# NATIONAL MARINE FISHERIES SERVICE
# ENDANGERED SPECIES ACT SECTION 7
# BIOLOGICAL OPINION

| | |
|---|---|
| **Title:** | Biological Opinion on the Issuance of Permit No. 20197 to Jon Hare (Northeast Fisheries Science Center), and Permit No. 19627 to Bonnie Ponwith (Southeast Fisheries Science Center) |
| **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 |
| **Publisher:** | Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce |
| **Consultation Tracking number:** | FPR-2016-9172 |
| **Digital Object Identifier (DOI):** | doi:10.7289/V51C1TZ2 |

# NATIONAL MARINE FISHERIES SERVICE
# ENDANGERED SPECIES ACT SECTION 7
# BIOLOGICAL OPINION

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

**Activity Considered:** Issuance of Permit No. 20197 to Jon Hare (Northeast Fisheries Science Center), and Permit No. 19627 to Bonnie Ponwith (Southeast Fisheries Science Center)

**Consultation Conducted By:** Endangered Species Act Interagency Cooperation Division, Office of Protected Resources, National Marine Fisheries Service

**Approved:**

for Donna S. Wieting
Director, Office of Protected Resources

**Date:** DEC 29 2016

**Public Consultation Tracking System number:** FPR-2016-9172

## TABLE OF CONTENTS

Page

## List of Tables

Page

## LIST OF FIGURES

Page

# 1 INTRODUCTION

The Endangered Species Act (ESA) of 1973, as amended (16 USC 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) the United States Fish and Wildlife Service (USFWS) or both, depending upon the endangered species, threatened species, or designated critical habitat that may be affected by the action. If a Federal agency's action may affect a listed species or designated critical habitat, the agency must consult with NMFS, USFWS, or both (50 CFR §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, the USFWS, or both concur with that determination, consultation concludes informally (50 CFR §402.14(b)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation the NMFS, the USFWS, or both provide an opinion stating whether the Federal agency's action is likely to jeopardize ESA-listed species or destroy or adversely modify their designated critical habitat. If either Service determines that the action is likely to jeopardize listed species or destroy or adversely modify designated critical habitat, that Service 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 the Services 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 and enhancement of propagation or survival permit pursuant to section 10(a)(1)(A) of the ESA. The Permits Division proposes to issue scientific research permits:

- No. 20197 for the capturing; handling; marking; measuring; photographing; Passive Integrated Transponder (PIT) tag scanning; flipper tagging; biopsy sampling; and resuscitating of incidentally caught green, Kemp's ridley, leatherback, and loggerhead sea turtles during commercial fishing operations throughout state waters and the Exclusive Economic Zone of the U.S. Northwest Atlantic Ocean; and
- No. 19627 for the capturing; handling; marking; measuring; weighing; photographing, Passive Integrated Transponder (PIT) and flipper tagging, skin biopsy sampling, and salvaging of incidentally caught green, Kemp's ridley, leatherback, loggerhead, hawksbill, and olive ridley sea turtles during commercial fishing operations in the Gulf of

Mexico, the Exclusive Economic Zone of the U.S. Atlantic Ocean, the Caribbean Sea and its tributaries.

Consultation in accordance with section 7(a)(2) of the statute (16 USC 1536 (a)(2)), associated implementing regulations (50 CFR §402), and agency policy and guidance (USFWS and NMFS 1998) was conducted by NMFS Office of Protected Resource's ESA Interagency Cooperation Division (hereafter referred to as "we") for each permit issued. Because of similarities in the proposed action of permit issuance and the activities that will be conducted under each permit, we have batched these two consultations into one biological opinion. This document was prepared by the NMFS Office of Protected Resource's ESA Interagency Cooperation Division in accordance with section 7(b) of the ESA and implementing regulations at 50 CFR §402.

This document represents NMFS' opinion on the effects of these actions on endangered and threatened species and designated critical habitat for those species. A complete record of this consultation is on file at the NMFS Office of Protected Resources in Silver Spring, Maryland.

## 1.1 Background

The NMFS Southeast Fisheries Science Center (SEFSC) and NMFS Northeast Fisheries Science Center's (NEFSC) Fishery Observer Programs provide data from U.S. commercial fishing and processing vessels for a range of conservation and management issues. The two current projects are ongoing multi-year efforts on behalf of the SEFSC and NEFSC.

An environmental assessment pursuant to the National Environmental Policy Act (NEPA) was completed in 2004 for the NEFSC Permit No. 1448 to authorize the biological sampling of turtles for scientific research in the Northwest Atlantic Ocean. The environmental assessment determined that the proposed research activities could result in low level of short-term physiological effects on sea turtles and resulted in a finding of no significant impact pursuant to NEPA. In December 2010, we received a request for consultation pursuant to section 7 of the ESA from the Permits Division on the issuance of Permit No. 15112 for the continuing research of the NEFSC. On December 30, 2010 the biological opinion concluded that the issuance of the permit was not likely to jeopardize the continued existence of currently listed ESA-species, and is not likely to destroy or adversely modify designated critical habitat. The issuance of Permit No. 20197 by the Permits Division would be a continuation renewal of Jon Hare's existing permit activities under a new permit.

An environmental assessment pursuant to NEPA was completed in July 2011 for the SEFSC Permit No. 15552 to authorize the biological sampling of turtles for scientific research in the Gulf of Mexico and east coast of the United States. On July 21, 2011, the biological opinion concluded that the issuance of the permit was not likely to jeopardize the continued existence of currently listed ESA-species, and is not likely to destroy or adversely modify designated critical habitat. The issuance of Permit No. 19627 by the Permits Division would be a continuation renewal of Bonnie Ponwith's existing permit activities under a new permit.

### 1.2 Consultation History

The following dates are important to the history of the consultation on Permit No. 19627:

- On May 2, 2016, the NMFS' Permits Division sent the initiation package to authorize Permit No. 19627.

The following dates are important to the history of the consultation on Permit No. 20197:

- On June 24, 2016, the NMFS' Permits Division provided initial notice that Permit No. 20197 was sent out for the public comment period open until July 25, 2016.
- On July 27, 2016, the NMFS' Permits Division sent the initiation package to authorize Permit No. 20197.
- On July 27, 2016, the ESA Interagency Cooperation Division received a request for formal consultation from NMFS' Permits Division to batch and authorize Permit No. 20197 to Jon Hare (Northeast Fisheries Science Center) and Permit No. 19627 to Bonnie Ponwith (Southeast Fisheries Science Center).
- On August 3, 2016, the ESA Interagency Cooperation Division initialized formal consultation on batched Permit Nos. 20197 and 19627.
- On Aug 19, 2016, Mike Tork on behalf of Jon Hare addressed a comment from the 30-day public period and asked for a modification in the language to clarify Permit No. 20197. The question posed to the researchers was if the observers would be able to PIT tag rather than flipper tag sea turtles under a certain age class. The researchers clarified that only turtles that are larger than 30 cm Standard Carapace Length (Notch-to-Tip) would receive PIT tags.

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

## 2 DESCRIPTION OF THE PROPOSED ACTION

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies. The proposed actions are the issuance of two scientific research permits:

- Permit No. 20197 to Jon Hare, NMFS Northeast Fisheries Science Center
- Permit No. 19627 to Bonnie Ponwith, NMFS Southeast Fisheries Science Center

Pursuant to Section 10(a)(1)(a) of the Endangered Species Act of 1973, as amended (ESA; 16 United States Code 1531 et seq.), to conduct scientific research on green (Permit Nos. 20197 and 19627), Kemp's ridley (Permit Nos. 20197 and 19627), leatherback (Permit Nos. 20197 and 19627), loggerhead (Permit Nos. 20197 and 19627), hawksbill (Permit No. 19627), and olive ridley sea turtles (Permit No. 19627).

## 2.1 Permit No. 20197 to Jon Hare, Northeast Fisheries Science Center

NMFS' Northeast Fisheries Observer Program exists to monitor and observe living marine resources and associated communities to provide information on biota, their habitats, and the human activities and actions that may impact coastal and ocean ecosystems. Data are the foundation of scientific advice, which provides information to management to support decision-making. A more consistent flow of high quality, credible information is required to improve decision-making. To collect the quantity and quality of data necessary, NMFS intends to improve its capacity to conduct surveys and to conduct research and studies for better understanding of ecosystems. Although vessel self-reporting is often utilized, only limited data collection demands can reasonably be placed on the captain and crew. Observers are the only independent data source for some types of at-sea information such as bycatch composition and mortality, and marine mammal, sea bird and sea turtle interactions.

The purpose of the proposed permit is to monitor the take of ESA-listed sea turtle species in observed commercial fisheries and to collect data to help estimate total bycatch of the following turtle species: green, Kemp's ridley, leatherback, and loggerhead. The data collected by Northeast Fisheries Observer Program observers will include the size, composition, overall health, and distribution of populations of sea turtles found in the commercial fishing areas of the Northwest Atlantic Ocean. The research aims to contribute to the understanding of the pelagic ecology of these species, provide information for more complete models of their population dynamics, and allow more reliable assessments of commercial fishery impacts, including ways of mitigating those impacts.

Captured individuals will be subjected to capturing; handling; marking; measuring; photographing; PIT tag scanning; flipper tagging; biopsy sampling; and resuscitating throughout the state waters and the Exclusive Economic Zone of the U.S. Northwest Atlantic Ocean over a five-year period. The research will take place through fisheries that are authorized to take turtles through an Incidental Take Statement. Those fisheries are: scallop (trawl and dredge); tilefish; red crab; lobster; northeast multi-species, monkfish, spiny dogfish, bluefish, skates, squid/mackerel/butterfish, summer flounder/scup/black sea bass; coastal migratory pelagics; and Atlantic shark fisheries. Gear types include: longline; gillnet; trawl; trap/pot; and dredge. Table 1 summarizes the actions to which individual sea turtles will be exposed.

**Table 1. Proposed annual "take" of ESA-listed species under Permit No. 20197.**

| Species | Listing Unit | Number of Animals | Take Action | Collect Method | Procedures |
|---|---|---|---|---|---|
| Green sea turtle | North Atlantic and South Atlantic DPS (Threatened) | 10 | Harass/ Sampling | Capture under other authority | Mark, flipper tag; Measure; Photography/Video; Salvage (carcass, tissue, parts); Sample, tissue |
| Loggerhead sea turtle | Northwest Atlantic DPS (Threatened) | 50 | Harass/ Sampling | Capture under other authority | Mark, flipper tag; Measure; Photography/Video; Salvage (carcass, tissue, parts); Sample, tissue |
| Kemp's ridley sea turtle | Range-wide (NMFS Endangered) | 10 | Harass/ Sampling | Capture under other authority | Mark, flipper tag; Measure; Photography/Video; Salvage (carcass, tissue, parts); Sample, tissue |
| Leatherback sea turtle | Range-wide (NMFS Endangered) | 50 | Harass/ Sampling | Capture under other authority | Mark, flipper tag; Measure; Photography/Video; Salvage (carcass, tissue, parts); Sample, tissue |
| Unidentified sea turtle | N/A | 20 | Harass/ Sampling | Capture under other authority | Mark, flipper tag; Measure; Photography/Video; Salvage (carcass, tissue, parts); Sample, tissue |

### 2.1.1 Capture

Sea turtles are incidentally caught during commercial fishing operations throughout state waters and the Exclusive Economic Zone in the U.S. Northwest Atlantic Ocean. In order to assess the extent that turtles interact with commercial fisheries and the impact those interactions may have, NEFSC certified observers are trained to conduct at sea data collection and biological sampling of all incidentally caught sea turtles during gillnet, trawl, scallop dredge, scallop trawl, purse seine, bottom longline, and pot/trap commercial fishing operations from North Carolina to Maine. Observers do not intentionally take turtles. They will only sample turtles incidentally caught during commercial fishing operations.

### 2.1.2 Handling, Restraint, and Release

Observers will not intentionally kill or cause any sea turtle to be killed. Care will be taken when handling live turtles to minimize injury to turtles and the observer. Observers will request that all observed sea turtles captured during commercial fishing operations be lowered to the deck as carefully as possible. All sea turtles brought on board will be protected from any weather or fishing activity that may cause injury. The area surrounding the turtle will be free of any material that the turtle might ingest. Healthy, active turtles will not be kept on board longer than 30 minutes. Appropriate resuscitation techniques will be used on any comatose turtle prior to returning it to the water. During release, engines must be in neutral and turtles will be released away from fishing gear and as close to the surface of the water as possible. The observer will observe the newly released animal and record the behavior on the Marine Mammal, Sea Turtle and Sea Bird Incidental Take Log. When possible, observers will coordinate with the Sea Turtle Stranding and Salvage Network to transfer stressed or injured animals to rehabilitation facilities ashore. The easiest and quickest way to do this might be through the Area Coordinator. It is understood that several of these requirements are out of the observer's control. In those cases, it is incumbent upon the observer to work with the crew to meet these requirements. If the vessel operator is unable or unwilling to meet a request, then the observer should provide comments on the Marine Mammal, Sea Turtle and Sea Bird Incidental Take Log. Observers are responsible for their actions only, not for those of the crew.

Sea turtles have powerful jaws. Observers will always keep clear of the head and wear durable foot wear when working around them on deck. Sea turtles of all species, except leatherbacks, have claws on their flippers. Observers will keep clear of flapping flippers, especially if the animal is on its back (carapace) and avoid straddling animals when they working with them. Observers will never pick up sea turtles by the flippers, head or tail. For all turtles except leatherbacks, they must be picked up by placing one hand at the front and one hand at the back of the carapace. Placing a clean, damp cloth over an agitated turtles head can have a calming effect. Turtles brought on deck will be protected from adverse weather conditions as much as possible. If it is sunny and hot, turtles will be covered with a clean damp cloth/towel and kept in the shade. If it is cold, turtles will be insulated with available clean material and kept out of the weather. Extra care will be taken when handling leatherback turtles since they are covered with skin. Leatherback turtles will never be turned over on their carapace and will always be picked by their plastron (i.e., by supporting their underneath instead of just picking up by their carapace). Since leatherback turtles can be large, additional assistance will be used when moving them and they will not be dragged or pushed. Gloves will be worn when possible and all cuts and abrasions will be cleaned and disinfected when handling sea turtles. Hands of observers will be routinely disinfected with provided alcohol wipes. The turtle's skin will be disinfected using betadine and alcohol swaps. The work area will be kept clean and only sterile, or new unused, instruments and sampling equipment will be used.

### 2.1.3 Resuscitation

Any live sea turtle incidentally taken during the course of commercial fishing activities must be handled with due care to prevent injury. Incidentally taken sea turtles should be observed for activity and then returned to the water according to the following procedures:

Sea turtles that are alive or dead must be released over the stern of the boat[1]. In addition, they must be released only when fishing gear is not in use, when the engine gears are in neutral

[1] Follow the above release guidelines for dead turtles only when it is not possible to salvage the dead animal and bring it in due to trip length.

position, and in areas where they are unlikely to be recaptured or injured by fishing gear or vessels[2].

Resuscitation techniques must be used on any comatose turtle prior to returning it to the water. Resuscitation must be attempted on sea turtles that are comatose or inactive but not dead by placing the turtle right side up (on plastron) and elevating the hindquarter six inches for a period of 4 up to 24 hours. The amount of the elevation depends on the size of the turtle (i.e., greater elevations are needed for larger turtles). Periodically rock the turtle from side to side by holding the outer edge of the carapace and lifting one side about 3 inches alternating from one side to the other. This allows the lungs to drain off water. Sea turtles being resuscitated must be protected from the elements at all times. If it is sunny and warm then shade the turtle and keep it moist using clean sea water or clean damp towels. If it is cold then keep the turtle out of the weather and warm by insulating with clean rags or other suitable material. Gently touch the upper eyelid and pinch the tail (reflex test) periodically to see if there is a response. Those that revive and become active must be released over the stern of the boat only when fishing gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by fishing gear or vessels. Sea turtles that fail to respond to the reflex test or fail to move within several hours (up to 24, if possible) must be returned to the water in the same manner.

Inactive turtles will not be assumed dead. The onset of rigor mortis or the rotting of flesh is the only definitive indication that a turtle is dead. Otherwise, the turtle is determined to be comatose or inactive and resuscitation attempts are necessary. There are three methods that may elicit a reflex response from an inactive animal:

1. Cloaca or tail reflex. Stimulate the tail with a light touch. This may cause a retraction or side movement of the tail.

2. Eye reflex. Lightly touch the upper eyelid. This may cause an inward pulling of the eyes, flinching or blinking response.

3. Nose reflex. Press the soft tissue around the nose which may cause a retraction of the head or neck region or an eye reflex response.

### 2.1.4 Genetic/Isotope Sampling for Live, Comatose, or Dead Turtles

For turtles larger than 25 cm Notch to Tip (total length) carapace length, tissue samples large enough for genetic analysis will be obtained using a 6mm disposable biopsy punch. This tool consists of a plastic handle that supports a sharp circular blade. Tissue samples will be preserved in 5 ml vials filled with saturated sodium chloride. Prior to using any sampling equipment, it will be thoroughly cleaned with alcohol wipes.

[2] Live and resuscitated animals should be released as close to the water surface as possible

To biopsy a sea turtle, the turtle will be gently placed on its carapace with plastron facing up (except leatherbacks). This will be done with assistance from a crew member as turtles that are placed on their carapace tend to flap their flippers aggressively. Observers will exercise caution around the head and jaws. If an observer is working alone, they will leave the turtle carapace up, with a damp cloth over its head. Latex gloves will be worn and the area will be thoroughly wiped on the ventral and dorsal surfaces of the rear flipper with a Betadine wipe. This area is along the posterior edge (trailing) of the flipper and is just past (away from the body) the Inconel tag location, which is the first scale closest to the body. An alcohol swab will be used to wipe the hard surface (plastic dive slate, biopsy vial cap or other available clean surface) that will be used under the flipper, and will be placed underneath the Betadine treated flipper.

Holding a new biopsy punch by the thumb and index finger, the observer will press the biopsy punch firmly into the flesh. The punch will be aligned a little past the flipper edge, creating a 3/4 crescent shaped biopsy. This technique promotes quicker healing. The punch will be rotated one or two complete turns to make a cut all the way through the flipper. The biopsy tool has a sharp cutting edge so caution will be exercised at all times. The punched area will be wiped with a Betadine swab. The procedure will be repeated to the other rear flipper using the same biopsy punch (if not too dull). The observer will then have two samples from this turtle in the same biopsy punch. The tissue plugs will be removed by using a pair of tweezers cleaned with alcohol wipes, a clean tooth pick or by tapping the punch on the edge of the vial. The plugs will be placed directly into a vial containing saturated sodium chloride. It is important that tissue samples do not come into contact with any other surface or materials during collection. The cap will be secured and using a fine point permanent marker (Sharpie) the vial will be labeled with the same consecutive identification number (PSID) used on the Sea Turtle Biological Sample Log and the trip number. The writing will be covered with a piece of clear tape to prevent smearing. Parafilm will be tightly wrapped around the vial cap and placed in a Whirlpak. The Whirlpak will be labeled with the trip number, collection date and species. All pertinent information will be included on the Sea Turtle Biological Sample Log and the Marine Mammal, Sea Turtle and Sea Bird Incidental Take Log. It will be indicated that a biopsy sample was taken on the Sea Turtle Biological Sample Log. The biopsy punch will be properly disposed of and a new punch will be used for each turtle. The vial will be submitted with the data.

### 2.1.5 Inconel Flipper Tagging

All turtles will be examined for existing external and/or PIT tags prior to applying new Inconel tags. If existing tags are found, tags will be recorded accurately. PIT tags are recorded on the Sea Turtle Biological Sample Log. Inconel and other external tags are recorded on the Marine Mammal, Sea Turtle and Sea Bird Incidental Take Log. Any damaged or unreadable tags will be removed. Prior to release, each turtle larger than 30 cm Standard Carapace Length (Notch-to-Tip) should have two well attached and clearly legible external Inconel tags. Inconel tags will be cleaned of the protective oil coat they are shipped with and stored in a sealed plastic bag. Tags will be thoroughly cleaned with alcohol wipes just before using and removed one at a time as needed.

Due to tag loss, double tagging is standard procedure, with one Inconel tag placed proximal to the first scale (scale closest to the body) of the trailing edge of each rear flipper for all turtles except leatherback. Leatherback turtles will be tagged along the posterior (trailing) edge of the rear flipper. The preferred site is approximately 5 cm (~ 2 inches) out from the base of the tail (leatherback turtles do not have flipper scales). Only turtles that are larger than 30 cm Standard Carapace Length (Notch-to-Tip) carapace length will receive an Inconel tag. If the recommended tagging site is damaged or is for some reason unsuitable for tag application, then an alternative site along the trailing edge of the front flipper will be used.

The tagging technique for all turtles except leatherbacks will be to first turn the turtle over onto its carapace with plastron (underside) facing upwards. This is best done with assistance from a crew member, as turtles that are placed on their carapace tend to flap their flippers aggressively. To prepare the rear flippers for tagging the area will be thoroughly swabbed with betadine. If someone is available to assist, they will hold the flipper to improve leverage while applying the Inconel tag. The tag identification number will be recorded prior to placing it into the applicator. The pointed (piercing) side of the tag will be placed up and at the end of the observer's index finger inside the tag against the bend. The tag will be pulled straight back into the open jaws of the applicator, aligning the pointed side of the tag opposite to the side of the pliers that has the small depression. It can be helpful to mark one jaw of the applicator with colored paint as a reminder of the correct way to insert the tag. The observer will not squeeze the pliers before they are ready to tag or the tag will fall out. The Inconel tag will be positioned so that it extends slightly past (approx. 1/3 the length of the tag) the trailing edge of the rear flipper. It will not be cinched in too tight against the flipper without room to move freely. Also observers will avoid positioning the tag close to edge of the flipper where it can rip out or catch on fishing gear.

There are two distinct motions involved in applying Inconel tags. The first step is to squeeze the applicator so the tag point pierces the flipper. The second step, a moment later, involves applying greater force to drive the point through the tag hole and make it bend over completely. Using both hands and squeezing in a firm, steady manner to ensure that the tag will fully lock. The handles of the applicator will always be gripped as far back as possible to gain maximum leverage. The tag point will pierce the flipper and lock into place with the tip bending securely over by 3-5 mm. After attachment, the observer will feel the tag with their finger and visually inspect to make sure the point has bent over into a fully locked position. The procedure will be repeated to apply a second tag on the other rear flipper. All turtles will be double tagged in this manner. If possible consecutive tag numbers will be used on the same turtle.

In the event that the Inconel tag does not lock, the pliers will be fitted back around the tag and applied with greater pressure. Tags that fail to lock when applied to a turtle are difficult, frustrating and sometimes impossible to properly correct, even when using additional tools.

Improperly applied tags can be shed quickly. A tag that malfunctions will be removed, recorded as being destroyed and replaced with a new tag.

When work is complete with one turtle, the applicator will be cleaned and disinfected to avoid cross contamination between turtles with alcohol swabs. Tag applicators will be maintained so they continue to work properly by washing them in fresh water after use, spraying the spring and pivot surface with WD40, and storing them in a sealed plastic bag.

### 2.1.6 Terms and Conditions

Section 10(a)(1) of the ESA requires the prescription of terms and conditions as part of the scientific research permit. The Permits Division proposes to include the following terms and conditions in Permit No. 20197. The text below was taken directly from the proposed permit provided to us in the consultation initiation package.

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

A. Duration of Permit

1. Personnel listed in Condition C.1 of this permit (hereinafter "Researchers") may conduct activities authorized by this permit through January 15, 2022. This permit expires on the date indicated and is non-renewable. This permit may be extended by the Director, NMFS Office of Protected Resources, pursuant to applicable regulations and the requirements of the ESA.

2. Researchers must immediately stop permitted activities and the Permit Holder must contact the Chief, NMFS' Permits Division for written permission to resume

   a. If serious injury or mortality[3] of protected species[4] occurs.

   b. If authorized take[5] is exceeded in any of the following ways:

      i. More animals are taken than allowed in Table 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.

---

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

[4] "Protected species" include species listed as threatened or endangered under the ESA, and marine mammals.

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

c. Following reporting requirements at Condition E.2.

3. The Permit Holder may continue to possess biological samples[6] acquired[7] under this permit after permit expiration without additional written authorization, provided the samples are maintained as specified in this permit.

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

1. Table 1 outlines the number of protected species, by species and authorized to be taken, and the locations, manner, and time period in which they may be taken.

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

3. The Permit Holder may use visual images and audio recordings collected under this permit, including those authorized in Table 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. 20197. 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:

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

<u>Turtles Captured Under Another Authority Prior to Research Activities</u>

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

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

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

<u>General Handling, Resuscitation, and Release</u>

d. Researchers must

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

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

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

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

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

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

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

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

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

g. While holding sea turtles, Researchers must:

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

ii. Provide adequate air flow.

iii. Keep sea turtles moist when the temperature is $\geq$ 75°F.

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

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

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

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

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

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

iii. not turn leatherbacks on their backs.

Handling, Measuring, Weighing and Flipper Tagging

k. 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.

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.

i. Clean technique:

1. Routine hand washing or use of non-sterile disposable gloves.

2. Cleaning and disinfection of equipment between individuals.

ii. 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 percent 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.

iii. 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

**Table 2. Research procedures and required sterile techniques under Permit No. 20197.**

| 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 |

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.

**Table 3. Research procedures and minimum requirements for pain management and field techniques under Permit No. 20197.**

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

l. Researchers must:

iv. 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.

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

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

vii. Clean and disinfect

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

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

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

Sampling

m. Biopsy Sampling

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

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

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

B. Turtles not boarded for sampling

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

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

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

Transfer of Sea Turtle Biological Samples

n. Samples may be sent to the Authorized Recipients listed in Table 4 provided that

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

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

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

p. The transfer of biological samples to anyone other than the Authorized Recipients in Table 5 requires written approval from the Chief, Permits Division.

q. Samples cannot be bought or sold.

C. <u>Qualifications, Responsibilities, and Designation of Personnel</u>

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 – Amy S. Martins

b. Co-Investigators –See Table 4 for list of names and corresponding activities.

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

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

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

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

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

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

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

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

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

    c. individuals included for training purposes.

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

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

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

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

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

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

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

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

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

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

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

c. a hard copy mailed or faxed to the Chief, Permits Division, Office of Protected Resources, NMFS, 1315 East-West Highway, Room 13705, Silver Spring, MD 20910; phone (301)427-8401; fax (301)713-0376.

D. Possession of Permit

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

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

a. Engaged in a permitted activity.

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

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

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

E. Reports

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

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

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 reports: must be submitted within two weeks of exceeding authorized takes, as specified in Condition A.2.

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

b. In addition to the written report, the Permit Holder must contact the Permits Division by phone (301-427-8401) as soon as possible, but no later than within two business days of the incident.

c. The Permits Division may grant authorization to resume permitted activities based on review of the incident report and in consideration of the Terms and Conditions of this permit.

3. Annual reports describing activities conducted during the previous permit year (from January 16th to January 15th of the following year) must

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

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

4. A final report summarizing activities over the life of the permit must be submitted by (July 15, 2022), or, if the research concludes prior to permit expiration, within 180 days of completion of the research.

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

F. Notification and Coordination

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

a. Notification must include the

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

ii. estimated dates of activities; and

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

b. Notification must be sent to the Greater Atlantic Region Assistant Regional Administrator for Protected Resources :

Greater Atlantic Region, NMFS, 55 Great Republic Drive, Gloucester, MA 01930; phone (978)281-9328; fax (978)281-9394

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

2. To the maximum extent practical, the Permit Holder must coordinate permitted activities with activities of other Permit Holders conducting the same or similar activities on the same species, in the same locations, or at the same times of year

to avoid unnecessary disturbance of animals. Contact the Regional Office listed above for information about coordinating with other Permit Holders.

G. Observers and Inspections

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

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

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

H. Modification, Suspension, and Revocation

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

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

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

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

   c. in response to a written request[8] from the Permit Holder;

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

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

[8] 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.

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

I. Penalties and Permit Sanctions

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

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

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

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

J. NMFS-Approved Personnel and Authorized Recipients

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

**Table 4. Approved personnel to act as Co-Investigators under Permit No. 20197.**

| Name of Co-Investigator | Activities |
|---|---|
| Amy S. Martins | All activities |
| Heather Haas | All activities |

3. Biological samples authorized for collection or acquisition in Tables 1 may be transferred to the following Authorized Recipients in Table 5 for the specified disposition, consistent with Condition B.6 of the permit.

**Table 5. Authorized recipients under Permit No. 20197.**

| Sample Type | Disposition | Authorized Recipient |
|---|---|---|
| Tissue | Analysis | Heather Haas, NMFS Northeast Fisheries Science Center, Woods Hole, MA |

## 2.2 Permit No. 19627 to Bonnie Ponwith, Southeast Fisheries Science Center

The purpose of the proposed permit is to monitor the take of ESA-listed species by fisheries, to collect data that can enhance efforts to estimate total bycatch and the effects of bycatch on the various sea turtle subpopulations, and to document interactions at various life stages to help in the recovery process of these species. The objective of the project is to provide data on green, loggerhead, Kemp's ridley, hawksbill, leatherback, olive ridley and unidentified hardshell sea turtles that interact with the following fisheries and activities: coastal gillnet; shark bottom longline; pelagic longline; commercial shrimp trawl; directed reef fish; oil/gas platform removal program; and other authorized fisheries and activities the SEFSC may observe and for which the sea turtle capture is legally authorized. The research will provide necessary biological and ecological information for these species. The significance of this research is to create a better understanding of turtle movement and migration, habitat use, genetics, and population dynamics. The information will be used to develop, implement, enhance, and evaluate conservation recovery efforts for sea turtles in the Gulf of Mexico, Atlantic Ocean, Caribbean Sea and its tributaries. Tables 6-11 summarize the actions to which individual sea turtles will be exposed. Turtles will only be sampled once (one take per animal) for the listed procedures.

**Table 6. Proposed annual "take" of ESA-listed species in the Commercial Shrimp Trawl Fishery under Permit No. 19627.**

| Species | Listing Unit | Number of Animals | Take Action | Collect Method | Procedures |
|---|---|---|---|---|---|
| Green sea turtle | Range-wide (NMFS Threatened) | 50 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue; Weigh |
| Loggerhead sea turtle | Range-wide (NMFS Threatened) | 150 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue; Weigh |
| Kemp's ridley sea turtle | Range-wide (NMFS Endangered) | 100 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue; Weigh |
| Hawksbill sea turtle | Range-wide (NMFS Endangered) | 50 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue; Weigh |
| Leatherback sea turtle | Range-wide (NMFS Endangered) | 50 | Harass/ Sampling | Capture under other authority | Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue; Weigh |

**Table 7. Proposed annual "take" of ESA-listed species in the Directed Shark Bottom Longline Fishery and Coastal Gillnet Fishery under Permit No. 19627.**

| Species | Listing Unit | Number of Animals | Take Action | Collect Method | Procedures |
|---|---|---|---|---|---|
| Green sea turtle | Range-wide (NMFS Threatened) | 8 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh |
| | | 11 | Handle/ Release | Capture under other authority | Salvage (carcass, tissue, parts) |
| Loggerhead sea turtle | Range-wide (NMFS Threatened) | 16 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/ Video; Sample, tissue; Weigh |
| | | 26 | Handle/ Release | Capture under other authority | Salvage (carcass, tissue, parts) |
| Kemp's ridley sea turtle | Range-wide (NMFS Endangered) | 5 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/ Video; Sample, tissue; Weigh |
| | | 3 | Handle/ Release | Capture under other authority | Salvage (carcass, tissue, parts) |
| Hawksbill sea turtle | Range-wide (NMFS Endangered) | 3 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/ Video; Sample, tissue; Weigh |
| | | 3 | Handle/ Release | Capture under other authority | Salvage (carcass, tissue, parts) |
| Leatherback sea turtle | Range-wide (NMFS Endangered) | 3 | Harass/ Sampling | Capture under other authority | Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh |
| | | 3 | Handle/ Release | Capture under other authority | Salvage (carcass, tissue, parts) |

**Table 8. Proposed annual "take" of ESA-listed species in the Oil/Gas Platform Removal Observer Program under Permit No. 19627.**

| Species | Listing Unit | Number of Animals | Take Action | Collect Method | Procedures |
|---|---|---|---|---|---|
| Green sea turtle | Range-wide (NMFS Threatened) | 2 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue; Weigh |
| Loggerhead sea turtle | Range-wide (NMFS Threatened) | 10 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue; Weigh |
| Kemp's ridley sea turtle | Range-wide (NMFS Endangered) | 2 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue; Weigh |
| Hawksbill sea turtle | Range-wide (NMFS Endangered) | 2 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue; Weigh |
| Leatherback sea turtle | Range-wide (NMFS Endangered) | 2 | Harass/ Sampling | Capture under other authority | Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue; Weigh |

**Table 9. Proposed annual "take" of ESA-listed species in the Miscellaneous Fisheries and Other Observed Activities under Permit No. 19627.**

| Species | Listing Unit | Number of Animals | Take Action | Collect Method | Procedures |
|---|---|---|---|---|---|
| Green sea turtle | Range-wide (NMFS Threatened) | 20 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh |
| Loggerhead sea turtle | Range-wide (NMFS Threatened) | 100 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh |
| Kemp's ridley sea turtle | Range-wide (NMFS Endangered) | 50 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh |
| Hawksbill sea turtle | Range-wide (NMFS Endangered) | 20 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh |
| Leatherback sea turtle | Range-wide (NMFS Endangered) | 50 | Harass/ Sampling | Capture under other authority | Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh |
| Olive ridley sea turtle | Range-wide (NMFS Threatened) | 20 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh |
| Unidentified sea turtle | N/A (NMFS Endangered) | 5 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh |
| Unidentified sea turtle | N/A (NMFS Endangered) | 50 | Handle/ Release | Capture under other authority | Salvage (carcass, tissue, parts) |

**Table 10. Proposed annual "take" of ESA-listed species in the Pelagic Longline Fishery under Permit No. 19627.**

| Species | Listing Unit | Number of Animals | Take Action | Collect Method | Procedures |
|---|---|---|---|---|---|
| Loggerhead sea turtle | Range-wide (NMFS Threatened) | 159 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh |
| | | 29 | Handle/ Release | Capture under other authority | Salvage (carcass, tissue, parts) |
| Leatherback sea turtle | Range-wide (NMFS Endangered) | 147 | Harass/ Sampling | Capture under other authority | Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh |
| | | 21 | Handle/ Release | Capture under other authority | Salvage (carcass, tissue, parts) |
| Unidentified sea turtle | N/A (NMFS Endangered) | 9 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/ Video; Sample, tissue; Weigh |
| | | 2 | Handle/ Release | Capture under other authority | Salvage (carcass, tissue, parts) |

**Table 11. Proposed annual "take" of ESA-listed species in the Gulf of Mexico Directed Reef Fish Fishery and Bottom Longline and Vertical Line Gear Fishery under Permit No. 19627.**

| Species | Listing Unit | Number of Animals | Take Action | Collect Method | Procedures |
|---|---|---|---|---|---|
| Green sea turtle | Range-wide (NMFS Threatened) | 6 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh |
| | | 6 | Handle/ Release | Capture under other authority | Salvage (carcass, tissue, parts) |
| Loggerhead sea turtle | Range-wide (NMFS Threatened) | 136 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/ Video; Sample, tissue; Weigh |
| | | 233 | Handle/ Release | Capture under other authority | Salvage (carcass, tissue, parts) |
| Kemp's ridley sea turtle | Range-wide (NMFS Endangered) | 8 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/ Video; Sample, tissue; Weigh |
| | | 3 | Handle/ Release | Capture under other authority | Salvage (carcass, tissue, parts) |
| Hawksbill sea turtle | Range-wide (NMFS Endangered) | 2 | Harass/ Sampling | Capture under other authority | Mark, carapace (temporary); Mark, flipper tag; Mark, PIT tag; Measure; Photograph/ Video; Sample, tissue; Weigh |
| | | 1 | Handle/ Release | Capture under other authority | Salvage (carcass, tissue, parts) |
| Leatherback sea turtle | Range-wide (NMFS Endangered) | 1 | Harass/ Sampling | Capture under other authority | Mark, flipper tag; Mark, PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh |
| | | 1 | Handle/ Release | Capture under other authority | Salvage (carcass, tissue, parts) |

### 2.2.1 Capture

The incidental capture of animals would not be covered by this permit but must be authorized under another authority (e.g., Incidental Take Statement of a biological opinion from a Sec. 7 consultation, Section 10(a)(1)(B) incidental take permit). Once the animals have been captured, all animals will be processed by NMFS observers with standard protocols. Training of observers in turtle handling and release will be conducted by qualified NMFS/SEFSC personnel and will follow SEFSC guidelines posted on our website: http://www.sefsc.noaa.gov/seaturtlefisheriesobservers.jsp. In most fisheries, the vessel crew is responsible for removing gear from hooked and/or entangled turtles where applicable, and the observer will instruct or assist in gear removal only if requested. One observer will be present per trip. Leatherback turtles and some very large hardshell turtles will not be brought aboard fishing vessels unless the vessel is equipped with a large turtle host apparatus. Therefore, if it is not possible to bring a turtle onboard, only biopsy sampling and gear removal will be attempted. Attempts to bring a small turtle will be conducted if the required turtle dip net is available on the boat. Without the dip net present, all turtle species will be released from the water surface. Below is a description of the observed fisheries and their capture techniques. We do not anticipate removing any animals from the wild into captivity. However, when we encounter an animal that is obviously debilitated, we will contact the nearest Sea Turtle Stranding and Salvage Network coordinator and try to make arrangements to transfer the animals for rehabilitation if practicable. Thus, only in rare circumstances would transport be involved. Rehabilitation would be permitted through the Sea Turtle Stranding and Salvage Network and the USFWS.

#### *2.2.1.1 Coastal Gillnet Fishery*

During the haulback of gillnet gear, a variety of bycatch is encountered including sea turtles, primarily leatherback and loggerhead turtles. There are several ways sea turtles can be brought aboard. Some specimens may be completely entangled (fully wrapped) in the net. Some individuals may be partially entangled, which allows for the cutting of the gear and the turtle to be brought on board by hand. For larger individuals, the animal may be partially entangled in the gear at which time the gear would be cut loose by the fishermen.

#### *2.2.1.2 Shark Bottom Longline Fishery*

During the haulback of bottom longline gear, a variety of bycatch is encountered including sea turtles, primarily loggerhead turtles. When any turtle species is encountered on the gear, the vessel crew will slowly retrieve the turtle until it is alongside the vessel.

#### *2.2.1.3 Pelagic Longline Fishery*

During the haulback of pelagic longline gear, a variety of bycatch is encountered including sea turtles, primarily leatherback and loggerhead turtles. When any turtle species is encountered on the gear, the vessel crew will slowly retrieve the turtle until it is alongside the vessel.

#### *2.2.1.4 Commercial Shrimp Trawl Fishery*

While all otter trawl nets are required to have TEDs, sea turtle interactions generally occur with the following species: Kemp's ridley, leatherback, loggerhead, and green. In the otter trawl fishery, trawls are used to capture shrimp on the sea floor and may be pulled for several hours at a time. Sea turtle interaction can occur anytime the gear is deployed. Typically, the captured sea turtle is in the mouth of the gear and has not made its way back to the TED release area of the net or is captured in a try net. Skimmer trawls do not have TEDs currently, but the cod end of the nets are checked frequently during deployment. In any type of trawl gear, the captured sea turtle is brought alongside the vessel.

#### *2.2.1.5 Directed Reef Fish Fishery*

During the retrieval of longline or vertical line gear, a variety of by catch is encountered including sea turtles, primarily leatherback and loggerhead turtles. When any turtle species is encountered on the gear, the vessel crew will slowly retrieve the turtle until it is alongside the vessel.

#### *2.2.1.6 Oil/Gas Platform Removal*

Five of the six species of sea turtle have been observed at offshore structures, however, the loggerhead is the most common species reported. In the unlikely event that a sea turtle is injured during offshore platform removal, the injured sea turtle would be recovered by commercial divers participating in the platform removals, rehabilitated, and eventually released in the Gulf of Mexico. On a few previous occasions, NOAA divers were dispatched prior to detonations to attempt capture of sea turtles observed around platforms. Once a sea turtle is located underwater, the capture process requires only a few minutes. Sea turtles are captured manually and placed in large mesh bags or cargo baskets to facilitate removal from the water. The main purpose of this project is to remove turtles from the areas where offshore platforms are detonated to minimize risk of injury or mortality. However, in the event that turtles are captured for relocation, they will be sampled (i.e., identified, tagged and biopsied) on the research vessel deployed to capture the turtles to characterize the nature of the population segments potentially interacting with these platform removals.

#### *2.2.1.7 Miscellaneous Fisheries*

The miscellaneous fisheries and activities use gear comparable to the fisheries discussed throughout this permit. As discussed above, when any turtle species is encountered on the gear or during an activity, the vessel crew will slowly retrieve the turtle until it is alongside the vessel.

### 2.2.2 Handling, Restraint, and Release

Turtles will be handled per guidance in Careful Release Protocols for Sea Turtle Release with Minimal Injury (SEFSC 2010, http://www.sefsc.noaa.gov/turtles/TM_580_SEFSC_CRP.pdf) and the SEFSC Sea Turtle Research Techniques Manual (SEFSC 2008, http://www.sefsc.noaa.gov/turtles/TM_579_SEFSC_STRTM.pdf). After assessing the animals' general condition, every captured animal will be subjected to general protocols: identified, photographed, biopsied (skin), and released. Boated animals will be subjected to additional procedures: standard measurements, PIT and flipper tags, and weights (if possible). These protocols are described in detail in the SEFSC Sea Turtle Research Techniques Manual.

The capture, handling and restraint of these animals are authorized by various Section 7 consultations and the effects of the captures were evaluated during that process. Methods to minimize negative effects of handling are described in detail in the attached SEFSC Sea Turtle Research Techniques Manual. While onboard the vessel, animals will be protected from temperature extremes, provided adequate air flow and kept moist during sampling. Extra care will be used when handling and sampling leatherback turtles, including supporting the animals from underneath during handling and release, as described in detail the SEFSC Sea Turtle Research Techniques Manual.

### 2.2.3 Tagging and Biopsy Sampling

PIT tag readers used will be capable of reading all frequencies currently in use by sea turtle researchers. If a turtle is encountered without tags, they will be marked with two Inconel flipper tags and one 125 - 134.2 kHz PIT tag. The tagging site will be disinfected using a povidone-iodine swab, an isopropyl alcohol swab, another povidone-iodine swab, and a second alcohol swab. Flipper tags will be cleaned prior to use and applied along the trailing edge of the rear flippers just proximal to the first scale. PIT tags will be applied in the triceps superficialis muscle on hardshells and in the dorsal musculature of the forelimb in leatherbacks. Boated turtles will have a 6mm tissue biopsy taken from the trailing edge of a rear flipper using a sterile biopsy punch, after the site has been disinfected using a povidone-iodine swab, an isopropyl alcohol swab, another povidone-iodine swab, and then a second alcohol swab. The minimum size turtle that we would PIT or flipper tag is 30 cm SCL. Non-boated turtles will be biopsied according to the protocols in the SEFSC Sea Turtle Research Techniques Manual (http://www.sefsc.noaa.gov/turtles/TM_579_SEFSC_STRTM.pdf): leatherbacks would be sampled using a carapace scrape, and hardshell turtles would be sampled in the soft tissues (e.g., flippers, shoulders).

Photographs and morphometric data will be archived by the SEFSC. Biopsy samples collected for genetic and stable isotope analysis will be cataloged and sent to the National Sea Turtle Genetics Laboratory in La Jolla, California. Tagging data, including PIT tag data, will be archived with the Cooperative Marine Turtle Tagging Program, currently managed by the Archie Carr Center for Sea Turtle Research at the University of Florida. These animals may also be accessed by other Section 10 permit holders for directed research, and those sampling activities would be covered by other permits. Only animals in good health will be accessed for other directed research purposes, unless the research specifically involves assessing post-interaction mortality for incidentally captured animals within a range of condition categories for the benefit of the species by understanding and decreasing mortality in fishery interactions. In addition, carcasses (including tissues or parts from them) may be collected from each of the fisheries or activities for which incidental lethal take has been previously authorized. We do not expect to have any non-target species takes because permitted activities will only involve boated turtles or turtles directly adjacent to the vessel.

Only minor stress, discomfort, and pain are expected during sample collection. The effect of each proposed procedure is described in detail in the attached SEFSC Sea Turtle Research Techniques Manual. All equipment that comes into contact with sea turtle body fluids, cuts or lesions will be disinfected between the processing of each turtle using a 1:10 solution of 5-6 percent bleach or other appropriate disinfectant. A separate set of sampling equipment for handling animals displaying fibropapilloma tumors will be maintained and thoroughly disinfected if ever used. Tagging and biopsy sites will be disinfected using 10 percent povidone-iodine solution and isopropyl alcohol swabs. This permit application has been approved by the Institutional Animal Care and Use Committee at the NMFS Southeast Fisheries Science Center, and the final approval letter has been submitted with this application.

### 2.2.4 Terms and Conditions

Section 10(a)(1) of the ESA requires the prescription of terms and conditions as part of the scientific research permit. The Permits Division proposes to include the following terms and conditions in Permit No. 19627. The text below was taken directly from the proposed permit provided to us in the consultation initiation package.

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

A. Duration of Permit

1. Personnel listed in Condition C.1 of this permit (hereinafter "Researchers") may conduct activities authorized by this permit through July 25, 2021. This permit expires on the date indicated and is non-renewable. This permit may be extended by the Director, NMFS Office of Protected Resources, pursuant to applicable regulations and the requirements of the ESA.

2. Researchers must immediately stop permitted activities and the Permit Holder must contact the Chief, NMFS' Permits Division for written permission to resume

    b. If serious injury or mortality[9] of protected species occurs.

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

d. If authorized take[10] is exceeded in any of the following ways:

iv. More animals are taken than allowed in Table 1 of Appendix 1.

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

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

e. Following reporting requirements at Condition E.2.

3. The Permit Holder may continue to possess biological samples[11] acquired[12] under this permit after permit expiration without additional written authorization, provided the samples are maintained as specified in this permit.

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

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

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

3. The Permit Holder may use visual images and audio recordings collected under this permit, including those authorized in 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. 19627. This statement must accompany the images and recordings in all subsequent uses or sales.

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

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

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

---

[10] 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.

[11] 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.

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

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

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

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

<u>Turtles Captured Under Another Authority Prior to Research Activities</u>

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

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

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

<u>General Handling, Resuscitation, and Release</u>

1. Researchers must
   a. Handle turtles according to procedures specified in 50 CFR 223.206(d)(1)(i). Use care when handling live animals to minimize any possible injury.
   b. Use appropriate resuscitation techniques on any comatose turtle prior to returning it to the water.
   c. When possible, transfer injured, compromised, or comatose animals to rehabilitation facilities and allow them an appropriate period of recovery before return to the wild.
   d. Have an experienced veterinarian, veterinary technician, or rehabilitation facility (i.e., medical personnel) on call for emergencies.
2. If an animal becomes highly stressed, injured, or comatose during capture or handling or is found to be compromised upon capture, Researchers must forego or cease activities that will further significantly stress the animal (erring on the side of caution) and contact the on call medical personnel as soon as possible. Compromised turtles include animals that are obviously weak, lethargic, positively buoyant, emaciated, or that have severe injuries or other abnormalities resulting in debilitation. One of the following options must be implemented (in order of preference):

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

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

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

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

5. While holding sea turtles, Researchers must

   1. Protect sea turtles from temperature extremes (ideal air temperature range is between 70°F and 80°F).
   2. Provide adequate air flow
   3. Keep sea turtles moist when the temperature is ≥ 75°F.
   4. Keep the area surrounding the turtle free of materials that could be accidentally ingested.

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

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

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

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

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

c. not turn leatherbacks on their backs.

Handling, Measuring, Weighing, PIT and Flipper Tagging

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 the 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 percent 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

**Table 12. Research procedures and required sterile techniques under Permit No. 19627.**

| 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.

**Table 13. Research procedures and minimum requirements for pain management and field techniques under Permit No. 19627.**

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

2. Researchers must:

    a. 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.

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

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

    d. Clean and disinfect

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

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

        iii. the application site before the tag pierces the animal's skin.

3. PIT Tagging

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

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

4. Marking the Carapace

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

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

<u>Sampling</u>

1. Biopsy Sampling

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

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

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

ii. Turtles not boarded for sampling

a. For larger individuals, like leatherbacks, the animal may be partially entangled in gear. Turtles must be sampled using a biopsy pole in the location most safely and easily accessed by the researcher and released.

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

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

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

a. Samples may be sent to the Authorized Recipients listed in Table 14 provided that

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

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

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

c. The transfer of biological samples to anyone other than the Authorized Recipients in Table 15 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 – Elizabeth Scott-Denton

b. Co-Investigators –See Table 14 for list of names and corresponding activities.

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

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

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

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

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

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

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

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

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

c. individuals included for training purposes.

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

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

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

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

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

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

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

8. The Responsible Party may request a change of PI by submitting a request to the Chief, Permits Division that includes a description of the individual's qualifications to conduct and oversee the activities authorized under this permit.
9. Submit requests to change the PI by one of the following:
   a. the online system at https://apps.nmfs.noaa.gov;
   b. an email attachment to the permit analyst for this permit; or
   c. a hard copy mailed or faxed to the Chief, Permits Division, Office of Protected Resources, NMFS, 1315 East-West Highway, Room 13705, Silver Spring, MD 20910; phone (301)427-8401; fax (301)713-0376.

D. <u>Possession of Permit</u>

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. <u>Reports</u>

4. The Permit Holder must submit annual, final, and incident reports containing the information and in the format specified by the Permits Division.
   a. Reports must be submitted to the Permits Division by one of the following:
      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 reports: must be submitted within two weeks of exceeding authorized takes, as specified in Condition A.2.
   a. The incident report must include a complete description of the events and identification of steps that will be taken to reduce the potential for

additional serious injury and research-related mortality or exceeding authorized take.

b. In addition to the written report, the Permit Holder must contact the Permits Division by phone (301-427-8401) as soon as possible, but no later than within two business days of the incident.

c. The Permits Division may grant authorization to resume permitted activities based on review of the incident report and in consideration of the Terms and Conditions of this permit.

3. Annual reports describing activities conducted during the previous permit year (from July 26 to July 25 of the following year) must

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

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

4. A final report summarizing activities over the life of the permit must be submitted by (January 15, 2022), or, if the research concludes prior to permit expiration, within 180 days of completion of the research.

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

F. Notification and Coordination

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

a. Notification must include the

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

ii. estimated dates of activities; and

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

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

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

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

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

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

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

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

G. Observers and Inspections

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

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

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

H. Modification, Suspension, and Revocation

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

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

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

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

   c. in response to a written request[13] from the Permit Holder;

[13] The Permit Holder may request changes to the permit related to: the objectives or purposes of the permitted

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

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

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

I. Penalties and Permit Sanctions

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

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

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

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

J. NMFS-Approved Personnel and Authorized Recipients for Permit No. 19627.

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

**Table 14. NMFS-approved personnel to act as Co-Investigators under Permit No. 19627.**

| Name of Co-Investigator | Activities |
|---|---|
| John Carlson | All activities |
| Gregg Gitschlag | All activities |
| Kenneth Keene | All activities |
| James Nance | All activities |

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.

Biological samples authorized for collection or acquisition in Tables 6-11 may be transferred to the following Authorized Recipients in Table 15 for the specified disposition, consistent with Condition B.6 of the permit.

**Table 15. Authorized recipients under Permit No. 19627.**

| Sample Type | Disposition | Authorized Recipient |
|---|---|---|
| Tissue | Analysis | NMFS Southwest Marine Fisheries Service National Sea Turtle Genetics Laboratory in La Jolla, California |

## 2.3 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 CFR 402.02). Each proposed permit has a particular action area (described further below), but in combination generally encompass nearshore and offshore Atlantic Ocean waters of the United States east coast from Florida to Maine, in the Gulf of Mexico, and the Caribbean Sea and its tributaries.

### 2.3.1 Permit No. 20197

The action area under these proposed activities is the United States nearshore and offshore waters of the northeast Atlantic Ocean from the coast of Maine to North Carolina (Figure 1).

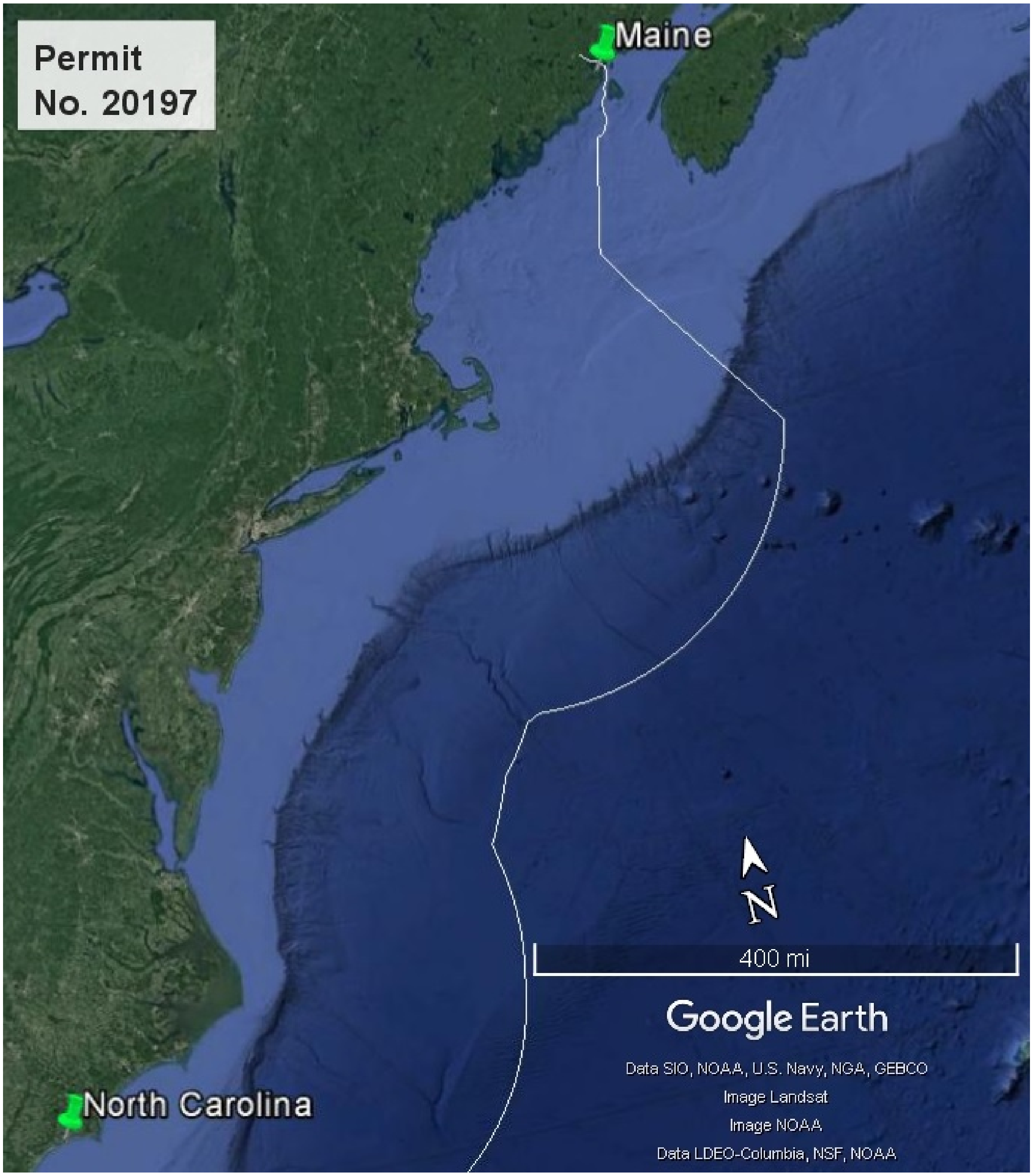



**Figure 1. Action area for Permit No. 20197 with the boundary of the Exclusive Economic Zone (white line).**

### 2.3.2 Permit No. 19627

The action area under these proposed activities is the United States nearshore and offshore waters of the Atlantic Ocean from the coast of Maine to Florida, the Gulf of Mexico, and the Caribbean Sea and its tributaries (Figure 2).

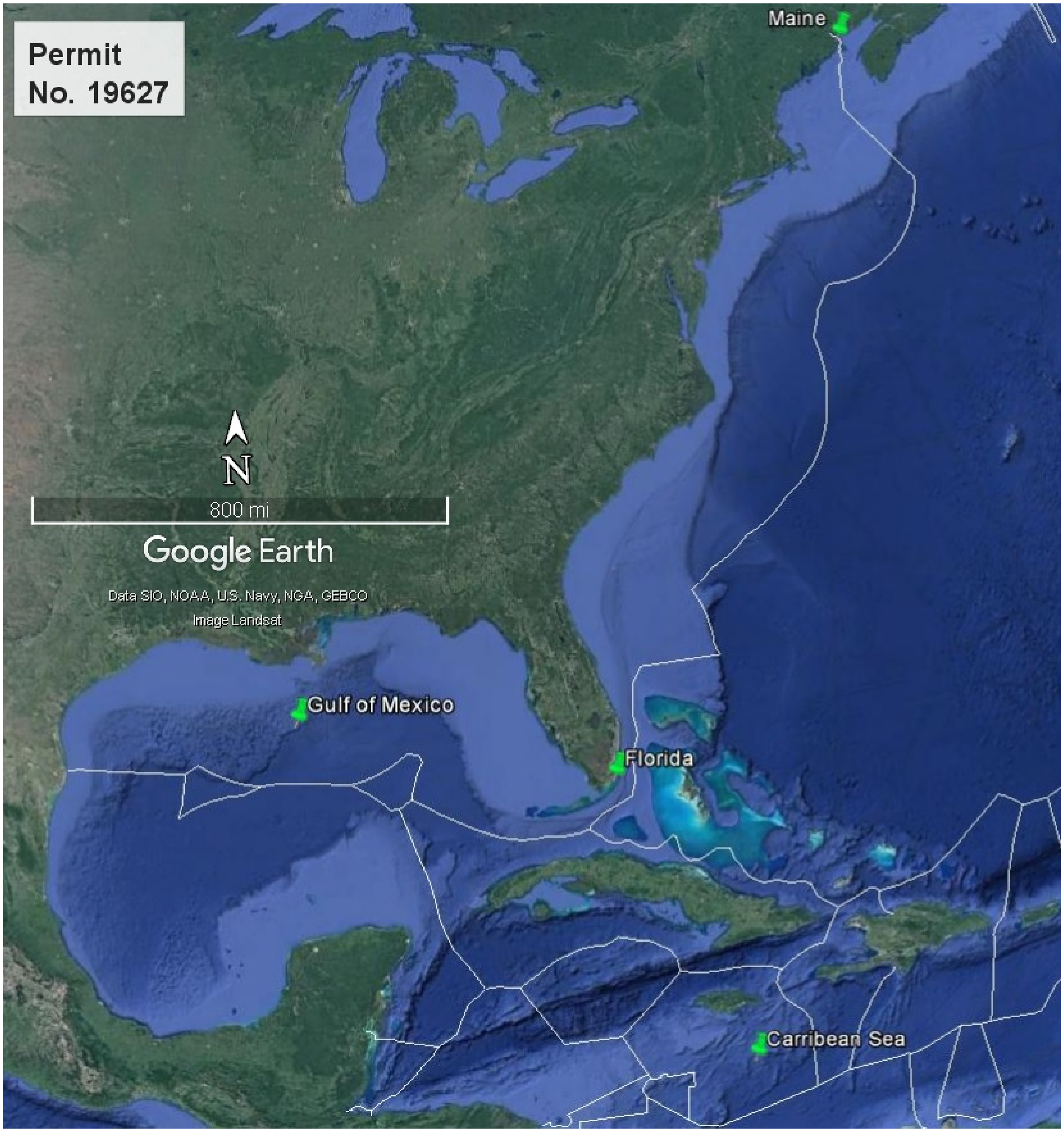



**Figure 2. Action area for Permit No. 19627 with the boundary of the Exclusive Economic Zone (white line).**

## 2.4 Interrelated and Interdependent Actions

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

# 3 THE ASSESSMENT FRAMEWORK

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

"To jeopardize the continued existence of an ESA-listed species" 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 CFR §402.02). The jeopardy analysis considers both survival and recovery of the species.

Section 7 assessment involves the following steps:

1) We identify the proposed action and those aspects (or stressors) of the proposed action that are likely to have direct or indirect effects on the physical, chemical, and biotic environment within the action area, including the spatial and temporal extent of those stressors.

2) We identify the ESA-listed species and designated critical habitat that are likely to co-occur with those stressors in space and time.

3) 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.

4) 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.

5) 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.

6) 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.

7) The adverse modification analysis considers the impacts of the proposed action on the essential habitat features and conservation value of designated critical habitat.

8) We describe any cumulative effects of the proposed action in the action area.

   Cumulative effects, as defined in our implementing regulations (50 CFR §402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation.

9) We integrate and synthesize the above factors by considering the effects of the action to the environmental baseline and the cumulative effects to determine whether the action could reasonably be expected to:

   a) Reduce appreciably the likelihood of both survival and recovery of the ESA-listed species in the wild by reducing its numbers, reproduction, or distribution; or

   b) Reduce the conservation value of designated or proposed critical habitat. These assessments are made in full consideration of the status of the species and designated critical habitat.

10) We state our conclusions regarding jeopardy and the destruction or adverse modification of designated critical habitat.

If, in completing the last step in the analysis, we determine that the action under consultation is likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify designated critical habitat, we must identify a reasonable and prudent alternative to the action. The reasonable and prudent alternative must not be likely to jeopardize the continued existence of ESA-listed species nor adversely modify their designated critical habitat and it must meet other regulatory requirements.

To comply with our obligation to use the best scientific and commercial data available, we used several sources to identify information relevant to the species, the potential stressors associated with the proposed action, and the potential responses of sea turtles to those stressors. We conducted electronic searches, using google scholar and the online database web of science, and considered all lines of evidence available through published and unpublished sources that represent evidence of adverse consequences or the absence of such consequences. We relied on information submitted by the Permits Division (applications and annual reports), government reports (including previously issued NMFS biological opinions, NMFS Science Center reports, and stock assessment reports), NOAA technical memos, peer-reviewed scientific literature, and other information. We organized the results of electronic searches using commercial bibliographic software. We also consulted with subject matter experts, within the NMFS as well as the academic and scientific community. When the information presented contradictory results, we described all results, evaluated the merits or limitations of each study, and explained how each was similar or dissimilar to the proposed action to come to our own conclusion based on our expert opinion.

# 4 Status of Endangered Species Act Protected Resources

This section identifies the ESA-listed species that potentially occur within the action areas that may be affected by Permit Nos. 20197 and 19627 (Figures 1 and 2, respectively). It then summarizes the biology and ecology of those species and what is known about their life histories in the action areas. The status is determined by the level of risk that the ESA-listed species and designated critical habitat face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This section also breaks down the species and designated critical habitats that may be affected by the proposed action, describing whether or not those species and designated critical habitats are likely to be adversely affected by the proposed action. The species and designated critical habitats deemed likely to be adversely affected by the proposed action are carried forward through the remainder of this opinion.

This section helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. More detailed information on the status and trends of these ESA-listed resources, 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 the NMFS web site (www.nmfs.noaa.gov/pr/species/).

The species potentially occurring within the action area that may be affected by the proposed action are listed in Table 16, along with their regulatory status.

**Table 16. ESA-listed species and designated critical habitat that may be affected by the Permit Division's proposed Permits No. 20197 and 19627.**

| Species | ESA Status | Critical Habitat | Recovery Plan |
|---|---|---|---|
| Green sea turtle (*Chelonia mydas*): North Atlantic DPS | Threatened 81 FR 20057 04/06/2016 | 63 FR 46693 09/02/1998 | 63 FR 28359 Notice North Atlantic 10/29/1991 |
| Green sea turtle (*Chelonia mydas*): South Atlantic DPS | Threatened 81 FR 20057 04/06/2016 | -- | 63 FR 28359 Notice South Atlantic 10/29/1991 |
| Hawksbill sea turtle (*Eretmochelys imbricata*) | Endangered 35 FR 8491 06/02/1970 | 63 FR 46693 09/02/1998 | 57 FR 38818 Notice U.S. Caribbean, Atlantic, and Gulf of Mexico 08/27/1992 |
| Kemp's ridley sea turtle (*Lepidochelys kempii*) | Endangered 35 FR 18319 12/02/1970 | -- | 75 FR 12496 Notice U.S. Caribbean, Atlantic, and Gulf of Mexico (draft) 03/16/2010 |
| Leatherback sea turtle (*Dermochelys coriacea*) | Endangered 35 FR 8491 06/02/1970 | 44 FR 17710 03/23/1979 | 63 FR 28359 Notice U.S. Caribbean, Atlantic, and Gulf of Mexico 10/29/1991 |
| Loggerhead sea turtle (*Caretta caretta*): Northwest Atlantic DPS | Threatened 76 FR 58868 09/22/2011 | 79 FR 39856 07/10/2014 | 74 FR 2995 Notice Northwest Atlantic 01/16/2009 |
| Olive ridley sea turtle (*Lepidochelys olivacea*) | Threatened 43 FR 32800 07/28/1978 | -- | 63 FR 28359 Notice (Pacific population only) |

### 4.1 Species and Designated Critical Habitat Not Likely to be Adversely Affected

NMFS uses two criteria to identify the ESA-listed or designated critical habitat that are not likely to be adversely affected by the proposed action, as well as the effects of activities that are interrelated to or interdependent with the Federal agency's proposed action. The first criterion is exposure, or some reasonable expectation of a co-occurrence, between one or more potential stressors associated with the proposed activities and ESA-listed species or designated critical habitat. If we conclude that an ESA-listed species or designated critical habitat is not likely to be exposed to the proposed activities, we must also conclude that the species or designated 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 habitats that are exposed to potential stressors but are likely to be unaffected by the exposure are also not likely to be adversely affected by the proposed action.

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

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

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

During this consultation, we determined that no ESA-listed species or designated critical habitat will be affected by these research activities other than the targeted sea turtle species. Both Permit Nos. 20197 and 19627 collect data and samples from turtles incidentally caught during commercial fishing operations. Any impacts to ESA-listed species or designated critical habitat in the action areas by fishing operations will be addressed in the permits of the fisheries.

### 4.2 Species and Designated Critical Habitat Likely to be Adversely Affected

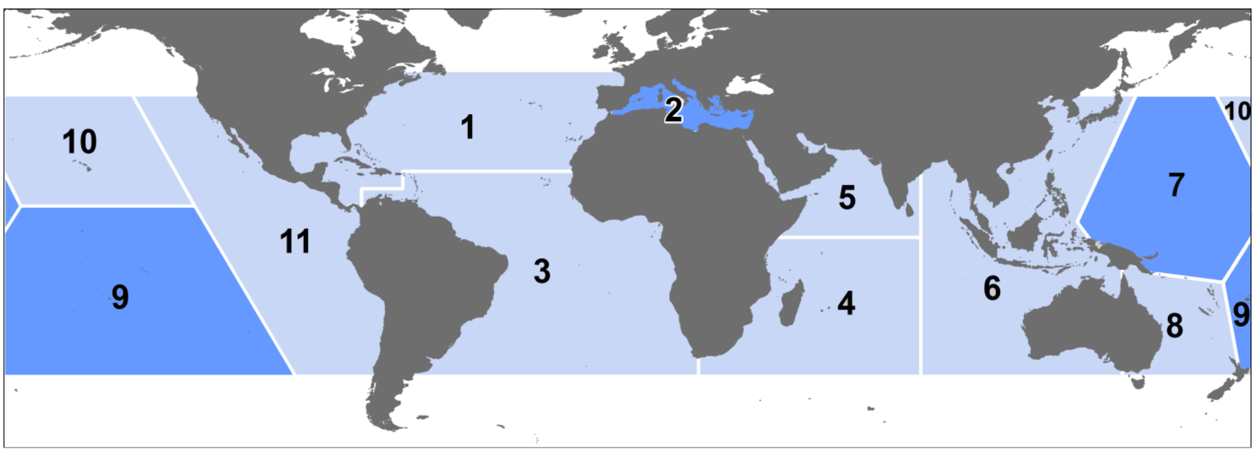
This opinion examines the status of each species that would be affected by the proposed action. The status is determined by the level of risk that the ESA-listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 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 designated critical habitat designations published in the Federal Register, status reviews, recovery plans, and on these NMFS Web sites: [http://www.nmfs.noaa.gov/pr/species/index.htm, *others*].

The opinion also examines the condition of designated critical habitat throughout the action area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential physical and biological features that help to form that conservation value.

### 4.2.1 Green Sea Turtle, North Atlantic and South Atlantic Distinct Population Segments

#### 4.2.1.1 Species Description

Green sea turtles spend almost their entire life in the ocean, coming ashore only to lay eggs or occasionally bask in the sun. When hatched, turtles weigh 25 grams and are 50 millimeters long, but can grow to be 135-150 kilograms and be one meter long. They have four flippers and a head that does not fully retract into their shell, which is black, gray, green, brown, or yellow on top and yellowish white on bottom (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 Distinct Population Segment boundaries for green sea turtles.**

Federal listing of the green sea turtle occurred on July 28, 1978 (43 FR 32800) (Table 17). On April 6, 2016, NMFS finalized a relisting of green sea turtles as 11 separate Distinct Population Segments (DPSs) globally (81 FR 20057). Eight DPSs are listed as threatened: Central North Pacific, East Indian-West Pacific, East Pacific, North Atlantic, North Indian, South Atlantic, Southwest Indian, and Southwest Pacific. Three DPSs are listed as endangered: Central South Pacific, Central West Pacific, and Mediterranean (Figure 3).

**Table 17. Green Sea Turtle information bar, North Atlantic and South Atlantic Distinct Population Segments.**

| Species | Common Name | Distinct Population Segment | ESA Status | Critical Habitat | Recovery Plan |
|---|---|---|---|---|---|
| *Chelonia mydas* | Green sea turtle | North Atlantic | Threatened 81 FR 20057 04/06/2016 | 63 FR 46693 09/02/1998 | 63 FR 28359 Notice North Atlantic 10/29/1991 |
| *Chelonia mydas* | Green sea turtle | South Atlantic | Threatened 81 FR 20057 04/06/2016 | -- | 63 FR 28359 Notice South Atlantic 10/29/1991 |

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

#### 4.2.1.2 Life History

The lifespan of green turtles is unknown, but sexual maturity occurs anywhere between 20-50 years. Green turtles are the largest of all the hard-shelled sea turtles, but have a comparatively small head. Adult green turtles are unique among sea turtles in that they eat only plants; they are herbivorous, feeding primarily on seagrasses and algae. This diet is thought to give them greenish-colored fat, from which they take their name.

While nesting season varies from location to location in the southeastern U.S., females generally nest in the summer between June and September; peak nesting occurs in June and July. Females return to the same beaches where they were born ("natal" beaches) every 2-4 years to lay eggs, generally in the summer months. During the nesting season, females nest at approximately two-week intervals. They lay an average of five nests, or "clutches." In Florida, green turtle nests contain an average of 135 eggs, which will incubate for approximately 2 months before hatching.

Green turtles appear to prefer waters that usually remain around 20º C in the coldest month, but may occur considerably north of these regions during warm-water events, such as El Niño. Available information indicates that green turtle resting areas are near feeding areas (Bjorndal and Bolten 2000). Green sea turtles in the Gulf of Mexico tend to remain along the coast (lagoons, channels, inlets, and bays), with nesting primarily occurring in Florida and Mexico and infrequent nesting in all other areas (NMFS and USFWS 1991a; Meylan et al. 1995; USAF 1996; Landry Jr. and Costa 1999).

#### 4.2.1.3 Population Dynamics

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

*Abundance*

Complete population abundance estimates do not exist for the 11 DPSs. Within the global range of the species, and within each DPS, the primary data available are collected on nesting beaches, either as counts of nests or counts of nesting females, or a combination of both.

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.

The South Atlantic DPS nesting sites can be roughly divided into four regions: western Africa, Ascension Island, Brazil, and the South Atlantic Caribbean. Seminoff et al. (2015) identified 51 nesting sites within the South Atlantic DPS. Of those sites, some are individual beaches while others represent multiple nesting beaches, typically when there is limited nesting and limited data (for example the Caribbean coast of Colombia, mainland Brazil and Venezuela, and most of the Caribbean islands that fall within the South Atlantic DPS nesting area). Of the nesting sites which could be derived, Poilão (in the Bijagos Archipelago, Guinea-Bissau) accounts for almost 46 percent of the total females with an estimated nester abundance of 29,016 using an average clutch of three each.

*Population Growth Rate*

The North Atlantic DPS has high-low trends in parts of Mexico while nesting has increased in the Yucatan Peninsula. The estimated total nester abundance for Mexico is 24,330 turtles. Tortuguero, Costa Rica is the most important nesting concentration for green turtles in this DPS and has increased markedly since the early 1970s with total nester abundance estimated at 30,052-64,396 in 2010 (Seminoff et al. 2015). In Florida, nesting has increased substantially over the last 20 years and peaked in 2011 with 15,352 nests statewide (Chaloupka et al. 2008). The estimated total nester abundance for Florida is 8,426 turtles.

Despite the numerous and widespread nesting beaches in the South Atlantic DPS, long-term monitoring data is relatively scarce. The only nesting concentration in the central Atlantic, and one of the largest in the South Atlantic DPS, is at Ascension Island (United Kingdom). This population has increased substantially over the last three decades (Broderick et al. 2006; Glen et al. 2006). The nesting concentration at Galibi Reserve and Matapica in Suriname was stable from the 1970s through the 1980s and since 2000, there appears to be a rapid increase in nest numbers (Seminoff et al. 2015). The southernmost nesting concentration in the western Atlantic is at Trindade Island, Brazil. This nesting population has been stable with a mean of approximately 1,500–2,000 females nesting per year since the early 1980s and since 2000, there appears to be a rapid increase in nest numbers (Moreira et al. 1995; Moreira and Bjorndal 2006; Almeida et al. 2012).

*Genetic Diversity*

As with other globally-distributed marine species, today's global green turtle population has been shaped by a sequence of isolation events created by tectonic and oceanographic shifts over geologic time scales, the result of which is population substructuring in many areas (Bowen et al. 1992; Bowen and Karl 2007). Examining the phylogeography of green turtles across their global distribution through mtDNA sequence diversity, Bowen and Karl (2007) found a separation of green turtles in the Atlantic-Mediterranean basins from those in the Indo-Pacific. Genetic mtDNA studies have shown that high levels of diversity and phylogeographic structure are found in both the Indo-Pacific and the Atlantic and Mediterranean basins.

A global phylogenetic analysis based on sequence data from a total of 129 mtDNA haplotypes (from approximately 4,400 individuals sampled from 105 nesting sites) available for green turtle nesting populations around the world. Results indicated that the mtDNA variation present in green turtles throughout the world today occurs within eight major clades that are structured geographically within ocean basins (Seminoff et al. 2015).

*Spatial Distribution*

The green turtle is globally distributed and generally found in tropical and subtropical waters along continental coasts and islands between 30° North and 30° South. Nesting occurs in over 80 countries throughout the year (though not throughout the year at each specific location). Green turtles are thought to inhabit coastal areas of more than 140 countries.

The North Atlantic DPS extends from the boundary of South and Central America, north to 10.5° N, 77° W, then extending due east across the Atlantic Ocean at 19° North latitude to the African continent, and extending north along the western coasts of Africa and Europe (west of 5.5° W) to 48° N. This DPS is found in the U.S. Atlantic and Gulf of Mexico in inshore and nearshore waters ranging from Texas through Massachusetts.

The South Atlantic DPS boundary begins at the border of Panama and Colombia at 77° W, 7.5°N, heads due north to77° W, 10.5° N, then northeast to 63.5° W, 19° N, and along 19° N latitude to Mauritania in Africa, to include the U.S. Virgin Islands in the Caribbean. It extends along the coast of Africa to South Africa, with the southern border being the 40° S latitude.

#### 4.2.1.4 Status

Federal listing of the green sea turtle occurred on July 28, 1978, with all populations listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which were listed endangered (43 FR 32800). On April 6, 2016, the range-wide and breeding population listings were removed and NMFS finalized a relisting of green sea turtles as 11 separate DPSs globally (81 FR 20057) with eight as threatened and three as endangered.

#### 4.2.1.5 Status within the Action Area

The action area for Permit No. 20197 overlaps with the range of the North Atlantic green sea turtle while Permit No. 19627 overlaps with the North Atlantic and South Atlantic populations of green sea turtles. Both of these populations are listed as threatened.

#### 4.2.1.6 Critical Habitat

Critical habitat was designated for the North Atlantic DPS of green sea turtle on September 2, 1998 (63 FR 46693) surrounding Culebra Island, Puerto Rico. Seagrasses are the principal dietary component of juvenile and adult green turtles throughout the Wider Caribbean region. The seagrass beds of Culebra consist primarily of turtle grass (*Thalassia testudinum*). The natal beaches of Culebra’s juvenile green turtles have not yet been identified. After emerging from nests on natal beaches, post-hatchlings may move into offshore convergence zones for an undetermined length of time (Carr 1986). Upon reaching approximately 25 to 35 cm carapace length, juvenile green turtles enter benthic feeding grounds in relatively shallow, protected waters (Collazo et al. 1992). The importance of the Culebra archipelago as green turtle developmental habitat has been well documented. Researchers have established that Culebra coastal waters support juvenile and subadult green turtle populations and have confirmed the presence of a small population of adults (Collazo et al. 1992). Additionally, the coral reefs and other topographic features within these waters provide green turtles with shelter during interforaging periods that serve as refuge from predators. No critical habitat has been designated for the South Atlantic DPS.

#### 4.2.1.7 Recovery Goals

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

1) The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years. Nesting data must be based on standardized surveys.

2) At least 25 percent (105 km) of all available nesting beaches (420 km) is in public ownership and encompass at least 50 percent of nesting activity.

3) A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.

4) All priority one tasks have been successfully implemented.

### 4.2.2 Loggerhead Sea Turtle, Northwest Atlantic Distinct Population Segment

#### 4.2.2.1 Species Description

Loggerhead sea turtles (Figure 5) are one of the larger sea turtle species, growing to 113 kg and about 1 m in length. Their shells are reddish-brown on top, but yellow on the bottom shell. They swim (and crawl on land when laying eggs) using four flattened flippers.

Loggerhead sea turtles were listed as threatened under the ESA of 1973 on July 28, 1978 (43 FR 32800). On September 22, 2011, NMFS finalized a relisting of loggerhead sea turtles as 9 separate DPSs. The Northwest Atlantic Ocean DPS was designated as threatened (76 FR 58868) (Table 18).

**Figure 5. Loggerhead sea turtle (*Caretta caretta*). Credit: National Oceanic and Atmospheric Administration.**

**Table 18. Loggerhead sea turtle information bar, Northwest Atlantic Distinct Population Segment.**

| Species | Common Name | Distinct Population Segment | ESA Status | Critical Habitat | Recovery Plan |
|---|---|---|---|---|---|
| *Caretta caretta* | Loggerhead sea turtle | Northwest Atlantic DPS | Threatened 76 FR 58868 09/22/2011 | 79 FR 39856 07/10/2014 | 74 FR 2995 Notice Northwest Atlantic 01/16/2009 |

#### 4.2.2.2 Life History

Loggerheads are long-lived, slow-growing animals that use multiple habitats across entire ocean basins throughout their life history. This complex life history encompasses terrestrial, inshore/estuarine, nearshore, and open ocean habitats. The three basic ecosystems in which loggerheads live are the terrestrial zone, neritic zone, and oceanic zone. Each ecosystem is required for distinct life stages of the sea turtle.

Loggerhead nesting is confined to lower latitudes temperate and subtropic zones but absent from tropical areas (NRC 1990; NMFS and USFWS 1991b; Witherington et al. 2006). The life cycle of loggerhead sea turtles can be divided into seven stages: eggs and hatchlings, small juveniles, large juveniles, subadults, novice breeders, first-year emigrants, and mature breeders (Crouse et al. 1987).

The lifespan of a loggerhead is unknown, but they reach sexual maturity at around 35 years old. Dodd (1988) estimated the maximum female life span at 47-62 years. Females nest from April-September and generally lay 3-5 nests per season and feed on whelks and conch.

#### 4.2.2.3 Population Dynamics

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

*Abundance*

The number of nesting females provides a useful index of the species' population size and stability at this life stage, even though there are doubts about the ability to estimate the overall population size (Bjorndal et al. 2013). An important caveat for population trends analysis based on nesting beach data is that this may reflect trends in adult nesting females, but it may not reflect overall population growth rates well. Adult nesting females often account for less than 1percent of total population numbers.

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).

*Population Growth Rate*

All of the five recovery units in the Northwest Atlantic Ocean DPS are currently in decline or data are insufficient to access trends (TEWG 1998; NMFS 2001). Loggerheads from Northwest Atlantic Ocean DPS nesting aggregations may or may not feed in the same regions from which they hatch. Loggerhead sea turtles from the northern recovery unit, which represents about 9 percent of the loggerhead nests in the western North Atlantic, comprise 25-59 percent of individuals foraging from Georgia up to the northeast U.S. (Sears 1994; Norrgard 1995; Sears et al. 1995; Bass et al. 1998; Rankin-Baransky et al. 1998). 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) and the Mediterranean Sea (where they represent about 45 percent of loggerhead sea turtles captured).

The northern recovery unit along Georgia, South Carolina, and North Carolina has comprehensive survey data (2009-2015) indicating a stable population over this fairly short period (www.seaturtle.org 2016). NMFS scientists have estimated that the northern recovery unit produces 65 percent males (NMFS 2001).

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

*Genetic Diversity*

As with other globally distributed marine species, today's global loggerhead population has been shaped by a sequence of isolation events created by tectonic and oceanographic shifts over geologic time scales, the result of which is population substructuring in many areas (Bowen et al. 1994; Bowen 2003). Globally, loggerhead turtles comprise a mosaic of populations, however, despite these differences, loggerheads from different populations often mix in common foraging grounds, thus creating unique challenges when attempting to delineate distinct population segments for management or listing purposes.

Examining the phylogeography of loggerheads across their global distribution through mtDNA sequence diversity, Bowen et al. (1994) found it to be similar to green turtles, with a separation of loggerheads in the Atlantic-Mediterranean basins from those in the Indo Pacific basins. Mitochondrial DNA data indicate that regional turtle rookeries within an ocean basin have been strongly isolated from one another over ecological timescales (Bowen et al. 1994; Bowen and Karl 2007). Regional genetic populations often are characterized by allelic frequency differences rather than fixed genetic differences. Through the evaluation of genetic data, tagging data, telemetry, and demography, the BRT determined that there are at least nine discrete population segments for loggerhead sea turtles globally. These discrete population segments are markedly separated from each other as a consequence of ecological, behavioral, and oceanographic factors, and given the genetic evidence.

*Spatial Distribution*

Loggerheads are circumglobal occurring throughout the temperate and tropical regions. Loggerheads are the most abundant species of sea turtle found in US coastal waters. Five groupings represent loggerhead sea turtles by major sea or ocean basin: Atlantic, Pacific, and

Indian oceans, as well as Caribbean and Mediterranean seas. As with other sea turtles, populations are frequently divided by nesting aggregation (Hutchinson and Dutton 2007).

Individuals of the Northwest Atlantic Ocean DPS are found north of the equator, south of 60° North latitude, and west of 40° West longitude (76 FR 58868).

#### 4.2.2.4 Status

Federal listing of the loggerhead sea turtle occurred on July 28, 1978 (43 FR 32800). On September 22, 2011, NMFS finalized a relisting of loggerhead sea turtles as 9 separate DPSs (76 FR 58868). Four DPSs have been listed as threatened (Northwest Atlantic, South Atlantic, Southeast Indo-Pacific, and Southwest Indian Ocean) while five are listed as endangered (Northeast Atlantic, Mediterranean Sea, North Indian Ocean, North Pacific, and South Pacific).

The Northwest Atlantic Ocean DPS is listed as threatened and this DPS occurs in the action area of both permits.

#### 4.2.2.5 Status within the Action Area

The action areas for Permit Nos. 20197 and 19627 overlap with the range of the Northwest Atlantic Ocean population of loggerhead sea turtles. This DPS is listed as threatened.

#### 4.2.2.6 Critical Habitat

On July 10, 2014 NMFS, and the U.S. Fish and Wildlife Service designated critical habitat for the Northwest Atlantic DPS for loggerhead sea turtles in waters and beach habitat of the Gulf of Mexico and along the coast of the U.S. Atlantic Ocean (79 FR 39856). USFWS identified critical habitat in terrestrial zones while NMFS identified nearshore areas extending seaward from nesting beaches. Winter, breeding, and migratory habitats are encompassed in the critical habitat designation.

#### 4.2.2.7 Recovery Goals

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

1) Ensure that the number of nests in each recovery unit is increasing and that this increase corresponds to an increase in the number of nesting females.
2) Ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes.
3) Manage sufficient nesting beach habitat to ensure successful nesting.
4) Manage sufficient feeding, migratory, and inter-nesting marine habitats to ensure successful growth and reproduction.
5) Eliminate legal harvest.
6) Implement scientifically based nest management plans.

7) Minimize nest predation.

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

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

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

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

12) Minimize marine debris ingestion and entanglement.

13) Minimize vessel strike mortality.

### 4.2.3 Kemp's Ridley Sea Turtle

#### 4.2.3.1 Species Description

Kemp's ridley sea turtles (Figure 6) live in the ocean and only come onto land to lay eggs. They are grayish-green in color on top but yellow on their bottom shell. Kemp's ridley are the smallest sea turtles, growing to only 60-70 cm long and 45 kg.

The Kemp's ridley sea turtle received protection on December 2, 1970 (35 FR 18319) under the Endangered Species Conservation Act and, since 1973, has been listed as endangered under the ESA (Table 19). Internationally, the Kemp's ridley is considered the most endangered sea turtle (NRC 1990; USFWS 1999).

**Figure 6. Kemp's ridley sea turtle (*Lepidochelys kempii*). Credit: The National Park Service.**

**Table 19. Kemp's ridley sea turtle information bar.**

| Species | Common Name | Distinct Population Segment | ESA Status | Critical Habitat | Recovery Plan |
|---|---|---|---|---|---|
| *Lepidochelys kempii* | Kemp's ridley sea turtle | None | Endangered 35 FR 18319 12/02/1970 | -- | 75 FR 12496 Notice U.S. Caribbean, Atlantic, and Gulf of Mexico (draft) 03/16/2010 |

#### 4.2.3.2 Life History

Adult Kemp's ridleys are considered the smallest marine turtle in the world. Similar to olive ridleys, Kemp's ridleys display one of the most unique synchronized nesting habits in the natural world. Large groups of Kemp's ridleys gather off a particular nesting beach near Rancho Nuevo, Mexico, in the state of Tamaulipas. Then, wave upon wave of females come ashore and nest in what is known as an "arribada," which means "arrival" in Spanish.

There are many theories on what triggers an arribada, including offshore winds, lunar cycles, and the release of pheromones by females. Scientists have yet to conclusively determine the cues for ridley arribadas. Currently, age to sexual maturity is believed to range from approximately 10 to 17 years for Kemp's ridleys (Caillouet Jr. et al. 1995; Schmid and Witzell 1997; Snover et al. 2007). Female Kemp's ridleys nest from May to July, laying two to three clutches of approximately 100 eggs, which incubate for 50-60 days. Kemp's ridleys life history pattern is characterized by three basic ecosystem zones: terrestrial, neritic, and oceanic. Their lifespan is unknown and they primarily feed on crabs, fish, jellyfish, and mollusks.

#### 4.2.3.3 Population Dynamics

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

*Abundance*

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

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 were alive at this time.

*Population Growth Rate*

Average population growth was estimated at 13 percent per year between 1991 and 1995 (TEWG 1998). Nest counts show that the population trend is increasing towards recovery, with an estimate of 4,047 nesters in 2006 and 5,500 in 2007 (NMFS and USFWS 2007b). In 2008, there were 17,882 nests in Mexico, and nesting in 2009 reached 21,144 (Burchfield 2009). In 2010, nesting declined significantly to 12,377 (NMFS 2015a). Estimates of 2011 and 2012 nesting were 18,215 and 18,184 nests, respectively (back to 2009 levels) (Gallaway et al. 2013; NMFS and USWFS 2015). Over one million hatchlings were released in 2011 and 2012 (Gallaway et al. 2013). However, this declined again in 2013 to 13,035 nests and down to 10,987 in 2014 (NMFS and USWFS 2015).

Nesting has also expanded geographically, with a headstart program occurring on Padre Island National Seashore, having begun 1978. Growth remained slow until 1988, when rates of return started to grow slowly (Shaver and Wibbels 2007). Nesting rose from 6 in 1996 to 128 in 2007, 195 in 2008, and 197 in 2009. Texas nesting then experienced a decline similar to that seen in Mexico for 2010, with 141 nests, but nesting rebounded in 2011 with a record 199 nests, 209 in 2012, 153 in 2013, and 119 in 2014 (NMFS and USWFS 2015).

*Genetic Diversity*

Genetic studies examined mtDNA restriction sites and found that the Kemp's ridley is distinct from the olive ridley in matriarchal phylogeny, and that the two species are sister taxa with respect to other marine turtles (Bowen et al. 1991). During further comparisons of mtDNA control region sequences, Bowen et al. (1998) confirmed a fundamental partition between the two species. A few turtles that phenotypically appeared to be hybrids between Kemp's ridley and loggerhead turtles, and Kemp's ridley and green turtles, have been observed nesting in Tamaulipas, Mexico.

Kichler (1996a, b) and Kichler et al. (1999) found Kemp's ridleys nesting in Rancho Nuevo to be polyandrous, in many cases with up to four fathers in one clutch and three fathers in 14 of the clutches (n=211) examined. Kichler (1996a) found allele heterozygosity at a few loci and concluded that there was not much difference in Kemp's ridley and olive ridley and that "The decline in the Kemp's ridley population does not appear to have been severe enough to affect their genetic health". However, Stephens (2003) concluded that Kemp's ridley sustained a measurable loss of genetic variation due to the demographic bottleneck. Nevertheless, Kichler (1996a) showed that the genetic variability as measured by heterozygosis at microsatellite loci is high (H=0.60), which indicates that the demographic bottleneck has occurred too fast to be detected even with highly variable markers. If this conclusion holds, the rapid population increase in the Kemp's ridley over one or two generations will likely prevent any negative consequence in the genetic variability of the species. Dutton et al. (2006) examined mtDNA control region sequences from 42 Kemp's ridley females that nested at Padre Island National Seashore (PAIS) between 2002 and 2004 and compared haplotype frequencies with those from the Rancho Nuevo population in order to test for a shift in haplotype frequencies that might indicate a possible founder event. They identified a total of six distinct haplotypes, with one found at high frequency both at PAIS and Rancho Nuevo.

*Spatial Distribution*

The Kemp's ridley was formerly known only from the Gulf of Mexico and along the Atlantic coast of the U.S. (TEWG 2000). However, recent records support Kemp's ridley sea turtles distribution extending into the Mediterranean Sea on occasion (Tomas and Raga 2008). The vast majority of individuals stem from breeding beaches at Rancho Nuevo on the Gulf of Mexico coast of Mexico, with some reintroduction resulting in nesting in Texas (Shaver and Caillouet Jr. 2015). Kemp's ridley sea turtles are considered to be a single population, although expansion of nesting may indicate differentiation.

### 4.2.3.4 Status

The Kemp's ridley sea turtle received protection on December 2, 1970 (35 FR 18319) under the Endangered Species Conservation Act and has been listed as endangered range-wide.

### 4.2.3.5 Status within the Action Area

Kemp's ridleys are distributed throughout the Gulf of Mexico and U.S. Atlantic seaboard, from Florida to New England. A few records exist for Kemp's ridleys near the Azores, waters off Morocco, and within the Mediterranean Sea. There is only one confirmed Kemp's ridley arribada in the state of Tamaulipas, Mexico, where nearly 95 percent of worldwide Kemp's ridley nesting occurs. Permit No. 20197 overlaps with the Kemp's ridley range along the Atlantic coast of the U.S. while Permit No. 19627 overlaps with the Atlantic coast as well as within the Gulf of Mexico basin.

#### 4.2.3.6 Critical Habitat

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

#### 4.2.3.7 Recovery Goals

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

1) A population of at least 10,000 nesting females in a season (as estimated by clutch frequency per female per season) distributed at the primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) in Mexico is attained. Methodology and capacity to implement and ensure accurate nesting female counts have been developed.
2) Recruitment of at least 300,000 hatchlings to the marine environment per season at the three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) in Mexico is attained to ensure a minimum level of known production through in situ incubation, incubation in corrals, or a combination of both.
3) An average population of at least 40,000 (Hildebrand 1963) nesting females per season (as measured by clutch frequency per female per season and annual nest counts) over a 6-year period distributed among nesting beaches in Mexico and the U.S. is attained. Methodology and capacity to ensure accurate nesting female counts have been developed and implemented.
4) Ensure average annual recruitment of hatchlings over a 6-year period from in situ nests and beach corrals is sufficient to maintain a population of at least 40,000 nesting females per nesting season distributed among nesting beaches in Mexico and the U.S into the future. This criterion may rely on massive synchronous nesting events (i.e., arribadas) that will swamp predators as well as rely on supplemental protection in corrals and facilities.

### 4.2.4 Leatherback Sea Turtle

#### 4.2.4.1 Species Description

Leatherback sea turtles (Figure 7) are by far the largest sea turtle and the heaviest of all reptiles. They can weigh 900 kg and be over 2 m long. Unlike all other sea turtles, they do not have a hard outer shell, but rather a tough black leathery hide (except for it being white on the animal's underside).

**Figure 7. Leatherback sea turtle. Credit: R. Tapilatu.**

Leatherback sea turtles received protection on June 2, 1970 (35 FR 8491) under the Endangered Species Conservation Act and, since 1973, have been listed as endangered under the ESA (Table 20).

**Table 20. Leatherback sea turtle information bar.**

| Species | Common Name | Distinct Population Segment | ESA Status | Critical Habitat | Recovery Plan |
|---|---|---|---|---|---|
| *Dermochelys coriacea* | Leatherback sea turtle | None | Endangered 35 FR 8491 06/02/1970 | 44 FR 17710 03/23/1979 | 63 FR 28359 Notice U.S. Caribbean, Atlantic, and Gulf of Mexico 10/29/1991 |

#### 4.2.4.2 Life History

The leatherback is the largest turtle and one of the largest living reptiles in the world. Females lay clutches of approximately 100 eggs several times during a nesting season, typically at 8-12 day intervals. Their diet consists of soft-bodied animals, such as jellyfish, salps, and pyrosomes.

Leatherbacks reach sexual maturity somewhat faster than other sea turtles (except Kemp's ridley), with estimated ranges of 3-6 years (Rhodin 1985) and 13-14 years (Zug and Parham 1996). However, recent research suggests otherwise, with western North Atlantic leatherbacks possibly not maturing until as late as 29 years of age (Avens and Goshe 2008; Avens et al. 2009). Female leatherbacks nest frequently (average of 5-7 nests per nesting year [but up to 13 nests/year] and about every 2-3 years) (Eckert et al. 2012). However, up to about 30 percent of the eggs can be infertile. Thus, the actual proportion of eggs that can result in hatchlings is less than this seasonal estimate. The eggs incubate for 55-75 days before hatching. Female leatherbacks remigrate to their respective nesting sites at 2-3 year intervals.

#### 4.2.4.3 Population Dynamics

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

*Abundance*

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

*Population Growth Rate*

Although the leatherback populations in the Caribbean and Atlantic Ocean are generally stable or increasing, the situation in the Pacific Ocean is dire: in recent decades, Western Pacific leatherbacks have declined more than 80 percent and Eastern Pacific leatherbacks have declined by more than 97 percent. Because adult female leatherbacks frequently nest on different beaches, nesting population estimates and trends are especially difficult to monitor.

Western pacific and Eastern Pacific leatherbacks continue to decline. Western Pacific leatherbacks have declined more than 80 percent over the last three generations, and Eastern Pacific leatherbacks have declined by more than 97 percent over the last three generations. Of the Eastern Pacific leatherbacks, the Mexico nesting population -- once considered to be the world's largest with 65 percent of the worldwide population -- is now less than one percent of its estimated size in 1980.

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

*Genetic Diversity*

The leatherback is unique among sea turtles because it is the only extant survivor of an evolutionary lineage that diverged from other sea turtles 100-150 million years ago (Zangerl 1980). Extinctions during the Pleistocene glaciations most likely reduced leatherbacks to a single lineage (Dutton 2004; Dutton et al. 1999). Analysis of maternally inherited mtDNA indicates an ancestral separation between the Atlantic and Indo-Pacific Ocean (Duchene et al. 2012).

Leatherbacks exhibit low genetic diversity in the mitochondrial genome (Dutton et al. 1996; 1999). The most divergent mtDNA haplotypes occur between the western Atlantic Ocean (Florida, Costa Rica, Trinidad, French Guiana/Suriname, St. Croix) and the eastern Pacific Ocean (Costa Rica, Mexico) (Dutton et al. 1999). Hypotheses for low genetic diversity include population bottlenecks due to recent extinction, selection pressure that led to the replacement of recent ancestral mtDNA, and insufficient time to accumulate new mutations at the population level (Dutton et al. 1999). Furthermore, low genetic diversity may be linked to infrequent or no multiple paternity within or among successive clutches of a female (Curtis 1998; Dutton and Davis 1998; Rieder et al. 1998; Dutton et al. 2000; Crim et al. 2002) suggesting that perhaps females rarely encounter multiple males or that sperm competition may occur (Dutton et al. 2000).

In the Atlantic Ocean, previous genetic analyses resulted in an earlier determination that within the Atlantic basin there are at least three genetically different nesting populations: the St. Croix nesting population (US Virgin Islands), the mainland nesting Caribbean population (Florida, Costa Rica, Suriname/French Guiana), and the Trinidad nesting population (Dutton et al. 1999). Further genetic analyses have resulted in Atlantic Ocean leatherbacks now being divided into seven groups or breeding populations: Florida, Northern Caribbean, Western Caribbean, Southern Caribbean/Guianas, West Africa, South Africa, and Brazil (TEWG 2007).

*Spatial Distribution*

Leatherbacks occur throughout marine waters, from nearshore habitats to oceanic environments (Schroeder and Thompson 1987; Shoop and Kenney 1992; Grant and Ferrell 1993; Starbird et al. 1993). Movements are largely dependent upon reproductive and feeding cycles and the oceanographic features that concentrate prey, such as frontal systems, eddy features, current boundaries, and coastal retention areas.

The global population of leatherbacks comprises seven biologically and geographically subpopulations, which are located in the Atlantic, Pacific, and Indian Ocean. The subpopulations with ranges overlapping U.S. territory are the West Pacific, East Pacific, and Northwest Atlantic leatherbacks. Western Pacific leatherbacks feed off the Pacific Coast of North America, and migrate across the Pacific to nest in Malaysia, Indonesia, Papua New Guinea, and the Solomon Islands. Eastern Pacific leatherbacks, on the other hand, nest along the Pacific coast of the Americas in Mexico and Costa Rica.

#### 4.2.4.4 Status

Leatherback sea turtles received protection on June 2, 1970 (35 FR 8491) under the Endangered Species Conservation Act and have been listed as endangered.

#### 4.2.4.5 Status within the Action Area

The Atlantic northwest subpopulation of leatherback sea turtle overlaps with the action areas of Permit Nos. 20197 and 19627. The species is listed range-wide as endangered.

#### 4.2.4.6 Critical Habitat

NMFS designated critical habitat to provide protection for endangered leatherback sea turtles along the U.S. West Coast on January 26, 2012 (77 FR 4170). In 1979, critical habitat was designated for leatherback turtles to include the coastal waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands (44 FR 17710).

#### 4.2.4.7 Recovery Goals

See the 1991Recovery Plan for the U.S. Caribbean, Atlantic, and Gulf of Mexico for complete down-listing criteria for the following recovery goals:

1) The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico, St. Croix, USVI, and along the east coast of Florida.
2) Nesting habitat encompassing at least 75 percent of nesting activity in USVI, Puerto Rico and Florida is in public ownership.
3) All priority one tasks have been successfully implemented.

### 4.2.5 Hawksbill Sea Turtle

#### 4.2.5.1 Species Description

Hawksbill sea turtles (Figure 8) are adapted to live in the ocean, like all other sea turtles, and come onto land only to lay eggs. They are the second-smallest sea turtle, growing to only 65-90 cm in length and 45-70 kg. They get their name from the curved tip of their upper beak, which is more pronounced than in other sea turtle species. The top of the shell is golden brown, streaked with orange, red, and/or black while the bottom shell is yellowish.

**Figure 8. Hawksbill sea turtle, *Eretmochelys imbricata*. Credit: Jordan Wilkerson.**

Hawksbill sea turtles received protection on June 2, 1970 (35 FR 8491) under the Endangered Species Conservation Act and, since 1973, have been listed as endangered under the ESA (Table 21).

**Table 21. Hawksbill sea turtle information bar.**

| Species | Common Name | Distinct Population Segment | ESA Status | Critical Habitat | Recovery Plan |
|---|---|---|---|---|---|
| *Eretmochelys imbricata* | Hawksbill sea turtle | None | Endangered<br>35 FR 8491<br>06/02/1970 | 63 FR 46693<br>09/02/1998 | 57 FR 38818 Notice<br>U.S. Caribbean, Atlantic, and Gulf of Mexico<br>08/27/1992 |

#### 4.2.5.2 Life History

The best estimate of age at sexual maturity for hawksbill sea turtles is 20-40 years (Chaloupka and Limpus 1997; Crouse 1999). Reproductive females undertake periodic (usually non-annual) migrations to their natal beaches to nest. Movements of reproductive males are less well known, but are presumed to involve migrations to their nesting beach or to courtship stations along the migratory corridor (Meylan 1999). Females nest an average of 3-5 times per season (Meylan and Donnelly 1999; Richardson et al. 1999). Their clutch size is up to 250 eggs, which is larger than that of other sea turtles (Hirth 1980).

The life history of hawksbills consists of a pelagic stage that lasts from hatching until they are approximately 22-25 cm straight carapace length (Meylan 1988; Meylan and Donnelly 1999), followed by residency in coastal developmental habitats. Growth accelerates early on until turtles reach 65-70 cm in curved carapace length, and growth slows to negligible amounts after 80 cm (Bell and Pike 2012). As with other sea turtles, growth is variable and likely depends on nutrition available (Bell and Pike 2012). Juvenile hawksbills along the British Virgin Islands grow at a relatively rapid rate of roughly 9.3 cm per year and gain 3.9 kg annually (Hawkes et al. 2014b).

#### 4.2.5.3 Population Dynamics

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

*Abundance*

Although no historical records of abundance are known, hawksbill sea turtles are considered to be severely depleted due to the fragmentation and low use of current nesting beaches (NMFS and USFWS 2007a). Worldwide, an estimated 21,212-28,138 hawksbills nest each year among 83 sites. Genetics supports roughly 6,000-9,000 adult females within the Caribbean (Leroux et al. 2012). Hatchlings in Brazil exhibit a strong female bias of 89-96 percent (dei Marcovaldi et al. 2014).

*Population Growth Rate*

Among the 58 sites for with historic trends, all show a decline during the past 20 to 100 years. Among 42 sites for which recent trend data are available, 10 (24 percent) are increasing, three (7 percent) are stable, and 29 (69 percent) are decreasing.

In the Atlantic, population increase has been greater in the Insular Caribbean than along the Western Caribbean Mainland or the eastern Atlantic (including Sao Tomé and Equatorial Guinea). Nesting populations of Puerto Rico appeared to be in decline until the early 1990's, but have universally increased during the survey periods. Mona Island now hosts 199-332 nesting females annually, and the other sites combined host 51-85 nesting females annually (NMFS and USFWS 2007a). The U.S. Virgin Islands have a long history of tortoiseshell trade (Schmidt 1916). At Buck Island Reef National Monument, protection has been in force since 1988, and during that time, hawksbill nesting has increased by 143 percent to 56 nesting females annually, with apparent spill over to beaches on adjacent St. Croix. However, St. John populations did not increase, perhaps due to the proximity of the legal turtle harvest in the British Virgin Islands. Populations have also been identified in Belize and Brazil as genetically unique (Hutchinson and Dutton 2007). An estimated 50-200 nests are laid per year in the Guinea-Bissau (Catry et al. 2009).

*Genetic Diversity*

Populations are distinguished generally by ocean basin and more specifically by nesting location. Our understanding of population structure is relatively poor. For example, 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 100,000-300,000 years ago based on genetic data (Leroux et al. 2012).

*Spatial Distribution*

The hawksbill has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical waters of the Atlantic Ocean. Satellite tagged turtles have shown significant variation in movement and migration patterns. In the Caribbean, distance traveled between nesting and foraging locations ranges from a few kilometers to a few hundred kilometers (Byles and Swimmer 1994; Miller et al. 1998; Hillis-Starr et al. 2000; Horrocks et al. 2001; Prieto et al. 2001; Lagueux et al. 2003).

#### 4.2.5.4 Status

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

#### 4.2.5.5 Status within the Action Area

The hawksbill range includes the U.S. Atlantic coast, Gulf of Mexico, and Caribbean. Permit Nos. 20197 and 19627 have action areas that overlap with the hawksbill range as it is currently listed as endangered.

#### 4.2.5.6 Critical Habitat

Critical habitat was designated on September 2, 1998 for hawksbill turtles in the coastal waters surrounding Mona and Monito Islands, Puerto Rico.

#### 4.2.5.7 Recovery Goals

See the 1992 Recovery Plan for the U.S. Caribbean, Atlantic, and Gulf of Mexico for complete down-listing criteria for the following recovery goals over a period of 25 years:

1) The adult female population is increasing, as evidenced by statistically significant trend in the annual number of nests on at least five index beaches, including Mona Island and the Buck Island Reef National Monument.
2) Habitat for at least 50 percent of the nesting activity that occurs in the USVI and Puerto Rico is protected in perpetuity.
3) Numbers of adults, subadults, and juveniles are increasing, as evidenced by a statistically significant trend on at least five key foraging areas within Puerto Rico, USVI, and Florida.
4) All priority one tasks have been successfully implemented

### 4.2.6 Olive Ridley Sea Turtle

#### 4.2.6.1 Species Description

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

**Figure 9. Olive ridley sea turtle, *Lepidochelys olivacea*. Credit: Robert Pitman, National Oceanic and Atmospheric Administration.**

The olive ridley sea turtle was listed July 28, 1978 as two populations: the breeding colony populations on Pacific coast of Mexico as endangered and all other populations as threatened (43 FR 32800) (Table 22).

**Table 22. Olive ridley sea turtle information bar.**

| Species | Common Name | Distinct Population Segment | ESA Status | Critical Habitat | |
|---|---|---|---|---|---|
| *Lepidochelys olivacea* | Olive ridley sea turtle | None | Threatened 43 FR 32800 07/28/1978 | -- | 63 FR 28359 Notice (Pacific population only) |

#### 4.2.6.2 Life History

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

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

#### *4.2.6.3* Population Dynamics

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

*Abundance*

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

*Population Growth Rate*

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

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

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

*Genetic Diversity*

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

*Spatial Distribution*

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

#### 4.2.6.4 Status

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

#### *4.2.6.5* Status within the Action Area

The action area of Permit No. 19627 includes the Caribbean Sea which is within the range of the olive ridley sea turtle. This population is currently listed as threatened.

#### 4.2.6.6 Critical Habitat

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

#### 4.2.6.7 Recovery Goals

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

1) All regional stocks that use U.S. waters have been identified to source beaches based on reasonable geographic parameters.
2) Foraging populations are statistically significantly increasing at several key foraging grounds within each stock region.
3) All females estimated to nest annually at "source beaches" are either stable or increasing for over 10 years.
4) A management plan based on maintaining sustained populations for turtles is in effect.
5) International agreements are in place to protect shared stocks.

# 5 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 CFR 402.02).

## 5.1 Climate Change

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

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

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

For sea turtles, temperature regimes generally lead toward female-biased nests (Hill et al. 2015). For sea turtles nesting in the Caribbean, temperature projections in 2030 suggest less than 3 percent of hatchlings will be male in leatherback, hawksbill, and green sea turtles; all of these are 36 percent male or less at present (Laloë et al. 2016). This can result in heavily feminized populations incapable of fertilization of available females(Laloë et al. 2014). This is not considered to be imminent and presently has the advantage of shifting the natural rates of population growth higher (Laloë et al. 2014). Fecundity of hatchlings from the Gulf of Mexico can also be influenced by nest temperatures (Lamont and Fujisaki 2014). Oceanographic models project a weakening of the thermohaline circulation resulting in a reduction of heat transport into high latitudes of Europe as well as an increase in the mass of the Antarctic and Greenland ice sheets, although the magnitude of these changes remain unknown.

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

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

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

Climactic shifts also occur because of natural phenomena. In the North Atlantic, this primarily concerns fluctuations in the North Atlantic Oscillation which results from changes in atmospheric pressure between a semi-permanent high pressure feature over the Azores and a subpolar low pressure area over Iceland (Hurrell 1995; Curry and McCartney 2001; Stenseth et al. 2002). This interaction affects sea surface temperatures, wind patterns, and oceanic circulation in the North Atlantic (Stenseth et al. 2002). This can change the oceanographic characteristics of hawksbill sea turtle habitat, which could affect the ability of areas to support foraging, breeding, or other vital life history parameters. Fluctuations in North Atlantic sea surface temperature are linked with variations in hawksbill nesting in the southern Gulf of Mexico (del Monte-Luna et al. 2012).

## 5.2 Habitat Degradation

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

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

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

For sea turtles, marine debris is a problem due primarily to individuals ingesting debris and blocking the digestive tract, causing death or serious injury (Lutcavage et al. 1997; Laist et al. 1999). Schuyler et al. (2015) estimated that, globally, 52 percent of individual sea turtles have ingested marine debris. Gulko and Eckert (2003) estimated that between one-third and one-half of all sea turtles ingest plastic at some point in their lives; this figure is supported by data from Lazar and Gracan (2011), who found 35 percent of loggerheads had plastic in their gut. A Brazilian study found that 60 percent of stranded green sea turtles had ingested marine debris (Bugoni et al. 2001). Loggerhead sea turtles had a lesser frequency of marine debris ingestion.

Plastic is possibly ingested out of curiosity or due to confusion with prey items. Marine debris consumption has been shown to depress growth rates in post-hatchling loggerhead sea turtles, elongating the time required to reach sexual maturity and increasing predation risk (McCauley and Bjorndal 1999). Sea turtles can also become entangled and die in marine debris, such as discarded nets and monofilament line (NRC 1990; Lutcavage et al. 1997; Laist et al. 1999).

## 5.3 Fisheries

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

*Federal Activities*

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

The only fishery that has been determined by NMFS to reduce the reproduction, numbers, or distribution of ESA-listed sea turtles, and thereby reduce appreciably their likelihood of survival and recovery, is the pelagic longline component of the Atlantic highly migratory species fishery.

On June 14, 2001, NMFS released a biological opinion that found that the continued operation of the Atlantic pelagic longline fishery was likely to jeopardize the continued existence of both loggerhead and leatherback sea turtles. To avoid jeopardy to these species, a Reasonable and Prudent Alternative (RPA) was developed. The RPA required the closure of the Northeast Distant Statistical Area of the Atlantic Ocean to pelagic longlining and the enactment of a research program to develop or modify fishing gear and techniques to reduce sea turtle interactions and mortality associated with such interactions. On June 1, 2004, NMFS released another Opinion on the Atlantic pelagic longline fishery which stated that the fishery was still likely to jeopardize the continued existence of leatherback sea turtles. Another RP A was then developed to attempt to remove jeopardy. The RPA required that NMFS (1) reduce post-release mortality of leatherbacks, (2) improve monitoring of the effects of the fishery, (3) confirm the effectiveness of the hook and bait combinations that are required as part of the proposed action, and (4) take management action to avoid long-term elevations in leatherback takes or mortality. NMFS stated in the Opinion that this RP A must be implemented in its entirety to avoid jeopardy. A brief summary of each consultation is provided below but more detailed information can be found in the respective biological opinions.

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

NMFS' consultation on the Atlantic Herring fishery FMP concluded that the federal herring fishery may adversely affect loggerhead, leatherback, Kemp's ridley, and green sea turtles as a result of capture in gear used in the fishery, but not jeopardize their continued existence. NMFS currently authorizes the use of trawl, purse seine, and gillnet gear in the commercial herring fishery (64 FR 4030). There is no direct evidence of takes of ESA-listed species in the herring fishery from the NMFS sea sampling program. However, observer coverage of this fishery has been minimal. Sea turtles have been captured in comparable gear used in other fisheries that occur in the same area as the herring fishery. Consultation on the Atlantic herring fishery was reinitiated on March 23, 2005 due to new information on the effects of the fishery on the Gulf of Maine DPS of Atlantic salmon and sea turtles. That consultation was completed in February 2010 and determined that the herring fishery is not likely to adversely affect any ESA-listed species, including sea turtles. Murray (2006) estimated zero sea turtle takes in trawl gear by the Atlantic herring fishery. In addition, over the 5 year period from 2004-2008, higher than normal observer coverage occurred in the herring fishery, without any observed takes of sea turtles.

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

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

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

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

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

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

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

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

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

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

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

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

The primary gear types for the Spiny dogfish fishery are sink gillnets, otter trawls, bottom long line, and driftnet gear (NMFS 2010d). Spiny dogfish are landed in every state from Maine to North Carolina, throughout a broad area with the distribution of landings varying by area and season. During the fall and winter months, spiny dogfish are captured principally in Mid-Atlantic waters from New Jersey to North Carolina. During the spring and summer months, spiny dogfish are landed mainly in northern waters from NY to ME. Sea turtles can be incidentally captured in all gear sectors of this fishery. Although there have been delays in implementing the FMP, quota allocations are expected to be substantially reduced over the 4.5-year rebuilding schedule; this should result in a substantial decrease in effort directed at spiny dogfish. The reduction in effort should be of benefit to protected turtle species by reducing the number of gear interactions that occur.

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

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

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

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

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

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

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

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

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

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

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

*State or Private Fisheries*

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

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

A detailed summary of the gillnet fisheries currently operating along the mid-and southeast U.S. Atlantic coastline, which are known to incidentally capture loggerheads, can be found in the TEWG report (2000). Although all or most nearshore gillnetting is prohibited by state regulations in state waters of South Carolina, Georgia, Florida, Louisiana, and Texas, gillnetting in other states' waters and in federal waters does occur. Of particular concern are the nearshore and inshore gillnet fisheries of the mid-Atlantic operating in Rhode Island, Connecticut, New

York, New Jersey, Delaware, Maryland, Virginia, and North Carolina state waters and/or federal waters. Incidental captures in these gillnet fisheries (both lethal and non-lethal) of loggerhead, leatherback, green and Kemp's ridley sea turtles have been reported. In addition, illegal gillnet incidental captures have been reported in South Carolina, Florida, Louisiana and Texas (NMFS SEFSC 2001).

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

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

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

## 5.4 Dredging

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

### 5.5 U.S. Military Activities

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

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

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

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

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

In 2013, NMFS issued a biological opinion to the US Navy on all testing and training activities in the Atlantic basin and Gulf of Mexico (Table 23) (NMFS 2013a). These actions would include the same behavioral and hearing loss effects as described above, but would also include other sub-lethal injuries that lead to fitness consequences and mortality that can lead to the loss of individuals from their populations.

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

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

## 5.6 Pollutants

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

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

### 5.7 Oil Spills and Releases

Oil pollution has been a significant concern in the Gulf of Mexico for several decades due to the large amount of extraction and refining activity in the region. Routine discharges into the northern Gulf of Mexico (not including oil spills) include roughly 88,200 barrels of petroleum per year from municipal and industrial wastewater treatment plants and roughly 19,250 barrels from produced water discharged overboard during oil and gas operations (MMS 2007b; USN 2008). These sources amount to over 100,000 barrels of petroleum discharged into the northern Gulf of Mexico annually. Although this is only 10 percent of the amount discharged in a major oil spill, such as the Exxon Valdez spill (roughly 1 million barrels), this represents a significant and “unseen” threat to Gulf of Mexico wildlife and habitats. Generally, accidental oil spills may amount to less than 24,000 barrels of oil discharged annually in the northern Gulf of Mexico, making non-spilled oil normally one of the leading sources of oil discharge into the Gulf of Mexico, although incidents such as the 2010 Deepwater Horizon incident are exceptional (MMS 2007b). The other major source from year to year is oil naturally seeping into the northern Gulf of Mexico. Although exact figures are unknown, natural seepage is estimated at between 120,000 and 980,000 barrels of oil annually (MacDonald et al. 1993; MMS 2007b).

Although non-spilled oil is the primary contributor to oil introduced into the Gulf of Mexico, concern over accidental oil spills is well-founded (Campagna et al. 2011). Over five million barrels of oil and one million barrels of refined petroleum products are transported in the northern Gulf of Mexico daily (MMS 2007b); worldwide, it is estimated that 900,000 barrels of oil are released into the environment as a result of oil and gas activities (Epstein and Selber 2002). Even if a small fraction of the annual oil and gas extraction is released into the marine environment, major, concentrated releases can result in significant environmental impacts. Oil released into the marine environment contains aromatic organic chemicals known to be toxic to a variety of marine life; these chemicals tend to dissolve into the air to a greater or lesser extent, depending on oil type and composition (Yender et al. 2002).

Several oil spills have affected the northern Gulf of Mexico over the past few years, largely due to hurricanes. The impacts of Hurricane Ivan in 2004 on the Gulf Coast included pipeline damage causing 16,000 barrels of oil to be released and roughly 4,500 barrels of petroleum products from other sources (USN 2008). The next year, Hurricane Katrina caused widespread damage to onshore oil storage facilities, releasing 191,000 barrels of oil (LHR 2010). Another 4,530 barrels of oil were released from 70 other smaller spills associated with hurricane damage. Shortly thereafter, Hurricane Rita damaged offshore facilities resulting in 8,429 barrels of oil released (USN 2008).

Major oil spills have impacted the Gulf of Mexico for decades (NMFS 2010i). Until 2010, the largest oil spill in North America (Ixtoc oil spill) occurred in the Bay of Campeche (1979), when a well “blew out,” allowing oil to flow into the marine environment for nine months, releasing 2.8-7.5 million barrels of oil. Oil from this release eventually reached the Texas coast, including the Kemp's ridley sea turtle nesting beach at Rancho Nuevo, where 9,000 hatchlings were airlifted and released offshore (NOAA 2010). Over 7,600 cubic meters of oiled sand was eventually removed from Texas beaches, and 200 gallons of oil were removed from the area around Rancho Nuevo (NOAA 2010). Eight dead and five live sea turtles were recovered during the oil spill event; although causes of deaths were not determined, oiling was suspected to play a part (NOAA 2010). Also in 1979, the oil tanker Burmah Agate collided with another vessel near Galveston, Texas, causing an oil spill and fire that ultimately released 65,000 barrels of oil into estuaries, beachfronts, and marshland along the northern and central Texas coastline (NMFS 2010i). Clean up of these areas was not attempted due to the environmental damage such efforts would have caused. Another 195,000 barrels of oil are estimated to have been burned in a multi-month-long fire aboard the Burmah Agate (NMFS 2010i). The tanker Alvenus grounded in 1984 near Cameron, Louisiana, spilling 65,500 barrels of oil, which spread west along the shoreline to Galveston (NMFS 2010i). One oiled sea turtle was recovered and released (NOAA 2010). In 1990, the oil tanker Megaborg experienced an accident near Galveston during the lightering process and released 127,500 barrels of oil, most of which burned off in the ensuing fire (NMFS 2010i).

On April 20 2010, a fire and explosion occurred aboard the semisubmersible drilling platform Deepwater Horizon roughly 80 km southeast of the Mississippi Delta. The platform had 17,500 barrels of fuel aboard, which likely burned, escaped, or sank with the platform. However, 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 US 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. Although estimates vary, roughly 4.1 million barrels of oil were released directly into the Gulf of Mexico (USDOI 2012). During surveys in offshore oiled areas, 1,050 sea turtles were seen and half of these were captured. Of the 520 sea turtles captured, 394 showed signs of being oiled (Witherington et al. 2012). A large majority of these were juveniles, mostly green (311) and Kemp's ridley sea turtles (451). An additional 78 adult or subadult loggerheads were observed (Witherington et al. 2012). Captures of sea turtles along the Louisiana's Chandeleur Islands in association with emergency sand berm construction resulted in 185 loggerheads, eight Kemp's ridley, and a single green sea turtle being captured and relocated (Dickerson and Bargo 2012). In addition, 274 nests along the Florida panhandle were relocated that ultimately produced 14,700 hatchlings, but also had roughly 2 percent mortality associated with the translocation (MacPherson et al. 2012). Females that laid these nests continued to forage in the area, which was exposed to the footprint of the oil spill (Hart et al. 2014). Large areas of Sargassum were affected, with some heavily oiled or dispersant-coated Sargassum sinking and other areas accumulating oil where sea turtles could inhale, ingest, or contact it (USDOI 2012; Powers et al. 2013). Of 574 sea turtles observed in these Sargassum areas, 464 were oiled (USDOI 2012).

Use of dispersants can increase oil dispersion, raising the levels of toxic constituents in the water column, but speeding chemical degradation overall (Yender et al. 2002). Although the effects of dispersant chemicals on sea turtles is unknown, testing on other organisms have found currently used dispersants to be less toxic than those used in the past (NOAA 2010). It is possible that dispersants can interfere with surfactants in the lungs (surfactants prevent the small spaces in the lungs from adhering together due to surface tension, facilitating large surface areas for gas exchange), as well as interfere with digestion, excretion, and salt gland function (NOAA 2010). The most toxic chemicals associated with oil can enter marine food chains and bioaccumulate in invertebrates such as crabs and shrimp to a small degree (prey of some sea turtles) (Law and Hellou 1999), but generally do not bioaccumulate or biomagnify in finfish (Varanasi et al. 1989; Meador et al. 1995; Yender et al. 2002). 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 2010), ultimately reducing growth, reproductive success, as well as increasing mortality and predation risk (Fraser 2014). Tarballs were found in the digestive tracts of 63 percent of post hatchling loggerheads in 1993 following an oil spill and 20 percent of the same species and age class in 1997 (Fraser 2014). Oil exposure can also cause acute damage on direct exposure to oil, 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 2010). Nearshore spills or large offshore spills can oil beaches on which sea turtles lay their eggs, causing birth defects or mortality in the nests (NOAA 2010).

Oil can also cause indirect effects to sea turtles through impacts to habitat and prey organisms. 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)s. 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 2010). 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 2010). Furthermore, Kemp’s ridley and loggerhead sea turtles, which commonly forage on crustaceans and mollusks, may ingest large amounts of oil due oil adhering to the shells of these prey and the tendency for these organisms to bioaccumulate the toxins found in oil (NOAA 2010). It is suspected that oil adversely affected the symbiotic bacteria in the gut of herbivorous marine iguanas when the Galapagos Islands experienced an oil spill, contributing to a more than 60 percent decline in local populations the following year. The potential exists for green sea turtles to experience similar impacts, as they also harbor symbiotic bacteria to aid in their digestion of plant material (NOAA 2010). Dispersants are believed to be as toxic to marine organisms as oil itself.

## 5.8 Entrainment, Entrapment, and Impingement in Power Plants

There are dozens of power plants in coastal areas of the action area, from South Carolina to Texas (Muyskens et al. 2015). Sea turtles have been affected by operation of cooling-water systems of electrical generating plants. We do not have data for many of these, but have reason to believe that impacts to particularly loggerhead and green sea turtles may be important. For example, in over 40 years of operation at the St. Lucie Nuclear Power Plant in Florida, 16,600 sea turtles have been captured to avoid being drawn into cooling structures (which likely would kill sea turtles that enter), and 297 have died (NMFS 2016). 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 2016). 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 2016).

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.

## 5.9 Seismic Surveys and Oil and Gas Development

The northern Gulf of Mexico is the location of massive industrial activity associated with oil and gas extraction and processing. Over 4,000 oil and gas structures are located outside of state waters in the northern Gulf of Mexico; 90 percent of these occur off Louisiana and Texas (USN 2009). This is both detrimental and beneficial for sea turtles. These structures appreciably increase the amount of hard substrate in the marine environment and provide shelter and foraging opportunities for species like loggerhead sea turtles (Parker Jr. et al. 1983; Stanley and Wilson 1989). However, the Bureau of Ocean Energy Management requires that structures must be removed within one year of lease termination. Many of these structures are removed by explosively severing the underwater supportive elements, which produces a shock wave that kills, injures, or disrupts marine life in the blast radius (Gitschlag et al. 1997). For sea turtles, this means death or serious injury for individuals within a few hundred meters of the structure and overt behavioral (potentially physiological) impacts for individuals further away from the structure (Duronslet et al. 1986; Klima et al. 1988). Although observers and procedures are in place to mitigate impacts to sea turtles (i.e., not blasting when sea turtles are present), not all sea turtles are observed all the time, and low-level sea turtle injury and mortality still occurs (Gitschlag and Herczeg 1994; Gitschlag et al. 1997). Two loggerheads were killed in August 2010, and one Kemp's ridley was killed in July 2013, along with several additional stunning or sub-lethal injuries reported over the past five years. In an August 28, 2006 Opinion, NMFS issued incidental take for Bureau of Ocean Energy Management-permitted explosive structure removals (NMFS 2006a). These levels were far surpassed by the *Deepwater Horizon* incident.

## 5.10 Hurricanes

The Gulf of Mexico is prone to major tropical weather systems, including tropical storms and hurricanes. The impacts of these storms on sea turtles in the marine environment is not known, but storms can cause major impacts to sea turtle eggs on land, as nesting frequently overlaps with hurricane season, particularly Kemp's ridley sea turtles (NRC 1990). Embryos (in eggs) or hatchlings can drown during heavy rainfalls, and major topographic alteration to beaches can cause hatchlings to die by preventing their entry to marine waters (NRC 1990). Kemp's ridley sea turtles are likely highly sensitive to hurricane impacts, as their only nesting locations are in a limited geographic area along southern Texas and northern Mexico (Milton et al. 1994).

## 5.11 Vessel Strikes

Potential sources of adverse effects from federal vessel operations in the action area and throughout the range of sea turtles include operations of the U.S. Navy (USN) and Coast Guard (USCG), which maintain the largest Federal vessel fleets, the Environmental Protection Agency, the National Oceanic and Atmospheric Administration (NOAA), and the Army Corps of Engineers. NMFS has conducted formal consultations with the USCG, the USN, and NOAA on their vessel operations. Through the section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. At the present time, however, they present the potential for some level of interaction.

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

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

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

## 5.12 Scientific Research and Permits

Scientific research similar to that which would be conducted under Permit Nos. 20197 and 19627 has and will continue to impact ESA-listed sea turtles within the action area. Authorized research on ESA-listed sea turtles includes: capturing; handling; marking; measuring; photographing; PIT tag scanning; flipper tagging and PIT tagging; and biopsy sampling. Annual takes of ESA-listed species resulting from research activities that are currently permitted by NMFS within the action area can be seen in Tables 25-30 for green, hawksbill, Kemp’s ridley, leatherback, loggerhead, and olive ridley sea turtles from 2009-2016.

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

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

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

## Table 25. Hawksbill sea turtle takes in the Atlantic Ocean.

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

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

## Table 26. Kemp's ridley sea turtle takes in the Atlantic Ocean.

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

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

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

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

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

## Table 28. Loggerhead sea turtle takes in the North Atlantic Ocean.

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

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

**Table 29. Olive ridley sea turtle takes in the Atlantic Ocean.**

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

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

# 6 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 designated critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 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.

As was stated in Section 3, this biological opinion includes both a jeopardy analysis and an adverse modification analysis.

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 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

The adverse modification analysis considers the impacts on the conservation value of designated critical habitat. This opinion relies on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR §402.02, "a direct or indirect alteration that appreciably diminishes the value of 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”.

The Permits Division proposes to issue Permits:

- No. 20197 for the capturing; handling; marking; measuring; photographing; PIT tag scanning; flipper tagging; biopsy sampling; and resuscitating of incidentally caught green, Kemp’s ridley, leatherback, and loggerhead sea turtles during commercial fishing operations throughout state waters and the Exclusive Economic Zone of the U.S. Northwest Atlantic Ocean; and
- No. 19627 for the capturing; handling; marking; measuring; weighing; photographing, PIT and flipper tagging, skin biopsy sampling, and salvaging of incidentally caught green, Kemp’s ridley, leatherback, loggerhead, hawksbill, and olive ridley sea turtles during commercial fishing operations in the Gulf of Mexico, the Exclusive Economic Zone of the U.S. Atlantic Ocean, the Caribbean Sea and its tributaries.

In this section, we describe the potential stressors associated with the proposed actions, 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, 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.

## 6.1 Stressors Associated with the Proposed Action

Stressors are any physical, chemical, or biological entity that may induce an adverse response either in an ESA-listed species or their designated critical habitat. The issuance of Permit Nos. 20197 and 19327 would authorize several research activities that may expose green, hawksbill, Kemp’s ridley, leatherback, loggerhead, and olive ridley 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) handing and restraint following capture

2) measuring, photographing, weighing

3) tissue and blood sampling, and

4) application of flipper and PIT tags

## 6.2 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 permits, as proposed by the Permits Division.

### 6.2.1 Permit No. 20197

The NMFS Northeast Fisheries Science Center (Woods Hole, MA) has held numerous scientific research permits issued by the Permits Division pursuant to ESA section 10(a)(1)(A) for similar sea turtle research activities. The issuance of each permit underwent consultation under section 7 of the ESA. Each consultation resulted in a biological opinion concluding the research was not likely to jeopardize the continued existence of ESA-listed species, nor adversely modify designated critical habitat. The research activities of the current permit have been reviewed previously through prior Permit Nos. 15112 and 1448.

To minimize effects of the actions, the applicant will have:

1. Provide comprehensive turtle sampling and data collection training for all Northeast Fisheries Observer Program observers.

2. Ensure that all Northeast Fisheries Observer Program sampling protocols/procedures are in line with current ESA guidelines/requirements.

3. Consult with NMFS turtle experts to ensure best sampling techniques are being used by Northeast Fisheries Observer Program Observers.

4. Review/monitor all observer data/sampling to ensure strict compliance with all terms and conditions of NEFSC's ESA permit.

In addition to these mitigation measures taken by the applicant, the Permits Division proposed to include mitigation measures as part of the terms and conditions of the permit found in Section 2.2.

The Permits Division would 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 Amy S. Martins, listed co-investigators, and research assistants. We anticipate that requiring that the research be conducted by experienced personnel will further minimize impacts to the ESA-listed cetaceans 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.

### 6.2.2 Permit No. 19627

The NMFS Southeast Fisheries Science Center (Miami, Florida) has held numerous scientific research permits issued by the Permits Division for similar sea turtle research. Each permit underwent ESA section 7 consultations that resulted in biological opinions concluding that the research was not likely to jeopardize the continued existence of ESA-listed species, nor adversely modify designated critical habitat. The research activities of the current permit have been reviewed previously through prior Permit Nos. 15552 and 1552.

To minimize effects of the actions, the applicant will follow the following:

> 1) Non-target species in the study area will not be affected by this research, as no capture methods will be authorized. Every effort will be made to minimize negative effects on research specimens, as described for each activity below. Short-term monitoring will be conducted upon release to monitor and record the animal's behavior until it dives out of sight. Observers will be trained according to a standard training protocol.
>
> 2) The capture, handling and restraint of these animals are authorized by various section 7 consultations and the effects of the captures were evaluated during that process. Methods to minimize negative effects of handling are described in detail in the attached SEFSC Sea Turtle Research Techniques Manual. While onboard the vessel, animals will be protected from temperature extremes, provided adequate air flow and kept moist during sampling. Extra care will be used when handling and sampling leatherback turtles, including supporting the animals from underneath during handling and release, as described in detail the SEFSC Sea Turtle Research Techniques Manual.
>
> 3) Only minor stress, discomfort, and pain are expected during sample collection. The effect of each proposed procedure is described in detail in the SEFSC Sea Turtle Research Techniques Manual. All equipment that comes into contact with sea turtle body fluids, cuts or lesions will be disinfected between the processing of each turtle using a 1:10 solution of 5-6 percent bleach or other appropriate disinfectant. A separate set of sampling equipment for handling animals displaying fibropapilloma tumors will be maintained and thoroughly disinfected if ever used. Tagging and biopsy sites will be disinfected using 10 percent povidone-iodine solution and isopropyl alcohol swabs. This permit application has been approved by the Institutional Animal Care and Use Committee (IACUC) at the NMFS Southeast Fisheries Science Center, and the final approval letter has been submitted with this application.

In addition to these mitigation measures taken by the applicant, the Permits Division proposed to include mitigation measures as part of the terms and conditions of the permit found in Section 2.4.

The Permits Division would 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 Elizabeth Scott-Denton, listed co-investigators, and research assistants. We anticipate that requiring that the research be conducted by experienced personnel will further minimize impacts to the ESA-listed cetaceans 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.

## 6.3 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 Permits Division proposes to issue two permits that authorize generally similar activities. Both of these permits that are proposed for authorization 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.

Both Permit No. 20197 and 19627 have previous annual reports and supplementary data available to help NMFS estimate the likely future levels of exposure. Exposure analyses for these permits follow. 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.

### 6.3.1 Permit No. 20197

The NMFS Northeast Fisheries Science Center has been conducting long-term sea turtle research similar to that being proposed under Permit No. 20197 for many years in the area of U.S. offshore Atlantic waters from Maine to North Carolina (the action area for the proposed permit). The applicant's annual reports from 2011-2014 were available to evaluate the activities the applicant has undertaken in the recent past (Table 31). These reports describe activities similar or identical to those proposed under Permit No. 20197. The Northeast Fisheries Observer Program is the only group that currently collects data and samples from incidentally caught turtles in the proposed action area. This effort is not being duplicated by another group. Their previous permits include 875, 1178, 1448, and 15112 have similar effort as in the past, however protocols and procedures have changed as sampling improvements were developed and approved. 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 32.

**Table 30. Number of annual takes that occurred from 2011-2014 during past performance of activities by the applicant for proposed Permit No. 20197.**

| Sea turtle species | Life Stage | Procedures | Takes per Animal | Actual Take |
|---|---|---|---|---|
| Loggerhead | All except hatchling | Mark, flipper tag; Measure; Other; Sample, tissue; Photograph/Video; Salvage (carcass, tissue, parts); Transport | 1 | 100 |
| Kemp's ridley | All except hatchling | Mark, flipper tag; Measure; Other; Sample, tissue; Photograph/Video; Salvage (carcass, tissue, parts); Transport | 1 | 2 |
| Green | All except hatchling | Mark, flipper tag; Measure; Other; Sample, tissue; Photograph/Video; Salvage (carcass, tissue, parts); Transport | 1 | 3 |
| Hawksbill | All except hatchling | Mark, flipper tag; Measure; Other; Sample, tissue; Photograph/Video; Salvage (carcass, tissue, parts); Transport | 1 | 0 |
| Leatherback | All except hatchling | Mark, flipper tag; Measure; Other; Sample, tissue; Photograph/Video; Salvage (carcass, tissue, parts); Transport | 1 | 5 |
| Unidentified | All except hatchling | Mark, flipper tag; Measure; Other; Sample, tissue; Photograph/Video; Salvage (carcass, tissue, parts); Transport | 1 | 9 |

**Table 31. Number of exposures to activities expected under Permit No. 20197 over the permit's lifespan.**

| Sea turtle species | Life Stage | Procedures | Takes per Animal | Annual No. Animals | Cumulative No. Animals Over Five Years | Cumulative Takes Per Animal Over Five Years |
|---|---|---|---|---|---|---|
| Loggerhead | All except hatchling | Mark, flipper tag; Measure; Other; Transport Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue | 1 | 50 | 250 | 5 |
| Kemp's ridley | All except hatchling | Mark, flipper tag; Measure; Other; Transport Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue | 1 | 10 | 50 | 5 |
| Green | All except hatchling | Mark, flipper tag; Measure; Other; Transport Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue | 1 | 10 | 50 | 5 |
| Leatherback | All except hatchling | Mark, flipper tag; Measure; Other; Transport Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue | 1 | 50 | 250 | 5 |
| Unidentified | All except hatchling | Mark, flipper tag; Measure; Other; Transport Photograph/Video; Salvage (carcass, tissue, parts); Sample, tissue | 1 | 20 | 100 | 5 |

We do not expect that individuals will be exposed to these stressors more than once in a given year, however it is possible that animals will be unintentionally recaptured. An individual of any life stage except hatchling could be exposed to the proposed activities. This analytical approach can be improved with more data on specific activities that each captured sea turtle is exposed to. By having this information, more activity-specific estimates can be produced, rather than assuming that each captured individual would be exposed to all other activities. This will allow for applicants to reach their scientific goals while minimizing the anthropogenic effects on ESA-listed individuals.

The North Atlantic DPS of green turtles has an estimated 30,058 to 64,396 female nesters in 2010 with an increasing population (Seminoff et al. 2015). The Northwest Atlantic DPS of loggerhead is estimated at 32,000 to 56,000 nesting females with populations in decline or not enough information to make a trend (TEWG 1998; NMFS 2001). Gallaway et al. (2013) estimated that nearly 189,000 female Kemp's ridley sea turtles over the age of two years were alive in 2012. Extrapolating based on sex bias, the authors estimated that nearly a quarter million age-two or older Kemp's ridleys alive now with counts show that the population trend is increasing towards recovery. North Atlantic leatherbacks likely number 34,000 to 94,000 individuals, with females numbering 18,800 and the eastern Atlantic segment numbering 4,700 (TEWG 2007) and populations in the Caribbean and Atlantic Ocean are generally stable or increasing. Based on these current population estimates, the proposed exposure to research activities represents a small portion of the population for each species of sea turtle.

#### 6.3.2 Permit No. 19627

The Southeast Fisheries Science Center has been conducting long-term sea turtle research similar to that being proposed under Permit No. 19627 for many years in the area of U.S. offshore Atlantic waters, Gulf of Mexico, Caribbean Sea and its tributaries. The applicant's annual reports from 2011 through 2014 were available to evaluate the activities the applicant has undertaken in the recent past (Table 33). These reports describe activities similar or identical to those proposed under Permit No. 19627. Their previous permits include 1260, 1552 and 15552 have similar effort as in the past, however protocols and procedures have changed as sampling improvements were developed and approved. 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 34.

**Table 32. Number of annual takes that occurred from 2011 through 2014 during past performance of activities by the applicant for proposed Permit No. 19627.**

| Sea turtle species | Life Stage | Procedures | Annual Takes per Animal | Actual Take |
|---|---|---|---|---|
| Loggerhead | All except hatchling | Mark, carapace (temporary); Mark, flipper tag; PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh; Salvage (carcass, tissue, parts) | 1 | 184 |
| Kemp's ridley | All except hatchling | Mark, carapace (temporary); Mark, flipper tag; PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh; Salvage (carcass, tissue, parts) | 1 | 59 |
| Green | All except hatchling | Mark, carapace (temporary); Mark, flipper tag; PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh; Salvage (carcass, tissue, parts) | 1 | 20 |
| Hawksbill | All except hatchling | Mark, carapace (temporary); Mark, flipper tag; PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh; Salvage (carcass, tissue, parts) | 1 | 0 |
| Leatherback | All except hatchling | Mark, carapace (temporary); Mark, flipper tag; PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh; Salvage (carcass, tissue, parts) | 1 | 153 |
| Olive ridley | All except hatchling | Mark, carapace (temporary); Mark, flipper tag; PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh; Salvage (carcass, tissue, parts) | 1 | 12 |
| Unidentified | All except hatchling | Mark, carapace (temporary); Mark, flipper tag; PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh; Salvage (carcass, tissue, parts) | 1 | 1 |

**Table 33. Number of exposures to activities expected under Permit No. 19627 over the permit's lifespan.**

| Sea turtle species | Life Stage | Procedures | Takes per Animal | Annual No. Animals | Cumulative No. Animals Over Five Years | Cumulative Takes Per Animal Over Five Years |
|---|---|---|---|---|---|---|
| Loggerhead | All except hatchling | Mark, carapace (temporary); Mark, flipper tag; PIT tag; Measure; Sample, tissue; Weigh; Photograph/Video Salvage (carcass/tissue/parts) | 1 | 859 | 4,295 | 5 |
| Kemp's ridley | All except hatchling | Mark, carapace (temporary); Mark, flipper tag; PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh; Salvage (carcass, tissue, parts) | 1 | 171 | 855 | 5 |
| Green | All except hatchling | Mark, carapace (temporary); Mark, flipper tag; PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh; Salvage (carcass, tissue, parts) | 1 | 103 | 525 | 5 |
| Leatherback | All except hatchling | Mark, carapace (temporary); Mark, flipper tag; PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh; Salvage (carcass, tissue, parts) | 1 | 278 | 1,390 | 5 |
| Hawksbill | All except hatchling | Mark, carapace (temporary); Mark, flipper tag; PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh; Salvage (carcass, tissue, parts) | 1 | 81 | 405 | 5 |
| Olive ridley | All except hatchling | Mark, carapace (temporary); Mark, flipper tag; PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh; Salvage (carcass, tissue, parts) | 1 | 20 | 100 | 5 |
| Unidentified | All except hatchling | Mark, carapace (temporary); Mark, flipper tag; PIT tag; Measure; Photograph/Video; Sample, tissue; Weigh; Salvage (carcass, tissue, parts) | 1 | 66 | 330 | 5 |

We do not expect that individuals will be exposed to these stressors more than once in a given year, however it is possible that animals will be unintentionally recaptured. An individual of any life stage except hatchling could be exposed to the proposed activities. This analytical approach can be improved with more data on specific activities that each captured sea turtle is exposed to. By having this information, more activity-specific estimates can be produced, rather than assuming that each captured individual would be exposed to all other activities. This will allow for applicants to reach their scientific goals while minimizing the anthropogenic effects on ESA-listed individuals.

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

## 6.4 Response Analysis

Given the exposure estimated above, in this section we describe the range of responses among ESA-listed sea turtles that may result from the stressors associated with the research activities that would be authorized under Permit Nos. 20197 and 19627. These include stressors associated the following activities: handling and restraint following capture; measuring, photographing and weighing; tissue and blood sampling; and application of flipper and PIT tags. 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. Overall, we do not expect reproduction to be impaired primarily because of the lack extreme stressors used by studies to induce adverse reproductive impacts and the acute nature of the stressors involved.

In sum, the common underling stressor of a human disturbance as could be caused by the research activities that would be authorized under Permit Nos. 20197 and 19627 may lead to a variety of different stress related responses. However, given the short duration of the activities and listed procedures, we do not anticipate these responses to result in negative fitness consequences. In addition to possibly causing a stress related response, each research activity is likely to produce unique responses as detailed further below.

### 6.4.1 Handling and Restraint Following Capture

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

Capture and handling activities may markedly affect metabolic rate (St. Aubin and Geraci 1988), reproduction (Mahmoud and Licht 1997), and hormone levels (Gregory et al. 1996). Handling has been shown to result in progressive changes in blood chemistry indicative of a continued stress response (Hoopes et al. 2000; Gregory and Schmid 2001). The additional on-board holding time imposes an additional stressor on these already acidotic turtles (Hoopes et al. 2000). It has been suggested that the muscles used by sea turtles for swimming might also be used during lung ventilation (Butler et al. 1984). Thus, an increase in breathing effort in negatively buoyant animals may have heightened lactate production. Understanding the physiological effects of capture methodology is essential to conducting research on endangered sea turtles, since safe return to their natural habitat is required. However, literature pertaining to the physiological effects of capture on sea turtles is scarce. No additional mortalities or injuries are expected as a result of this research.

### 6.4.2 Measuring, Photographing and Weighing

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.

Measuring, photographing and weighing can result in raised levels of stressor hormones in sea turtles. However, the measuring, photographing and weighing procedures are simple, non-invasive, with a relatively 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.

### 6.4.3 Tissue and Blood Sampling

Sea turtles will also be biopsied during the course of the research. We expect that this will involve stress associated with pain stimuli (Balazs 1999). Although the skin will be breached and tissue exposed, we expect disinfection protocols to make the risk of infection minimal from the small hole that will be produced by the biopsy punch. Disinfection of biopsy punches and surgical equipment will also reduce the risk of pathogen spread between individuals.

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

### 6.4.4 Application of Flipper and Passive Integrated Transponder Tagging

All sea turtles will also be scanned or visually inspected for PIT and flipper tags, respectively. If either of these is absent, then individuals will be tagged with them. Turtles that have lost external tags must be re-tagged if captured again at a later date, which subjects them to additional effects of tagging. Both procedures involve the implantation of tags in or through skin and/or muscle of the flippers. The PIT tags remain internal while flipper tags have both internal and external components. For both, internal tag parts are expected to be biologically inert. In addition to the stress sea turtles are expected to experience by handling and restraint associated with inspection and tagging, we expect an additional stress response associated with the short-term pain experienced during tag implantation (Balazs 1999), although this will be reduced by a standard injection of an anesthetic. We expect disinfection methods proposed by the applicant should mitigate infection risks from tagging. Wounds are expected to heal without infection.

Researchers applying for all permits have routinely applied tags over many years. Tags are designed to be small, physiologically inert, and not hinder movement or cause chafing; we do not expect the tags themselves to negatively impact sea turtles (Balazs 1999). Flipper tags occasionally come off of turtle flippers, which may cause tissue ripping and subsequent trauma and infection risk; an observation reported occasionally be researchers under the proposed permits considered here. However, individuals who have lost flipper tags have not been observed to be in any different body condition than turtles lacking tags or those who still retain their tags. Based upon these experiences, behavioral responses may or may not be evident during tag implantation; when evident, behavioral responses will be fleeting, and lasting effects resulting in pathological consequences are not expected.

### 6.5 Risk Analysis

In this section we assess the consequences of the responses to the individuals that have been exposed, the populations those individuals represent, and the species those populations comprise. Whereas the Response Analysis (Section 6.4) 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 6.3) and the expected responses to those stressors (as described in Section 6.4).

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.

The research activities that would take place under Permit Nos. 20197 and 19627 are not expected to result in sea turtle mortality. The research activities under the proposed permits will, however, result in temporary stress to the sea turtles which is not expected to have more than short-term effects on individual North Atlantic and South Atlantic green, Northwest Atlantic loggerhead, hawksbills, Kemp's ridley, leatherback, and olive ridley sea turtles.

Biopsy, tissue and blood sampling, and tagging are all activities that will break the integument and create the potential for infection or other physiological disruptions. The applicants generally have extensive 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.

As noted in the Response Analysis, none of the research activities as proposed with the mitigation measures to minimize exposure and associated responses, are expected reduce the fitness of any ESA-listed species. As such, the issuance of Permit Nos. 20197 and 19627 is not expected to present any risk to individuals, populations, or species listed under the ESA.

### 6.6 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 (Section 5), 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.

### 6.7 Integration and Synthesis

The Integration and synthesis section is the final step in our assessment of the risk posed to species and critical habitat because of implementing the proposed action. In this section, we add the Effects of the Action (Section 6) to the Environmental Baseline (Section 5) and the

Cumulative Effects (Section 6.6) 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 ESA-Listed Species and Critical Habitat (Section 4).

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

We expect all targeted sea turtles to experience some degree of stress response to handling and restraint following capture, blood and tissue sampling, and PIT and flipper tagging. 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.

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.

# 7 CONCLUSION

After reviewing the current status of the ESA-listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS' biological opinion that the proposed actions are not likely to jeopardize the continued existence of the North Atlantic DPS or South Atlantic DPS green, Northwest Atlantic DPS loggerhead, hawksbill, Kemp's ridley, olive ridley, or leatherback sea turtles or to destroy or adversely modify the designated critical habitat for the North Atlantic DPS of green, Northwest Atlantic DPS of loggerhead, hawksbill or leatherback sea turtles.

# 8 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. 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.

All activities associated with the issuance of Permit Nos. 20197 and 19627 involve directed take for the purposes of scientific research. Therefore, the NMFS does not expect the proposed action would incidentally take threatened or endangered species such that an incidental take statement is not warranted.

# 9 Conservation Recommendations

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

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

In order for NMFS' Office of Protected Resources Endangered Species Act 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 Endangered Species Act Interagency Cooperation Division of any conservation recommendations they implement in their final action.

# 10 REINITIATION OF CONSULTATION

This concludes formal consultation for the Permits Division proposed issuance of Permit Nos. 20197 and 19627. 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.

# 11 References

Acevedo-Whitehouse, K., and A.L.J. Duffus. 2009. Effects of environmental change on wildlife health. Philosophical Transactions of the Royal Society of London B Biological Sciences 364(1534):3429-3438.

Aguilera, G., and C. Rabadan-Diehl. 2000. Vasopressinergic regulation of the hypothalamic-pituitary-adrenal axis: Implications for stress adaptation. Regulatory Peptides 2296(1-2):23-29.

Almeida, A.P., L.M.P. Moreira, S.C. Bruno, M.A. Marcovaldi, A.S. Martins, A.B. Bolten, and K.A. Bjorndal. 2012. Green turtle nesting on Trindade Island, Brazil. Page 208 *in* T.T. Jones and B.P. Wallace, editors. Thirty-First Annual Symposium on Sea Turtle Biology and Conservation. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, San Diego, California.

Atkinson, S., D. Crocker, D. Houser, and K. Mashburn. 2015. Stress physiology in marine mammals: How well do they fit the terrestrial model? Journal of Comparative Physiology B Biochemical, Systemic and Environmental Physiology 185(5):463-486.

Auster, P.J., R.J. Malastesta, R.W. Langton, L. Watling, P.C. Valentine, C.L.S. Donaldson, E.W. Langton, A.N. Shepart, and I.G. Babb. 1996. The impacts of mobile fishing gear on the sea floor habitats in the Gulf of Maine (Northwest Atlantic): Implications for conservation of fish populations. Reviews in Fisheries Science 4:185-200.

Avens, L., and L.R. Goshe. 2008. Skeletochronological analysis of age and growth for leatherback sea turtles in the western North Atlantic. Page 223 *in* M. Frick, A. Panagopoulou, A.F. Rees, and K. Williams, editors. Twenty-Seventh Annual Symposium on Sea Turtle Biology and Conservation, Myrtle Beach, South Carolina.

Avens, L., J.C. Taylor, L.R. Goshe, T.T. Jones, and M. Hastings. 2009. Use of skeletochronological analysis to estimate the age of leatherback sea turtles *Dermochelys coriacea* in the western North Atlantic. Endangered Species Research 8(3):165-177.

Balazs, G.H. 1999. Factors to consider in the tagging of sea turtles. Pages 101-109 *in* K.L. Eckert, K.A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly editors. Research and Management Techniques for the Conservation of Sea Turtles, International Union for Conservation of Nature and Natural Resources, Survival Service Commission Marine Turtle Specialist Group Publication No. 4.

Barnosky, A.D., E.A. Hadly, J. Bascompte, E.L. Berlow, J.H. Brown, M. Fortelius, W.M. Getz, J. Harte, A. Hastings, and P.A. Marquet. 2012. Approaching a state shift in Earth's biosphere. Nature 486(7401):52-58.

Barton, B.A. 2002. Stress in fishes: A diversity of responses with particular reference to changes in circulating corticosteroids. Integrative and Comparative Biology 42(3):517-525.

Bass, A.L., S.P. Epperly, J. Braun, D.W. Owens, and R.M. Patterson. 1998. Natal origin and sex ratios of foraging sea turtles in the Pamlico-Albemarle Estuarine Complex. NMFS-SEFSC-415, National Marine Fisheries Service, Southeast Fisheries Science Center, Miami, Florida.

Baulch, S., and M.P. Simmonds. 2015. An update on research into marine debris and cetaceans. IWC Scientific Committee, San Diego, California.

Bayunova, L., I. Barannikova, and T. Semenkova. 2002. Sturgeon stress reactions in aquaculture. Journal of Applied Ichthyology 18(4-6):397-404.

Beale, C.M., and P. Monaghan. 2004. Human disturbance: People as predation-free predators? Journal of Applied Ecology 41:335-343.

Bearzi, G. 2000. First report of a common dolphin (*Delphinus delphis*) death following penetration of a biopsy dart. Journal of Cetacean Research and Management 2(3):217-221.

Bell, I., and D.A. Pike. 2012. Somatic growth rates of hawksbill turtles *Eretmochelys imbricata* in a northern Great Barrier Reef foraging area. Marine Ecology Progress Series 446:275-283.

Bellmund, S.A., J.A. Musick, R.C. Klinger, R.A. Byles, J.A. Keinath, and D.E. Barnard. 1987. Ecology of sea turtles in Virginia. College of William and Mary, Virginia Institute of Marine Science, Gloucester Point, Virginia.

Bjorndal, K.A., and A.B. Bolten. 2000. Proceedings on a workshop on accessing abundance and trends for in-water sea turtle populations. NOAA Technical Memorandum.

Bjorndal, K.A., K.J. Reich, and A.B. Bolten. 2010. Effect of repeated tissue sampling on growth rates of juvenile loggerhead turtles *Caretta caretta*. Diseases of Aquatic Organisms 88(3):271-273.

Bjorndal, K.A., B.A. Schroeder, A.M. Foley, B.E. Witherington, M. Bresette, D. Clark, R.M. Herren, M.D. Arendt, J.R. Schmid, A.B. Meylan, P.A. Meylan, J.A. Provancha, K.M. Hart, M.M. Lamont, R.R. Carthy, and A.B. Bolten. 2013. Temporal, spatial, and body size effects on growth rates of loggerhead sea turtles (*Caretta caretta*) in the Northwest Atlantic. Marine Biology 160(10):2711-2721.

Blunden, J., and D.S. Arndt. 2014. State of climate in 2013. Bulletin of the American Meteorological Society 95(7):S1-S257.

Blunden, J., and D.S. Arndt. 2016. State of the Climate in 2015. Bulletin of the American Meteorological Society 97(8):1-300.

Bowen, B.W. 2003. What is a loggerhead turtle? The genetic perspective. Pages 7-27 *in* A.B. Bolten and B.E. Witherington, editors. Loggerhead Sea Turtles, Smithsonian Books, Washington, D.C.

Bowen, B.W., A.M. Clark, A.F. Abreu-Grobois, A. Chaves, H.A. Reichart, and R.J. Ferl. 1998. Global phylogeography of the ridley sea turtles (*Lepidochelys* spp.) as inferred from mitochondrial DNA sequences. Genetica 101:179-189.

Bowen, B.W., N. Kamezaki, C.J. Limpus, G.R. Hughes, A.B. Meylan, and J.C. Avise. 1994. Global phylogeography of the loggerhead turtle (*Caretta caretta*) as indicated by mitochondrial DNA haplotypes. Evolution 48(6):1820-1828.

Bowen, B.W., and S.A. Karl. 2007. Population genetics and phylogeography of sea turtles. Molecular Ecology 16(23):4886-4907.

Bowen, B.W., A.B. Meylan, and J.C. Avise. 1991. Evolutionary distinctiveness of the endangered Kemp's ridley sea turtle. Nature 352(22 Aug):709-711.

Bowen, B.W., A.B. Meylan, J.P. Ross, C.J. Limpus, G.H. Balazs, and J.C. Avise. 1992. Global population structure and natural history of the green turtle (*Chelonia mydas*) in terms of matriarchal phylogeny. Evolution 46(4):865-881.

Broderick, A.C., R. Frauenstein, F. Glen, G.C. Hays, A.L. Jackson, T. Pelembe, G.D. Ruxton, and B.J. Godley. 2006. Are green turtles globally endangered? Global Ecology and Biogeography 15(1):21-26.

Bugoni, L., L. Krause, and M.V. Petry. 2001. Marine debris and human impacts on sea turtles in southern Brazil. Marine Pollution Bulletin 42(12):1330-1334.

Burchfield, P.M. 2009. Report on the Mexico/United States of America population restoration project for the Kemp's ridley sea turtle, *Lepidochelys kempii*, on the coasts of Tamualipas, Mexico. Gladys Porter Zoo, Brownsville, Texas.

Busch, D.S., and L.S. Hayward. 2009. Stress in a conservation context: A discussion of glucocorticoid actions and how levels change with conservation-relevant variables. Biological Conservation 142(12):2844-2853.

Butler, P.J., W.K. Milsom, and A.J. Woakes. 1984. Respiratory cardio vascular and metabolic adjustments during steady state swimming in the green turtle *Chelonia mydas*. Journal of Comparative Physiology B Biochemical Systemic and Environmental Physiology 154(2):167-174.

Byles, R.A., and Y.B. Swimmer. 1994. Post-nesting migration of *Eretmochelys imbricata* in the Yucatan Peninsula. Page 202 *in* K.A. Bjorndal, A.B. Bolten, D.A. Johnson, and P.J. Eliazar, editors. Fourteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum, Hilton Head, South Carolina.

Caillouet Jr., C., C.T. Fontaine, S.A. Manzella-Tirpak, and T.D. Williams. 1995. Growth of head-started Kemp's ridley sea turtles (*Lepidochelys kempii*) following release. Chelonian Conservation and Biology 1:231-234.

Campagna, C., F.T. Short, B.A. Polidoro, R. McManus, B.B. Collette, N.J. Pilcher, Y.S. de Mitcheson, S.N. Stuart, and K.E. Carpenter. 2011. Gulf of Mexico oil blowout increases risks to globally threatened species. BioScience 61(5):393-397.

Cannon, A.C., and J.P. Flanagan. 1996. Trauma and treatment of Kemp's ridley sea turtles caught on hook-and-line by recreational fisherman. Sea Turtles Biology and Conservation Workshop.

Carr, A.F. 1972. Great reptiles, great enigmas. Audubon 74(2):24-35.

Carr, A.F. 1986. RIPS, FADS, and little loggerheads. BioScience 36(2):92-100.

Catry, P., C. Barbosa, B. Paris, B. Indjai, A. Almeida, B. Limoges, C. Silva, and H. Pereira. 2009. Status, ecology, and conservation of sea turtles in Guinea-Bissau. Chelonian Conservation and Biology 8(2):150-160.

Caut, S., E. Guirlet, and M. Girondot. 2009. Effect of tidal overwash on the embryonic development of leatherback turtles in French Guiana. Marine Environmental Research 69(4):254-261.

Chaloupka, M., K.A. Bjorndal, G.H. Balazs, A.B. Bolten, L.M. Ehrhart, C.J. Limpus, H. Suganuma, S. Troeeng, and M. Yamaguchi. 2008. Encouraging outlook for recovery of a once severely exploited marine megaherbivore. Global Ecology and Biogeography 17(2):297-304.

Chaloupka, M.Y., and C.J. Limpus. 1997. Robust statistical modelling of hawksbill sea turtle growth rates (southern Great Barrier Reef). Marine Ecology Progress Series 146(1-3):1-8.

Clarke, D., C. Dickerson, and K.J. Reine. 2003. Characterization of underwater sounds produced by dredges. Third Specialty Conference on Dredging and Dredged Material Disposal, Orlando, Florida.

Clifton, K., D.O. Cornejo, and R. Felger. 1982. Sea turtles of the Pacific coast of Mexico. Pages 199-209 Biology and Conservation of Sea Turtles, Smithsonian Institution Press, Washington, D.C.

Collazo, J.A., R. Boulan, and T.L. Tallevast. 1992. Abundance and growth patterns of *Chelonia mydas* in Culebra, Puerto Rico. Journal of Herpetology 26(3):293-300.

Conant, T.A., P.H. Dutton, T. Eguchi, S.P. Epperly, C.C. Fahy, M.H. Godfrey, S.L. MacPherson, E.E. Possardt, B.A. Schroeder, J.A. Seminoff, M.L. Snover, C.M. Upite, and B.E. Witherington. 2009. Loggerhead sea turtle (*Caretta caretta*) 2009 status review under the U.S. Endangered Species Act. National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

Cowan, D.E., and B.E. Curry. 2008. Histopathology of the alarm reaction in small odontocetes. Journal of Comparative Pathology 139(1):24-33.

Cowan, D.F., and B.E. Curry. 2002. Histopathological assessment of dolphins necropsied onboard vessels in the eastern tropical Pacific tuna fishery. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center.

Craig, J.K., L.B. Crowder, C.D. Gray, C.J. McDaniel, T.A. Henwood, and J.G. Hanifen. 2001. Ecological effects of hypoxia on fish, sea turtles & marine mammals in the northwestern Gulf of Mexico. Coastal and Estuarine Studies 58:269-291.

Crim, J.L., L.D. Spotila, J.R. Spotila, M. O'Connor, R. Reina, C.J. Williams, and F.V. Paladino. 2002. The leatherback turtle, *Dermochelys coriacea*, exhibits both polyandry and polygyny. Molecular Ecology 11(10):2097-2106.

Crouse, D.T. 1999. Population modeling and implications for Caribbean hawksbill sea turtle management Chelonian Conservation and Biology 3(2):185-188.

Crouse, O.T., L.B. Crowder, and H. Caswell. 1987. A site based population model for loggerhead sea turtles and implications for conservation. Ecology 68(5):1412-1423.

Curry, B.E., and E.F. Edwards. 1998. Investigation of the potential influence of fishery-induced stress on dolphins in the eastern tropical Pacific Ocean: Research planning. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center.

Curry, R.G., and M.S. McCartney. 2001. Ocean gyre circulation changes associated with the North Atlantic Oscillation. Journal of Physical Oceanography 31:3374-3400.

Curtis, C. 1998. Genotyping with polymorphic markers reveals multiple paternity in leatherback turtle clutches. Master's thesis. Drexel University, Philadelphia, Pennsylvania.

Daan, N. 1996. Multispecies assessment issues for the North Sea. Pages 126-133 *in* E.K. Pikitch, D.D. Huppert, and M.P. Sissenwine, editors. American Fisheries Society Symposium 20, Seattle, Washington.

dei Marcovaldi, M.A., A.J. Santos, A.S. Santos, L.S. Soares, G.G. Lopez, M.H. Godfrey, M. Lopez-Mendilaharsu, and M.M. Fuentes. 2014. Spatio-temporal variation in the incubation duration and sex ratio of hawksbill hatchlings: Implication for future management. Journal of Thermal Biology 44:70-77.

del Monte-Luna, P., V. Guzmán-Hernández, E.A. Cuevas, F. Arreguín-Sánchez, and D. Lluch-Belda. 2012. Effect of North Atlantic climate variability on hawksbill turtles in the Southern Gulf of Mexico. Journal of Experimental Marine Biology and Ecology 412:103-109.

Desantis, L.M., B. Delehanty, J.T. Weir, and R. Boonstra. 2013. Mediating free glucocorticoid levels in the blood of vertebrates: Are corticosteroid-binding proteins always necessary? . Functional Ecology 27:107-119.

DiBello, A., C. Valastro, D. Freggi, V. Saponaro, and D. Grimaldi. 2010. Ultrasound-guided vascular catheterization in loggerhead sea turtles (*Caretta caretta*). Journal of Zoo and Wildlife Medicine 41(3):516-518.

Dickerson, D., C. Theriot, M. Wolters, C. Slay, T. Bargo, and W. Parks. 2007. Effectiveness of relocation trawling during dredging for reducing inciodental take of sea turtles. Pages 509-530 World Dredging Congress.

Dickerson, D.D., and T. Bargo. 2012. Occurrence of a sea turtle congregation near Louisiana Chandeleur Islands following the *Deepwater Horizon* oil spill. Page 11 *in* T.T. Jones and B.P. Wallace, editors. Thirty-First Annual Symposium on Sea Turtle Biology and Conservation. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, San Diego, California.

Dierauf, L., and M. Gulland. 2001. Marine mammal unusual mortality events. Pages 69-81 CRC Handbook of Marine Mammal Medicine, CRC Press, Boca Raton, Florida.

Dodd Jr., C.K. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). 88(14), U.S. Fish and Wildlife Service.

Doney, S.C. 2010. The growing human footprint on coastal and open-ocean biogeochemistry. Science 328(5985):1512-1516.

Duchene, S., A. Frey, A. Alfaro-Nunez, P.H. Dutton, P.G.M. Thomas, and P.A. Morin. 2012. Marine turtle mitogenome phylogenetics and evolution. Molecular Phylogenetics and Evolution 65(1):241-250.

Duronslet, M.J., C.W. Caillouet, S. Manzella, K.W. Indelicato, C.T. Fontaine, D.B. Revera, T. Williams, and D. Boss. 1986. The effects of an underwater explosion on the sea turtles *Lepidochelys kempii* and *Caretta caretta* with observations of effects on other marine organisms. National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

Dutton, P.H., E. Bixby, and S.K. Davis. 2000. Tendency toward single paternity in leatherbacks detected with microsatellites. Page 39 *in* F.A. Abreu-Grobois, R. Briseño-Dueñas, R. Márquez, and L. Sarti, editors. Eighteenth International Sea Turtle Symposium, Mazatlán, Sinaloa, México.

Dutton, P.H., B.W. Bowen, D.W. Owens, A. Barragan, and S.K. Davis. 1999. Global phylogeography of the leatherback turtle (*Dermochelys coriacea*). Journal of Zoology 248:397-409.

Dutton, P.H., and S.K. Davis. 1998. Use of molecular genetics to identify individuals and infer mating behavior in leatherbacks. Page 42 *in* R. Byles and Y. Fernandez, editors. Sixteenth Annual Symposium on Sea Turtle Biology and Conservation.

Dutton, P.H., S.K. Davis, T. Guerra, and D. Owens. 1996. Molecular phylogeny for marine turtles based on sequences of the ND4-leucine tRNA and control regions of mitochondrial DNA. Molecular Phylogenetics and Evolution 5(3):511-521.

Dutton, P.H., V. Pease, and D. Shaver. 2006. Characterization of mtDNA variation among Kemp's ridleys nesting on Padre Island with reference to Rancho Nuevo genetic stock. Page 189 Twenty-Sixth Annual Conference on Sea Turtle Conservation and Biology.

Eckert, K.L., B.P. Wallace, J.G. Frazier, S.A. Eckert, and P.C.H. Pritchard. 2012. Synopsis of the biological data on the leatherback sea turtle (*Dermochelys coriacea*). U.S. Fish and Wildlife Service.

Eguchi, T., T. Gerrodette, R.L. Pitman, J.A. Seminoff, and P.H. Dutton. 2007. At-sea density and abundance estimates of the olive ridley turtle Lepidochelys olivacea in the eastern tropical Pacific. Endangered Species Research 3(2):191-203.

Epperly, S., L. Avens, L. Garrison, T. Henwood, W. Hoggard, J. Mitchell, J. Nance, J. Poffenberger, C. Sasso, E. Scott-Denton, and C. Yeung. 2002. Analysis of sea turtle bycatch in the commercial shrimp fisheries of southeast U.S. waters and the Gulf of Mexico. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center.

Epperly, S.P., J. Braun-McNeill, A.L. Bass, D.W. Owens, and R.M. Patterson. 2000. Inwater population index surveys: North Carolina, USA. NOAA Technical Memorandum, Sinaloa, Mexico.

Epstein, P.R., and J. Selber. 2002. Oil, a life cycle analysis of its health and environmental impacts. Center for Health and the Global Environment, Harvard Medical School, Boston, Massachusetts.

Feare, C.J. 1976. Desertion and abnormal development in a colony of Sooty terns infested by virus-infected ticks. Ibis 118:112-115.

FFWCC. 2006. Long-term monitoring program reveals a decline in Florida loggerhead sea turtle nesting Florida Fish and Wildlife Conservation Commission.

FFWCC. 2007. Florida statewide nesting beach survey data–2005 season. Florida Fish and Wildlife Conservation Commission.

FFWCC. 2016. Index nesting beach survey totals (1989-2016). Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.

Fraser, G.S. 2014. Impacts of offshore oil and gas development on marine wildlife resources. Pages 191-217 *in* J.E. Gates, D.L. Trauger, and B. Czech, editors. Peak Oil, Economic Growth, and Wildlife Conservation, Springer Publishers, New York.

Frid, A. 2003. Dall's sheep responses to overflights by helicopter and fixed-wing aircraft. Biological Conservation 110(3):387-399.

Frid, A., and L.M. Dill. 2002. Human-caused disturbance stimuli as a form of predation risk. Conservation Ecology 6(1):1-16.

Fuentes, M.M.P.B., M. Hamann, and C.J. Limpus. 2010. Past, current and future thermal profiles of green turtle nesting grounds: Implications from climate change. Journal of Experimental Marine Biology and Ecology 383:56-64.

Fuentes, M.M.P.B., C.J. Limpus, and M. Hamann. 2011. Vulnerability of sea turtle nesting grounds to climate change. Global Change Biology 17:140-153.

Fuentes, M.M.P.B., J.A. Maynard, M. Guinea, I.P. Bell, P.J. Werdell, and M. Hamann. 2009. Proxy indicators of sand temperature help project impacts of global warming on sea turtles in northern Australia. Endangered Species Research 9:33-40.

Gallaway, B.J., C.W. Caillouet Jr., P.T. Plotkin, W.J. Gazey, J.G. Cole, and S.W. Raborn. 2013. Kemps Ridley Stock Assessment Project: Final report. Gulf States Marine Fisheries Commission, Ocean Springs, Mississippi.

Garbarino, J.R., H.C. Hayes, D.A. Roth, R.C. Antweiler, T.I. Brinton, and H.E. Taylor. 1995. Heavy metals in the Mississippi River.

Giese, M. 1996. Effects of human activity on adelie penguin *Pygoscelis adeliae* breeding success. Biological Conservation 75(2):157-164.

Gill, J.A., K. Norris, and W.J. Sutherland. 2001. Why behavioural responses may not reflect the population consequences of human disturbance. Biological Conservation 97(2):265-268.

Gitschlag, G.R., and B.A. Herczeg. 1994. Sea turtle observations at explosive removals of energy structures. Marine Fisheries Review 56(2):1-8.

Gitschlag, G.R., B.A. Herczeg, and T.R. Barcak. 1997. Observations of sea turtles and other marine life at the explosive removal of offshore oil and gas structures in the Gulf of Mexico. Gulf Research Reports 9(4):247-262.

Glen, F., A.C. Broderick, B.J. Godley, and G.C. Hays. 2006. Thermal control of hatchling emergence patterns in marine turtles. Journal of Experimental Marine Biology and Ecology 334(1):31-42.

GMFMC. 2007. Final Amendment 27 to the reef fish fishery management plan and Amendment 14 to the shrimp fishery management plan. Gulf of Mexico Fishery Management Council, Tampa, Florida.

Grant, G.S., and D. Ferrell. 1993. Leatherback turtle, *Dermochelys coriacea* (Reptilia: *Dermochelidae*): Notes on near-shore feeding behavior and association with cobia. Brimleyana 19:77-81.

Greer, A.W. 2008. Trade-offs and benefits: Implications of promoting a strong immunity to gastrointestinal parasites in sheep. Parasite Immunology 30(2):123-132.

Gregory, L.F., T.S. Gross, A. Bolten, K. Bjorndal, and L.J. Guillette. 1996. Plasma corticosterone concentrations associated with acute captivity stress in wild loggerhead sea turtles (*Caretta caretta*). General and Comparative Endocrinology 104:312-320.

Gregory, L.F., and J.R. Schmid. 2001. Stress responses and sexing of wild Kemp's ridley sea turtles (*Lepidochelys kempii*) in the northwestern Gulf of Mexico. General and Comparative Endocrinology 124:66-74.

Gulko, D., and K.L. Eckert. 2003. Sea Turtles: An Ecological Guide. Mutual Publishing, Honolulu, Hawaii.

Guyton, A.C., and J.E. Hall. 2000. Textbook of Medical Physiology, 10th edition. W.B. Saunders Company, Phildelphia, Pennsylvania.

Harrington, F.H., and A.M. Veitch. 1992. Calving success of woodland caribou exposed to low-level jet fighter overflights. Arctic 45(3):213-218.

Hart, K.M., M.M. Lamont, A.R. Sartain, and I. Fujisaki. 2014. Migration, foraging, and residency patterns for northern gulf loggerheads: Implications of local threats and international movements. PLoS ONE 9(7):e103453.

Hawkes, L.A., A.C. Broderick, H. Godfrey, B. Godley, and M.J. Witt. 2014a. The impacts of climate change on marine turtle reproductoin success. Pages 287-310 *in* B. Maslo and L. Lockwood, editors. Coastal Conservation, Cambridge University Press, Cambridge.

Hawkes, L.A., A. McGowan, A.C. Broderick, S. Gore, D. Wheatley, J. White, M.J. Witt, and B.J. Godley. 2014b. High rates of growth recorded for hawksbill sea turtles in Anegada, British Virgin Islands. Ecology and Evolution.

Hazel, J., I.R. Lawler, H. Marsh, and S. Robson. 2007. Vessel speed increases collision risk for the green turtle *Chelonia mydas*. Endangered Species Research 3:105-113.

Heppell, S.S., D.T. Crouse, L.B. Crowder, S.P. Epperly, W. Gabriel, T. Henwood, R. Márquez, and N.B. Thompson. 2005. A population model to estimate recovery time, population size, and management impacts on Kemp’s ridley sea turtles. Chelonian Conservation and Biology 4(4):767-773.

Herraez, P., E. Sierra, M. Arbelo, J.R. Jaber, A. Espinosa de los Monteros, and A. Fernandez. 2007. Rhabdomyolysis and myoglobinuric nephrosis (capture myopathy) in a striped dolphin. Journal of Wildlife Diseases 43(4):770-774.

Herrenkohl, L.R., and J.A. Politch. 1979. Effects of prenatal stress on the estrous cycle of female offspring as adults. Experientia 34:1240.

Hildebrand, H.H. 1963. Hallazgo del area de anidacion de la tortuga marina "lora", *Lepidochelys kempi* (Garman), en la costa occidental del Golfo de Mexico (Rept., Chel.). Ciencia, Mexico 22:105-112.

Hill, J.E., F.V. Paladino, J.R. Spotila, and P.S. Tomillo. 2015. Shading and watering as a tool to mitigate the impacts of climate change in sea turtle nests. PLoS ONE 10(6):e0129528.

Hillis-Starr, Z.M., M. Coyne, and M. Monaco. 2000. Buck Island and back: Hawksbill turtles make their move. Page 159 *in* H.J. Kalb and T. Wibbels, editors. Nineteenth Annual Symposium on Sea Turtle Biology and Conservation.

Hirth, H.F. 1980. Some aspects of the nesting behavior and reproductive biology of sea turtles. American Zoologist 20(3):507-523.

Hoopes, L.A., A.M. Landry Jr., and E.K. Stabenau. 2000. Physiological effects of capturing Kemp's ridley sea turtles, *Lepidochelys kempii*, in entanglement nets. Canadian Journal of Zoology 78:1941-1947.

Horrocks, J.A., L.A. Vermeer, B. Krueger, M. Coyne, B.A. Schroeder, and G.H. Balazs. 2001. Migration routes and destination characteristics of post-nesting hawksbill turtles satellite-tracked from Barbados, West Indies. Chelonian Conservation and Biology 4(1):107-114.

Hurrell, J.W. 1995. Decadal trends in the North Atlantic Oscillation: Regional temperatures and precipitation. Science 269:676-679.

Hutchinson, B.J., and P. Dutton. 2007. Modern genetics reveals ancient diversity in the loggerhead Pages 18-19 *in* R.B. Mast, L.M. Bailey, B.J. Hutchinson, A. Hutchinson, K. Koenig, and M.S. Rowe, editors. The State of the World's Sea Turtles Report, Conservational International, Washington, D.C.

Illingworth Rodkin Inc. 2004. Conoco/Phillips 24-inch steel pile installation – Results of underwater sound measurements. Conoco, Phillips Company.

IPCC. 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)], Geneva, Switzerland.

Isaac, J.L. 2009. Effects of climate change on life history: Implications for extinction risk in mammals. Endangered Species Research 7(2):115-123.

Kichler, K., M.T. Holder, S.K. Davis, R. Marquez, and D.W. Owens. 1999. Detection of multiple paternity in the Kemp's ridley sea turtle with limited sampling. Molecular Ecology 8(5):819-830.

Kichler, K.L. 1996a. Microsatellites and conservation genetics: Genetic variability and mating behavior of the Kemp's ridley sea turtle, *Lepidochelys kempii*. Master's thesis. Texas A&M University, College Station, Texas.

Kichler, K.L. 1996b. Microsatellites and marine turtle conservation: The Kemp's ridley diversity project. Pages 95-97 *in* B.W. Bowen and W.N. Witzell, editors. International Symposium on Sea Turtle Conservation Genetics. NOAA Technical Memorandum

Klima, E.F., G.R. Gitschlag, and M.L. Renaud. 1988. Impacts of the explosive removal of offshore petroleum platforms on sea turtles and dolphins. Marine Fisheries Review 50(3):33-42.

Komesaroff, P.A., M. Esler, I.J. Clarke, M.J. Fullerton, and J.W. Funder. 1998. Effects of estrogen and estrous cycle on glucocorticoid and catecholamine responses to stress in sheep. American Journal of Physiology - Endocrinology and Metabolism 275(4):E671-E678.

Lagueux, C.J., C.L. Campbell, and W.A. McCoy. 2003. Nesting and conservation of the hawksbill turtle *Eretmochelys imbricata*, in the Pearl Cays, Nicaragua. Chelonian Conservation and Biology 4(3):588-602.

Laist, D.W., J.M. Coe, and K.J. O'Hara. 1999. Marine debris pollution. Pages 342-366 *in* J.R. Twiss Jr. and R.R. Reeves, editors. Conservation and Management of Marine Mammals, Smithsonian Institution Press, Washington, D.C.

Laloë, J.-O., J. Cozens, B. Renom, A. Taxonera, and G.C. Hays. 2014. Effects of rising temperature on the viability of an important sea turtle rookery. Nature Climate Change 4(6):513-518.

Laloë, J.-O., N. Esteban, J. Berkel, and G.C. Hays. 2016. Sand temperatures for nesting sea turtles in the Caribbean: Implications for hatchling sex ratios in the face of climate change. Journal of Experimental Marine Biology and Ecology 474:92-99.

Lamont, M.M., and I. Fujisaki. 2014. Effects of ocean temperature on nesting phenology and fecundity of the loggerhead sea turtle (*Caretta caretta*). Journal of Herpetology 48(1):98-102.

Landry Jr., A.M., and D. Costa. 1999. Status of sea turtle stocks in the Gulf of Mexico with emphasis on the Kemp's ridley. Pages 248-268 *in* H. Kumpf, K. Steidinger, and K. Sherman, editors. The Gulf of Alaska: Physical Environment and Biological Resources, Blackwell Science, Malden, Massachusetts.

Lankford, S.E., T.E. Adams, R.A. Miller, and J.J. Cech Jr. 2005. The cost of chronic stress: Impacts of a nonhabituating stress response on metabolic variables and swimming performance in sturgeon. Physiological and Biochemical Zoology 78:599-609.

Law, R.J., and J. Hellou. 1999. Contamination of fish and shellfish following oil spill incidents. Environmental Geoscience 6:90-98.

Lazar, B., and R. Gračan. 2011. Ingestion of marine debris by loggerhead sea turtles, *Caretta caretta*, in the Adriatic Sea. Marine Pollution Bulletin 62(1):43-47.

Leroux, R.A., P.H. Dutton, F.A. Abreu-Grobois, C.J. Lagueux, C.L. Campbell, E. Delcroix, J. Chevalier, J.A. Horrocks, Z. Hillis-Starr, S. Troeng, E. Harrison, and S. Stapleton. 2012. Re-examination of population structure and phylogeography of hawksbill turtles in the wider Caribbean using longer mtDNA sequences. Journal of Heredity 103(6):806-820.

LGL Ltd. 2007. Environmental assessment of a marine geophysical survey by the R/V *Marcus G. Langseth* off Central America, January–March 2008. Prepared for the Lamont-Doherty Earth Observatory, Palisades, NY, and the National Science Foundation, Arlington, VA, by LGL Ltd., Environmental Research Associates, Ontario, Canada.

LHR. 2010. Energy, oil & gas. Louisiana Hurricane Resources.

Lima, S.L. 1998. Stress and decision making under the risk of predation: Recent developments from behavioral, reproductive, and ecological perspecitves. Advances in the Study of Behavior 27:215-290.

LUMCON. 2005. Mapping of dead zone completed. Louisiana Universities Marine Consortium, Chauvin, Louisiana.

Lutcavage, M.E., and P.L. Lutz. 1997. Diving physiology. Pages 277-295 *in* P.L. Lutz and J.A. Musick, editors. The Biology of Sea Turtles, CRC Press, Boca Raton, Florida.

Lutcavage, M.E., P. Plotkin, B.E. Witherington, and P.L. Lutz. 1997. Human impacts on sea turtle survival. Pages 387-409 *in* P.L. Lutz and J.A. Musick, editors. The Biology of Sea Turtles, CRC Press, Boca Raton, Florida.

Lutz, P.L., and T.B. Bentley. 1985. Respiratory physiology of diving in the sea turtle. Copeia 3:671-679.

MacDonald, I.R., N.L. Guinasso Jr., S.G. Ackleson, J.F. Amos, R. Duckworth, R. Sassen, and J.M. Brooks. 1993. Natural oil slicks in the Gulf of Mexico visible from space. Journal of Geophysical Research 98(C9):16351-16364.

MacPherson, S.L., R.N. Trindell, B.A. Schroeder, L.A. Patrick, D.K. Ingram, K.P. Frutchey, J.A. Provancha, A.M. Lauritsen, B.S. Porter, A.M. Foley, A.B. Meylan, B.E. Witherington, and M.K. Pico. 2012. Sea turtle nest translocation effort in the Florida panhandle and Alabama, USA, in response to the *Deepwater Horizon* (MC-252) oil spill in the Gulf of Mexico. Page 15 *in* T.T. Jones and B.P. Wallace, editors. Thirty-First Annual Symposium on Sea Turtle Biology and Conservation. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, San Diego, California.

Mahmoud, I.Y., and P. Licht. 1997. Seasonal changes in gonadal activity and the effects of stress on reproductive hormones in the common snapping turtle, *Chelydra serpentina*. General and Comparative Endocrinology 107(3):359-372.

Márquez, M.R. 1990. Sea turtles of the world. An annotated and illustrated catalogue of sea turtle species known to date.

Márquez, M.R., M.A. Carrasco, and M.C. Jimenez. 2002. The marine turtles of Mexico: An update. Pages 281-285 *in* I. Kinan, editor. Proceedings of the Western Pacific Sea Turtle Cooperative Research and Management Workshop. Western Pacific Regional Fishery Management Council, Honolulu, Hawaii.

Márquez, M.R., A. Villanueva, and P.M. Burchfield. 1989. Nesting population, and production of hatchlings of Kemp's ridley sea turtle at Rancho Nuevo, Tamaulipas, Mexico. Pages 16-19 *in* C.W.C. Jr. and A.M.L. Jr., editors. First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation, and Management.

Mazaris, A.D., A.S. Kallimanis, S.P. Sgardelis, and J.D. Pantis. 2008. Do long-term changes in sea surface temperature at the breeding areas affect the breeding dates and reproduction performance of Mediterranean loggerhead turtles? Implications for climate change. Journal of Experimental Marine Biology and Ecology 367:219-226.

McCauley, S., and K. Bjorndal. 1999. Conservation implications of dietary dilution from debris ingestion: Sublethal effects in post-hatchling loggerhead sea turtles. Conservation biology 13(4):925-929.

McClellan, C.M., J. Braun-McNeill, L. Avens, B.P. Wallace, and A.J. Read. 2010. Stable isotopes confirm a foraging dichotomy in juvenile loggerhead sea turtles. Journal of Experimental Marine Biology and Ecology 387:44-51.

McConnachie, S.H., K.V. Cook, D.A. Patterson, K.M. Gilmour, S.G. Hinch, A.P. Farrell, and S.J. Cooke. 2012. Consequences of acute stress and cortisol manipulation on the physiology, behavior, and reproductive outcome of female Pacific salmon on spawning grounds. Hormones and Behavior 62(1):67-76.

McFee, W.E., D.L. Wolf, D.E. Parshley, and P.A. Fair. 1996. Investigations of marine mammal entanglement associated with a seasonal coastal net fishery. NOAA Technical Memorandum.

Meador, J.P., R. Stein, and U. Varanasi. 1995. Bioaccumulation of polycyclic aromatic hydrocarbons by marine organisms. Reviews of Environmental Contamination and Toxicology 143:79-165.

Meylan, A. 1988. Spongivory in hawksbill turtles: A diet of glass. Science 239(4838):393-395.

Meylan, A., and M. Donnelly. 1999. Status justification for listing the hawksbill turtle (*Eretmochelys imbricata*) as critically endangered on the 1996 IUCN Red List of threatened animals. Chelonian Conservation and Biology 3(2):200-224.

Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea turtle nesting activity in the State of Florida 1979-1992. Florida Marine Research Publications 52(1-51).

Meylan, A.B. 1999. Status of the hawksbill turtle (*Eretmochelys imbricata*) in the Caribbean region. Chelonian Conservation and Biology 3(2):177-184.

Miller, J.D., K.A. Dobbs, C.J. Limpus, N. Mattocks, and A.M. Landry Jr. 1998. Long-distance migrations by the hawksbill turtle, *Eretmochelys imbricata*, from north-eastern Australia. Wildlife Research 25(1):89-95.

Milton, S.L., S. Leone-Kabler, A.A. Schulman, and P.L. Lutz. 1994. Effects of Hurricane Andrew on the sea turtle nesting beaches of South Florida. Bulletin of Marine Science 54:974-981.

MMS. 1998. Gulf of Mexico OCS oil and gas lease sales 171, 174, 177, and 180, Western Planning Area, Final Environmental Impact Statement. U.S. Department of the Interior, Minerals Management Service.

MMS. 2007a. Eastern Gulf of Mexico OCS oil and gas lease sale 224. U.S. Department of the Interior, Minerals Management Service.

MMS. 2007b. Gulf of Mexico OCS oil and gas lease sales: 2007-2012, Western planning area sales 204, 207, 210, 215, and 218; Central planning area sales 205, 206, 208, 213, 216, and 222. Final Environmental Impact Statement. U.S. Department of the Interior, Minerals Management Service.

Moberg, G.P. 1991. How behavioral stress disrupts the endocrine control of reproduction in domestic animals. Journal of Dairy Science 74:304-311.

Monzón-Argüello, C., C. Rico, A. Marco, P. López, and L.F. López-Jurado. 2010. Genetic characterization of eastern Atlantic hawksbill turtles at a foraging group indicates major undiscovered nesting populations in the region. Journal of Experimental Marine Biology and Ecology.

Moreira, L., C. Baptistotti, J. Scalfone, J.C. Thomé, and A.P.L.S. de Almeida. 1995. Occurrence of *Chelonia mydas* on the Island of Trindade, Brazil. Marine Turtle Newsletter 70(2).

Moreira, L., and K.A. Bjorndal. 2006. Estimates of green turtle (*Chelonia mydas*) nests on Trindade Island, Brazil, South Atlantic. Page 174 *in* N. Pilcher, editor. Twenty-Third Annual Symposium on Sea Turtle Biology and Conservation.

Morreale, S.J., and E.A. Standora. 1998. Early life stage ecology of sesa turtles in northeastern U.S. waters. NOAA Technical Memorandum.

Mourlon, V., L. Naudon, B. Giros, M. Crumeyrolle-Arias, and V. Daugé. 2011. Early stress leads to effects on estrous cycle and differential responses to stress. Physiology & Behavior 102:304-310.

Muller, R.G., T.M. Bert, and S.D. Gerhard. 2006. The 2006 Stock Assessment Update for the Stone Crab, *Menippe* spp. Fishery in Florida. Florida Fish and Wildlife Commission Florida Marine Research Institute, St. Petersburg, Florida.

Müllner, A., K. Eduard Linsenmair, and M. Wikelski. 2004. Exposure to ecotourism reduces survival and affects stress response in hoatzin chicks (*Opisthocomus hoazin*). Biological Conservation 118(4):549-558.

Murray, K.T. 2006. Estimated average annual bycatch of loggerhead sea turtles (*Caretta caretta*) in U.S. mid-Atlantic bottom otter trawl gear, 1996-2004. National Oceanic and

Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center.

Muyskens, J., D. Keating, and S. Granados. 2015. Mapping how the United States generates its electricity. The Washington Post, Washington, D.C.

Nedwell, J., and B. Edwards. 2002. Measurement of underwater noise in the Arun River during piling at county wharf, Littlehampton. Subacoustech Ltd, Southampton, UK.

NMFS. 2001. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the western North Atlantic. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Baltimore, Maryland.

NMFS. 2005. Biological opinion on the continued authorization of reef fish fishing under the Gulf of Mexico (GOM) reef fish fishery management plan (RFFMP) and proposed amendment 23. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Office, Protected Resources Division.

NMFS. 2006a. Biological opinion on permitting structure removal operations on the Gulf of Mexico outer continental shelf and the authorization for take of marine mammals incidental to structure removals on the Gulf of Mexico outer continental shelf. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Spring, Maryland.

NMFS. 2006b. Biological opinion on the 2006 Rim-of-the-Pacific Joint Training Exercises (RIMPAC). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, Silver Spring, Maryland.

NMFS. 2006c. Biological opinion on the issuance of Section 10(a)(1)(A) permits to conduct scientific research on the southern resident killer whale (*Orcinus orca*) distinct population segment and other endangered or threatened species. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northwest Region, Seattle, Washington.

NMFS. 2007. Endangered Species Act Section 7 consultation on the Continued Authorization of Fishing under the Fishery Management Plan (FMP) for Coastal Migratory Pelagic Resources in Atlantic and Gulf of Mexico. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources.

NMFS. 2008a. Endangered Species Act Section 7 Consultation on the Continued Authorization of Shark Fisheries (Commercial Shark Bottom Longline, Commercial Shark Gillnet and Recreational Shark Handgear Fisheries) as Managed under the Consolidated Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (Consolidated HMS FMP) including Amendment 2 to the Consolidated HMS FMP. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources.

NMFS. 2008b. Recovery plan for southern resident killer whales (*Orcinus orca*). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northwest Region, Seattle, Washington.

NMFS. 2010a. Endangered Species Act Section 7 Consultation on the Atlantic Bluefish Fishery Management Plan. Consultation No. F/NER/2007/09036. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources.

NMFS. 2010b. Endangered Species Act Section 7 Consultation on the Authorization of fisheries under the Monkfish Fishery Management Plan. Consultation No. F/NER/2008/01754. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources.

NMFS. 2010c. Endangered Species Act Section 7 Consultation on the Authorization of fisheries under the Northeast Multispecies Fishery Management Plan. Consultation No. F/NER/2008/01755. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources.

NMFS. 2010d. Endangered Species Act Section 7 Consultation on the Authorization of fisheries under the Spiny Dogfish Fishery Management Plan. Consultation No. F/NER/2008/01757. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources.

NMFS. 2010e. Endangered Species Act Section 7 Consultation on the Authorization of fisheries under the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan. Consultation No. F/NER/2003/00956. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources.

NMFS. 2010f. Endangered Species Act Section 7 Consultation on the Continued Implementation of Management Measures for the American Lobster Fishery. Consultation No. F/NER/2003/00956. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources.

NMFS. 2010g. Endangered Species Act Section 7 Consultation on the Federal Atlantic Mackerel, Squid and Atlantic Butterfish Fishery Management Plan. Consultation No. F/NER/2010/09091. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources.

NMFS. 2010h. Endangered Species Act Section 7 Consultation on the Northeast Skate Complex Fishery Management Plan. Consultation No. F/NER/2008/01756. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources.

NMFS. 2010i. Other significant oil spills in the Gulf of Mexico. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Response and Restoration, Emergency Response Division, Silver Spring, Maryland.

NMFS. 2013a. Biological Opinion on the U.S. Navy's Atlantic Fleet Training and Testing Activities from November 2013 through Novermber 2018. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources.

NMFS. 2013b. Fisheries of the United States 2013. Silver Spring, Maryland.

NMFS. 2016. Biological Opinion on Continued Opeation of St. Lucie Nuclear Power Plant, Units 1 and 2 in St. Lucie County, Florida. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Spring, Maryland.

NMFS, and USFWS. 1991a. Recovery plan for U.S. population of Atlantic green turtle *Chelonia mydas*. National Oceanic and Atmospheric Administration, National Marine Fisheries Service and U.S. Fish and Wildlife Service, Washington, D.C.

NMFS, and USFWS. 1991b. Recovery plan for U.S. population of loggerhead turtle (*Caretta caretta*). National Oceanic and Atmospheric Administration, National Marine Fisheries Service and U.S. Fish and Wildlife Service, Washington, D.C.

NMFS, and USFWS. 2007a. Hawksbill sea turtle (*Eretmochelys imbricata*) 5-year review: Summary and evaluation National Oceanic and Atmospheric Administration, National Marine Fisheries Service and U.S. Fish and Wildlife Service, Silver Spring, Maryland.

NMFS, and USFWS. 2007b. Kemp's ridley sea turtle (*Lepidochelys kempii*) 5-year review: Summary and evaluation. National Oceanic and Atmospheric Administration, National Marine Fisheries Service and U.S. Fish and Wildlife Service, Silver Spring, Maryland.

NMFS, and USFWS. 2008. Draft recovery plan for the northwest Atlantic population of the loggerhead sea turtle (*Caretta caretta*): Second revision. National Oceanic and Atmospheric Administration, National Marine Fisheries Service and U.S. Fish and Wildlife Service, Silver Spring, Maryland.

NMFS, and USFWS. 2010. Final draft report: Summary report of a meeting of the NMFS/USFWS cross-agency working group on joint listing of North Pacific and Northwest Atlantic loggerhead turtle distinct population segments. National Oceanic and Atmospheric Administration, National Marine Fisheries Service and U.S. Fish and Wildlife Service, Silver Spring, Maryland.

NMFS, and USFWS. 2015. Kemp's ridley sea turtle (*Lepidochelys kempii*) 5-year review: Summary and evaluation. National Oceanic and Atmospheric Administration, National Marine Fisheries Service and U.S. Fish and Wildlife Service.

NMFS, and USWFS. 2015. Kemp's ridley sea turtle (*Lepidochelys kempii*) 5-year review: Summary and evaluation. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources and U.S. Fish and Wildlife Service, Southwest Region.

NMFS SEFSC. 2001. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. NOAA Technical Memorandum.

NMMA. 2007. 2006 recreational boating statistical abstract. National Marine Manufacturers Association, Chicago, Illinois.

NOAA. 2010. Oil and Sea Turtles: Biology, Planning, and Response. National Oceanic and Atmospheric Administration, National Ocean Service, Office of Response and Restoration, Emergency Response Division, Seattle, Washington.

Norrgard, J.W. 1995. Determination of the natal origin and genetic stock composition of a juvenile feeding population of the loggerhead turtle (*Caretta caretta*) in Chesapeake Bay. Master's thesis. College of William and Mary, Williamsburg, Virginia.

NRC. 1990. Sea turtle mortality associated with human activities. National Academy Press, National Research Council Committee on Sea Turtle Conservation, Washington, D.C.

Omsjoe, E.H., A. Stein, J. Irvine, S.D. Albon, E. Dahl, S.I. Thoresen, E. Rustad, and E. Ropstad. 2009. Evaluating capture stress and its effects on reproductive success in Svalbard reindeer. Canadian Journal of Zoology 87(1):73-85.

Owens, D.W. 1999. Reproductive cycles and endocrinology in research and management techniques for the conservation of sea turtles. International Union for Conservation of Nature and Natural Resources, Survival Service Commission, Marine Turtle Specialist Group.

Parker Jr., R.O., D.R. Colby, and T.D. Willis. 1983. Estimated amount of reef habitat on a portion of the U.S. South Atlantic and Gulf of Mexico continental shelf. Bulletin of Marine Science 33(4):935-940.

Pike, D.A., E.A. Roznik, and I. Bell. 2015. Nest inundation from sea-level rise threatens sea turtle population viability. Royal Society Open Science 2:150127.

Plot, V., B. de Thoisy, S. Blanc, L. Kelle, A. Lavergne, H. Roger-Bérubet, Y. Tremblay, S. Fossette, and J.-Y. Georges. 2012. Reproductive synchrony in a recovering bottlenecked sea turtle population. Journal of Animal Ecology 81(2):341-351.

Plotkin, P. 2007. Biology and Conservation of Ridley Sea Turtles. The Johns Hopkins University Press, Baltimore, Maryland.

Poloczanska, E.S., C.J. Limpus, and G.C. Hays. 2009. Vulnerability of marine turtles in climate change. Pages 151-211 *in* D.W. Sims, editor. Advances in Marine Biology, Academic Press, Burlington.

Polyakov, I.V., V.A. Alexeev, U.S. Bhatt, E.I. Polyakova, and X. Zhang. 2010. North Atlantic warming: patterns of long-term trend and multidecadal variability. Climate Dynamics 34:439-457.

Powers, S.P., F.J. Hernandez, R.H. Condon, J.M. Drymon, and C.M. Free. 2013. Novel pathways for injury from offshore oil spills: Direct, sublethal and indirect effects of the *Deepwater Horizon* oil spill on pelagic *Sargassum* communities. PLoS ONE 8(9):e74802.

Prescott, R.L. 1988. Leatherbacks in Cape Cod Bay, Massachusetts, 1977-1987. NOAA Technical Memorandum, Proceedings of the Eighth Annual Workshop on Sea Turtle Conservation and Biology.

Prieto, A., F. Moncada, G. Nodarse, R. Puga, M.E. de Leon, R. Diaz-Femfndez, G. Espinosa, D. Castillo, M. Hemandez, E. Peregrin, M. de Arazoza, D. Salabarriaa, E. Morales, G. Webb, C. Manolis, and R. Gomez. 2001. Biological and ecological aspects of the hawksbill turtle population in Cuban waters. Republic of Cuba, Mexico City.

Queisser, N., and N. Schupp. 2012. Aldosterone, oxidative stress, and NF-κB activation in hypertension-related cardiovascular and renal diseases. Free Radical Biology and Medicine 53:314-327.

Rabalais, N., R. Turner, and D. Scavia. 2002. Beyond science into policy: Gulf of Mexico hyposiz and the Mississippi River. BioScience 52(2).

Rankin-Baransky, K., C.J. Williams, B.W. Bowen, S.E. Encalada, and J.R. Spotila. 1998. Origin of loggerhead sea turtles in the western North Atlantic as determined by mtDNA analysis. Page 85 *in* S.P. Epperly and J. Braun, editors. Seventeenth Annual Sea Turtle Symposium. U.S. Department of Commerce, Orlando, Florida.

Reina, R.D., J.R. Spotila, F.V. Paladino, and A.E. Dunham. 2009. Changed reproductive schedule of eastern Pacific leatherback turtles *Dermochelys coriacea* following the 1997-98 El Niño to La Niña transition. Endangered Species Research 7:155-161.

Reyff, J.A. 2003. Underwater sound levels associated with constuction of the Benicia-Martinez Bridge. lllingworth and Rodkin, Inc.

Rhodin, A.G.J. 1985. Comparative chondro-osseous development and growth in marine turtles. Copeia 1985:752-771.

Richardson, J.I., R. Bell, and T.H. Richardson. 1999. Population ecology and demographic implications drawn from an 11-year study of nesting hawksbill turtles, *Eretmochelys imbricata*, at Jumby Bay, Long Island, Antigua, West Indies. Chelonian Conservation and Biology 3(2):244-250.

Rieder, J.P., P.G. Parker, J.R. Spotila, and M.E. Irwin. 1998. The mating system of the leatherback turtle: A molecular approach. Bulletin of the Ecological Society of America 77(Supplement 3).

Rivier, C., and S. Rivest. 1991. Effect of stress on the activity of the Hypothalamic-Pituitary-Gonadal Axis: Peripheral and Central Mechanisms. Biology of Reproduction 45:523-532.

Robinson, R.A., H.Q.P. Crick, J.A. Learmonth, I.M.D. Maclean, C.D. Thomas, F. Bairlein, M.C. Forchhammer, C.M. Francis, J.A. Gill, B.J. Godley, J. Harwood, G.C. Hays, B. Huntley, A.M. Hutson, G.J. Pierce, M.M. Rehfisch, D.W. Sims, M.B. Santos, T.H. Sparks, D.A. Stroud, and M.E. Visser. 2009. Travelling through a warming world: Climate change and migratory species. Endangered Species Research 7:87-99.

Romero, L.M. 2004. Physiological stress in ecology: Lessons from biomedical research. Trends in Ecology and Evolution 19(5):249-255.

Rostal, D.C. 2007. Reproductive physiology of the ridley sea turtle. Pages 151-165 *in* P.T. Plotkin, editor. Biology and Conservation of Sea Turtles, Johns Hopkins University Press, Baltimore, Maryland.

Rostal, D.C., J.S. Grumbles, R.A. Byles, M.R. Marquez, and D.W. Owens. 1997. Nesting physiology of Kemp's ridley sea turtles, *Lepidochelys kempii*, at Rancho Nueveo, Tamaulipas, Mexico, with observation on population estimates. Chelonia Conservation and Biology 2(4):538-547.

Sapolsky, R.M., L.M. Romero, and A.U. Munck. 2000. How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative actions. Endocrine Reviews 21(1):55-89.

Schmid, J.R., and W.N. Witzell. 1997. Age and growth of wild Kemp's ridley turtles (*Lepidochelys kempii*): Cumulative results of tagging studies in Florida. Chelonian Conservation and Biology 2(4):532-537.

Schmidt, J. 1916. Marking experiments with turtles in the Danish West Indies. Danmarks Fiskeri-og Harundersogelser Meddelelser 5(1):1-26.

Schroeder, B.A., and N.B. Thompson. 1987. Distribution of the loggerhead turtle, *Caretta caretta*, and the leatherback turtle, *Dermochelys coriacea*, in the Cape Canaveral, Florida area: Results of aerial surveys Pages 45-53 *in* W.N. Witzell, editor. Cape Canaveral, Florida Sea Turtle Workshop. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

Schumann, N., N.J. Gales, R.G. Harcourt, and J.P.Y. Arnould. 2013. Impacts of climate change on Australian marine mammals. Australian Journal of Zoology 61(2):146-159.

Schuyler, Q.A., C. Wilcox, K.A. Townsend, K.R. Wedemeyer-Strombel, G. Balazs, E. van Sebille, and B.D. Hardesty. 2015. Risk analysis reveals global hotspots for marine debris ingestion by sea turtles. Global Change Biology.

Sears, C.J. 1994. Preliminary genetic analysis of the population structure of Georgia loggerhead sea turtles. Pages 135-139 *in* K.A. Bjorndal, A.B. Bolten, D.A. Johnson, and P.J. Eliazar, editors. Fourteenth Annual Symposium on Sea Turtle Biology and Conservation, National Marine Fisheries Service, Southeast Fisheries Center, Miami, Florida.

Sears, C.J., B.W. Bowen, R.W. Chapman, S.B. Galloway, S.R. Hopkins-Murphy, and C.M. Woodley. 1995. Demographic composition of the feeding population of juvenile loggerhead sea turtles (*Caretta caretta*) off Charleston, South Carolina: Evidence from mitochondrial DNA markers. Marine Biology 123:869-874.

Seminoff, J.A., C.D. Allen, G.H. Balazs, P.H. Dutton, T. Eguchi, H.L. Haas, S.A. Hargrove, M. Jensen, D.L. Klemm, A.M. Lauritsen, S.L. MacPherson, P. Opay, E.E. Possardt, S. Pultz, E. Seney, K.S. Van Houtan, and R.S. Waples. 2015. Status review of the green turtle

(*Chelonia mydas*) under the Endangered Species Act. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center.

Shaver, D.J., and C.W. Caillouet Jr. 2015. Reintroduction of Kemp’s ridley (*Lepidochelys kempii*) sea turtle to Padre Island National Seashore, Texas and its connection to head-starting. Herpetological Conservation and Biology 10:378-435.

Shaver, D.J., and T. Wibbels. 2007. Head-starting the Kemp's ridley sea turtle. Pages 297-323 *in* P.T. Plotkin, editor. Biology and Conservation of Ridley Sea Turtles, The Johns Hopkins University Press, Baltimore, Maryland.

Shoop, C.R., and R.D. Kenney. 1992. Seasonal distributions and abundances of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs 6:43-67.

Simmonds, M.P., and W.J. Eliott. 2009. Climate change and cetaceans: Concerns and recent developments. Journal of the Marine Biological Association of the United Kingdom 89(1):203-210.

Snover, M.L., A.A. Hohn, L.B. Crowder, and S.S. Heppell. 2007. Age and growth in Kemp's ridley sea turtles: Evidence from mark-recapture and skeletochronology. Pages 89-105 *in* P.T. Plotkin, editor. Biology and Conservation of Ridley Sea Turtles, The Johns Hopkins University Press, Baltimore, Maryland.

Spotila, J.R., A.E. Dunham, A.J. Leslie, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: Are leatherback turtles going extinct? Chelonian Conservation and Biology 2(2):209-222.

St. Aubin, D.J., and J.R. Geraci. 1988. Capture and handling stress suppresses circulating levels of thyroxine (T4) and triiodothyronine (T3) in beluga whale, *Delphinapterus leucas*. Physiological Zoology 61(2):170-175.

Stanley, D.R., and C.A. Wilson. 1989. Utilization of offshore platforms by recreational fishermen and scuba divers off the Louisiana coast. Bulletin of Marine Science 44(2):767-775.

Starbird, C.H., A. Baldridge, and J.T. Harvey. 1993. Seasonal occurrence of leatherback sea turtles (*Dermochelys coriacea*) in the Monterey Bay region, with notes on other sea turtles, 1986-1991. California Fish and Game 79(2):54-62.

Stenseth, N.C., A. Mysterud, G. Ottersen, J.W. Hurrell, K.-S. Chan, and M. Lima. 2002. Ecological effects of climate fluctuations. Science 297(5585):1292-1296.

Stephens, S.H. 2003. Genetic analysis of the kemp’s ridley sea turtle (*Lepidochelys kempii*) with estimates of effective population size. Master's thesis. Texas A&M University.

Sutherland, W.J., and N.J. Crockford. 1993. Factors affecting the feeding distribution of red breasted geese, *Branta ruficollis*, wintering in Romania. Biological Conservation 63:61-65.

TEWG. 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the Western North Atlantic. NOAA Technical Memorandum, Turtle Expert Working Group, Miami, Florida.

TEWG. 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Turtle Expert Working Group.

TEWG. 2007. An assessment of the leatherback turtle population in the Atlantic Ocean. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, Turtle Expert Working Group.

Tomas, J., and J.A. Raga. 2008. Occurrence of Kemp's ridley sea turtle (*Lepidochelys kempii*) in the Mediterranean. Marine Biodiversity Records 1:1-2.

USACOE. 2010. Sea turtle data warehouse. U.S. Army Corps of Engineers.

USAF. 1996. Sea turtles in the Gulf. Air Force Material Command, Eglin Air Force Base.

USCG. 2003. 2002 national recreational boating survey state data report. United States Coast Guard, Columbus, Ohio.

USCG. 2005. Boating statistics - 2005. United States Coast Guard, Washington D.C.

USCOP. 2004. An ocean blueprint for the 21st century. U.S. Commission on Ocean Policy, Washington, D.C.

USDOI. 2012. Natural Resource Damage Assessment: April 2012 status update for the *Deepwater Horizon* oil spill. U.S. Department of the Interior.

USFWS. 1999. South Florida multi-species recovery plan U.S. Fish and Wildlife Service, Atlanta, Georgia.

USFWS. 2002. Report on the Mexico/United States of America population restoration project for the Kemp's ridley sea turtle, *Lepidochelys kempii*, on the coasts of Tamaulipas and Veracruz, Mexico. U.S. Fish and Wildlife Service.

USFWS. 2006. Report on the Mexico/United States of America population restoration project for the Kemp's ridley sea turtle, *Lepidochelys kempii*, on the coasts of Tamaulipas, and Veracruz, Mexico. United States Fish and Wildlife Service.

USFWS, and NMFS. 1992. Recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*). U.S. Fish and Wildlife Service and National Marine Fisheries Service, St. Petersburg, Florida.

USN. 2008. Biological evaluation for the Gulf of Mexico rangle complex. U.S. Navy.

USN. 2009. Gulf of Mexico range complex final environmental impact statement/overseas environmental impact statement (EIS/OEIS) volume 1 (version 3). United States Navy, Norfolk, Virginia.

Varanasi, U., J.E. Stein, and M. Nishimoto. 1989. Biotransformation and disposition of polycyclic aromatic hydrocarbons (PAH) in fish. Pages 94-149 *in* U. Varanasi, editor. Metabolism of polycyclic aromatic hydrocarbons in the aquatic environment, CRC Press, Boca Raton, Florida.

Vargo, S., P. Lutz, D. Odell, E.V. Vleet, and G. Bossart. 1986. Study of the effects of oil on marine turtles. U.S. Department of the Interior, Minerals Management Service, Vienna, Virginia.

Wagner, E.J., R.E. Arndt, and B. Hilton. 2002. Physiological stress responses, egg survival and sperm motility for rainbow trout broodstock anesthetized with clove oil, tricaine methanesulfonate or carbon dioxide. Aquaculture 211:353-366.

Walker, B.G., P. Dee Boersma, and J.C. Wingfield. 2005. Physiological and behavioral differences in magellanic Penguin chicks in undisturbed and tourist-visited locations of a colony. Conservation biology 19(5):1571-1577.

Wallace, B.P., and R.H. George. 2007. Alternative techniques for obtaining blood samples from leatherback turtles. Chelonian Conservation and Biology 6(1):147-149.

Wilcox, C., G. Heathcote, J. Goldberg, R. Gunn, D. Peel, and B.D. Hardesty. 2015. Understanding the sources and effects of abandoned, lost, and discarded fishing gear on marine turtles in northern Australia. Conservation biology 29(1):198-206.

Wilkinson, C., and D. Souter. 2008. Status of Caribbean coral reefs after bleaching and hurricanes in 2005. Global Coral Reef Monitoring Network, and Reef and Rainforest Research Centre, Townsville.

Witherington, B., R. Herren, and M. Bresette. 2006. *Caretta caretta* – loggerhead sea turtle. Chelonian Research Monographs 3:74-89.

Witherington, B., P. Kubilis, B. Brost, and A. Meylan. 2009. Decreasing annual nest counts in a globally important loggerhead sea turtle population. Ecological Applications 19(1):30-54.

Witherington, B., B. Schroeder, S. Hirama, B. Stacy, M. Bresette, J. Gorham, and R. DiGiovanni. 2012. Efforts to rescue oiled turtles at sea during the BP *Deepwater Horizon* blowout event, April—September 2010. Page 21 *in* T.T. Jones and B.P. Wallace, editors. Thirty-First Annual Symposium on Sea Turtle Biology and Conservation. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Fisheries Science Center, San Diego, California.

Wolfe, S.H., J.A. Reidenauer, and D.B. Means. 1988. An ecological characterization of the Florida Panhandle. U.S. Fish and Wildlife Service and Minerals Management Service, New Orleans, Louisiana.

Work, P.A., A.L. Sapp, D.W. Scott, and M.G. Dodd. 2010. Influence of small vessel operation and propulsion system on loggerhead sea turtle injuries. Journal of Experimental Marine Biology and Ecology 393(1-2):168-175.

www.myfwc.com. 2016. Loggerhead nesting in Florida. Florida Fish and Wildlife Conservation Commission.

www.nmfs.noaa.gov/pr. 2006. National Marine Fisheries Service, Office of Protected Resources.

www.seaturtle.org. 2016. Sea turtle nest monitoring system. seaturtle.org.

Yender, R., J. Michel, and C. Lord. 2002. Managing seafood safety after an oil spill. National Oceanic and Atmospheric Administration, National Ocean Service, Office of Response and Restoration, Seattle, Washington.

Zangerl, R. 1980. Patterns of phylogenetic differentiation in the toxochelyid and cheloniid sea turtles. American Zoologist 20(3):585-596.

Zug, G.R., and J.F. Parham. 1996. Age and growth in leatherback turtles, *Dermochelys coriacea*: A skeletochronological analysis. Chelonian Conservation and Biology 2:244-249.