increases in sea surface temperature can also reduce the amount of nutrients supplied to surface waters from the deep sea leading to declines in fish populations (EPA 2010), and, therefore, declines in those species whose diets are dominated by fish. 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.

The potential for invasive species to spread may increase under the influence of climatic change. If water temperatures warm in marine ecosystems, native species may shift poleward to cooler habitats, opening ecological niches that can be occupied by invasive species introduced via ships ballast water or other sources (Ruiz et al. 1999; Philippart et al. 2011). Invasive species that are better adapted to warmer water temperatures can also outcompete native species that are physiologically geared towards lower water temperatures (Lockwood and Somero 2011). Altered ranges can also result in the spread of novel diseases to new areas via shifts in host ranges (Simmonds and Eliott. 2009). For example, it has been suggested that increases in harmful algal blooms could result from increases in sea surface temperature (Simmonds and Eliott. 2009). Moore et al. (2011) estimated that the impacts of a dinoflagellate establishment would likely intensify with a warming climate, resulting in roughly 13 more days of potential bloom conditions per year by the end of the 21st century.

Climate change will likely have its most pronounced effects on vulnerable species whose populations are already in tenuous positions (Williams et al. 2008). As such, we expect the risk of extinction to listed species to rise with the degree of climate shift associated with global warming. Increasing atmospheric temperatures have already contributed to documented changes in the quality of freshwater, coastal, and marine ecosystems and to the decline of endangered and threatened species populations (Mantua et al. 1997; Karl 2009).

Changes in the marine ecosystem caused by global climate change (e.g., ocean acidification, salinity, oceanic currents, dissolved oxygen levels, nutrient distribution) could influence the distribution and abundance of lower trophic levels (e.g., phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish), ultimately affecting primary foraging areas of ESA-listed species including marine mammals, sea turtles, and fish. Marine species ranges are expected to shift as they align their distributions to match their physiological tolerances under changing environmental conditions (Doney et al. 2011). Hazen et al. (2013) examined top predator distribution and diversity in the Pacific Ocean in light of rising sea surface temperatures using a database of electronic tags and output from a global climate model. They predicted up to a 35 percent change in core habitat area for some key marine predators in the Pacific Ocean, with some species predicted to experience gains in available core habitat and some predicted to experience losses. Notably, leatherback turtles were predicted to gain core habitat area, whereas loggerhead turtles and blue whales were predicted to experience losses in available core habitat. McMahon and Hays (2006) predicted increased ocean temperatures will expand the distribution of leatherback turtles into more northern latitudes. The authors noted this is already occurring in the Atlantic Ocean. MacLeod (2009) estimated, based upon expected shifts in water temperature, 88 percent of cetaceans will be affected by climate change, with 47 percent predicted to experience unfavorable conditions (e.g., range contraction). Willis-Norton et al. (2015) acknowledged there will be both habitat loss and gain, but overall climate change could result in a 15 percent loss of core pelagic habitat for leatherback turtles in the eastern South Pacific Ocean.

Sea turtles occupy a wide range of terrestrial and marine habitats, and many aspects of their life history have been demonstrated to be closely tied to climatic variables such as ambient temperature and storminess (Hawkes et al. 2009). Sea turtles have temperature-dependent sex determination, and many populations produce highly female-biased offspring sex ratios, a skew likely to increase further with global warming (Newson et al. 2009; Patrício et al. 2017). Genetic analyses and behavioral data suggest that populations with temperature-dependent sex determination may be unable to evolve rapidly enough to counteract the negative fitness consequences of rapid global temperature change (Hays 2008 as cited in Newson et al. 2009). Altered sex ratios have been observed in sea turtle populations worldwide (Mazaris et al. 2008; Reina et al. 2008; Robinson et al. 2008; Fuentes et al. 2009a). This does not yet appear to have affected population viabilities through reduced reproductive success, although average nesting and emergence dates have changed over the past several decades by days to weeks in some locations (Poloczanska et al. 2009). Hayes et al. (2010) suggests that because of the increased frequency of male loggerhead breeding (based on visits to breeding sites) versus female breeding, the ability of males to breed with many females and the ability of females to store sperm and fertilize many clutches, skewed sex ratios due to climate change could be compensated for in some turtle populations and population effects may be ameliorated. However, such a fundamental shift in population demographics may cause a fundamental instability in the viability of some populations. In addition to altering sex ratios, increased temperatures in sea turtle nests can result in reduced incubation times (producing smaller hatchling), reduced clutch size, and reduced nesting success due to exceeded thermal tolerances (Fuentes et al. 2009b; Fuentes et al. 2010; Fuentes et al. 2011; Azanza-Ricardo et al. 2017).

Other climatic aspects, such as extreme weather events, precipitation, ocean acidification and sea level rise also have potential to affect marine turtle populations. Changes in global climatic patterns will likely have profound effects on the coastlines of every continent, thus directly impacting sea turtle nesting habitat (Wilkinson and Souter 2008). In some areas, increases in sea level alone may be sufficient to inundate turtle nests and reduce hatching success by creating hypoxic conditions within inundated eggs (Caut et al. 2009; Pike et al. 2015). Flatter beaches, preferred by smaller sea turtle species, would likely be inundated sooner than would steeper beaches preferred by larger species (Hawkes et al. 2014). Relatively small increases in sea level can result in the loss of a large proportion of nesting beaches in some locations. For example, a study in the northwestern Hawaiian Islands predicted that up to 40 percent of green turtle nesting beaches could be flooded with 0.9 meters of sea level rise (Baker et al. 2006). The loss of nesting beaches would have catastrophic effects on sea turtle populations globally if they are unable to colonize new beaches that form, or if the newly formed beaches do not provide the habitat attributes (sand depth, temperature regimes, refuge) necessary for egg survival.

Changing patterns of coastal erosion and sand accretion, combined with an anticipated increase in the number and severity of extreme weather events, may further exacerbate the effects of sea level rise on turtle nesting beaches (Wilkinson and Souter 2008). Climate change is expected to affect the intensity of hurricanes through increasing sea surface temperatures, a key factor that influences hurricane formation and behavior (EPA 2010). The intensity of tropical storms in the Atlantic Ocean, Caribbean, and Gulf of Mexico has risen noticeably over the past 20 years and six of the 10 most active hurricane seasons have occurred since the mid-1990s (EPA 2010). Extreme weather events may directly harm sea turtles, causing “mass” strandings and mortality

(Poloczanska et al. 2009). Studies examining the spatio-temporal coincidence of marine turtle nesting with hurricanes, cyclones and storms suggest that cyclical loss of nesting beaches, decreased hatching success and hatchling emergence success could occur with greater frequency in the future due to global climate change (Hawkes et al. 2009). Pike et al. (2006) concluded that warming sea surface temperatures may lead to potential fitness consequences in sea turtles resulting from altered seasonality and duration of nesting. Sea turtles may expand their range as temperature-dependent distribution limits change (McMahon and Hays 2006). Warming ocean temperatures may extend poleward the habitat which sea turtles can utilize (Poloczanska et al. 2009).

6.2 Fisheries

Bycatch occurs when fisheries interact with living marine resources (e.g., marine mammals, sea turtles, non-market fish species, corals, or seabirds) that are not the target species for commercial sale. Bycatch represents a global threat to many ESA-listed species. Populations of marine megafauna (e.g., turtles, mammals, sharks) can be particularly sensitive to the detrimental effects of bycatch due to life history parameters such as slow growth, late age at maturity, and low reproductive rates (Hall et al. 2017). Highly migratory, transboundary species that spend large amounts of time in ocean jurisdictions lacking adequate bycatch mitigation measures, monitoring, or enforcement are often most vulnerable to this threat.

While mitigation and minimization measures have reduced fisheries bycatch in the United States in recent years, large numbers of ESA-listed species are still routinely captured in federal and state commercial fisheries targeting other species. Some ESA-listed species also interact with recreational hook-and-line fisheries. Fisheries management plans (FMPs) developed for federally regulated fisheries with ESA-listed species bycatch are required to undergo section 7 consultation, including a NMFS issued opinion and an incidental take statement. The incidental take statement includes the anticipated amount of take (lethal and nonlethal) and reasonable and prudent measures with specific terms and conditions for mitigating and minimizing the adverse effects of the proposed action on ESA-listed species and designated critical habitat. Some state-managed fisheries with ESA-listed species bycatch have also been the subject of section 7 consultations with NMFS for issuance of ESA section 10(a)(1)(B) incidental take permits. Incidental take permits are issued based on NMFS approval of a state’s Conservation Plan, which includes ESA-listed species mitigation and minimization measures.

Bycatch of ESA-listed sea turtles occurs in a diversity of fisheries throughout the broad geographic oceanic ranges of these species. Sea turtle bycatch occurs in both large-scale commercial fishing operations as well as small-scale, artisanal fisheries throughout the world. Fishing gears that are known to interact with sea turtles include trawls, longlines, purse seines, gillnets, pound nets, dredges and to a lesser extent, pots and traps (Finkbeiner et al. 2011; Lewison et al. 2013).

Sea turtle bycatch rates (i.e., individuals captured per unit of fishing effort) and mortality rates (i.e., individuals killed per number captured) can vary widely both within and across particular fisheries due to a combination of factors. These include gear types and gear configurations, fishing methods (e.g., depth fished, soak times), fishing locations, fishing seasons, time fished (i.e., day versus night), and turtle handling and release techniques used (Wallace et al. 2010; Lewison et al. 2013). Henwood (1987) found a strong positive correlation between shrimp trawl tow time and mortality rate of turtles bycaught in commercial shrimp trawlers. Similarly, Murray (2009) found that sea turtle mortality rates in sink gillnet gear was largely a function of soak time. Differences in bycatch rates among gear deployment practices and gear configurations have driven many of the bycatch reduction strategies in longline ships (Watson et al. 2005; Lewison et al. 2013). Shallow-set longlines (less than 50 meters) have been shown to result in higher turtle bycatch rates than deeper sets (Gilman et al. 2006; Beverly et al. 2009); leatherbacks are caught more often during nighttime longline sets compared to daytime sets; increased longline soak times have resulted in higher catches of loggerhead turtles (Gilman et al. 2006); and switching from J-shaped hooks with squid bait to circle hooks with fish bait resulted in significant declines in loggerhead (83 percent) and leatherback (90 percent) bycatch in the Hawaii longline swordfish fishery (Gilman et al. 2007). Estimated turtle mortality rates from capture in longline gear have also been shown to vary widely (8 percent to over 30 percent) depending on numerous factors including hook type used, set depth, and hook location (Chaloupka et al. 2004; Casale et al. 2008).

If mortality is not directly observed during gear retrieval, it may occur after the turtle is released due to physiological stress and injury suffered during capture. Entanglement in fishing gear and/or plastics can result in severe ulcerative dermatitis, and amputation of flippers (Orós et al. 2005). Although rates of post-release mortality and serious injury are essential to understanding the impact of bycatch on sea turtle populations, it is a major knowledge gap for many fisheries that interact with turtles (Lewison et al. 2013).

There have been some major advancements in sea turtle bycatch reduction technologies and management approaches in the past few decades. Direct gear and fishery modifications such as changes to bait type, modifying gear to make it less visible or attractive to sea turtles, making gear less likely to cause direct mortality, or changing the way that gear is deployed are all examples of bycatch mitigation techniques that have been employed to reduce sea turtle bycatch in trawl, passive net, and longline large-scale fisheries (Lewison et al. 2013; Hall et al. 2017). Time-area closures have also proven effective at reducing sea turtle bycatch in commercial fishing gear (Dunn et al. 2011). Swimmer et al. (2017) analyzed 20 years of U.S. longline observer data from the Atlantic and Pacific Ocean basins during periods before and after sea turtle bycatch reduction regulations to assess the effectiveness of the regulations. They found that in two federally managed longline fisheries, rates of sea turtle bycatch significantly declined after the regulations. Capture probabilities were lowest when using a combination of circle hooks (versus J-hooks) and fish bait (versus squid bait). In the Atlantic (all regions), rates declined by 40 and 61 percent for leatherback and loggerhead turtles, respectively, after the regulations. In the Pacific shallow set fishery, mean bycatch rates declined by 84 and 95 percent, for leatherback and loggerhead turtles, respectively, for the post-regulation period (Swimmer et al. 2017).

In 2003, NMFS developed a National Bycatch Strategy that identified concrete actions necessary for reducing bycatch in U.S. fisheries (Benaka and Dobrzynski 2004). This document was recently updated and expanded to enhance the effectiveness of existing bycatch reduction approaches. The 2016 National Bycatch Reduction Strategy identifies several key objectives including: (1) improved monitoring of bycatch and bycatch mortality, (2) conduct research to improve bycatch estimates, (3) implement management measures to further reduce the effects of bycatch, and (4) more emphasis on enforcement to ensure compliance with bycatch measures (NMFS 2016c). The most effective way to monitor sea turtle bycatch is to place trained observers aboard fishing ships. Although observer programs have increased in recent decades, many fisheries still lack the level of observer coverage necessary to produce reliable estimates of bycatch and associated mortalities needed to assess fishery impacts on ESA-listed species. In 2007, NMFS established a new regulation (72 FR 43176) to annually review sea turtle interactions across fisheries, identify those that require monitoring, and require fishermen to accommodate observers if requested. This annual process should help NMFS and the fishing industry learn more about sea turtle interactions with fishing operations, continually evaluate existing measures to reduce sea turtle takes, and determine whether additional measures to address prohibited sea turtle takes may be necessary to avoid exceeding established take limits.

6.2.1 Gulf of Mexico

The Southeast shrimp trawl fishery in the Atlantic and Gulf of Mexico has historically accounted for the overwhelming majority (up to 98 percent) of sea turtle bycatch in U.S. fisheries (Finkbeiner et al. 2011). Regulations that went into effect in the early 1990's require shrimp trawlers in the Atlantic and Gulf of Mexico to modify their gear with turtle excluder devices (TEDs) designed to allow turtles to escape trawl nets and avoid drowning. Although mitigation measures have greatly reduced the impact on sea turtle populations, the shrimp trawl fishery is still responsible for large numbers of turtle mortalities each year. The Gulf of Mexico fleet accounts for a large percentage of the sea turtle bycatch in this fishery. In 2010, the Gulf of Mexico shrimp trawl fishery had an estimated bycatch mortality of 5,166 turtles (18 leatherback, 778 loggerhead, 486 green and 3,884 Kemp's ridley). By comparison, the southeast Atlantic fishery had an estimated bycatch mortality of 1,033 turtles (8 leatherback, 673 loggerhead, 28 green and 324 Kemp's ridley) in 2010 (NMFS 2014).

The U.S. Atlantic pelagic longline fishery began in the early 1960s. This fishery is currently comprised of five distinct fishing sectors: Gulf of Mexico yellowfin tuna fishery; southern Atlantic swordfish fishery; Mid-Atlantic and New England swordfish and tuna fishery; U.S. Atlantic Distant Water swordfish fishery; and the Caribbean tuna and swordfish fishery. The pelagic longline fishery mainly interacts with leatherback sea turtles and pelagic juvenile loggerhead sea turtles. The estimated average annual bycatch in this fishery (all geographic areas combined) between 1992 to 2002 was 912 loggerhead interactions (including seven captured dead) and 846 leatherback interactions (including 11 captured dead) (NMFS 2004). These mortality estimates do not account for post-release mortality, which historically was likely substantial (NMFS 2014). The leatherback take estimate reached a historical high in 2004, and prior to that had increased sharply since 1998 (Garrison and Stokes 2014). A significant decrease in the leatherback bycatch rate occurred beginning in 2005, after the implementation of regulations in August 2005. The take of leatherbacks remained low and generally trended downward during 2007 to 2011, then sharply increased in 2012 associated with an increase in the reported fishing effort (Garrison and Stokes 2014). Loggerhead interactions, following the implementation of regulations, dropped in 2005, but rebounded slightly lower than the pre-regulation period. Generally, the period from 2009 to 2013 had lower overall estimates of loggerhead takes relative to previous cycles, despite a generally increasing trend in fishing over time (Garrison and Stokes 2014). The longline fishery take estimates numbers in 2013 were 51 loggerhead interactions and 72 leatherback interactions.

6.3 Ship Strike

Marine habitats occupied by ESA-listed species often feature both heavy commercial and recreational ship traffic. Ship strikes represent a recognized threat to large, air breathing marine species including sea turtles. This threat is increasing as commercial shipping lanes cross important breeding and feeding habitats and as ESA-listed species populations recover and populate new areas or areas where they were previously extirpated (Swingle et al. 1993; Wiley et al. 1995). As ships continue to become faster and more widespread, an increase in ship interactions with ESA-listed species is expected.

Sea turtles must surface to breathe and several species are known to bask at the surface for long periods making them more susceptible to ship strike. Ship strikes have been identified as one of the important mortality factors in several nearshore turtle habitats worldwide (Denkinger et al. 2013). However, available information is sparse regarding the overall magnitude of this threat or the impact on sea turtle populations globally. Although sea turtles can move somewhat rapidly, they apparently are not adept at avoiding ships that are moving at more than 4 km per hour; most ships move far faster than this in open water (Hazel and Gyuris 2006; Hazel et al. 2007; Work et al. 2010). Hazel et al. (2007) suggests that green turtles may use auditory cues to react to approaching ships rather than visual cues, making them more susceptible to strike as ship speed increases. Since turtles that were previously killed or injured as a result of some other stressor (e.g., fishing net entanglement or disease) may be more susceptible to a ship strike, it is not always known what proportion of ship wounds were sustained ante-mortem versus post mortem (or post injury). In one study from Virginia, Barco et al. (2016) found that all fifteen dead loggerhead turtles encountered with signs of acute ship interaction were apparently normal and healthy prior to being struck by a ship.

High levels of ship traffic in nearshore areas along the U.S. Atlantic and Gulf of Mexico coasts result in frequent sea turtle ship strikes. The incidence of propeller wounds of stranded turtles from the U.S. Atlantic and Gulf of Mexico doubled from about ten percent in the late 1980s to about twenty percent in 2004. Singel et al. (2007) reported a tripling of boat strike injuries in Florida from the 1980’s to 2005. Over this time period, in Florida alone over 4,000 (approximately 500 live; approximately 3500 dead) sea turtle strandings were documented with propeller wounds, which represents 30 percent of all sea turtle strandings for the state (Singel et al. 2007). These studies suggest that the threat of ship strikes to sea turtles may be increasing over time as ship traffic continues to increase in the United States.

6.4 Coastal Development and Land Use Changes

The modification and destruction of habitat remains one of the primary threats to many threatened and endangered species. In this section, we summarize the impacts of general anthropogenic stressors associated with coastal development and other land use changes on the aquatic habitats used by ESA-listed species. The effects of human activities on aquatic habitats are discussed in more detail in subsequent sections addressing the following specific threats: dredging, oil pollution, contaminants, nutrient loading, marine debris, and sound.

Many stream, riparian, and coastal areas within the action area have been degraded by the effects of land and water use associated with urbanization, road construction, forest management, agriculture, mining, transportation, water development, and other human activities. Development activities contribute to a variety of interrelated factors that lead to the decline of ESA-listed anadromous fish species considered in this opinion. These include reduced in-channel and off-channel habitat, restricted lateral channel movement, increased flow velocities, increased erosion, decreased cover, reduced prey sources, increased contaminants, increased water temperatures, degraded water quality, and decreased water quantity.

Urbanization and increased human population density within a watershed result in changes in stream habitat, water chemistry, and the biota (plants and animals) that live there. In many cases, these changes negatively impact species, particularly those with small population sizes like some of the ESA-listed species within the action area. The most obvious effect of urbanization is the loss of natural vegetation, which results in an increase in impervious cover and dramatic changes to the natural hydrology of urban and suburban streams (O'Driscoll et al. 2010). Urbanization generally results in land clearing, soil compaction, modification and/or loss of riparian buffers, and modifications to natural drainage features. The increased impervious cover in urban areas leads to increased volumes of runoff, increased peak flows and flow duration, and greater stream velocity during storm events (Booth et al. 1995; Bledsoe and Watson 2001). Runoff from urban areas also contains chemical pollutants from vehicles and roads, industrial sources, and residential sources (Connor et al. 2003). Urban runoff is typically warmer than receiving waters and can significantly increase temperatures, particularly in smaller streams (O'Driscoll et al. 2010).

Municipal wastewater treatment plants replace septic systems, resulting in point discharges of nutrients and other contaminants not removed in the processing (Booth et al. 1995). Municipalities with combined sewer/stormwater overflows or older treatment systems may directly discharge untreated sewage following heavy rainstorms. Urban and suburban nonpoint and point source discharges affect water quality and quantity in basin surface waters (O'Driscoll et al. 2010). Dikes and levees constructed to protect infrastructure and agriculture have isolated floodplains from their river channels and restricted fish access (Bayley 1995). The many miles of roads and rail lines that parallel streams within the action area have degraded stream bank conditions and decreased floodplain connectivity by adding fill to floodplains (O'Driscoll et al. 2010). Culvert and bridge stream crossings have similar effects and create additional problems for fish when they act as physical or hydraulic barriers that prevent fish access to spawning or rearing habitat, or contribute to adverse stream morphological changes upstream and downstream of the crossing itself.

6.5 Dredging

Riverine, nearshore, and offshore coastal areas are often dredged to support commercial shipping, recreational boating, construction of infrastructure, and marine mining. In addition to the indirect impacts described above, hydraulic dredging operations can directly harm large marine animals (e.g., sea turtles) by lethally entraining them through the dredge drag-arms and impeller pumps. Large animals that are entrained in hydraulic dredges rarely survive the encounter. Hopper dredges, in particular, are capable of moving relatively quickly compared to turtles which can be overtaken and entrained by the suction draghead of the advancing dredge.

An estimated 609 incidental takes (lethal or sublethal interactions) of sea turtles were documented from hopper dredging activity in the southeastern U.S. from 1980 through 2006 (Dickerson et al. 2007). Reductions in dredge entrainment rates for sea turtles have been achieved through mitigation measures including gear modifications, operational changes, time-area restrictions, and the capture and relocation of turtles away from dredge sites (Dickerson et al. 2007). Dickerson et al. (2007) studied the effectiveness of turtle relocation trawling in reducing the incidental take of sea turtles in hopper dredge operations. They found that relocation trawling can be an effective management option provided that a substantial amount of trawling effort is conducted either at the onset of dredging or early in the project.

Dredging operations also emit sounds at levels that could potentially disturb individuals of many marine taxa. Depending on the type of dredge, peak sound pressure levels from 100 to 140 decibel (dB) re 1 micro Pascal (μPa) 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 1000 Hz (Clarke et al. 2003).

6.6 Pollution

Many different types of pollution can adversely affect ESA-listed species and habitats within the action area. In this section, we focus on four major categories of marine and estuarine pollution: oil pollution, contaminants and pesticides, nutrient loading and algal blooms, and marine debris. Considering the large area covered by the proposed action, we do not attempt to provide a detailed analysis of the effects of pollution throughout the entire action area. Instead, this section provides a more general discussion of the four pollution categories above, including the stressor pathways and anticipated effects on ESA-listed resources, with an emphasis on geographic areas, habitats or species that are particularly susceptible to these threats.

6.6.1.1 Oil Pollution

Oil released into the marine environment contains aromatic organic chemicals known to be toxic to a variety of marine life (Yender et al. 2002). Oil spills can impact wildlife directly through three primary pathways: (1) ingestion—when animals swallow oil particles directly or consume prey items that have been exposed to oil, (2) absorption—when animals come into direct contact with oil, and (3) inhalation—when animals breath volatile organics released from oil or from "dispersants" applied by response teams in an effort to increase the rate of degradation of the oil in seawater. Direct exposure to oil can cause acute damage including skin, eye, and respiratory irritation, reduced respiration, burns to mucous membranes such as the mouth and eyes, diarrhea, gastrointestinal ulcers and bleeding, poor digestion, anemia, reduced immune response, damage to kidneys or liver, cessation of salt gland function, reproductive failure, and death (Vargo et al. 1986; NOAA 2003).

Nearshore spills or large offshore spills that reach shore can oil beaches on which sea turtles lay their eggs, causing birth defects or mortality in the nests (NOAA 2003). Disruption of other essential behaviors, such as breeding, communication, and feeding may also occur. The loss of invertebrate communities due to oiling or oil toxicity would also decrease prey availability for hawksbill, Kemp's ridley, and loggerhead sea turtles (NOAA 2003). Sea turtles species which commonly forage on crustaceans and mollusks may be vulnerable to oil ingestion due to oil adhering to the shells of these prey and the tendency for these organisms to bioaccumulate toxins found in oil (NOAA 2003).

Seagrass beds may be particularly susceptible to oiling as oil contacts grass blades and sticks to them, hampering photosynthesis and gas exchange (Wolfe et al. 1988). If spill cleanup is attempted, mechanical damage to seagrass can result in further injury and long-term scarring. Loss of seagrass due to oiling would be important to green sea turtles, as this is a significant component of their diets (NOAA 2003). Sea turtles are known to ingest and attempt to ingest tar balls, which can block their digestive systems, impairing foraging or digestion and potentially causing death (NOAA 2003).

The Gulf of Mexico is an area of high-density offshore oil extraction with chronic, low-level spills and occasional massive spills (such as the *Deepwater Horizon* oil spill, *IXTOC I* oil well blowout and fire in the Bay of Campeche in 1979, and the explosion and destruction of a loaded supertanker, the Mega Borg, near Galveston in 1990). Oil spills remain a significant threat to marine ecosystems in the Gulf of Mexico due to the large amount of extraction and refining activity in the region. There are approximately 4,000 oil and gas structures in the northern Gulf of Mexico, 90 percent of which are off Louisiana and Texas (USN 2009).

The largest spill within the action area occurred in April of 2010 as a result of a fire and explosion aboard the semisubmersible drilling platform Deepwater Horizon roughly 80 km southeast of the Mississippi Delta (Ramseur 2010). Once the platform sank, the riser pipe connecting the platform to the wellhead on the seafloor broke in multiple locations, initiating an uncontrolled release of oil from the exploratory well. Over the next three months, oil was released into the Gulf of Mexico, resulting in oiled regions of Texas, Louisiana, Mississippi, Alabama, and Florida and widespread oil slicks throughout the northern Gulf of Mexico that closed more than one-third of the Gulf of Mexico exclusive economic zone to fishing due to contamination concerns. Apart from the widespread surface slick, massive undersea oil plumes formed, possibly through the widespread use of dispersants, and reports of tarballs washing ashore throughout the region were common. NOAA has estimated that 4.9 million barrels of oil were released (Lubchenco et al. 2010).

In addition to oil spills, routine oil discharges into the northern Gulf of Mexico (not including oil spills) account for roughly 88,200 barrels of petroleum per year from municipal and industrial wastewater treatment plants, and roughly 19,250 barrels from produced water discharges during oil and gas operations (MMS 2007; USN 2008). Another major source of oil found in the northern Gulf of Mexico is natural seepage. Estimates of natural seepage are highly imprecise, ranging from 120,000 to 980,000 barrels of oil annually (MacDonald et al. 1993; MMS 2007).

6.7 Nutrient Loading and Algal Blooms

Industrial and municipal activities can result in the discharge of large quantities of nutrients into coastal waters. Excessive nutrient enrichment results in eutrophication, a condition associated with degraded water quality, algal blooms (including harmful algal blooms), oxygen depletion, loss of seagrass and coral reef habitat, and in some instances the formation of hypoxic “dead zones” (USCOP 2004). Hypoxia (low dissolved oxygen concentration) occurs when waters become overloaded with nutrients such as nitrogen and phosphorus, which enter oceans from agricultural runoff, sewage treatment plants, bilge water, atmospheric deposition, and other sources. An overabundance of nutrients can stimulate algal blooms resulting in a rapid expansion of microscopic algae (phytoplankton).

When excess nutrients are consumed, the algae population dies off and the remains are consumed by bacteria. Bacterial consumption decreases the dissolved oxygen level in the water which may result in mortality of fish and crustaceans, reduced benthic and demersal organism abundance, reduced biomass and species richness, and abandonment of habitat to areas that are sufficiently oxygenated (Craig et al. 2001; Rabalais et al. 2002). Higher trophic level species (e.g. turtles and marine mammals) may be impacted by the reduction of available prey as a result of hypoxic conditions. High nutrient loads from the Mississippi River create a massive hypoxic “dead zone” in the northern Gulf of Mexico each year. This hypoxic event occurs annually from as early as February to as late as October, spanning from the Mississippi River Delta to Galveston, Texas. In 2017, NOAA estimated that the Gulf of Mexico dead zone covered over 8,000 square miles, an area about the size of New Jersey.

Marine algal toxins are produced by unicellular algae that are often present at low concentrations but that may proliferate to form dense concentrations under certain environmental conditions

(National Academies of Sciences and Medicine 2016). When high cell concentrations form, the toxins that they produce can harm marine life, and this is referred to as a harmful algal bloom. Marine mammals can be exposed to harmful algal bloom toxins directly by inhalation or indirectly through food web transfer, and these toxins can cause severe neurotoxic effects (Van Dolah 2005). Mortality and morbidity related to harmful algal bloom toxins have been increasingly reported over the past several decades, and biotoxicosis has been a primary contributor to large scale die-offs across marine mammal taxa (Van Dolah 2005; Simeone et al. 2015).

Domoic acid has also been detected in tissues of marine mammals along the southeast U.S. coast (Twiner et al. 2011), but perhaps of greater concern in this area are the brevetoxins produced by Gulf of Mexico red tides. Brevetoxin has been implicated in multiple die-offs involving common bottlenose dolphins, as well as the endangered Florida manatee (Flewelling et al. 2005; Twiner et al. 2012; Simeone et al. 2015). Capper et al. (2013) found that both turtles and manatees were exposed to multiple harmful algal bloom toxins (okadaic acid, brevetoxins, saxitoxins, and likely others) in Florida. A recent survey of the peer reviewed literature on marine mammal diseases and reports of marine mammal mass mortality events suggests an increase in the frequency of marine mammal die-offs resulting from exposure to harmful algal blooms over the past 40 years (Gulland and Hall 2007).

6.8 Marine Debris

Marine debris has become a widespread threat for a wide range of marine species that are increasingly exposed to it on a global scale. Plastic is the most abundant material type worldwide, accounting for more than 80 percent of all marine debris (Poeta et al. 2017). The most common impacts of marine debris are associated with ingestion or entanglement and both types of interactions can cause the injury or death of animals of many different species. Ingestion occurs when debris items are intentionally or accidentally eaten (e.g., through predation on already contaminated organisms or by filter feeding activity, in the case of large filter feeding marine organisms, such as whales) and enter in the digestive tract. Ingested debris can damage digestive systems and plastic ingestion can also facilitate the transfer of lipophilic chemicals (especially POPs) into an animal’s body. An estimated 640,000 tons of fishing gear is lost, abandoned, or discarded at sea each year throughout the world’s oceans (Macfadyen et al. 2009). These “ghost nets” drift in the ocean and can fish unattended for decades (ghost fishing), killing large numbers of marine animals through entanglement.

Marine debris is a significant concern for ESA-listed species, particularly sea turtles. The initial developmental stages of all turtle species are spent in the open sea. During this time both juvenile turtles and their buoyant food are drawn by advection into fronts (convergences, rips, and drift lines). The same process accumulates large volumes of marine debris, such as plastics and lost fishing gear, in ocean gyres (Carr 1987). An estimated four to twelve million metric tons of plastic enter the oceans annually (Jambeck et al. 2015). It is thought that some sea turtles eat plastic because it closely resembles jellyfish, a common natural prey item (Schuyler 2014).

Ingestion of plastic debris can block the digestive tract which can cause turtle mortality as well as sub-lethal effects including dietary dilution, reduced fitness, and absorption of toxic compounds (Lutcavage et al. 1997; Laist et al. 1999).

Santos et al. (2015) found that a surprisingly small amount of plastic debris was sufficient to block the digestive tract and cause death. They reported that 10.7 percent of green turtles in Brazilian waters were killed by plastic ingestion, while 39.4 percent had ingested enough plastic to have killed them. These results suggest that debris ingestion is a potentially important source of turtle mortality, one that may be masked by other causes of death. Gulko and Eckert (2003) estimated that between one-third and one-half of all sea turtles ingest plastic at some point in their lives. A more recent study by Schuyler et al. (2016) estimates that 52 percent of sea turtles globally have ingested plastic debris. Schuyler et al. (2016) synthesized the factors influencing debris ingestion by turtles into a global risk model, taking into account the area where turtles are likely to live, their life history stage, the distribution of debris, the time scale, and the distance from stranding location. They found that oceanic life stage turtles are at the highest risk of debris ingestion. Based on this model, olive ridley turtles are the most at-risk species; green, loggerhead, and leatherback turtles were also found to be at a high and increasing risk from plastic ingestion (Schuyler 2014).

The regions of highest risk to global turtle populations are off the east coasts of the United States, Australia, and South Africa; the East Indian Ocean, and Southeast Asia. In addition to ingestion risks, sea turtles can also become entangled in marine debris such as fishing nets, monofilament line, and fish-aggregating devices or FADs (NRC 1990; Lutcavage et al. 1997; Laist et al. 1999). Turtles are particularly vulnerable to ghost nets due to their tendency to use floating objects for shelter and as foraging stations (Kiessling 2003; Dagorn et al. 2013).

6.9 Anthropogenic Sound

The ESA-listed species that occur in the action area are regularly exposed to multiple sources of anthropogenic sounds. Anthropogenic sound is generated by commercial and recreational ships, aircraft, sonar, ocean research activities, dredging, construction, offshore mineral exploration, military activities, seismic surveys, and other human activities. These activities occur within the action area to varying degrees throughout the year. ESA-listed species have the potential to be impacted by increased levels of both background sound and high intensity, short-term sounds. Sources of anthropogenic noise are becoming both more pervasive and more powerful, increasing both oceanic background sound levels and peak intensity levels (Hildebrand 2004).

Sounds are often considered to fall into one of two general types: impulsive and non-impulsive, which differ in the potential to cause physical effects to animals (Southall et al. 2007). Impulsive sound sources produce brief, broadband signals that are atonal transients and occur as isolated events or repeated in some succession. They are characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury. Non-impulsive sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or non-continuous. Some can be transient signals of short duration but without the essential properties of pulses (e.g., rapid rise time). The duration of non-impulsive sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

Anthropogenic sound within the marine environment is recognized as a potential stressor that can harm marine animals and significantly interfere with their normal activities (NRC 2005). The sea turtle species considered in this opinion may be impacted by anthropogenic sound in various ways. There are limited data on the hearing abilities of sea turtles, their uses of sounds, and their vulnerability to sound exposure. The functional morphology of the sea turtle ear is poorly understood and debated. Some evidence suggests that sea turtles are able to detect (Ridgway et al. 1969; Bartol et al. 1999a; Bartol and Ketten 2006; Martin et al. 2012) and behaviorally respond to acoustic stimuli (O'Hara and Wilcox 1990; Moein et al. 1995; McCauley et al. 2000; DeRuiter and Doukara 2012). Sea turtles may use sound for navigation, locating prey, avoiding predators, and general environmental awareness (Dow Piniak et al. 2012).

Despite the potential impacts on individual ESA-listed sea turtles, information is not currently available to determine the potential population level effects of cumulative anthropogenic sound sources in the marine environment (MMC 2007). For example, we currently lack empirical data on how sound impacts growth, survival, reproduction, and vital rates, nor do we understand the relative influence of such effects on the population being considered. As a result, the consequences of anthropogenic sound on ESA-listed sea turtles at the population or species scale remain uncertain.

6.10 Entrainment, Entrapment, and Impingement in Power Plants

There are dozens of power plants in coastal areas of the United States, 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: 9552 loggerheads (including 180 mortalities), 6886 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). The current incidental take limits for operation at the St. Lucie Nuclear Power Plant for severe causal injury are: seven green turtles annually and three loggerheads (Northwest Atlantic DPS) annually (NMFS 2016a). The current incidental take limits for causal mortalities are: five green turtles annually, and three loggerhead (Northwest Atlantic DPS) turtles annually (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.

6.11 United States Oil and Gas Exploration

The U.S. 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 of which have been analyzed in opinions 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 of three sea turtles per year, or eighteen sea turtles during the following six years of detonations (NMFS 2006a). These levels were far surpassed by the *Deepwater Horizon* incident.

6.12 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 led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs and an increased presence of native species (e.g. raccoons, armadillos, and opossums) which raid 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.

6.13 Scientific Research and Permits

Scientific research similar to that which would be conducted under Permit No. 22281 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, lavage, ultrasound, laparoscopy, and imaging.

Annual takes of ESA-listed sea turtles resulting from research activities that have previously been permitted by NMFS within the action area can be seen in the tables below. 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. In 2017, the Permits Division implemented a sea turtle research program. In 2018, there were 418 reported takes of green, 3 hawksbill, 60 Kemp's ridley, and 36 loggerhead sea turtles in the Atlantic Ocean with no mortalities (NMFS 2019).

Table 10. Green sea turtle takes permitted in the Atlantic Ocean from 2009 to 2016.

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**	**1666**	**1656**	**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 11. Hawksbill sea turtle takes permitted in the Atlantic Ocean from 2009 to 2016.

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	5260	1536	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

Table 12. Kemp's ridley sea turtle takes in the Atlantic Ocean from 2009 to 2016.

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**	**4084**	**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 13. Loggerhead sea turtle takes permitted in the North Atlantic Ocean from 2009 to 2016.

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**	**1804**	**1541**	**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.

7 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 consequences of 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.

In this section, we describe the potential stressors associated with the proposed action, the probability of individuals of ESA-listed species being exposed to these stressors based on the best scientific and commercial evidence available, and the probable responses of those individuals (given probable exposures) based on the available evidence. As described in Section 3 of this opinion, for any responses that would be expected to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, or lifetime reproductive success), the assessment would consider the risk posed to the viability of the population(s) those individuals comprise and to the ESA-listed species those populations represent. For this consultation, we are particularly concerned about behavioral and stress-based physiological disruptions and potential unintentional mortality that may result in animals that fail to feed, reproduce, or survive because these responses are likely to have population-level consequences as well as the potential for mortality. The purpose of this assessment and, ultimately, of this consultation is to determine if it is reasonable to expect the proposed action to have effects on ESA-listed species that could appreciably reduce their likelihood of surviving and recovering in the wild. We do not expect different responses to each activity based on the species of sea turtle. That is, we expect green turtle and hawksbill turtle responses to each of the procedures to be similar. Hence, we summarize the likely stress and risk to each species together.

7.1 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 No.

22281 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 handing and restraint following capture;
2) measuring and marking;
3) sampling (tissue, blood, carapace, fecal);
4) gastric lavage;
5) epibiota removal, and
6) application of flipper tags, acoustic tags, accelerometers, PIT tags, and satellite transponders

The following potential stressors associated with activities authorized under Permit No. 22281 could pose a risk to ESA-listed non-target species (i.e., Gulf sturgeon) are:

1) Interactions between research vessels and non-target fish species including effects of vessel sounds, physical presence, and potential vessel/propeller strikes
2) Incidental capture of non-target species in trawl nets
3) Incidental recapture of non-target species in trawl nets

7.2 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 (Appendix 1).

This ongoing research is the continuation of previous research that began in 2011. The proposed procedures have been performed by Dr. Kristen Hart and co-investigators for many years. All previous activities were thoroughly analyzed and found they would not jeopardize listed species, appreciably reduce the likelihood of survival or recovery of sea turtles, or destroy or adversely modify designated critical habitat.

To minimize the effects of the actions proposed for the current permit, the applicant will:

1) Use care when handling live animals to minimize any possible injury.
2) Captured individuals are kept protected from temperature extremes, provided with adequate air flow, kept moist, and ensure area around turtle is free of materials that could be ingested.
3) Travel at low or idle boat speeds all the time and not engage the motor when near sea turtles.

4) 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

In addition to these mitigation measures taken by the applicant, the Permits Division will include mitigation measures as part of the terms and conditions (Section B5) of the permit found in Appendix A of this document.

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 Dr. Kristen Hart, 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.

7.3 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 No. 22281 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 No. 17304, and modifications 17304-02 and 17304-03 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.

The applicant's annual reports from 2013 through 2017 are summarized in Table 14. A summary of the proposed exposures, including the cumulative exposure over the entire five-year duration of the permit, can be seen below in Table 15.

Table 14. Number of annual takes that occurred from 2013 through 2017 during past performance of Permit No. 17304.

Sea turtle species	Life Stage	Procedures	Actual Take[1]
Green	All except hatchling	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment (e.g., satellite tag, VHF[3] tag); Lavage; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT[2] tag; Measure; Photograph/Video; Recapture (gear removal); Sample, blood; Sample, fecal; Sample, scute scraping; Sample, tissue; Tracking; Weigh	120
Hawksbill	All except hatchling	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment (e.g., satellite tag, VHF[3] tag); Lavage; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT[2] tag; Measure; Photograph/Video; Recapture (gear removal); Sample, blood; Sample, fecal; Sample, scute scraping; Sample, tissue; Tracking; Weigh	0
Loggerhead	All except hatchling	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment (e.g., satellite tag, VHF[3] tag); Lavage; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT[2] tag; Measure; Photograph/Video; Recapture (gear removal); Sample, blood; Sample, fecal; Sample, scute scraping; Sample, tissue; Tracking; Weigh	17
Kemp's ridley	All except hatchling	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment (e.g., satellite tag, VHF[3] tag); Lavage; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT[2] tag; Measure; Photograph/Video; Recapture (gear removal); Sample, blood; Sample, fecal; Sample, scute scraping; Sample, tissue; Tracking; Weigh	11

[1]One take per animal, not all animals received every procedure listed; [2]PIT=passive integrated transponder; [3]VHF=very high frequency.

Table 15. Number of exposures to activities expected under Permit No. 22281 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	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Carapace swabs; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Tracking; Weigh; Up to 3 tags[3]: ADL, acoustic, & satellite tags.	1	300	1,500	5
Hawksbill	All except hatchling	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Carapace swabs; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Tracking; Weigh; Up to 3 tags[3]: ADL, acoustic, & satellite tags.	1	20	100	5
Loggerhead	All except hatchling	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Carapace swabs; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Tracking; Weigh; Up to 3 tags[3]: ADL, acoustic, & satellite tags	1	300	1,500	5
Kemp's ridley	All except hatchling	Epibiota removal; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Carapace swabs; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Weigh; Up to 3 tags[3]: ADL, acoustic, & satellite tags.	1	300	1,500	5

1Not all turtles receive all procedures; Individual turtles are subjected to procedures one time per year and no more than 3 transmitters on an animal at one time; [2]PIT=passive integrated transponder; [3]VHF=very high frequency.

Worldwide, nesting data at 464 sites indicate that 563,826 to 564,464 females nest each year. 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). In the U.S., green turtles nest primarily along the central and southeast coast of Florida where an estimated 8,426 females nest annually.

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 2007b). 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. In the Atlantic, hawksbill population increase has been greater in the Insular Caribbean than along the Western Caribbean Mainland or the eastern Atlantic. 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 to 332 nesting females annually, and the other sites combined host 51 to 85 nesting females annually (NMFS and USFWS 2007b). Within the U.S., hawksbills are most common in Puerto Rico and its associated islands and in the U.S. Virgin Islands. In the continental U.S., hawksbills are found primarily in Florida and Texas, though they have been recorded in all the Gulf States and along the east coast as far north as Massachusetts. In Florida, hawksbills are observed on the reefs off Palm Beach, Broward, Miami-Dade, and Monroe Counties. Most sightings involve post-hatchlings and juveniles that are believed to originate from nesting beaches in Mexico.

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 determine a trend (TEWG 1998; NMFS 2001). 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 US 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 South 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).

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. 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, 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 2007c). 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.

Based on these current population estimates, the proposed exposure of the research activities under Permit No. 22281 represents a small portion of the population for each species of sea turtle.

7.4 Sea Turtle Response to Stressors

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 No. 22281. These include stressors associated the following activities: capture with handing and restraint following capture; measuring and marking; sampling (tissue, blood, carapace, fecal); gastric lavage; epibiota removal, and application of flipper tags, acoustic tags, accelerometers, 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 underlying stressor of a human disturbance caused by the research activities that would be authorized under Permit No. 22281 may lead to a variety of different stress related responses which we discuss below. For a thorough analysis, refer to the biological opinions for Permit Nos. 17304, 17304-02, 17304-03, and the sea turtle research programmatic (NMFS 2013, 2016b, 2017b, c).

7.4.1 Capture, Handling, and Restraint

Capture can cause stress responses in sea turtles (Gregory 1994; Hoopes et al. 1998; Gregory and Schmid 2001; Jessop et al. 2003, 2004; Thomson and Heithaus 2014). We expect behavioral responses (attempts to break away via rapid swimming and biting) as well as physiological responses such as the release of stress hormones (Stabenau et al. 1991; Gregory et al. 1996; Hoopes et al. 2000; Gregory and Schmid 2001; Harms et al. 2003).

Selective Capture

Selective capture methods will include cast and dip nets, and hand capture. Nets used to catch turtles will be of large enough mesh size to diminish bycatch of other species, and highly visible buoys will be attached to the float line of each net and spaced at intervals of every ten yards or less. Researchers will take precautions to minimize potential adverse effects. The net will be deployed by boat and carefully monitored from the boat continuously. Researchers will place fixed bullet-shaped styrofoam floats (which will bob whenever a large animal is entangled in the net) on the portions of the net that are out of the water, and these will alert them to the presence of a turtle, so that they can check the nets and quickly retrieve a turtle.

We do not expect that individual turtles will experience more than short-term stresses during this type of capture, and no injury or mortality is expected from cast or dip-netting. Capture by dip-netting is an active capture method that Dr. Hart has experience with in her sea turtle capture work in both Everglades (Hart and Fujisaki 2010) and Dry Tortugas National Parks in south Florida. Dr. Hart has so far successfully and safely captured over one hundred sea turtles (many juveniles) using this technique (a 15 foot long handle and approximately a one meter by one meter net). All captured turtles exhibited normal behavioral responses and were released unharmed.

Capture by hand (Limpus and Reed 1985) is an active capture method that Dr. Hart has experience with in her Dry Tortugas sea turtle sampling project. In that project, Dr. Hart and colleagues have successfully captured over 30 subadult and adult loggerhead and green turtles using this technique, and some of the same members of Hart's same crew will be conducting the proposed in-water work in the Gulf. Capture by hand is a relatively simple and non-invasive capture method. We do not expect that individual turtles will experience more than short-term stresses during this type of capture, and no injury or mortality is expected from hand capture. Researchers will only conduct hand captures during the day.

Non-Selective Capture

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).

Tangle Nets

Tangle netting will not be the primary form of capture. Tangle nets are a type of passive, stationary fishing gear that incidentally captures turtles. Sea turtles readily enter this net and usually are able to come to the surface to breathe. Thus, they are minimally stressed within the confines of the net. However, turtles may attempt to swim vigorously, attempting to elude capture. Turtles will become entangled in the webbing of the net itself, which results in constriction marks around their head and flippers and may lead to their death due to forced submergence and traumatic injury. Forced submergence from entanglement in or impingement on net gear is likely comparable to forced submergence in other kinds of fishing gear, given that both instances involve sea turtles unable to reach the surface in a relatively stressful situation. Sea turtles forcibly submerged in any type of restrictive gear eventually suffer fatal consequences from prolonged anoxia and/or seawater infiltration of the lung (Lutcavage and Lutz 1997). Types of injuries sustained during net capture include abrasions and injury from other taxa caught in nets (e.g., stingrays, sharks). Sea turtles may also experience damage to appendages if the entanglement is prolonged and compromises blood flow.

Capture could result in restricted access to air, intense struggling, and physiologic injuries such as induction of a systemic stress response, hypoxia, or various other changes in blood chemistry (Gregory et al. 1996, Jessop et al. 2004). Because sea turtles rely on anaerobic metabolism during periods of activity, struggles to escape nets would likely result in the build-up of lactate, metabolic acidosis, and changes in ion concentrations in sea turtles' blood that could have deleterious effects on normal physiological function (Stabenau et al. 1991; Hoopes et al. 2000; Gregory and Schmid 2001; Harms et al. 2003; Stabenau and Vietti 2003).

Hoopes et al. (2000) noted that blood lactate levels of turtles caught by entanglement nets were only slightly elevated over captive reared animals compared to lactate concentrations in trawl caught turtles as reported by others. While it appears that captures have the potential to result in temporary changes in blood chemistry of sea turtles, it also appears that animals quickly returned to the marine environment after removal from the gear can recover from the short-term stress of capture (Hoopes et al. 2000). Hoopes et al. (2000) concluded that entanglement netting is an appropriate "low stress" method for researchers working on turtles in shallow, coastal areas.

The rapidity and extent of the physiological changes that occur during forced submergence likely are functions of the intensity of struggling as well as the duration of submergence (Lutcavage and Lutz 1997). Additional factors that may influence the intensity of effects resulting from capture include the size or species of the turtle, location in the net, 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 entanglement stress. Larger turtles have a larger lung capacity than smaller turtles and, the bigger the turtle, the greater chance it has of reaching the surface after being entangled. During warmer months, routine metabolic rates are higher, so the impacts of the stress due to entanglement may be magnified at that time.

While capture in non-research entanglement nets has been shown to result in injuries, such injuries are not anticipated as a result of the Permit Division's permitted research due to standard mitigation measures that researchers would be required to follow. In particular, researchers would be required to continuously monitor and physical check entanglement nets, thus allowing them to respond quickly to remove captured turtles from the net and safely bring aboard the research vessel. Entanglement time, depth of entanglement, and severity of entanglement may have an effect on the health status of turtles upon release from the net and effect probability of post-release survival (Snoddy et al. 2009). Prolonged anaerobiosis due to entanglement in fishing gear or restraint may leave sea turtles exhausted and vulnerable to other threats upon release from gear (Snoddy et al. 2009). Sea turtles subjected to forced submergence may require an extended period of time at the surface to rest, recover, and repay oxygen debt (Stabenau and Vietti 2003). Holding the animals on deck while conducting research procedures provides animals time to recover from the capture event. For this reason, we expect most animals to recover from the physiological effects of capture. Entanglement nets have been successfully and safely employed by the NMFS Southwest Fisheries Science Center permitted researchers to sample green turtles in San Diego Bay, California since the early 1990s and in the San Gabriel River/Los Alamitos Bay/Seal Beach National Wildlife Refuge since 2010.

Trawling

Trawls pose a greater risk of impacts from forced submergence to sea turtles than the other authorized capture gears. A study examining the relationship between tow time and sea turtle mortality showed that mortality was strongly dependent on trawling duration, with no mortality or serious injury in tows of 50 minutes or less, but increasing rapidly to 70 percent mortality after 90 minutes (Henwood and Stuntz 1987; Epperly et al. 2002). In line with this data (the best information available at the time), the Permit's Division previously allowed tow times for up to 50 minutes. NMFS researchers updated and reanalyzed the association between tow times and sea turtle deaths (Epperly et al. 2002; Sasso and Epperly 2006). Seasonal differences in the likelihood of mortality for sea turtles caught in trawl gear were apparent. For example, the observed mortality exceeded one percent after ten minutes of towing in the winter (defined by the authors as December through February), while the observed mortality did not exceed one until after 50 minutes in the summer (March through November) (Sasso and Epperly 2006). Intermediate tow times (10 to 200 minutes in summer and 10 to 150 minutes in winter) result in a rapid escalation of mortality, and eventually reach a plateau of high mortality, but will not equal 100 percent, as a sea turtle caught within the last hour of a long tow will likely survive (Epperly et al. 2002; Sasso and Epperly 2006). In both seasons, a rapid escalation in the mortality rate did not occur until after 50 minutes (Sasso and Epperly 2006) as had been found by Henwood and Stuntz (1987).

Though rare, mortality has been observed in summer trawl tows as short as 15 minutes (Sasso and Epperly 2006). Serious injury and mortality, when it occurs, is likely due to acid-base imbalances resulting from accumulation of carbon dioxide and lactate in the bloodstream (Lutcavage and Lutz 1997); this imbalance can become apparent in captured, submerged sea turtles after a few minutes (Stabenau et al. 1991). Although extremely rare, sea turtles entangled in nets exhibiting lethargy can die even with professional supportive care, possibly due to severe exertion resulting in muscle damage (Phillips et al. 2015). Fahlman et al. (2017) correlate trawl gear depth with the risk of developing gas embolisms and their severity in loggerhead sea turtles. Though trawl captures for research would not be deployed for the durations and at the depths typically used in commercial fisheries, we recognize there is risk of gas embolism and decompression sickness in sea turtles captured in trawls. Even at trawl depths of up to 20 meters, moderate to severe gas embolisms that go untreated could result in death (Fahlman et al. 2017). For this reason, trawls may pose an added risk of delayed mortality after the capture event that goes unseen and undocumented. Most animals are expected to have a very low likelihood of delayed mortality; most animals that are captured are observed to be in good physical condition, consistent with Category 1 of NMFS' post-interaction mortality guidance (NMFS 2017d).

To minimize the risk of mortality, the Permits Division has set forth requirements of the permit: trawl tows must be limited to 30 minutes bottom time and trawl tow depths no deeper than 20 meters. In July 2017, a permit holder (Permit No. 19621) reported the death of an emaciated loggerhead while in transit to a rehabilitation facility after capture by trawl. This was a rare event. In most cases, we do not expect observed mortalities because captured sea turtles have time to recover from the stress of capture during holding for examination prior to release. This holding time should help minimize risks from the accumulation of other stressors that can cumulatively impair physiological function or result in sublethal or delayed effects that cannot be observed upon capture. In addition, veterinary assistance would be sought for any comatose, injured or compromised animals as a requirement of the permit. Researchers must also try to resuscitate any comatose animals.

Five comatose turtles were reported during research trawling activities conducted under a section 10(a)(1)(A) permit (Permit No. 1245) from 2000 to 2003. The trawl tow times that resulted in the capture of comatose turtles were 30 minutes, the maximum tow time authorized under sea turtle research permits at that time. Four of these turtles were intubated successfully and returned to the wild in good condition. The fifth turtle, a loggerhead, exhibited limited movement after capture and became very lethargic (Stender 2001). The individual was intubated, which resulted in the disabled turtle moving around the deck. Alternating periods of activity and lethargy occurred repeatedly. At one point, the turtle was so active that it was tagged in anticipation of release, but again showed signs of problems. The turtle was returned to the lab for observation, blood samples were taken, and the turtle was kept in a covered, outdoor tank with a minimal amount of water for observation overnight. By 9:00 am the next day, the turtle had died. A necropsy showed that the turtle was healthy in all respects except that water had caused the anterior lobes of the lungs to swell and cease to function properly. There have been no other reports of comatose sea turtles as a result of research trawl capture since 2003.

Satellite tracking data is available in published studies on sea turtles released after research trawling (Arendt et al. 2012a; Arendt et al. 2012b, c). Satellite tagged turtles caught by trawl in these studies all behaved normally, including normal dive patterns, migrations and movements between foraging and breeding grounds, following release. Transmitters remained attached from 7 days to over 400 days, with most having transmissions and tracks for at least several months. One study trawl captured 34 juvenile loggerhead sea turtles between May 2004 and August 2007 with tow bottom times ranging from 9 to 21 minutes (Arendt et al. 2012c). In another study, 29 adult male loggerheads were captured by trawling from April 2006 through April 2007 with a tow bottom time of 15 minutes (Arendt et al. 2012b). There were no apparent injuries or health risks to any trawl captured turtles in these studies.

No literature is available indicating that animals subjected to the proposed trawls at night would alter these anticipated effects. Dr. Hart's trawling research is a collaboration with relocation trawlers, which operate twenty-four hours a day to fulfill mitigation requirements for the U.S. Army Corps of Engineers dredging actions. Trawling activities will be consistent with those methodologies required during construction. Night trawling would take place at locations where 24-hour trawling has been and is currently being performed under NMFS section 7 consultations. Biological opinions by the National Marine Fisheries Service, prepared for the U.S. Army Corps of Engineers actions, do not identify any specific impacts, or higher risk of impacts, to sea turtles captured at night vs during the day (NMFS 2003, 2005, 2007).

No information is available describing sea turtle behavior or physiology at night or that directly assesses the effects of capturing animals at night. Because sea turtles could be resting at day or night prior to capture, we have no data to indicate that conducting trawls at night would result in a greater stress response or risk of drowning from reduced oxygen reserves. Bycatch of non-target species during trawls is significantly reduced by using a large mesh size that minimizes catch of smaller species.

Recapture

Turtles could be captured more than once during a sampling day. Cumulative physiological stress can result from capture and handling of captured sea turtles. Recaptured animals that have not properly recovered from stressors associated with the previous capture have a higher risk of mortality. As a mitigation measure to minimize the risks associated with recapture, as a condition of the permit, turtles may be sampled no more than two times during the same permit year. With this mitigation measure in place, the researchers will have incentive to avoid recapturing the same sea turtles if it can be easily determined (through markings, tag number, etc.) that a sea turtle has already been sampled.

Although recaptures may still occur, we anticipate they will be limited in number because of this permit condition. For recaptured turtles, researchers will still be required to adhere to the sampling protocols and mitigation measures for safe handling of sea turtles and ensure they are active and healthy prior to release. Recaptured turtles may need more time to achieve full recovery prior to release.

While the recapture of sea turtles in a given day may result in increased levels of stress responses, those responses are not likely to manifest into any long-term adverse effects, reduced fitness, or mortality. This conclusion can be reached as long as all of the sampling protocols, mitigation measures, and any other required conditions of the research permit are followed by all permit holders.

Handling and Restraint

Turtles will be handled in such a way as to avoid injury to the turtles themselves and to the researchers. During extremely warm weather, the turtle will be kept in the shade. If for some unexpected reason that is not possible, the turtle's carapace and head will be covered with a wet towel to avoid desiccation. During cooler weather, the towel will not be wet to avoid hypothermia. Hard-shelled turtles will be kept in large, plastic containers before sampling and prior to release. All turtles will be placed on foam pads for added comfort and to minimize the potential for flipper injuries during restraint. Under the applicant’s current Permit No. 17304-03, all recaptured turtles since 2013 had increases in growth and were in good health.

NMFS expects no mortality or long-term adverse effects as a result of capture or the activities to bring a captured turtle aboard the research vessel. Animals may attempt to evade researchers when approached, indicating some level of stress. The stress is expected to be short-term and animals should quickly resume normal behavior once released. These capture techniques are already permitted and used by other researchers and represent a negligible risk of injury or mortality. Individuals will be constantly monitored once captured and all work will stop if an animal appears to be in danger. No mortality is expected using any type of capture technique or gear. Additionally, these methods will not affect the physical or biological environment.

7.4.2 Measuring and Marking

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.

Turtles will be handled in such a way as to avoid injury to the turtles themselves and to the researchers. During extremely warm weather, the turtle's carapace and head will be covered with a wet towel to avoid desiccation. Hard-shelled turtles will kept in large, plastic containers before sampling and prior to release. All turtles will be placed on foam pads for added comfort. If a turtle becomes stressed during the sampling process, we will cover the eyes with a wet towel; this often has a calming effect on the turtle.

Measuring and marking can result in raised levels of stressor hormones in sea turtles. 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.

The measuring and weighing procedures are simple, non-invasive, completed in a short time period and NMFS does not expect that individual turtles would normally experience more than short-term stresses as a result of these activities. No injury is expected from these activities, and turtles will be worked up as quickly as possible to minimize stresses resulting from their capture and handling activities.

7.4.3 Sampling: Tissue, Blood, Carapace, and Fecal

The sampling activities that would be authorized by this permit can result in raised levels of stressor hormones in sea turtles and would be in addition to any stresses or effects already experienced during capture. It is not expected that the collection of a tissue and carapace sample will cause any additional significant stress or discomfort to the turtle beyond what was experienced during the other research activities. Sterile techniques will be utilized to minimize the possibility of infection at the biopsy sites. The procedure will not be performed on any compromised animals (e.g., those that are emaciated or having heavy parasite loads, bacterial infections, etc.). During the more than five years since implementing this manner of collecting DNA samples, the Hart-U.S. Geological Survey team has not encountered any infections or mortality resulting from this procedure.

It is expected that individual turtles will experience only a short-term stress during blood sampling. Taking an approximately five milliliter blood sample from the sinuses in the dorsal side of the neck is now a routine procedure (Owens 1999). According to Owens (1999), with practice, it is possible to obtain a blood sample ninety-five percent of the time and the sample should be about thirty seconds in duration. Blood samples will be taken by NMFS-approved personnel only. Dr. Hart has been trained by other NMFS researchers in the techniques of blood sampling and has used these techniques successfully on turtles through other permits (e.g. Permit No. 1541 and Permit No. 13307). If a blood sample is not collected after four attempts (two on either side of the neck), the procedure will be stopped to avoid stressing the animal.

Fecal samples will be collected either after turtles have defecated during biological sampling or by digital extraction of feces from the cloaca. Those turtles that do not defecate during the sampling period will be temporarily overturned onto the carapace and restrained. While wearing lubricated latex gloves, a finger will be inserted into the cloaca of the turtle to feel for the presence of a fecal mass. This procedure might result in some minor discomfort to the turtle with no lasting effects.

Effects of these procedures could be low-level pain, handling discomfort, possible hemorrhage at the site. There is a small risk of infection. Mitigation to minimize or avoid these risks (such as pressure and disinfection) lessen those possibilities. The sea turtles are to experience a short-term stress response in association with the handling, restraint, and pain associated with tissue, carapace, blood, and fecal sampling. The applicants have experience in tissue and blood sampling and no sea turtle mortalities have occurred during the previous sampling activity from the applicant under any previous permit that we are aware of, nor are we aware of any meaningful pathological consequences by sampled individuals on the part of the applicant.

7.4.4 Gastric Lavage

The feeding habits of turtles can be determined by a variety of methods, but the method used under this research permit is gastric lavage or stomach flushing. This comparatively simple and reliable technique has been used to successfully sample the gut contents of various vertebrate animal groups without harm to the animal (Forbes 1999). This technique has been successfully used on green, hawksbill, olive ridley and loggerhead turtles ranging in size from twenty-five to one hundred and fifteen centimeters curved carapace length. Forbes (1999) stated that many individual turtles have been lavaged more than three times without any known detrimental effect. Individuals that have been recaptured from the day after the procedure up to three years later appear to be healthy and to feed normally. As well, laparoscopic examination of the intestines following the procedure has not detected any swelling or damage to the intestines.

The ends of tubing will be rounded by melting them with a flame and allowing them to cool which ensures that the tubing will not damage the walls of the esophagus during insertion. The tube will be aligned exterior to the turtle to pre-measure the distance to the caudal margin of the pectoral scute of the plastron, roughly corresponding to the level of the stomach, and mark the distance on the tube for that particular turtle with either tape or erasable marker. The tube will be passed no further than this mark, or no further than they will pass without resistance. Whereas individual turtles are likely to experience discomfort during this procedure, NMFS does not expect individual turtles to experience more than short-term distress and no injuries are anticipated.

7.4.5 Epibiota Removal

Epibionts (barnacles, algae, etc.) will be carefully removed from the carapace at the site of transmitter attachment(s) using a paint-scraper. In general, where the first and second vertebral scutes meet is the ideal location to place the transmitter as this section of the carapace rises to a maximum point above the sea surface each time the turtle breathes and the base antenna on the transmitter will break the plane of the water's surface. Attachment media, will also encompass sections of the first and third vertebral scutes as well as the first and second costal scutes. These areas will be thoroughly scrubbed and rinsed with fresh water, dried, and then lightly sanded with sandpaper. When smooth, the entire area will be lightly wiped with an alcohol pad or a small amount of acetone. It is a short-duration, non-invasive procedure, with no evidence of harm to turtles under previous permits.

7.4.6 Application of Tags and Transponders

Sea turtles will be tagged with flipper tags, acoustic tags, accelerometers, PIT tags, and/or satellite transponders. All tags will be sterilized as well as the area of attachment to minimize the possibility of infection. No compromised or sick turtles will receive acoustic tags, accelerometers or satellite tags.

Turtles can experience some discomfort during PIT-tagging procedures and these procedures will produce some level of pain. The discomfort is usually short and highly variable between individuals (Balazs 1999). Most turtles barely seem to notice the tag application, while a few others exhibit a marked response. NMFS expects the stresses to be minimal and short-term and that the small wound-site resulting from a tag applied to the front flipper should heal completely in a short period of time, similar to what happens when a human has his or her ear pierced for an earring. Similarly, turtles that must be re-tagged should also experience minimal short-term stress and heal completely in a short period of time. Re-tagging is not expected to appreciably affect these turtles. The proposed tagging methods have been regularly employed in sea turtle research with little lasting impact on the individuals tagged and handled (Balazs 1999).

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. (1999b) 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 no longer than necessary after attaching the transmitters to allow adhesives to set. These areas will be thoroughly scrubbed and rinsed with fresh water, dried, and then lightly sanded with sandpaper. When smooth, the entire area will be lightly wiped with an alcohol pad. NMFS does not expect any negative effects of these chemicals on the turtles. Drying time will vary from twenty to sixty minutes depending on ambient temperatures and humidity. When the attachment materials are dry the turtle will then be released at or near the exact point of capture. The researchers have successfully recaptured tagged turtles and have found them to be in good health. Based on past experience with these types of techniques by other turtle researchers, NMFS expects that the turtles will experience some small additional stress from attaching acoustic (sonic) transmitters, but not significant increases in stress or discomfort to the turtle beyond what was experienced during other research activities. We do not expect the transmitters or the tracking to interfere with the turtles normal activities after they are released.

7.5 Sea Turtle Risk Analysis

In this section we assess the consequences of the responses to the sea turtle individuals that have been exposed, the populations those individuals represent, and the species those populations comprise. Whereas the Response Analysis (Section 8.4) 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 (as described in Section 8.3) and the expected responses to those stressors (as described in Section 8.4).

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.

Sampling (blood, tissue, and carapace) 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 FP 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.

Although we evaluated each of the research activities separately above, the activities do not occur in isolation of each other. Turtles must first be captured, handled, and restrained, measured and marked, before any of the other activities would occur. In summary, individually or in any combination we do not expect individual turtles to experience anything more than short term stress, discomfort, or slight pain from the research activities.

The research activities that would take place under Permit No. 22281 are not expected to result in sea turtle mortality. The research activities under the proposed permit will result in temporary stress to the sea turtles that is not expected to have more than short-term effects on individual North Atlantic green, hawksbill, Northwest Atlantic loggerhead, and Kemp's ridley sea turtles.

7.6 Non-Target Species Exposure and Response Analysis

Gulf sturgeon will be exposed to activities conducted under Permit No. 22281. Below, we address the exposure, response, and risk to this species.

7.6.1 Vessel Interactions

Sea turtle research vessels could potentially interact with Gulf sturgeon, although there is little available information on the impact of this threat on these or any other ESA-listed fish species considered in this opinion. While a sea turtle research vessel strike could result is serious injury or death, the likelihood of this occurring is extremely small (i.e., discountable) given that (1) there has never been a reported incident of a vessel strike on any species (listed or non-listed) by a NMFS permitted sea turtle researcher (NMFS 2017a), (2) vessel strikes of any marine fish species are generally a rare event, (3) turtle research vessels account for a very small fraction of vessel activity in the action area, and (4) research vessel operators are expected to be vigilant and proceed carefully to minimize risk of vessel strike and unnecessary disturbance when ESA-listed species may be in the area. In the unlikely event that a research vessel strikes an ESA-listed species, the researcher will be required to report the incident to the Permits Division.

The presence of a research vessel may disturb non-target fishes resulting in their movement away from the vessel for a short time. Reactions may include a brief startle response, diving, submerging, or attempting to evade the vessel or personnel. Based on the anticipated responses, any disruptions are expected to be temporary in nature, with animals resuming normal behaviors shortly after the exposure. No reduction in fitness or overall health of individual fish is anticipated due to the presence of sea turtle research vessels.

7.6.2 Capture by Tangle or Trawl Nets

Nets used by researchers to capture sea turtles could potentially interact with Gulf sturgeon. The non-selective capture methods authorized as part of the permit that could result in the incidental capture of fish species are entanglement nets and trawls. Some interactions between Gulf sturgeon and turtle research gear would likely occur as a result of the proposed action. If any non-target ESA-listed species is incidentally captured or harmed by research activities, all activities would be suspended until the Permits Division has granted approval to continue research.

Animals entangled or captured in nets can become stressed, harmed, injured, and/or die. Animals may experience additional stress and other adverse effects during subsequent handling for disentanglement and release. Signs of stress include reduced respiration and prolonged struggling while being held. Impacts to each species or taxa that may be affected by the proposed action are described below.

Any stationary netting used in this permit would require that nets be continuously monitored for entanglements. This will ensure that all incidentally captured animals will be freed from the net as quickly as possible. As a result, the effects of temporary entanglement are, in most instances, expected to be minor and short-term, with resumption of normal behaviors to occur shortly after release. Sea turtle research permits that authorize trawling would set a limit on the tow duration to minimize impacts to turtles and incidentally caught non-target species. Additional mitigation measures, as a condition of sea turtle research permits, designed to minimize effects on particular species, are describe below. Even with the required mitigation measures in place, we anticipate that some very small proportion of these interactions will result in mortality due to the effects of capture (e.g., entanglement in trawl net or other capture gear). The anticipated number of takes (lethal and sublethal) of ESA-listed fish species as a result of sea turtle research authorized under the Program is provided below for each non-target species or DPS that may be affected.

7.6.2.1 Gulf sturgeon

There have been no reported incidental takes of sturgeon during permitted sea turtle research. However, the use of non-selective capture gear (e.g., entanglement nets and trawls) by turtle researchers could result in the incidental capture of sturgeon species. Due to their life history, Gulf sturgeon could potentially interact with sea turtle research gear in marine, coastal, and estuarine environments.

Entanglement in research nets used to capture sea turtles can constrict a sturgeon's gills, resulting in increased stress and risk of suffocation (Collins et al. 2000; Moser et al. 2000; Kahn and Mohead 2010). Sturgeon stress and mortality associated with capture in nets has been directly related to environmental conditions. However, except for very rare instances, results from previous sturgeon research indicate that capture in nets does not cause any effects on the vast majority of fish beyond 24 hours. For all species of sturgeon, research has revealed that stress from capture is affected by temperature, dissolved oxygen, and salinity, and this vulnerability may be increased by the research-related stress of capture, holding, and handling (Kahn and Mohead 2010). Other factors affecting the level of stress or mortality risk from netting include the amount of time the fish is caught in the net, mesh size, net composition, and, in some instances, the researcher's experience level or preparedness. Analysis of the empirical evidence suggests that individuals collected in high water temperatures and low dissolved oxygen concentrations, combined with longer times between net checks, were more at risk of elevated stress and mortality (Kahn and Mohead 2010).

As a condition of their permit, turtle researchers will be required to take necessary precautions while deploying capture gear to ensure target and non-target ESA-listed species are not unnecessarily harmed, including: (1) continuously monitoring nets, (2) removing animals from nets as soon as capture is recognized, and (3) limiting the time and depth for use of trawling gear. These actions are expected to substantially reduce the likelihood of injuring or killing sturgeon during research activities.

Although interactions between turtle research gear and ESA-listed sturgeon species are expected to occur infrequently, it is likely that some small amount incidental take will occur as a result of the permit issuance. While the incidental capture of ESA-listed sturgeon species in capture gear used by turtle researchers (i.e., entanglement nets and trawls) may result in short-term negative effects (i.e., elevated stress levels, net abrasion), with the exception of those extremely rare instances of capture mortality, these activities are not expected to result in reduced fitness or have any long-term adverse effects on individual sturgeon. This conclusion can be reached as long as all of the sampling protocols, mitigation measures, and any other required conditions of the sea turtle research permit are closely followed by all permit holders.

We estimate that Permit No. 22281 will result in the take of up to one Gulf sturgeon annually, with up to five over the length of the permit (five years). To arrive at this estimates we considered the history of sea turtle research interactions with ESA-listed sturgeon species, the mitigation measures in place to avoid or minimize the effects of future interactions, and the potential future sturgeon population growth that could increase the risk of exposure to sea turtle research sampling gear.

7.7 Non-Target Species Risk Analysis

Based on our exposure and response analysis of the effects of the permit on non-target ESA-listed fish species, we anticipate that a one Gulf sturgeon annually will occur as a result of incidental capture in sea turtle research gear. These takes are not expected to result in reduced fitness or have any long-term adverse effects on individual fish.

We do not expect any lethal interactions for encounters of non-target species. The applicant has had no reported take of Gulf sturgeon nor any other listed non-target species under her current Permit No. 17304-03. The encounters with Gulf sturgeon are expected to be infrequent and the majority of the work will be done using selective capture gear. The researchers are trained in handling sturgeon, so if a take should occur, it is not expected to result in a mortality.

8 CUMULATIVE EFFECTS

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action 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.

9 INTEGRATION AND SYNTHESIS

The *Integration and Synthesis* section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the *Effects of the Action* (Section 7) to the *Environmental Baseline* (Section 6) and the *Cumulative Effects* (Section 8) to formulate the agency's biological 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 5).

Here we summarize the probable risks the proposed action poses to threatened and endangered species 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.

As discussed above, we expect similar responses to each activity for each species of sea turtle. That is, we expect green, hawksbill, Kemp's ridley, and loggerhead turtle responses to each of the procedures to be similar. Hence, we summarize the likely risk to each species together.

9.1 Sea Turtles

As discussed, there are several key components to Permit No. 22281 that are designed to minimize adverse effects on individual sea turtles and to mitigate risks to the survival and recovery of sea turtle populations.

ESA regulations require that all research and enhancement permits issued by the Permits Division must meet specific regulatory issuance criteria. These include: (1) the permit will be used in a manner consistent with the ESA goal of listed-species conservation and will not be used to the disadvantage of species, (2) the research is bona fide and necessary for the survival and recovery of species, (3) a surrogate (non-listed) species cannot be used instead, (4) the permit holder has the necessary expertise, facilities, or other resources to achieve research objectives, and (5) the validity and need for the proposed research is reviewed by other researchers and species experts. These criteria are designed to reduce adverse effects and risk by decreasing the likelihood that ESA-listed species will be exposed to stressors from research activities that are either duplicative, extraneous or will not result in information (e.g., data, published papers) that can be used for the conservation of ESA-listed species.

In addition to regulatory issuance criteria, all permit holders authorized under the Program are required to follow general permit terms and conditions. These include: (1) reporting requirements that are necessary to track take (lethal and sublethal) and monitor the effects of authorized research activities on sea turtle populations, (2) notification and coordination requirements designed to maximize efficiency and minimize duplicative research efforts that could result in higher levels of exposure to stressors than absolutely necessary, and (3) requirements related to the qualifications, responsibilities, and designation of personnel designed to assure that mitigation measures are closely followed and all procedures are performed using the required standard protocols. Also included in all research and enhancement permits issued by the Permits Division are terms and conditions related to permit modification, suspension, and revocation. These assure that the Permits Division can take the appropriate measures a permit holder's actions result in increased risk to individual sea turtles (or other ESA-listed species) or to the populations they comprise, beyond what was authorized in the permit. In addition, the Permits Division can modify a research or enhancement permit if, based on new information, it determines that the previously authorized activities will unnecessarily expose individual turtles to stressors or will result in a greater risk to the survival and recovery of threatened and endangered species.

9.2 Current Status and Threats

As discussed in the Environmental Baseline, the major anthropogenic stressors that contributed to the sharp decline of sea turtle populations in the past include habitat degradation, direct harvest, commercial fisheries bycatch, and marine debris. While sea turtle populations are still at risk, efforts made over the past few decades to reduce the impact of these threats have slowed the rate of decline for many sea turtle populations. Increasing abundance trends have now been reported for several populations (or subpopulations) of ESA-listed sea turtles.

Bycatch reduction devices have reduced the incidental take of sea turtles in many U.S. commercial fisheries. TEDs, which are required in federal shrimp trawl fisheries, are estimated to have reduced mortality of sea turtles by approximately 95 percent (NMFS 2014). Mitigation measures required in other federal and state fisheries (e.g., gill net, pelagic longline, pound nets) have also resulted in reduced sea turtle interactions and mortality rates. In 2001, NMFS published as a final rule (66 FR 67495) requiring people participating in scientific research or fishing activities to handle and resuscitate (as necessary) incidentally caught sea turtles to help further reduce sea turtle mortalities and injuries due to capture. Increased conservation awareness at the international scale has led to greater global protection of sea turtles. All six ESA-listed sea turtles are listed in CITES Appendix I and many countries now have regulations banning turtle harvest and export. Among the countries that still allow directed take of sea turtles, harvest has decreased by more than 60 percent over the past three decades (Humber et al. 2014). Implementation of the Clean Water Act of 1972 resulted in estuarine and coastal water quality improvements throughout the range of many sea turtle species. While vessel strikes, power plants, dredging, pollutants, oil spills, and hydromodification still represent sources of mortality, sea turtle mortalities resulting from these activities within the action area are expected to either remain at current levels, or possibly decrease with additional research efforts, conservation measures, and the continued implementation of existing environmental regulations. In addition, many activities that result in sea turtle take have already undergone formal section 7 consultation and are covered for take by an existing incidental take statement; some of which would presumably need to reinitiate consultation with NMFS in the future to continue the activity.

Based on our Cumulative Effects analysis, it is likely that some current threats to sea turtles will increase in the future. These include global climate change, marine debris, and habitat degradation. It is difficult to predict the magnitude of these threats in the future or their impact on sea turtle populations.

9.3 Sea Turtle Exposure, Response and Risk Analysis: Summary

The proposed permit would have sublethal effects on ESA-listed sea turtles. We expect all targeted sea turtles to experience some degree of stress response to handling and restraint following capture, blood, tissue, and carapace sampling, epibiont removal, and PIT/flipper tagging, acoustic/accelerometer 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 determine that sub-lethal effects resulting from research activities authorized under the proposed action will be minimal, short-term, and are not likely to result in any reduced fitness or loss of fecundity to individual turtles. 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.

9.4 Gulf Sturgeon Exposure, Response and Risk Analysis: Summary

The decline in the abundance of Gulf sturgeon has been attributed to targeted fisheries in the late 19th and early 20th centuries, habitat loss associated with dams and sills, habitat degradation associated with dredging, de-snagging, and contamination by pesticides, heavy metals, and other industrial contaminants, and certain life history characteristics (e.g., slow growth and late maturation) (56 FR 49653). In general, Gulf sturgeon populations in the eastern portion of the range appear to be stable or slightly increasing, while populations in the western portion are associated with lower abundances and higher uncertainty (USFWS and NMFS 2009).

Based on our Exposure and Response Analysis above, we estimate that the proposed action will result in the take of no more than five Gulf sturgeon over the five-year permit. We do not anticipate any long-term adverse effects on either individual fish or their populations resulting from the capture and live release of sturgeon by turtle researchers. In summary, we determine that the proposed action will not appreciably reduce the likelihood of both the survival and recovery of Gulf sturgeon.

10 CONCLUSION

After reviewing the current status of the ESA-listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed actions are not likely to jeopardize the continued existence or recovery of the North Atlantic DPS green, hawksbill, Northwest Atlantic DPS loggerhead, Kemp's ridley sea turtle, or Gulf sturgeon. Further, we do not expect the issuance of Permit No. 22281 to destroy or adversely modify any designated critical habitat.

11 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to ESA-listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.

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 an incidental take statement.

11.1 Amount or Extent of Take

Section 7 regulations require NMFS to specify the impact of any incidental take of endangered or threatened species; that is, the amount or extent, of such incidental taking on the species (50 CFR § 402.14(i)(1)(i)). The amount of take represents the number of individuals that are expected to be taken by the proposed action. The extent of take represents the "extent of land or marine area that may be affected by an action" and 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).

Activities authorized as part of this permit may also result in the incidental take of non-target ESA-listed species. Gulf sturgeon may be exposed to stressors resulting from incidental capture in non-selective capture gears (tangle nets or trawls) used to capture sea turtles.

Anticipated incidental take of non-target species was determined based on our evaluation of the proposed action and information provided by the Permits Division (Table 16). Incidental take estimates of the numbers of individuals by species, were developed by considering the following: (1) level of historical incidental take that has occurred under sea turtle research permits authorized by the Permits Division, (2) mitigation measures in place to avoid future incidental take of non-target species, (3) population trends of each non-target species (as available), and (4) projected changes in environmental conditions or sea turtle research focus that could potentially affect the spatial/temporal overlap between non-target species and turtle research activities.

Table 16. Authorized incidentally captured non-target ESA-listed species resulting from the permit activities.

ESA-listed species	Non-lethal Take (Number of individuals annually)	Non-lethal Take (Number of individuals over life of permit)
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)	1	5

11.2 Effects of the Take

In this opinion, we have determined that the amount of anticipated incidental take, coupled with other effects of the proposed action, is not likely to result in jeopardy to any of the ESA-listed species or DPSs evaluated in this opinion. We have also determined that the amount of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to any ESA-listed species or DPSs evaluated in this opinion.

11.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). 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 terms 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.

The measures described below are nondiscretionary, and must be undertaken by the Permits Division so that they become binding conditions for the exemption in section 7(o)(2) to apply. 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:

Reasonable and prudent measure #1: All section 10(a)(1)(A) sea turtle research permits authorized as part of the proposed action will include required terms and conditions (as described below) to minimize the impacts of incidental take on non-target ESA-listed species.

Reasonable and prudent measure #2: The Permits Division will monitor and evaluate the incidental take of ESA-listed species resulting from the proposed action and report the impacts of such incidental take to the Interagency Cooperation Division.

11.4 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the Permits Division must comply with the following terms and conditions, which implement the Reasonable and Prudent Measures 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 nondiscretionary. If the Permits Division fails to ensure compliance with these terms and conditions and their implementing reasonable and prudent measures, the protective coverage of section 7(o)(2) may lapse.

Terms and Conditions Required to Implement Reasonable and Prudent Measure # 1

The Permits Division will assure that all section 10(a)(1)(A) sea turtle research permits authorized as part of the proposed action will include the following required terms and conditions:

All Non-target ESA-listed Species

1. All incidentally captured species (e.g., Gulf sturgeon) must be released alive as soon as possible.
2. If any ESA-listed non-target species are taken (captured, injured, etc.) during research, Researchers must stop activities and submit an incident report. Adverse interactions must be documented in the report, including any pertinent details of the interaction (gear type, what was done to handle and release the animals, location, date, size, water and air temperature, and photos if possible).

Terms and Conditions Required to Implement Reasonable and Prudent Measure # 2

1. The Permits Division will include an incidental take section in their reporting to the ESA Interagency Cooperation Division. This section of the report will include the following:
   a) The number of individuals incidentally taken by species (or DPS), life stage, and type of take (i.e., nonlethal and lethal)
   b) A copy of each incident report, which includes the dates, locations, gear types, and any other relevant information that may assist in evaluating the impacts of incidental take on ESA-listed populations, DPS(s), or species
   c) Any permits modifications (e.g., changes in protocols, methods, or mitigation measures) made by the Permits Division in response to an incidental take occurrence in order to minimize the chance of additional incidental take by the permit holder in the future.
2. In addition to the annual reporting requirement, the Permits Division will maintain a file with real-time updates on incidental take numbers (by species/DPS and type of take) resulting

from the proposed action. This file will be stored on a shared network drive accessible to the Interagency Cooperation Division.

12 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to help implement recovery plans or develop information (50 C.F.R. §402.02).

- 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, as well as work done during the day and at night. 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.
- We recommend that the Permits Division considering requesting that researchers collect and report information on any ESA-listed fish species captured incidentally during sea turtle research. This may include collection of biological data, morphometrics, or tag information. Depending on the species, turtle researchers may need special training for handling and collecting information from ESA-listed fish.

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.

13 REINITIATION NOTICE

This concludes formal consultation for the Permits Division proposed issuance of Permit No. 22281. 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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15 APPENDICES

15.1 Appendix A, Permit Terms and Conditions

I. Authorization

This permit is issued to Kristen Hart, Ph.D., U.S. Geological Survey, Wetland and Aquatic Research Center, Davie Field Office, 3321 College Ave., Davie, FL 33314, (hereinafter "Permit Holder"), pursuant to the provisions of the Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 et seq.) and the regulations governing the taking, importing, and exporting of endangered and threatened species (50 CFR Parts 222-226).

II. Abstract

The objective of the permitted activity, as described in the application, is to determine distribution, seasonal movements, vital rates and habitat use of juvenile, sub-adult, and adult sea turtles in the northern Gulf of Mexico.

III. Terms and Conditions

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 appendices and attachments. 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 December 31, 2024. This permit may be extended by the Director, National Marine Fisheries Service (NMFS) Office of Protected Resources or the Chief, Permits and Conservation Division (hereinafter Permits Division), pursuant to applicable regulations and the requirements of the ESA.

2. Researchers must immediately stop permitted activities and the Permit Holder or Principal Investigator 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 Table 1 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.

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

3. The Permit Holder may continue to possess biological samples[3] acquired[4] under this permit after permit expiration without additional written authorization provided a copy of this permit is kept with the samples and they are maintained as specified in this permit.

B. Number and Kinds of Protected Species, Locations and Manner of Taking

1. The table in Appendix 1 outlines the authorized species and distinct population segments (DPS) authorized; number of animals to be taken; and the manner of take, locations, and time period.

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[1] This permit does not allow for unintentional serious injury and mortality caused by the presence or actions of researchers. This includes, but is not limited to: deaths resulting from infections related to sampling procedures or invasive tagging; and deaths or injuries sustained by animals during capture and handling, or while attempting to avoid researchers or escape capture. Note that for marine mammals, a serious injury is defined by regulation as any injury that will likely result in mortality.

[2] By regulation, a take under the Marine Mammal Protection Act (MMPA) 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. 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.

[3] Biological samples include, but are not limited to: carcasses (whole or parts); and any tissues, fluids, or other specimens from live or dead protected species; except feces, urine, and spew collected from the water or ground.

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

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

3. The Permit Holder may use visual images and audio recordings collected under this permit, including those authorized in Table 1 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 NMFS ESA Permit No. 22281. 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:

   a. <u>Capture Methods</u>

1. Keep in-water chase activities and exertion as brief as possible to minimize the increased stress and associated physiological changes that accompany capture.

2. *Hand Capture and Dip Netting*

   a. For capture by dip net, Researchers must remove turtles from the net as quickly and safely as possible. This includes efficient and safe removal of turtles from the net.

   b. Limit the number of attempts to capture an individual turtle to three (3) attempts per day.

3. *Entanglement Netting*

   a. Use nets with mesh size designed to minimize bycatch of non-sea turtle species.

   b. Attach highly visible surface buoys to the float line of each net, spaced at intervals of every 10 yards or less.

   c. “Net checking” is defined as a thorough check of the net either by snorkeling the net in clear water (entire net must be visible) or by pulling up on the top line such that the full depth of the net is viewed along the entire length. The following intervals are the maximum time between viewing any single point of the net (i.e., each point of the net must be viewed every 30 or 20 minutes, depending on water temperature).

      i. Check nets every 30 minutes and more frequently if turtles or other organisms are observed in the net.

      ii. Check nets every 20 minutes or less if water temperatures are $\leq 10^{o}C$ ($50^{o}F$) or $\geq 30^{o}C$ ($86^{o}F$).

   d. Continuously observe the surface float line of all nets for movement indicating an animal has encountered the net.

When this occurs, the net must be immediately and thoroughly checked.

e. Plan for unexpected circumstances or demands of the research activities and have the ability and resources to meet the net checking requirements at all times. Contingencies for inclement weather must be in place. For example:

i. If an animal is highly 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.

ii. If inclement weather is predicted that would prevent meeting the net checking requirements, Researchers must remove nets in advance of the weather event.

f. Preventing Transmission of Fibropapilloma (FP) to New Areas:

i. When working at sites where FP is known to occur, thoroughly clean and disinfect nets prior to use in areas where FP is either not known to be present, is considered uncommon, or where there is limited or no information on FP prevalence.

ii. Prior to use in these other areas, Researchers must disinfect nets using a broadcidal solution and the product-recommended contact time or by thoroughly drying nets in sunlight to inactivate FP-associated herpesvirus.

iii. Appropriate disinfectants include 70% isopropyl alcohol, 10% bleach, and other virucidal solutions with proven efficacy against herpesviruses.

4. *Trawling*

a. Do not tow nets for longer than 30 minutes bottom time or in waters deeper than 20 m.

b. To avoid interactions with Florida manatees, Researchers must conduct trawls more than 500 m from shore in waters > 4 m deep.

5. *Mitigation for Marine Mammals for Trawls and Entanglement Nets*

a. Researchers must make every effort to prevent interactions with marine mammals and be aware of their presence and location.

b. Do not deploy tangle nets when Researchers observe marine mammals within the vicinity of the study area.

c. Do not initiate trawling when Researchers observe marine mammals, except dolphins, within the vicinity of the study area.

d. Allow marine mammals to leave or pass through the area safely before deploying nets.

e. When tangle netting, Researchers must raise and drop the lead line to make marine mammals in the vicinity aware of the net should they enter the research area after nets have been deployed. Tangle nets must be removed if marine mammals remain in the vicinity of the study area.

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

1. Stop trawling or netting activities immediately.

2. If the animal is alive, immediately free it from the net in a safe manner (including cutting the net as necessary).

3. If the animal is dead, hold the carcass.

4. Notify the appropriate NMFS Regional Stranding Coordinator within 8 hours (see https://www.fisheries.noaa.gov/contact-directory/marine-mammal-stranding-network-coordinators).

5. Report the incident as specified in Condition E.2.

6. Suspend permitted activities until the NMFS Permits Division has granted approval to continue research per Condition E.2.

b. Turtles Captured Under Another Legal Authority Prior to Research Activities

1. The Permit Holder must maintain records demonstrating that sea turtles obtained from other sources were taken legally (e.g., an incidental take statement of an ESA Section 7 biological opinion with a "no jeopardy" conclusion or an ESA Section 10 permit) before research may occur.

c. Handling Compromised Turtles

1. Researchers must have an experienced sea turtle veterinarian on call for emergencies, and a permitted rehabilitation facility(ies) identified for areas outside of Florida, should veterinary care be required on shore to treat a compromised turtle. Compromised turtles include animals that are obviously weak, lethargic, positively buoyant, emaciated, or that have severe injuries or other debilitating abnormalities. Prior to conducting research, notify both the veterinarian, and facility for areas outside of Florida, of the dates and times of the research to ensure their availability. If care at a rehabilitation facility is required in Florida, contact the Florida Fish and Wildlife Conservation Commission (FFWCC) via text/email at seaturtlestranding@myfwc.com or via phone at (888)404-3922 for assistance.

2.

. If researchers encounter a stranded sea turtle that they have not captured or handled during permitted research activities (e.g. the researcher encounters a floating dead or injured turtle while en route to their research site), they must immediately report the stranding to the appropriate regional or state stranding hotline number and follow instructions on what to do with the animal. See here for contact information: https://www.fisheries.noaa.gov/report. Researchers working in an area where real-time contact is not possible, or is uncertain, must work with the appropriate regional or state stranding coordinating entity to establish a stranded turtle protocol before going into the field. The collection or handling of a stranded sea turtle, outside of permitted research activities, is not considered a 'take' under this permit and should not be included in the permit annual report.

3. If an animal exhibits any major abnormality (including weakness, lethargy, or unresponsiveness) or is severely injured during capture or handling, or is found to be severely injured or otherwise compromised upon capture, Researchers must forego or cease activities that will further stress the animal (erring on the side of caution) and contact the on-call veterinarian as soon as possible. In this case, Researchers must count and report the animal as a 'take' under this permit.

   In such cases, Researchers must implement one of the following options (in order of preference):

   a. <u>For areas outside of Florida</u>: Contact and follow the instructions of the on-call veterinarian, and, if necessary, immediately transfer the animal to the veterinarian or to a permitted rehabilitation facility to receive veterinary care.

      <u>When working in Florida</u>: Contact and follow the instructions of the on-call veterinarian. If care at a rehabilitation facility is needed, contact Florida Fish and Wildlife Conservation Commission (FFWCC) via text/email at seaturtlestranding@myfwc.com or via phone at (888)404-3922.

   b. <u>For areas outside of Florida</u>: If the on-call veterinarian and the permitted rehabilitation facility cannot be reached, Researchers should err on the side of caution and bring the animal to shore for medical evaluation and rehabilitation, at a permitted rehabilitation facility, as soon as possible.

      <u>When working in Florida</u>: If the on-call veterinarian and the FFWCC cannot be reached, Researchers should err on the side of caution and bring the animal to shore for medical evaluation and rehabilitation, at a permitted rehabilitation facility, as soon as possible. Notify the FFWCC via text/email at seaturtlestranding@myfwc.com or via phone at (888)404-3922, of the incident including the

name of the facility receiving the animal once back on shore.

c. If the animal cannot be taken to a permitted rehabilitation facility due to logistical or safety constraints, allow it to recuperate as directed by the veterinarian (if successfully contacted), or as conditions dictate, and return the animal to the water. When working in Florida waters, notify the FFWCC via text/email at seaturtlestranding@myfwc.com or via phone at (888)404-3922, of the incident.

d. If the animal is taken to rehabilitation, the Permit Holder is responsible for providing all requested information pertaining to the capture, following the status of the sea turtle, and reporting the final disposition (death, permanent injury, recovery and return to wild, etc.) of the animal to the NMFS Permits Division. Upon transfer, the possession and care of the turtle falls under the authority of the permitted rehabilitation facility.

4. Unresponsive animals: Use the following resuscitation techniques on any turtles that are unresponsive or exhibit severe weakness or lethargy following in-water capture. Resuscitation must be attempted unless the turtle is determined to be deceased based on rigor mortis, decomposition, or confirmation of cardiac arrest by Doppler, ECG, or ultrasonography.

a. Place the turtle on its plastron so that the turtle is right side up, and elevate its hindquarters at least 6 inches. The amount of the elevation depends on the size of the turtle; greater elevations are needed for larger turtles. Contact the on-call veterinarian immediately for additional instructions.

b. While it is elevated, periodically rock the turtle gently left to right and right to left by holding the outer edge of the carapace and lifting one side about 3 inches then alternate to the other side.

c. Keep sea turtles being resuscitated shaded and damp or moist. A water-soaked towel placed over the head, carapace, and flippers is the most effective method to keep a turtle moist. DO NOT place a turtle into a container holding water.

d. Continue resuscitation until recovery or confirmation of death by onset of rigor mortis, decomposition, or cardiac arrest.

e. Bring live turtles to shore for medical evaluation at a permitted rehabilitation facility at the direction of FFWCC when in Florida as soon as possible. If the animal cannot be taken to a rehabilitation facility due to logistical or safety constraints, allow it to recuperate as directed by the veterinarian (if successfully contacted), or as conditions dictate, and return the animal to the water. Return all dead turtles to shore for necropsy to be performed by your on-call veterinarian or the permitted rehabilitation facility. When working in Florida waters, notify the FWCC of all events and prior to conducting any necropsy via text/email at seaturtlestranding@myfwc.com or via phone at (888)404-3922.

5. Submit an incident report (see Conditions A.2 and E.2) if an animal becomes compromised or dies during any research activities.

d. General Handling and Release Requirements

1. Use care when handling live animals to minimize injury.

2. While holding sea turtles out of water, Researchers must:

a. Protect sea turtles from temperature extremes (ideal air temperature range is between 70°F (21.1°C) and 80°F (26.7°C);

b. Provide adequate airflow;

c. Keep sea turtles moist when the temperature is ≥75°F (23.9°C);

d. Prevent sea turtles from sustaining any injuries; and

e. Keep the area surrounding the turtle free of materials that could be accidentally ingested or harm the turtle.

3. To prevent injury during release, lower sea turtles as close to the water's surface as possible.

4. Researchers must carefully monitor newly released turtles' abilities to swim and dive in a normal manner. If a turtle is not behaving normally upon release, recapture the turtle, if safely feasible, and contact your on-call veterinarian (see Condition B.5.c.1 above).

5. When working at night, Researchers must keep the vessel deck well lit where Researchers process and hold animals. When releasing these animals, Researchers must also have sufficient lighting in the water around the vessel to monitor the animal's behavior as required at Condition B.5.d.4.

e. Handling, Measuring, Weighing, and Marking

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

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

3. *Turtles with Fibropapillomas (FP)*

   a. Maintain a designated set of instruments for use on turtles with FP. Items that come into contact with turtles with FP tumors must not be used on turtles without tumors.

   b. Exercise all measures possible 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.

   c. Appropriate disinfectants include 70% isopropyl alcohol, 10% bleach, and other virucidal solutions with proven efficacy against herpesviruses.

4. *Flipper and Passive Integrated Transponder (PIT) Tagging*

a. Examine turtles for existing flipper and PIT tags before attaching or inserting new ones. Researchers must check all flippers.

b. If Researchers find existing tags, record all tag identification numbers and promptly report them to the Cooperative Marine Turtle Tagging Program (CMTTP) at the Archie Carr Center for Sea Turtle Research (ACCSTR): http://accstr.ufl.edu/resources/report-a-tag/ or by email: accstr@ufl.edu. Researchers must have PIT tag readers capable of reading 125, 128, 134.2, and 400 kHz tags.

c. Clean and disinfect:

i. Flipper tags before use (i.e., no contamination, minimal handling).

ii. Flipper and PIT tag applicators, including the tag injector handle, between turtles.

iii. The application site before the tag pierces the animal’s skin.

5. *Flipper Tagging*

a. Do not apply more than one tag per flipper for a total of no more than two flipper tags (includes existing flipper tags) per turtle.

b. Researchers must clean the flipper tag application site and then scrub it with a medical disinfectant solution (e.g., Betadine, Chlorhexidine) followed by 70% percent alcohol before the applicator pierces the animal’s skin.

c. For turtles 20-30 cm SCL, only use 1005 series tags or similar (~ 4.8 x 11.1 mm).

d. For turtles >30 cm SCL, only use Standard 681 tags.

6. *PIT Tagging*

a. Use a new, sterile needle for each PIT tag application.

b. Clean the application site and then scrub it with two replicates of a medical disinfectant solution (e.g., Betadine, Chlorhexidine) followed by 70% alcohol (disinfectant/alcohol/disinfectant/alcohol) before the applicator pierces the animal's skin. Disinfect the injector handle between animals if it has been exposed to fluids from another animal.

c. For turtles 20-30 cm SCL:

i. Only Researchers with specialized experience may PIT tag turtles of this size.

ii. Only use 10 mm PIT tags and a 16-gauge injector needle.

iii. Researchers must insert the PIT tag 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.

iv. Researchers may use alternative sites provided the muscle has sufficient mass to accommodate the PIT tag ($\leq$20%) and PIT tagging poses minimal risk of injury to vital structures or other anatomical features.

7. *Marking the Carapace*

a. Use non-toxic paints or markers that do not generate heat or contain xylene or toluene.

b. Make markings easily legible using the least amount of paint or marker necessary to re-identify the animal.

f. Biological Sampling

1. Blood Sampling

a. Only experienced personnel must directly take or supervise blood samples.

b. Use new disposable needles on each animal. Change needles immediately if they contact other surfaces or otherwise become contaminated or damaged.

c. Researchers must thoroughly swab blood collection sites with a medical disinfectant solution (e.g., Betadine, Chlorhexidine) followed by 70% alcohol before sampling. Researchers may use two (2) applications of alcohol if disinfectant solutions may affect intended analyses.

d. Do not attempt blood sampling if an animal cannot be adequately immobilized or conditions on the boat/holding platform preclude the safety and health of the turtle.

e. Researchers must limit attempts (needle insertions) to extract blood from the neck to a total of four, two on either side. Use an individual needle for only one or two attempts before replacing it.

f. You must follow best practices, including retracting the needle to the level of the subcutis prior to redirection to avoid lacerating vessels and causing other unnecessary soft tissue injury and immediately removing the needle if the animal begins to move.

g. Blood Volume Limits:

   i. *Sample volume:* Limit the amount of blood withdrawn to the minimal volume necessary to complete permitted activities. Researchers must not collect more than 3 ml per 1 kg of animal per sample.

   ii. *Sampling period:* Do not exceed the cumulative maximum safe limit described above from a single turtle within a 45-day period. If Researchers take more than 50% of the maximum safe limit 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.

2. Tissue Sampling

a. Use a new sterile biopsy punch on each turtle.

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

i. Only tissue sample from the limbs, neck, or shoulder region as described in the application. Researchers must avoid sensitive areas.

2. For small skin biopsy samples (6 mm diameter or smaller): Use aseptic techniques at all times. At a minimum, thoroughly swab the tissue surface with a medical disinfectant solution (e.g., Betadine, Chlorhexidine) followed by 70% alcohol before sampling. Researchers may use two applications of alcohol if disinfectants may interfere with analyses. Keep the procedure area and your hands clean.

c If Researchers can easily determine (through markings, tag number, etc.) that a sea turtle has been recaptured and has been already sampled, Researchers may not sample turtles more than two times during the same permit year.

3. *Gastric Lavage*

   a. Experienced personnel must directly perform or supervise lavage.

   b. Discontinue washing within 3 minutes.

   c. Once the samples have been collected, turn off the water and allow water and food to drain until all flow has stopped. Slightly elevate the posterior of the turtle to assist in drainage.

   d. Researchers must thoroughly clean and disinfect equipment after each use.

   e. Do not attempt to lavage compromised animals.

4. *Fecal Sampling*: Researchers may only attempt to digitally extract feces on turtles >50 cm SCL.

g. <u>Transmitters and Instrument Attachments</u>

1. Minimum size of sea turtles for tagging:

   a. 30 cm SCL for an acoustic tag.

   b. 40 cm SCL for a satellite tag or accelerometer.

2. *Tag Combinations*

   a. Animals 40 - 60 cm SCL may receive two transmitters at a time: a satellite tag and either an accelerometer or acoustic tag.

   b. Animals over 60 cm SCL may receive up to three transmitters at a time: a satellite tag, acoustic tag, and accelerometer.

3. *External Units (Accelerometers, Acoustic Tags, and Satellite Tags)*

   a. For telemetry devices, attachment material selection, and protocols, Researchers should first use best available, currently published methods, especially with regard to risk for thermal injury. Researchers should test (including monitoring temperature) products not previously used for animal attachment by mock application prior to use on sea turtles.

b. Always incorporate the following considerations into external tag selection and application:

i. Minimize the frontal area (e.g., the anterior or leading side and edges) of the external tag and ensure it has a low profile.

ii. Streamline the external tag attachment while covering as small of an area on the turtle as possible. Minimize the use of adhesives, base plates, and build-up of adhesive material.

iii. To the degree possible, avoid placing the external tag at the peak height of the carapace. Place tags slightly anterior or posterior to the peak where uplinks will be maintained and the saltwater switch will still be exposed to the air during breathing, but the frontal area is minimized.

iv. Minimize the antenna length and diameter to reduce risk of entanglement and/or drag.

a. Researchers must minimize the risk of entanglement for each external attachment. 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.

b. Provide adequate ventilation around the head of the turtle if attachment materials produce fumes. To prevent skin or eye contact with harmful chemicals, do not hold turtles in water during tag attachment.

e. For procedures that drill through marginal scutes, Researchers must follow aseptic techniques with two alternating applications of medical disinfectant (e.g., Betadine, Chlorhexidine) followed by 70% alcohol. Use a separate drill bit for each turtle. Bits may be reused if sterilized by autoclave or cold sterilization (e.g., glutaraldehyde) before reuse.

h. Holding

1. Researchers must not exceed the following holding times for an animal from the time of capture to release:

   a. 1 hour for standard work-up (no transmitter attachments).

   b. 3 hours if receiving a transmitter attachment to the maximum extent practicable (e.g., weather delays).

i. Non-target Species

1. This permit does not authorize takes of any protected species not identified in Appendix 1, including those species under the jurisdiction of the United States Fish and Wildlife Service (USFWS). Should other protected species be encountered during the research activities authorized under this permit, Researchers must exercise caution and remain a safe distance from the animal(s) to avoid take, including harassment.

2. In addition to the marine mammal mitigation at Condition B.5.a.5, see Attachment 2 for measures specific to Florida manatees during all research activities.

3. *Bycatch*: Release all incidentally captured species (e.g., fishes and birds) alive as soon as possible.

4. If any ESA-listed non-target species are taken (captured, injured, etc.) during research, Researchers must stop activities per Condition A.2 and submit an incident report per Condition E.2. Document adverse interactions in the report, including any pertinent details of the interaction (gear type, what was done to handle and release the animals, location, date, size, water and air temperature, and photos if possible).

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

   a. 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.

   b. Do not set, anchor on, or pull gear across SAV, coral or hard/live bottom habitats.

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

   d. Seagrass species: Researchers must avoid setting and deploying gear over, on, or immediately adjacent to any seagrass species. If Researchers cannot avoid these species, Researchers must implement the following measures to reduce the potential for seagrass damage:

      i. Set anchors by hand when water visibility is acceptable, to reduce the potential for seagrass damage. Researchers must place anchors in unvegetated areas within seagrass meadows or areas having relatively sparse vegetation coverage. Remove anchors in a manner that would avoid the dragging of anchors and anchor chains.

      ii. Avoid damaging any seagrass species, and if the potential for anchor or net drag is evident, suspend research activities immediately.

      iii. Do not to tread or trample on seagrass and coral reef habitat.

6. Transfer of Sea Turtle Biological Samples

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, and

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 – Kristen Hart, Ph.D. See Appendix 2 for corresponding activities.

b. Co-Investigators – 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. 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. This includes coordination of field activities of all personnel working 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 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 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.

8. Where the Permit Holder is an institution/facility, 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 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 and annual 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 a serious injury or mortality occurs or authorized takes have been exceeded as specified in Condition A.2, 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. 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 January 1st 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 their effects.

4. A joint annual/final report including a discussion of whether the objectives were achieved must be submitted by March 31, 2025, or, if the research concludes prior to permit expiration, within 90 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 upon request.

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 ensure written notification of planned field work for each project is provided to the NMFS Regional Office listed below at least two weeks prior to initiation of each field trip/season.

   a. Notification must include the following:

      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, animal restrainer, Research Assistant "in training").

   b. Notification must be sent to the Southeast 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

3. Researchers must coordinate their activities with other permitted researchers to avoid unnecessary disturbance of animals or duplication of efforts. 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 and document 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[5] from the Permit Holder;

[5] 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 MMPA, ESA, or the regulations at 50 CFR 216 and 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 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.

______________________________ __________________

Donna S. Wieting Date Issued

Director, Office of Protected Resources

National Marine Fisheries Service

______________________________ __________________

Kristen Hart, Ph.D. Date Effective

U.S. Geological Survey

Permit Holder

Appendix 1: Table Specifying the Kinds of Protected Species, Location, and Manner of Taking

Table 1. Authorized Annual Take of Juvenile, Subadult, and Adult Sea Turtles in the Northern Gulf of Mexico During Vessel-based Research. Animals captured under another authority must have been legally captured via an ESA Section 7 incidental take statement or Section 10 permit.

Line	Species	Listing Unit	No. Animals	Collect Method	Procedures	Details
1	Turtle, green sea	North Atlantic DPS (Threatened)	250	Trawl	Epibiota removal; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Other; Photograph/Video; Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Tracking; Weigh	Capture methods include trawl, tangle and strike net, dip net, cast net, and hand capture or work up turtles captured under another authority: relocation trawling. Other = carapace swabs.
2	Turtle, hawksbill sea	Range-wide (Endangered)	20	Trawl	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Other; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy and skin swab; Tracking; Weigh	Capture methods include trawl, tangle and strike net, dip net, cast net, and hand capture or work up turtles captured under another authority: relocation trawling. Up to 3 tags: ADL, acoustic, and sat tags. Other = carapace swabs.
3	Turtle, green sea	North Atlantic DPS (Threatened)	50	Trawl	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Other; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Tracking; Weigh	Capture methods include trawl, tangle and strike net, dip net, cast net, and hand capture or work up turtles captured under another authority: relocation trawling. Up to 3 tags: ADL, acoustic, & satellite tags. Other = carapace swabs.

Line	Species	Listing Unit	No. Animals	Collect Method	Procedures	Details
4	Turtle, loggerhead sea	Range-wide (Threatened)	100	Trawl	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Other; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Tracking; Weigh	Capture includes trawl, tangle and strike net, dip net, cast net, hand capture, and turtles captured under another authority: relocation trawling. A turtle may receive up to 3 tags: ADL, acoustic, and satellite tags. Other = carapace swabs.
5	Turtle, Kemp's ridley sea	Range-wide (Endangered)	90	Trawl	Epibiota removal; Instrument, drill carapace attachment; Instrument, epoxy attachment; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Other; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Tracking; Weigh	Capture includes trawl, tangle and strike net, dip net, cast net, hand capture, and turtles captured under another authority: relocation trawling. A turtle may receive up to 3 tags: ADL, acoustic, and satellite tags. Other = carapace swabs.
6	Turtle, loggerhead sea	Range-wide (Threatened)	200	Trawl	Epibiota removal; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Other; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Weigh	Capture includes trawl, tangle and strike net, dip net, cast net, hand capture, and turtles captured under another authority: relocation trawling. A turtle may receive up to 3 tags: ADL, acoustic, and satellite tags. Other = carapace swabs.
7	Turtle, Kemp's ridley sea	Range-wide (Endangered)	210	Trawl	Epibiota removal; Lavage, gastric; Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Other; Photograph/Video; Recapture (gear removal); Sample, blood, cloacal swab, fecal, nasal swab, oral swab, scute, skin biopsy, and skin swab; Weigh	Capture includes trawl, tangle and strike net, dip net, cast net, hand capture, and turtles captured under another authority: relocation trawling. A turtle may receive up to 3 tags: ADL, acoustic, and satellite tags. Other =carapace swabs.

Appendix 2: NMFS-Approved Personnel and Authorized Recipients for Permit No. 22281. [under construction]

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

Name	Research Activities
Dr. Kristen Hart (PI)	All activities
Dr. Margaret Lamont	All activities except trawls
Dr. Donna Shaver	All activities except trawls, strike nets, hand and snorkel captures
Joseph Alday	All activities except trawls
Carson Arends	All activities except trawls
Daniel Catizone	All activities except trawls
Michael Cherkiss	All activities
Andrew Crowder	All activities except strike netting
Matthew Denton	All activities except trawls and acoustic transmitters
Christian Gredzens	All activities except trawls, snorkel captures and flipper tagging
David Roche	All activities except trawls, strike netting, and acoustic transmitters
Brian Smith	All activities except cast, strike and tangle netting,
Mandy Tumlin	All activities except trawls and acoustic transmitters

Biological samples authorized for collection or acquisition in Table 1 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
Dr. Brian Shamblin University of Georgia	Blood and skin	Analysis and curation of remaining samples

Authorized Recipient	Sample Type	Disposition
Dr. Hannah Vander Zanden University of Florida	Scute, blood and skin	Analysis
Dr. Kim Reich Texas A&M University	Scute	Analysis
Dr. Elizabeth Burgess and Katherine Graham Anderson Cabot Center for Ocean Life New England Aquarium	Plasma	Analysis
Dr. Amanda Demopolous USGS SE Ecological Science Center Gainesville, FL	Blood and skin	Analysis
Dr. Margaret Hunter USGS SE Ecological Science Center Gainesville, FL	Blood and skin	Analysis
NMFS Southwest Fisheries Science Center La Jolla, CA	Blood and skin	Analysis
Dr. Thane Wibbels University of Alabama	Blood	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.

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

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. Any protocols that do not include the minimum requirements below, e.g., omission of a systemic analgesic, must be approved by a consulting veterinarian with due consideration of pain management.

Research Procedure	Minimum Requirement
Tissue sampling (biopsy punch or comparable)	None
Blood sampling	None
Flipper tagging	None
Carapace drilling for instrument attachment	Local[1] and/or 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

[1]Local anesthetic may be administered by immediate application to the wound following drilling (i.e,, “splash block”).

Attachment 2: Standard Conditions for Vessel Surveys and Netting in Manatee Habitat During Scientific Research

Permittees engaged in vessel surveys and netting activities in manatee habitat shall comply with the following conditions 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 Marine Mammal Protection Act, the Endangered Species Act, 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: https://myfwc.com/wildlifehabitats/wildlife/manatee/protection-zones/

3. Project personnel shall take steps to avoid the accidental vessel strike or 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, excluding trawls, 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. An observer must be on each vessel that is operated at high speed (i.e., plowing or planing speeds). 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 has 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 or struck by a research vessel:

   a. Immediately discontinue research and netting operations and turn off or idle boat motors.

   b. Verify that the animal has been struck or 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. For a manatee struck by a vessel, maintain visual contact and assess any visible external injuries and note if blood is exuding from the mouth or nostrils or if the manatee is listing to one side or exhibiting any buoyancy problems.

   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 released from the gear without significant risk to human safety, detailed plans, including safety measures, shall be described to project personnel prior to attempting to release 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 released 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 No. 7 below "To Report Accidental Manatee Captures or Vessel Strike," for contact information.

k. Upon release or after a vessel strike, researchers must make efforts to monitor animals for at least 30 minutes at a safe distance. In addition, if sub-adult animals (and especially dependent calves) are involved, researchers should make extra efforts to determine if the calf rejoins its mother.

l. 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.

m. All accidental manatee captures or vessel strikes shall be reported immediately to State or Commonwealth wildlife officials and to USFWS's North Florida Ecological Services Office. In Florida, the Florida Fish and Wildlife Conservation Commission's Wildlife Alert dispatcher must be notified. Within 24 hours of an accidental manatee capture or vessel strike, the incident must also be reported to the local USFWS ecological services office, and to the Chief of Permits, NMFS, Permits and Conservation Division. See No. 7 below "To Report Accidental Manatee Captures or Vessel Strike" for contact information.

n. Within 30-days of an accidental capture or vessel strike, 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 Chief of Permits, NMFS, Permits and Conservation Division describing the circumstances and gear that led to the capture or strike of the manatee, the condition of the animal, steps taken to free or monitor the animal, and any recommendations to prevent and minimize any future events.

5. In the event an accidental capture or vessel strike results in injury to or the death of a manatee:

    a. Project activities must stop and accidental manatee captures or vessel strikes shall be reported immediately to State or Commonwealth wildlife officials and to the USFWS's North Florida Ecological Services Office. In Florida, the Florida Fish and Wildlife Conservation Commission's Wildlife Alert dispatcher must be notified. Within 24 hours of a manatee injury or death, the event must be reported to the local USFWS ecological services office (if not already notified), and to the Chief of Permits, NMFS, Permits and Conservation Division. See No. 7 below "To Report Accidental Manatee Captures or Vessel Strike" 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. Researchers must make all reasonable efforts to maintain visual contact with the manatee until responders arrive, or until given other directions by responders, USFWS, or NMFS.

    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 30-days of an injury or death, the permittee shall submit a written report to the USFWS's North Florida Ecological Services Office, the local USFWS ecological services office (if different), and NMFS describing the circumstances and gear that led to the injury or death of the manatee and the steps taken to free, monitor, and/or 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.

7. To Report Accidental Manatee Captures or Vessel Strikes, Including Injured and Dead Manatees:
    a. NMFS, Permits and Conservation Division
       Phone: 301-427-8401;
    b. USFWS, North Florida Ecological Services Office
       Phone: 904-731-3286 or 904-731-3336; and

       FAX: 904-731-3045

       Email: jaxregs@fws.gov; and
    c. Local USFWS ecological services office; and
    d. State contact.

To Report Accidental Manatee Captures, Including Injured, and Dead Manatees

U.S Fish and Wildlife Service (USFWS), North Florida Ecological Services Office
PHONE: 904 731-3286 (or 3336) and FAX: 904 731-3045. Email: jaxregs@fws.gov.
U.S Fish and Wildlife Service (USFWS), Alabama Ecological Services Office
PHONE: 251 441-5181
U.S Fish and Wildlife Service (USFWS), Louisiana Ecological Services Office
PHONE: 337 291-3100
U.S Fish and Wildlife Service (USFWS), Mississippi Ecological Services Office
PHONE: 601 965-4900
U.S Fish and Wildlife Service (USFWS), Clear Lake Ecological Services Office (Houston area)
PHONE: 281 286-8282
U.S Fish and Wildlife Service (USFWS), Corpus Christi Ecological Services Office
PHONE: 361 994-9005
Florida (Florida Fish and Wildlife Conservation Commission, Wildlife Alert)
PHONE: 888 404-3922
For Florida manatees outside of Florida, contact respective state wildlife officials:
Alabama (Dauphin Island Sea Lab's Manatee Sightings Network)
PHONE: 866 493-5803
Louisiana (Louisiana Department of Wildlife and Fisheries)
PHONE: 800 256-2749
Mississippi (Mississippi Department of Wildlife, Fisheries, and Parks)
PHONE: 800 BE SMART (237-6278)
Texas (Texas Marine Mammal Stranding Network)
PHONE: 800 9 MAMMAL (962-6625)