**NOAA's National Marine Fisheries Service**
**Endangered Species Act Section 7 Consultation**

# Biological Opinion

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| **Agency:** | Permits and Conservation Division of the Office of Protected Resources, NOAA's National Marine Fisheries Service |
| **Activity Considered:** | The Proposal to Issue Permit Modification No. 10022-02 to Raymond Carthy of the Florida Cooperative Fish and Wildlife Unit, University of Florida, for research on sea turtles in the Coastal Bays of Northwest Florida pursuant to the Endangered Species Act Section 10(a)(1)(A) |
| **Consultation Conducted by:** | Endangered Species Act Interagency Cooperation Division of the Office of Protected Resources, NOAA's National Marine Fisheries Service |
| **Approved by:** | |
| **Date:** | DEC 07 2011 |

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA) (16 U.S.C. 1531 *et seq.*) requires each federal agency to insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When a federal agency's action "may affect" listed species or designated critical habitat, that agency is required to consult formally with either NOAA's National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the listed resources that may be affected. Federal agencies are exempt from this requirement if they have concluded that an action "may affect", but is "unlikely to adversely affect" listed species or designated critical habitat, and NMFS and/or USFWS concur with that conclusion (50 CFR 402.14[b]).

For the actions described in this document, the action agency is NMFS' Office of Protected Resources – Permits and Conservation Division (Permits Division). The consulting agency is NMFS' Office of Protected Resources – Endangered Species Act Interagency Cooperation Division (ESA Interagency Cooperation Division). This document represents NMFS' Biological Opinion (Opinion) of the effects of the proposed research activities on listed threatened and endangered species and designated critical habitat in accordance with section 7 of the ESA. This Opinion is based on information submitted by the Permits Division as part of their initiation package (i.e. draft environmental assessment, draft permit, and previous biological opinion), recovery plans, published and unpublished scientific information on the biology and ecology of the listed species affected, and other relevant sources of information.

## CONSULTATION HISTORY

On April 23, 2008, the Permits Division issued permit No. 10022 to Raymond Carthy for research on sea turtles in coastal bays of northwest Florida after consulting with the ESA Interagency Cooperation Division (referred to at the time as NMFS' Office of Protected Resources—Endangered Species Division). The 2008 biological opinion concluded that the proposed action was not likely to jeopardize the continued existence of loggerhead sea turtles, green sea turtles, Kemp's ridley sea turtles, and Gulf sturgeon and was not likely to destroy or adversely modify any designated critical habitat.

On April 23, 2010, the Permits Division issued permit modification No. 10022-01 after consulting with the ESA Interagency Cooperation Division (again referred to at the time as NMFS' Office of Protected Resources—Endangered Species Division). The modification authorized the use of satellite and sonic tags on sea turtles captured in St. Andrew's Bay and St. Joseph Bay. The 2010 Biological Opinion concluded that the proposed action of authorizing the additional research activities was not likely to jeopardize the continued existence of loggerhead sea turtles, green sea turtles, hawksbill sea turtles, Kemp's ridley sea turtles, and Gulf sturgeon and was not likely to destroy or adversely modify any designated critical habitat.

On June 3, 2011, the Permits Division requested initiation of formal consultation with the ESA Interagency Cooperation Division on a proposed action to issue permit modification No. 10022-02 in order to authorize the researcher to capture green sea turtles by hand and/or by dip net in St. Joseph bay and temporarily mark their carapace, alter the method of satellite tag attachment, attach satellite/sonic tags to two additional species (Kemp's ridleys and loggerheads), obtain blood samples in addition to the other research activities already authorized, and increase the numbers of loggerhead, green, and Kemp's ridley sea turtles captured in all bays. The permit would remain valid for the remainder of the original permit period (i.e. through April 30, 2013). The initiation package included the permit application from the applicant, a draft of the proposed permit, the biological opinion for the applicant's first permit modification, and the draft Environmental Assessment detailing the anticipated effects of the proposed action.

Upon reviewing the initiation package, the ESA Interagency Cooperation Division initiated formal consultation on June 3, 2011.

# BIOLOGICAL OPINION

## DESCRIPTION OF THE PROPOSED ACTION

The Permits Division proposes to issue permit modification No. 10022-02 to Dr. Raymond Carthy of the Florida Cooperative Fish and Wildlife Unit, University of

Florida, for scientific research activities resulting in direct "takes"[1] of listed loggerhead (*Caretta caretta*) [Northwest Atlantic Ocean Distinct Population Segment (DPS)], green (*Chelonia mydas*) (Florida Breeding Population), Kemp's ridley (*Lepidochelys kempii*), and hawksbill (*Eretmochelys imbricata*) sea turtles as well as takes of Gulf sturgeon (*Acipenser oxyrinchus desotoi*) incidental to the proposed research to occur off the northwest coast of Florida pursuant to section 10(a)(1)(A) of the ESA. Takes of sea turtles are expected to be in the form of capture, wounding, and harassment[2] as a result of directed research activities while Gulf sturgeon would be incidentally captured and harassed as well. Researchers are currently authorized to capture sea turtles directly by way of strike-net and set-net (i.e., entanglement net) techniques in St. Joseph, St. Andrews, and Apalachicola bays and indirectly obtain turtles captured by relocation trawlers operating under a separate authority in St. Josephs bay and the surrounding Gulf of Mexico waters. All captured turtles are weighed, measured, photographed, skin biopsied, flipper and passive integrated transponder (PIT) tagged, and released under the current permit (i.e. permit No. 10022-01). In addition, a subset of green sea turtles is fitted with satellite/sonic tags.

Researchers are proposing to capture green sea turtles by hand and/or by dip net in St. Joseph bay and temporarily mark their carapace, alter the method of satellite tag attachment, attach satellite/sonic tags to two additional species (Kemp's ridleys and loggerheads), obtain blood samples, and increase the numbers of loggerhead, green, and Kemp's ridley sea turtles captured in all bays. The proposed permit modification would be in effect for the remainder of the original permit duration which is set to expire April 30, 2013. The proposed activities would result in additional takes of sea turtles in the form of capture (by strike-net, set-net, dipnet, and by hand), wound (by blood and skin/tissue sampling), and harassment (all activities) in addition to the takes already authorized under the current permit.

The objective of the research is to gather information on sea turtle species assemblage, population abundance, size classes, growth, seasonal movements, natal origin, and overwintering behaviors. The proposed modification would allow for further assessment of habitat use by different sea turtles species and adjust the number of captures based on the expected research effort to be employed for the remainder of the permit period. The modification would also allow blood samples from wild-caught turtles to be collected in

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1 The ESA defines "take" as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct

2 The ESA does not define harassment nor has NMFS defined the term pursuant to the ESA through regulation. However, the Marine Mammal Protection Act defines harassment as "any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal population in the wild or has the potential to disturb a marine mammal or marine mammal population in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering" [16 U.S.C. 1362(18)(A)]. The latter portion of this definition (that is, "...causing disruption of behavioral patterns including...migration, breathing, nursing, breeding, feeding, or sheltering") is almost identical to the USFWS' regulatory definition of "harass" pursuant to the ESA. For this Opinion, "harassment" is defined similarily: as an intentional or unintentional human act or omission that creates the probability of injury to an individual animal by disrupting one or more behavioral patterns that are essential to the animal's life history or its contribution to the population the animal represents.

order to obtain baseline data in determining physiological pathways of cold-stunning effects. This ESA Section 7 consultation considers the effects of the research activities to be authorized in the proposed permit modification on listed species and designated critical habitat occurring in the action area. **Tables 1a and 1b** below display the take of listed species exempted under the current permit while **tables 2a, 2b, and 2c** display the modified take numbers and additional activities proposed by the Permits Division on this modified action. No mortality of listed species is currently exempted as part of the proposed action and all targeted and non-targeted species captured are expected to be released alive.

**Table 1a. Takes Exempted under the Current Permit (No. 10022-01)**

| Directed Research in St. Joseph, St. Andrews, and Apalachicola Bays, Florida | | | | | |
|---|---|---|---|---|---|
| Species | Life Stage | Sex | No. of Takes | Take Action | Details |
| Loggerhead sea turtle | juvenile, subadult or adult | M,F | 8 | Capture by strike net or entanglement net, weigh, measure, photograph, skin biopsy, flipper tag, PIT tag, release | Actions to occur year-round |
| Green sea turtle | juvenile, subadult or adult | M,F | 108 | Capture by strike net or entanglement net, weigh, measure, photograph, skin biopsy, flipper tag, PIT tag, release | Actions to occur year-round |
| Green sea turtle | juvenile, subadult or adult | M,F | 12* | Capture by strike net or entanglement net, weigh, measure, photograph, skin biopsy, flipper tag, PIT tag, satellite tag, sonic tag, release, track | Actions to occur year-round |
| Kemp's ridley sea turtle | juvenile, subadult or adult | M,F | 22 | Capture by strike net or entanglement net, weigh, measure, photograph, skin biopsy, flipper tag, PIT tag, release | Actions to occur year-round |

* Only 12 transmitters may be attached over course of the permit period, not annually

**Table 1b. Additional Takes Exempted Under the Current Permit**

| Turtles Obtained Opportunistically from Relocation Trawlers (incidental captures authorized under a separate authority) | | | | | |
|---|---|---|---|---|---|
| Species | Life Stage | Sex | No. of Takes | Take Action | Details |
| Loggerhead sea turtle | juvenile, subadult or adult | M,F | 25* | Weigh, measure, photograph, tissue biopsy, flipper tag, PIT tag, satellite tag, release | Actions to occur year-round. |
| Green sea turtle | juvenile, subadult or adult | M,F | 25* | Weigh, measure, photograph, tissue biopsy, flipper tag, PIT tag, satellite tag, release | Actions to occur year-round |
| Hawksbill sea turtle | juvenile, subadult or adult | M,F | 25* | Weigh, measure, photograph, tissue biopsy, flipper tag, PIT tag, satellite tag, release | Actions to occur year-round |
| Kemp's ridley sea turtle | juvenile, subadult or adult | M,F | 25* | Weigh, measure, photograph, tissue biopsy, flipper tag, PIT tag, satellite tag, release | Actions to occur year-round |

** Only 25 transmitters may be attached over the course of the entire permit period (not annually) and may be of any combination of loggerhead, green, hawksbill, or Kemp's ridley sea turtles

**Table 2a. Takes to be Exempted under the Proposed Permit Modification (No. 10022-02)**

| Directed Research in St. Joseph, St. Andrews, and Apalachicola Bays, Florida (proposed changes highlighted in **BOLD**) | | | | | |
|---|---|---|---|---|---|
| Species | Life Stage | Sex | No. of Takes | Take Action | Details |
| Loggerhead sea turtle | juvenile, subadult or adult | M,F | **10** | Capture by strike net or entanglement net, weigh, measure, photograph, skin biopsy, **blood sample**, flipper tag, PIT tag, release | Actions to occur year-round. **All turtles captured in St. Joseph Bay will be blood sampled** |
| **Loggerhead sea turtle** | **juvenile, subadult or adult** | **M,F** | **10** | **Capture by strike net or entanglement net, weigh, measure, photograph, skin biopsy, blood sample, flipper tag, PIT tag, satellite tag, sonic tag, release, track** | **Actions to occur year-round. Only turtles satellite tagged in St. Andrews and Apalachicola Bays will be blood sampled.** |
| Green sea turtle | juvenile, subadult or adult | M,F | **238** | Capture by strike net or entanglement net, weigh, measure, photograph, skin biopsy, **blood sample**, flipper tag, PIT tag, release | Actions to occur year-round. **All turtles captured in St. Joseph Bay will be blood sampled** |
| Green sea turtle | juvenile, subadult or adult | M,F | 12 | Capture by strike net or entanglement net, weigh, measure, photograph, skin biopsy, **blood sample**, flipper tag, PIT tag, satellite tag, sonic tag, release, track | Actions to occur year-round. **Only turtles satellite tagged in St. Andrews and Apalachicola Bays will be blood sampled** |
| Kemp's ridley sea turtle | juvenile, subadult or adult | M,F | **40** | Capture by strike net or entanglement net, weigh, measure, photograph, skin biopsy, **blood sample**, flipper tag, PIT tag, release | Actions to occur year-round. **All turtles captured in St. Joseph Bay will be blood sampled** |
| **Kemp's ridley sea turtle** | **juvenile, subadult or adult** | **M,F** | **10** | **Capture by strike net or entanglement net, weigh, measure, photograph, skin biopsy, blood sample, flipper tag, PIT tag, satellite tag, sonic tag, release, track** | **Actions to occur year-round. Only turtles satellite tagged in St. Andrews and Apalachicola Bays will be blood sampled** |

**Table 2b. Additional Takes to be Exempted under the Proposed Permit Modification**

| Additional Research Project (Foraging Study) to be Conducted in St. Joseph Bay Only | | | | | |
|---|---|---|---|---|---|
| Species | Life Stage | Sex | No. of Takes | Take Action | Details |
| **Green sea turtle** | **juvenile, subadult or adult** | **M,F** | **20** | **Capture by hand/dip net, measure, weigh, photograph, flipper tag, PIT tag, carapace mark (temporary), release** | **Actions to occur year-round in St. Joseph Bay only.** |

**Table 2c. Additional Takes to be Exempted under the Proposed Permit Modification**

| Turtles Obtained Opportunistically from Relocation Trawlers (no changes from the previous permit) | | | | | |
|---|---|---|---|---|---|
| Species | Life Stage | Sex | No. of Takes | Take Action | Details |
| Loggerhead sea turtle | juvenile, subadult or adult | M,F | 25* | Weigh, measure, photograph, tissue biopsy, flipper tag, PIT tag, satellite tag, release | Actions to occur year-round |
| Green sea turtle | juvenile, subadult or adult | M,F | 25* | Weigh, measure, photograph, tissue biopsy, flipper tag, PIT tag, satellite tag, release | Actions to occur year-round |
| Hawksbill sea turtle | juvenile, subadult or adult | M,F | 25* | Weigh, measure, photograph, tissue biopsy, flipper tag, PIT tag, satellite tag, release | Actions to occur year-round |
| Kemp's ridley sea turtle | juvenile, subadult or adult | M,F | 25* | Weigh, measure, photograph, tissue biopsy, flipper tag, PIT tag, satellite tag, release | Actions to occur year-round |

* Only 25 transmitters may be attached over the course of the entire permit period (not annually) and may be of any combination of loggerhead, green, hawksbill, or Kemp's ridley sea turtles.

The following is a summary of the research activities to be authorized in the proposed permit modification:

*Capture*

Under the proposed permit modification, researchers will capture sea turtles by four different methods (i.e., strike nets, entanglement nets, dipnets, and hand capture). Annual captures by strike and/or entanglement nets will increase by the following amounts:

loggerhead sea turtle captures will increase from 8 to 20, green sea turtle captures will increase from 120 to 250, and Kemp's ridley sea turtle captures will increase from 22 to 50. These numbers reflect annual captures to occur in all three bays combined. Researchers are also proposing to use two new capture methods (i.e. hand and/or dipnets) to capture 20 green sea turtles in St. Joseph Bay as part of a separate foraging study to be conducted in conjunction other research activities. Captures will occur year round for the remainder of the permit period (through April 30, 2013).

For strike netting, a 150 meter (m) by 2.4 m net made of 20.3 centimeter (cm) by 20.3 cm mesh line will be deployed from an 8 foot net tender dinghy towed behind a 17 foot (ft) Boston whaler boat. Once a turtle becomes entangled, the net would be pulled aboard the boat and the turtle immediately removed for further processing (see additional research activities described below). For set nets, the same type of net would be set in the water in a straight line and passively capture sea turtles as they swim into it. The top line of the net will be equipped with floating buoys at 10 m intervals in order to assist researchers in spotting entangled animals. Set nets will be inspected every 20 minutes (min) and any non-targeted bycatch will be removed from the nets and released immediately.

For the specific green sea turtle foraging study to be conducted in St. Joseph Bay, dipnets and/or capture by hand will be used to capture green sea turtles spotted at the surface in shallow water. Turtles will be lifted onboard and undergo further sampling as described below.

*Handling and Size Measurements*
Captured sea turtles will be held on board in a rectangular tub approximately two ft wide by three feet long by one foot deep. Researchers would place a foam pad on the bottom of the tub and a cloth will be placed over the turtle's eyes to help calm the turtle and restrict movement. During all measurements and sampling, sea turtles will be sheltered from direct sunlight, wind, or rain. Under severe weather conditions or an unforeseen emergency (e.g., physical injury to personnel, etc.) requiring a return to shore, researchers will secure tubs carrying sea turtles to the bottom of the boat and transport them to shore. During transport and holding on land, sea turtles will remain in the tubs with towels over their heads. As soon as conditions allow, researchers will return each turtle near the capture site. Turtles captured using netting techniques will be released at the capture site within two hours of capture. Sea turtles obtained from relocation trawlers would be released into designated safe release zones established by relocation trawler protocols within four hours of capture.

All captured and recaptured turtles would be measured, weighed, and photographed on board. Straight carapace length (SCL) would be measured from the nuchal notch to the posterior-most portion of the rear marginals using a forester's caliper while curved carapace length (CCL) would be measured using a flexible tape. Each turtle will also be weighed using a hanging spring scale [35 kilogram (kg) maximum].

*Blood Sampling*
Within St. Joseph Bay, all captured sea turtles will be blood sampled except for the 20 green sea turtles to be captured by dipnet and carapace marked in the specific foraging study proposed for that bay. Within St. Andrews and Apalachicola bays, only sea turtles fitted with satellite/acoustic tags (maximum of 10 loggerheads, 12 greens, and 10 Kemp's ridleys) will be blood sampled. No blood samples will be taken from sea turtles obtained opportunistically from relocation trawlers.

Blood samples would be taken from the dorsal cervical sinus immediately after sea turtles are safely secured on deck. The skin at the sampling site would be scrubbed for a minimum of 30 seconds (sec) with 70 percent ethanol and Betadine to avoid infection. To facilitate bleeding of the cervical sinus, turtles would be positioned so that their head is lower than the body. The blood sample would be taken using a 21 gauge, 1-1.5 inch (in) vacutainer needle and a heparinized vacutainer tube, processed and frozen. Researchers will use smaller needles (23 gauge, 0.5 in) to obtain samples from smaller turtles. Researchers will ensure that the total volume of blood taken from each turtle will not exceed one milliliter (ml) per one kg of turtle weight and for turtles weighing less than one kg, a single blood sample will not exceed six percent of the turtle's total blood volume. Due to permit conditions, attempts (needle insertions) to extract blood from the neck must be limited to a total of four with two attempts allowed for either side of the neck.

*Skin/Tissue Sampling*
All captured sea turtles and all sea turtles obtained opportunistically from relocation trawlers will be biopsied except for the 20 green sea turtles to be captured by dipnet and carapace marked in the specific foraging study proposed for St. Joseph Bay. All sea turtles will be sampled once and researchers will make sure that recaptures are not sampled a second time in any given year. Following established procedures, researchers will obtain tissue samples using standard four to six millimeter (mm) biopsy punches in order to take a total of two skin samples from the posterior edge of a rear flipper of each turtle. The sample site will be properly cleaned and disinfected with 10 percent povidine-iodine and isopropyl alcohol to prevent infection. Samples would then be stored in 70 percent ethanol and analyzed at a later date. After the tissue sample has been taken, slight pressure would be applied to the area using gauze and 10 percent povidine-iodine until there is no visible bleeding.

*Carapace Marking*
Researchers are proposing to carapace mark 20 green sea turtles as part of the specific foraging study to be performed in St. Joseph Bay. Non-toxic, white polyester resin paint will be used to mark the sea turtle with a specific number for identification and tracking. The paint will dry within 10 min and is expected to wear off after about a month. The researchers would wear nitrile gloves, and the turtles would be held in the shade to prevent over-heating.

*Flipper and PIT Tagging*

All sea turtles captured in the study along with sea turtles obtained opportunistically from relocation trawlers will be fitted with Iconel flipper tags as well as PIT tags. Each turtle will be scanned for existing tags before being fitted with new tags. Double tagging with PIT and flipper tags minimizes the probability of complete tag loss of sampled turtles during the study. Recaptured turtles will not be retagged unless tag loss has occurred. Flipper tags will placed on the trailing edge of each fore flipper while one PIT tag is applied to a front flipper as well. All tagging equipment would be cleaned with isopropyl alcohol before each use and between turtles, and 10 percent povidine-iodine would be applied to the tag site pre and post inserting the tag to prevent infection. To avoid injury and to minimize tag loss, researchers would ensure that flipper tags are securely folded over and strategically located to accommodate future growth in young turtles.

*Satellite and Acoustic Transmitter Attachment*

Researchers will apply satellite and acoustic transmitters to a maximum of 10 loggerheads, 12 green, and 10 Kemp's ridley sea turtles obtained in all three bays combined and a maximum of 25 loggerhead, 25 green, 25 hawksbill, and 25 Kemp's ridley sea turtles obtained opportunistically from relocation trawlers. Before transmitter attachment, the carapace of each turtles will be scrubbed and epibionts will be removed. Satellite transmitters would be attached at the highest point of the carapace where the first and second vertebral scutes meet while acoustic transmitters will be attached at the base of the carapace near the tail. All transmitters will be coated with antifouling paint. Transmitters would not exceed five percent of the turtle's body weight and attachment materials would be configured and stream-lined to minimize effects of buoyancy and drag on the turtle's swimming ability as required by the proposed permit. Based on tag configurations and battery life, researchers anticipate that tags will remain attached to turtles for approximately one year.

Satellite and acoustic tags are currently authorized to be attached to the carapace using a two-part Power-Fast® epoxy glue. The epoxy emits no odor and produces minimal heat when activated. Drying time varies from 20-60 minutes, depending on ambient temperatures and humidity. When attaching acoustic transmitters, small holes are drilled through the outer edges of the marginal scutes and the instrument is then wired and glued in place. Sonic tagged turtles would be tracked using hand-held hydrophones from a 17-foot Boston Whaler. Relocation and tracking of the animals will take place daily following tag attachment.

Under this proposed permit modification, researchers are proposing a slightly altered methodology for attaching satellite transmitters [i.e. neoprene tag attachment method consistent with methods proposed by Seney et al. (2010)]. This method is expected to increase tag retention in juvenile sea turtles fitted with these types of tags compared to the two-part epoxy method currently being utilized. Upon capture, 60-grit sandpaper would be used to sand the attachment site and the underside of the satellite tag will be coated in anti-fouling paint. After cleaning the carapace, outlines of neoprene pieces to be attached will be traced onto the turtle's carapace at the attachment site and a vulcanizing silicone (known as "Megablue" or "sensorsafe") is applied to outline the scutes and act as a barrier to the epoxy (see **Figure 1a** below). After the silicone has set, the epoxy would be applied to the carapace at the attachment site, avoiding the silicone and thereby allowing for less-encumbered growth along the scutes suture lines (see **Figure 1b** below). Neoprene would then be carefully placed on top of the epoxy, nylon side up, and the satellite transmitter is affixed to the neoprene with another application of the epoxy (see **figures 1c**, **1d**, and **1e** below). Only sea turtles greater than 40 cm SCL will be fitted with satellite transmitters.

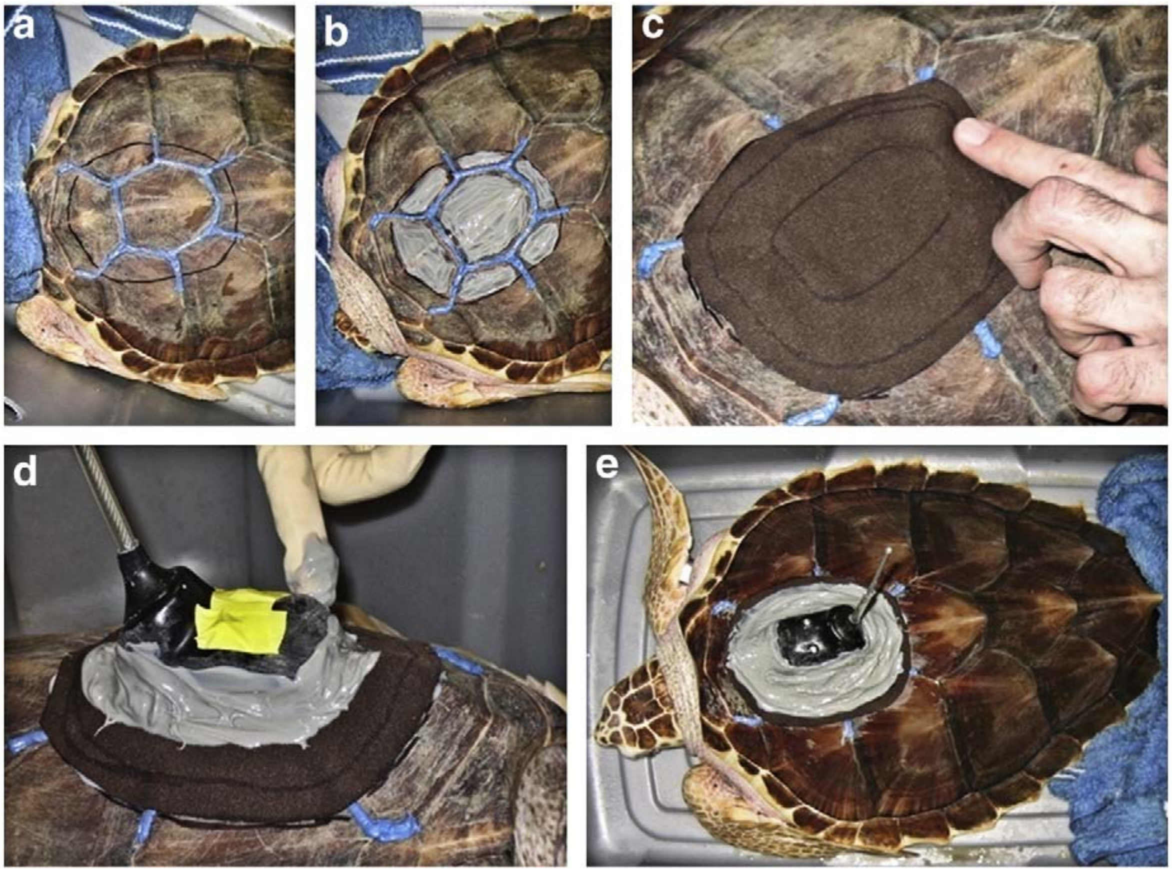

**Figure 1**: Photos detailing steps in the neoprene satellite tag attachment method. Figure obtained from Seney et al. (2010) and provided to the ESA Interagency Cooperation Division as part of the Permits Division's initiation package for permit modification No. 10022-02.

<u>Mitigation Measures</u>

The following section summarizes the mitigation measures associated with permit modification No. 10022-02 to mitigate effects to targeted and any non-targeted protected species during research activities. More detailed information may be found in the associated permit and Environmental Assessment documents. The following conditions are included in the proposed permit modification:

1. In the event a serious injury or mortality[3] of a protected species occurs, the Researchers must suspend permitted activities and contact the Chief of the

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3 The permit does not allow for unintentional serious injury and mortality caused by the presence or actions of researchers. This includes, but is not limited to; deaths resulting from infections related to sampling

Permits Division by phone within two business days. Researchers must also submit a written incident report. 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 the permit.

2. If authorized take[4] is exceeded, the Researchers must cease all permitted activities and notify the Chief of the Permits Division by phone as soon as possible but not later than two business days. Researchers must also submit a written incident report within two weeks of the incident. 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 exceedance of authorized take.

3. Application instruments and equipment must be cleaned and disinfected between animals.

4. When handling, measuring, and/or tagging turtles, researchers must use the following procedures:

    a. All equipment (tagging equipment, tape measures, etc.) that comes in contact with sea turtles must be cleaned and disinfected between the processing of each turtle; and

    b. Maintain a separate set of sampling equipment for handling animals displaying fibropapillomas tumors/or lesions (all equipment that comes in contact with the turtle must be cleaned with a disinfectant between the processing of each turtle).

    c. All turtles must be examined for existing tags, including PIT tags, before attaching or inserting new ones. If existing tags are found, the tag identification numbers must be recorded and included in the annual report. Researchers must have PIT tag readers capable of reading 125, 128, 134.2, and 400 kilohertz (kHz) tags.

    d. Flipper Tagging with Metal Tags- All tags must be cleaned (e.g., to remove oil residue) and disinfected before being used. Applicators must be cleaned (and disinfected when appropriate, e.g., contaminated with fluids) between animals. The application site must be cleaned and then scrubbed with a disinfectant (e.g. Betadine) before the tag pierces the animal's skin.

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procedures; and deaths or injuries sustained by animals during capture and handling, or while attempting to avoid researchers or escape capture.

4 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.

e. PIT Tagging- New, sterile tag applicators (needles) must be used. The application site must be cleaned and then scrubbed with a disinfectant (e.g. Betadine) before the applicator pierces the animal's skin. The injector handle must be disinfected if it has been exposed to fluids from other animals.

5. For general handling and releasing of turtles:

    a. The Permit Holder, Principal Investigator (PI), Co-investigator(s) (CI), or Research Assistant(s) acting on the Permit Holder's behalf must use care when handling live animals to minimize any possible injury, and appropriate resuscitation techniques must be used on any comatose turtle prior to returning it to the water. Whenever possible, injured animals should be transferred to rehabilitation facilities and allowed an appropriate period of recovery before return to the wild. An experienced veterinarian, veterinary technician, or rehabilitation facility must be named for emergencies. If an animal becomes highly stressed, injured, or comatose during the course of the research activities the researchers must contact a veterinarian immediately. Based on the instructions of the veterinarian, if necessary, the animal must be immediately transferred to the veterinarian or to a rehabilitation facility to receive veterinary care. All turtles must be handled according to procedures specified in 50 CFR 223.206(d)(1)(i).

    b. Turtles are to be protected from temperature extremes of heat and cold, provided adequate air flow, and kept moist (if appropriate) during sampling. Turtles must be placed on pads for cushioning and this surface must be cleaned and disinfected between turtles. The area surrounding the turtle must not contain any materials that could be accidentally ingested.

    c. During release, turtles must be lowered as close to the water's surface as possible to prevent potential injuries.

    d. The Permit Holder, PI, CI(s), or Research Assistant(s) acting on the Permit Holder's behalf must carefully observe newly released turtles and record observations on the turtle's apparent ability to swim and dive in a normal manner. If a turtle is not behaving normally within one hour of release, the turtle must be recaptured and taken to a rehabilitation facility.

6. For biopsy (tissue-skin) sampling:

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

    b. Sterile techniques must be used at all times. Samples must be collected from the trailing edge of a rear flipper. The tissue surface must be thoroughly swabbed once with both Betadine and alcohol, sampled, and then thoroughly swabbed again with just betadine. The procedure area and hands must be clean.

If the procedure has to involve more tissue (i.e., not just the flipper edge) including skin, fat, and muscle, the biopsy site and surrounding tissue must be treated to a surgical scrub. It must be cleansed with three alternating applications of 70 percent ethanol and a surgical iodine (e.g. Betadine) before the sample is collected. The sample area shall also be swabbed with Betadine after the sample is collected.

c. If it can be easily determined (through markings, tag number, etc.) that a sea turtle has been recaptured and has been already sampled under the activities authorized by this permit, no further biopsy samples must be collected from the animal.

7. For blood sampling:

    a. Blood samples must be taken by experienced personnel that have been authorized under this permit. New disposable needles must be used on each animal. Care should be taken to ensure no injury results from the sampling. If an animal cannot be adequately immobilized for blood sampling, efforts to collect blood must be discontinued. Attempts (needle insertions) to extract blood from the neck must be limited to a total of four, two on either side. Sample collection sites must always be scrubbed with alcohol or another antiseptic prior to sampling. No blood sample will be taken should conditions on the boat preclude the safety and health of the turtle

    b. A single sample must not exceed three ml per one kg of animal.

    c. Sampling period- Within a 45-day period of time, the cumulative blood volume taken from a single turtle must not exceed the maximum safe limit described above. If more than 50 percent of the maximum safe limit is taken, in a single event or cumulatively from repeat sampling events, from a single turtle within a 45-day period that turtle must not be re-sampled for 3 months from the last blood sampling event.

    d. Research coordination- Researchers must, to the maximum extent practicable, attempt to determine if any of the turtles they blood sample may have been sampled within the past three months or will be sampled within the next three months by other researchers. The permit holder must contact the other researchers working in the area that could capture the same turtles to ensure that none of the above limits are exceeded.

8. Transfer of biological samples- The transfer of any biological samples from the Permit Holder to researchers other than those specifically identified in the

application requires written approval from NMFS. The terms and conditions concerning any samples collected under this authorization remain in effect as long as the Permit Holder maintains authority and responsibility of the material taken.

9. For entanglement netting:

    a. Nets used to catch turtles must be of large enough mesh size to diminish bycatch of other species.

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

    c. Nets must be checked at intervals of less than 20 min, and more frequently whenever turtles or other organisms are observed in the net. The float line of all nets must be observed at all times for movements that indicate an animal has encountered the net. When this occurs the net must be immediately checked. "Net checking" is defined as a complete and thorough visual check of the net either by snorkeling the net in clear water or by pulling up on the top line such that the full depth of the net is viewed along the entire length. Researchers must plan for unexpected circumstances or demands of the research activities and have the ability and resources to meet this net checking condition at all times (e.g. if one animal is very entangled and requires extra time and effort to remove from the net, researchers must have sufficient staff and resources to continue checking the rest of the net at the same time).

    d. Nets must not be put in the water when marine mammals are observed within the vicinity of the research, and the marine mammals must be allowed to either leave or pass through the area safely before net setting is initiated. Should any marine mammals enter the research area after the nets have been set, the lead line must be raised and dropped in an attempt to make marine mammals in the vicinity aware of the net. If marine mammals remain within the vicinity of the research area, nets must be removed.

10. For hand capture- Researchers must be aware of the increased stress that accompanies hand captures and do their best to minimize stress levels.

11. For transport and holding:

    a. Turtles must be transported via a climate-controlled environment, protected from temperature extremes and kept moist (if appropriate). The turtles must be placed on pads for cushioning. The area surrounding the turtle must not contain any materials that could be accidentally ingested. Please refer to and follow the Florida Fish and Wildlife Conservation

Commission Marine Turtle Conservation Guidelines at: http://www.myfwc.com/seaturtle/Guidelines/Seaturtle_Guidelines_Sect3.pdf

b. Turtles transported to a facility and held (e.g., for rehabilitation) must be maintained and cared for under the "Care and Maintenance Guidelines for Sea Turtles Held in Captivity" issued by the USFWS or if in the State of Florida, following Florida Fish and Wildlife Conservation Commission Sea Turtle Conservation Guidelines, Section 4, Holding Turtles in Captivity. You must ensure the rehabilitation facility you utilize complies with the guidelines. You must also report the disposition of any animals taken to rehabilitation facilities (e.g., treated and released).

12. For relocation trawler captured sea turtles- Holding time of the sea turtle on board the trawler and transport of the animal to the transmitter attachment work site must not exceed one hour (i.e., total combined time). Animals must be returned to the water in four hours or less from the time of initial capture.

    Researchers must have a means for participating trawlers to contact them from the capture site. The trawlers must contact researchers when a sea turtle is captured in order to discuss its condition and possible transport or transfer. If researchers working under this permit are not able to promptly retrieve the turtle from the trawler and meet the one-hour time restriction, the turtle must not be used by researchers and must be released per the trawler's existing protocol. An injured or sick animal is a special case in which all efforts should be made to transport the turtle as soon as possible to a vet.

13. For compromised or injured sea turtles- The Permit Holder may conduct the activities authorized by this permit on compromised or injured sea turtles, but only if the activities will not further compromise the animal. Care must be taken to minimize handling time and reduce further stress to the animal.

14. For bycatch: All incidentally captured species (e.g. fishes) must be released alive as soon as possible.

15. For any listed sturgeon species encountered:

    a. Should a sturgeon be taken incidentally during the course of netting, if possible and if it can be done rapidly, the animal must be scanned for PIT tags and measured before release. Researchers shall ensure animals are not out of the water for any period greater than is absolutely necessary. Animals shall be released as soon as possible, near the capture area but in a manner that minimizes recapture in net gear if researchers continue netting activities.

    b. Sturgeon tend to inflate their swim bladder when stressed and in air. If the fish has air in its bladder, it will float and be susceptible to sunburn or bird attacks. Efforts must be made to return the fish to neutral buoyancy prior to and during release. Air must be released by gently applying ventral pressure in a posterior to anterior direction. The specimen must then be propelled rapidly downward during release. For help with any questions relating to sturgeon researchers should contact Stephania Bolden, of NMFS' Southeast Regional Office. The Permit Holder must report any sturgeon interactions to NMFS' Assistant Regional Administrator for Protected Resources, Southeast Regional Office, within 14 days of the incident. This report must contain: the description of the take (including length and weight if possible), the PIT tag number, latitude and longitude of capture, water depth the animal was taken in, substrate type animal was in when captured, any other environmental conditions that are already being recorded (e.g., water salinity, temperature), and final disposition of the sturgeon (i.e., released in good health, etc.).

16. For submerged aquatic vegetation (SAV), coral communities, live or hard bottom ecosystems:

    a. Researchers shall take all practicable steps to identify SAV, coral communities, and live/hard bottom habitats and avoid setting gear in such areas. Researchers shall use strategies to identify SAV, coral, and live or hard bottom types and avoid adverse impacts to essential fish habitat, including the use of tools such as charts, geographic information system software (GIS), sonar, fish finders, or other electronic devices to help determine characteristics and suitability of bottom habitat prior to using gear. If research gear is lost, diligent efforts shall be made to recover the lost gear to avoid further damage to benthic habitat and impacts related to "ghost fishing".

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

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

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

iii. Researchers must be careful not to tread or trample on seagrass and coral reef habitat.

c. For coral or hard/live bottom habitats- No gear may be set, anchored on, or pulled across coral or hard/live habitats.

17. For any manatees encountered- The following conditions to the permit are provided by the USFWS to prevent adverse interactions with endangered Florida manatees:

a. Vessel personnel must be informed that it is illegal to intentionally or unintentionally harm, harass, or otherwise "take" manatees, and to obey all posted manatee protection speed zones, Federal manatee sanctuary and refuge restrictions, and other similar state and local regulations while conducting in-water activities. Such information shall be provided in writing to all vessel personnel prior to beginning the permitted research.

b. Crew involved in research activities must wear polarized sunglasses to reduce glare while on the water and keep a look out for manatee. The crew shall include at least one member experienced in and dedicated to watching for manatee during all in-water activities.

c. All vessels engaged in netting and trapping shall operate at the slowest speed consistent with those activities. All netting and trapping shall be restricted to the hours between one-half hour after sunrise to one-half hour before sunset.

d. Rope attaching floats to nets or traps shall not have kinks or contain slack that could present an entanglement hazard to manatee.

e. All nets and traps must be continuously monitored. Netting activities must cease if a manatee is sighted within a 100-foot radius of the research vessel or the net, and may resume only when the animal is no longer within this safety zone, or 30 min has elapsed since the manatee was last observed within the safety zone.

f. If a manatee is accidentally captured:

i. Devote all research staff efforts to freeing the animal. Remember that a manatee must breathe and surface approximately every four min. The Permit Holder or PI must brief all research participants to ensure that they understand that freeing a manatee can dangerous. This briefing will caution people to keep fingers out of the nets, that no jewelry should be worn, that they be careful to stay away from the manatee’s paddle, and that they give the animal adequate time and room to breathe as they are freeing it.

ii. As appropriate, turn off the vessel motors or put the engine in neutral. Propellers can seriously injure or kill manatees.

iii. Release tension on the net to allow the animal the opportunity to free itself. Exercise caution when attempting to assist the animal in freeing itself. Manatee are docile animals but can thrash violently if captured or become entangled in a net. A 1,200 to 3,500 pound (lb) manatee can cause extensive damage to nets while trying to escape or breathe, so quick action is essential to protect both the manatee and the net. Ensure that the animal does not escape with net still attached to it.

iv. Contact the Florida Fish and Wildlife Conservation Commission, Division of Law Enforcement immediately to report any incidents. If a manatee is injured, the sooner the animal receives treatment, the better its chance of recovery. Immediately contact Nicole Adimey of the USFWS to report any gear or vessel interactions with manatees. Also contact NMFS (Chief of the Permits Division) as soon as possible.

18. Instrument tagging and marking:

a. Procedures for painting of carapace:

i. For turtles approximately four years old or younger- Paint must be applied without crossing suture lines (margins) if the paint will remain on the shell for three months or more.

ii. For juvenile turtles older than four years of age- Paint must be applied without crossing suture lines (margins) if the paint will remain on the shell for one year or more.

iii. For adult turtles- Paint must be applied without crossing suture lines (margins) if the paint will remain on the shell for two years or more.

iv. Researchers must not use paints with exothermic set-up reactions to avoid any effects from heat that could affect the turtle as the paint cures.

b. Procedures for TDRs, VHF, sonic or satellite tags:

i. Total weight of transmitter attachments must not exceed five percent of the body mass of the animal. Each attachment must be made so that there is no risk of entanglement. The transmitter attachment must either contain a weak link (where appropriate) or have no gap between the transmitter and the turtle that could result in entanglement. Researchers must make attachments as hydrodynamic as possible.

ii. Adequate ventilation around the head of the turtle must be provided during the attachment of satellite tags or attachment of radio/sonic tags if attachment materials produce fumes. To prevent skin or eye contact with harmful chemicals used to apply tags, turtles must not be held in water during the application process.

iii. When drilling through marginal scutes, a separate drill bit shall be used for each turtle. Bits may be reused if sterilized via the autoclave procedure before reuse.

19. Individuals conducting permitted activities must possess qualifications commensurate with their roles and responsibilities.

20. The PI must be onsite during any activities conducted under this permit unless a CI is present to act in place of the PI. Research assistants cannot conduct permitted activities in the absence of the PI or a CI.

21. Persons who require state or Federal licenses to conduct activities authorized under the permit (e.g. veterinarians, pilots) must be duly licensed when undertaking such activities.

22. The Permit holder must submit annual reports to the Chief of the Permits Division and a final report must be submitted within 180 days after expiration of the permit, or, if the research concludes prior to permit expiration, within 180 days of completion of the research.

23. Research results must be published or otherwise made available to the scientific community in a reasonable period of time.

24. The Permit Holder must provide written notification of planned field work to the Southeast Assistant Regional Administrator for NMFS' Office of Protected Resources. Such notification must be made at least two weeks prior to initiation of a field trip/season and must include the locations of the intended field study and/or survey routes, estimated dates of research, and number and roles of participants.

25. To the maximum extent practicable, 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.

## APPROACH TO THE ASSESSMENT

NMFS approaches its section 7 analyses of agency actions through a series of steps. The first step identifies those aspects of a proposed action likely to have direct and/or indirect physical, chemical, and biotic effects on listed species or on the physical, chemical, and biotic environment of an action area. As part of this step, we identify the spatial extent of these direct and indirect effects, including changes in that spatial extent over time. The result of this step includes defining the *Action Area* for the consultation. The second step of our analyses identifies the listed resources that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (these represent our *Exposure Analyses*). In this step of our analyses, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to an action's effects and the populations or subpopulations those individuals represent. Once we identify which listed resources are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to determine whether and how those listed resources are likely to respond given their exposure (these represent our *Response Analyses*).

The final steps of our analyses establishes the risks those responses pose to listed resources (these represent our *Risk Analyses*). Our jeopardy determinations must be based on an action's effects on the continued existence of threatened or endangered species as those "species" have been listed, which can include true biological species, subspecies, or DPSs. The continued existence of these "species" depends on the fate of the populations that comprise them. Similarly, the continued existence of populations are determined by the fate of the individuals that comprise them – populations grow or decline as the individuals that comprise the population live, die, grow, mature, migrate, and reproduce (or fail to do so).

Our risk analyses reflect these relationships between listed species, the populations that comprise that species, and the individuals that comprise those populations. Our risk analyses begin by identifying the probable risks actions pose to listed individuals that are likely to be exposed to an action's effects. Our analyses then integrate those individual risks to identify consequences to the populations those individuals represent. Our analyses conclude by determining the consequences of those population-level risks to the species those populations comprise.

We measure risks to listed individuals using the individuals' "fitness," or the individual's growth, survival, annual reproductive success, and lifetime reproductive success. In particular, we examine the scientific and commercial data available to determine if an individual's probable lethal, sub-lethal, or behavioral responses to an action's effect on the environment (which we identify during our *Response Analyses*) are likely to have consequences for the individual's fitness.

When individual listed plants or animals are expected to experience reductions in fitness in response to an action, those fitness reductions are likely to reduce the abundance, reproduction, or growth rates (or increase the variance in these measures) of the populations those individuals represent (see Stearns, 1992). Reductions in at least one of these variables (or one of the variables we derive from them) is a necessary condition for reductions in a population's viability, which is itself a necessary condition for reductions in a species' viability. As a result, when listed plants or animals exposed to an action's effects are not expected 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 (e.g., Brandon, 1978; Mills and Beatty, 1979; Stearns, 1992; Anderson, 2000). As a result, if we conclude that listed plants or animals are not likely to experience reductions in their fitness, we would conclude our assessment.

Although reductions in fitness of individuals is a *necessary* condition for reductions in a population's viability, reducing the fitness of individuals in a population is not always *sufficient* to reduce the viability of the population(s) those individuals represent. Therefore, if we conclude that listed plants or animals are likely to experience reductions in their fitness, we determine whether those fitness reductions are likely to reduce the viability of the populations the individuals represent (measured using changes in the populations' abundance, reproduction, spatial structure and connectivity, growth rates, variance in these measures, or measures of extinction risk). In this step of our analyses, we use the population's base condition (established in the *Environmental Baseline* and *Status of the Species* sections) as our point of reference. If we conclude that reductions in the fitness of individuals are not likely to reduce the viability of the populations those individuals represent, we would conclude our assessment.

Reducing the viability of a population is not always *sufficient* to reduce the viability of the species those populations comprise. Therefore, in the final step of our analyses, we determine if reductions in a population's viability are likely to reduce the viability of the species those populations comprise using changes in a species' reproduction, numbers, distribution, estimates of extinction risk, or probability of being conserved. In this step of our analyses, we use the species' status (established in the *Status of the Species* section) as our point of reference. Our final jeopardy determinations are based on whether threatened or endangered species are likely to experience reductions in their viability and whether such reductions are likely to be appreciable.

Destruction or adverse modification[5] determinations must be based on an action's effects on the conservation value of habitat that has been designated as critical to threatened or endangered species. If an area encompassed in a critical habitat designation is likely to be exposed to the direct or indirect consequences of the proposed action on the natural environment, we ask if primary or secondary constituent elements included in the designation (if there are any) or physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species are likely to respond to that

5 We are aware that several courts have ruled that the definition of destruction or adverse modification that appears in the section 7 regulations at 50 CFR 402.02 is invalid and do not rely on that definition for the determinations we make in this Opinion. Instead, as we explain in the text, we use the "conservation value" of critical habitat for our determinations which focuses on the designated area's ability to contribute to the conservation or the species for which the area was designated.

exposure. If primary or secondary constituent elements of designated critical habitat (or physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species) are likely to respond given exposure to the direct and/or indirect consequences of the proposed action on the natural environment, we ask if those responses are likely to be sufficient to reduce the quantity, quality, or availability of those constituent elements or physical, chemical, or biotic phenomena.

If the quantity, quality, or availability of the primary or secondary constituent elements of the area of designated critical habitat (or physical, chemical, or biotic phenomena) are reduced, we ask if those reductions are likely to be sufficient to reduce the conservation value of the designated critical habitat for listed species in the action area. In this step of our assessment, we combine information about the contribution of constituent elements of critical habitat (or of the physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species, particularly for older critical habitat designations that have no constituent elements) to the conservation value of those areas of critical habitat that occur in the action area, given the physical, chemical, biotic, and ecological processes that produce and maintain those constituent elements in the action area.

If the conservation value of designated critical habitat in an action area is reduced, the final step of our analyses asks if those reductions are likely to be sufficient to reduce the conservation value of the entire critical habitat designation. In this step of our assessment, we combine information about the constituent elements of critical habitat (or of the physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species) that are likely to experience changes in quantity, quality, and availability given exposure to an action with information on the physical, chemical, biotic, and ecological processes that produce and maintain those constituent elements in the action area. We use the conservation value of the entire designated critical habitat as our point of reference for this comparison. For example, if the designated critical habitat has limited current value or potential value for the conservation of listed species that limited value is our point of reference for our assessment.

To conduct these analyses, we rely on all of the evidence available to us. This evidence might consist of monitoring reports submitted by past and present permit holders, reports from NMFS Science Centers, reports prepared by State or Tribal natural resource agencies, reports from non-governmental organizations involved in marine conservation issues, the information provided by the Permits Division when it initiates formal consultation, and the general scientific literature. We supplement this evidence with reports and other documents – environmental assessments, environmental impact statements, and monitoring reports – prepared by other federal and state agencies whose operations extend into the marine environment.

During each consultation, we conduct electronic searches of the general scientific literature using *American Fisheries Society*, *Google Scholar*, *ScienceDirect*, *BioOne*, *Conference Papers Index*, *JSTOR*, and *Aquatic Sciences and Fisheries Abstracts* search engines, among others. We supplement these searches with electronic searches of doctoral dissertations and master's theses. These searches specifically try to identify data or other information that supports a particular conclusion (for example, a study that suggests sea turtles will exhibit a particular response to a particular tagging procedure) as well as data that does not support that conclusion.

We rank the results of these searches based on the quality of their study design, sample sizes, level of scrutiny prior to and during publication, and study results. Carefully designed field experiments (for example, experiments that control potentially confounding variables) are rated higher than field experiments that are not designed to control those variables. Carefully designed field experiments are generally ranked higher than computer simulations. Studies that produce large sample sizes with small variances are generally ranked higher than studies with small sample sizes or large variances. Finally, in keeping with the direction from the U.S. Congress to provide the "benefit of the doubt" to threatened and endangered species [House of Representatives Conference Report No. 697, 96th Congress, Second Session, 12 (1979)], when data are equivocal, or in the face of substantial uncertainty, our decisions are designed to avoid the risks associated with incorrectly concluding an action has no adverse effect on a listed species when, in fact, such adverse effects are likely (i.e. avoiding statistical Type II error in our decisions).

## ACTION AREA

The action area is defined in 50 CFR 402.2 as "all areas to be affected directly or indirectly by the Federal Action and not merely the immediate area involved in the action." Research is authorized to occur in waters of St. Joseph Bay, Apalachicola Bay, and St. Andrews Bay along the Florida Panhandle in the northern Gulf of Mexico (see **Figure 2** below).

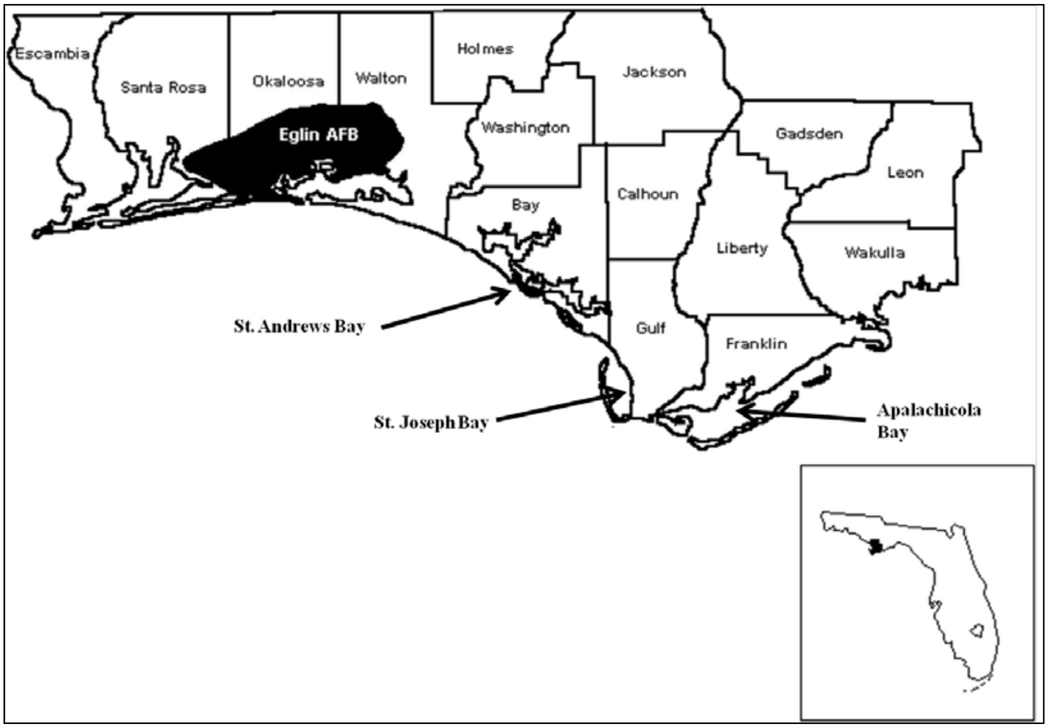


**Figure 2**: Action Area for Permit Modification No. 10022-02 showing the locations of St. Andrews, St. Joseph, and Apalachicola bays. Figure was included in the Permits Division's initiation package.

Since sea turtles may also be obtained indirectly as a result of captures in relocation trawlers operating in St. Andrews Bay and nearshore waters extending out in the greater Gulf of Mexico, the action area for this consultation includes all three bays as well as nearshore Gulf of Mexico waters surrounding St. Andrews Bay.

## STATUS OF THE SPECIES

The ESA Interagency Cooperation Division has determined that the following listed resources provided protection under the ESA occur within the action area and therefore may be affected by proposed action:

| LISTED RESOURCE (BY TAXON) | SCIENTIFIC NAME | LISTING |
|---|---|---|
| **Cetaceans** | | |
| Fin whale | *Balaenoptera physalus* | Endangered |
| Humpback whale | *Megaptera novaeangliae* | Endangered |
| Sei whale | *Balaenoptera borealis* | Endangered |
| Sperm whale | *Physeter macrocephalus* | Endangered |

| | | |
|---|---|---|
| **Sea Turtles** | | |
| Loggerhead sea turtle Northwest Atlantic Ocean DPS[6] | *Caretta caretta* | Threatened |
| Green sea turtle | *Chelonia mydas* | Endangered[7] |
| Hawksbill sea turtle | *Eretmochelys imbricata* | Endangered |
| Leatherback sea turtle | *Dermochelys coriacea* | Endangered |
| **Anadromous Fish** | | |
| Gulf Sturgeon | *Acipenser oxyrinchus desotoi* | Threatened |
| Largetooth sawfish | *Pristis perotteti* | Endangered |
| **Critical Habitat** | | |
| Gulf Sturgeon Critical Habitat | | Designated |

Listed Resources Not Likely to be Adversely Affected

*Fin, Humpback, Sei, and Sperm Whales*
Endangered fin, humpback, sei, and sperm whales occur within the action area in the greater Gulf of Mexico waters and could be subject to harassment and/or harm from boat strikes or entanglement in netting gear as a result of the proposed activities. However, these species are typically located further offshore in deeper waters than the areas targeted by the proposed research and would be highly unlikely to be encountered during sampling activities performed by the research applicants. These species are highly unlikely to be exposed to the effects of the proposed action and any potential threats are discountable. Therefore, the proposed action is not likely to adversely affect any listed cetaceans and these species will not be considered further in this Opinion.

*Leatherback Sea Turtles*
Leatherback sea turtles inhabit the waters off the coast of Florida including the Gulf of Mexico and may therefore be incidentally harassed through net capture (particularly for set nets). However, the researchers authorized under permit 10022-02 are experienced in turtle surveys and will restrict their research to the targeted species. Leatherback sea turtles do nest in the action area and researchers have never encountered a leatherback in the study area during surveys conducted in the past. Based on these data, NMFS believes the probability of this species being exposed to the effects of the research activities to be highly unlikely and the threats posed to this species are discountable. Therefore, the proposed research permit modifications are not likely to adversely affect leatherback sea turtles and this species will not be considered further in this Opinion.

6 A distinct population segment, is a vertebrate population or group of populations that is discrete from other populations of the species and significant in relation to the entire species. The ESA provides for listing species, subspecies, or distinct population segments of vertebrate species.

7 Green sea turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered. Due to difficulties in distinguishing between individuals from the Florida breeding population from other populations, green sea turtles are considered endangered wherever they occur in U.S. waters.

*Largetooth Sawfish*
Largetooth sawfish historically occupied waters in the Gulf of Mexico off Texas and Florida and therefore have the possibility of being present during research activities. However, sightings of largetooth sawfish in the Panhandle region of Florida are extremely rare and the last reported sighting of the species in Florida waters occurred in 1941 (NMFS, 2010a). Researchers did not report any sightings of largetooth sawfish in monitoring reports submitted since 2008 under the original permit. While the possibility exists that transient fish may enter Florida's waters, NMFS believes it is highly unlikely that these species would be exposed to effects from the proposed action. Therefore, the proposed action is not likely to adversely affect endangered largetooth sawfish and this species will not be considered further in this Opinion.

*Gulf Sturgeon Critical Habitat*
Critical habitat is designated for Gulf sturgeon in 14 geographic areas (units) including rivers and tributaries and nearshore Gulf of Mexico waters utilized by the species for spawning and foraging habitat. The proposed research activities are expected to be conducted in the following three designated units: Unit 6 (i.e., Apalachicola River system in Franklin, Gulf, Liberty, Calhoun, Jackson, and Gadsen counties, Florida), unit 11 (i.e., Florida Nearshore Gulf of Mexico in Escambia, Santa Rosa, Okaloosa, Walton, Bay and Gulf counties, Florida), and unit 13 (i.e., Apalachicola Bay in Gulf and Franklin counties, Florida).

The primary constituent elements (PCE) identified in the critical habitat designation include the following: abundant prey items within riverine habitats for larval and juvenile life stages and within estuarine and marine habitats for juvenile, subadult, and adult life stages; riverine spawning sites with substrates suitable for egg deposition and development; riverine aggregation areas believed necessary for minimizing energy expenditures during fresh water residency and possibly for osmoregulatory functions; a flow regime necessary for normal behavior, growth, and survival of all life stages in the riverine environment and necessary for maintaining spawning sites in suitable condition for egg attachment, eggs sheltering, resting, and larvae staging; water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages; sediment quality, including texture and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages; and safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats.

Researchers are not expected to have a measurable impact on prey items, riverine spawning sites, flow regimes, water quality, sediment quality, or migratory pathways. Permit conditions require researchers to remove anchors and gear in a manner that avoids dragging them across the bottom to avoid disturbing sediments and any turbidity from placing set nets on the bottom of estuarine areas is expected to be minimal. The research team has experience performing similar types of surveys and would be expected to take all proper precautions to avoid any physical disturbance or minimizing the impact of an accidental fuel spill. NMFS believes that exposure of Gulf sturgeon critical habitat to the proposed research activities would not be expected to impact the quality, quantity, and/or availability of PCEs nor would it impact the conservation value of the affected units. Therefore, the proposed action is not likely to adversely affect Gulf sturgeon critical habitat and this critical habitat will not be considered further in this Opinion.

Listed Resources Likely to be Adversely Affected

The sections below provide information on the status of listed resources likely to be adversely affected by the proposed action. The biology and ecology of these species as well as their global status and trends are described below, and inform the effects analysis for this Opinion.

### ***Loggerhead Sea Turtle Northwest Atlantic Ocean DPS***

*Species Description, Distribution, and Population Structure*

Adult and subadult loggerhead sea turtles are characterized as having a light yellow plastron and a reddish brown carapace covered by non-overlapping scutes that meet along seam lines. They typically have 11 or 12 pairs of marginal scutes, five pairs of costals, five vertebrals, and a nuchal (pre-central) scute that is in contact with the first pair of costal scutes. Hatchlings lack the reddish tinge and vary from light to dark brown dorsally. Both pairs of appendages are dark brown and have distinct white margins. Hatchling mean body mass is about 20 grams and mean SCL is about 45 mm (Dodd, 1988).

In the most recent status review conducted for the species, the loggerhead biological review team identified $60^{o}$N latitude and the equator as the north-south boundaries and $40^{o}$W longitude as the east boundary of the Northwest Atlantic Ocean population segment based on oceanographic features, loggerhead sightings, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies (Conant et al., 2009). The majority of loggerhead nesting in the Northwest Atlantic is concentrated along the U.S. coast from southern Virginia to Alabama. Additional nesting beaches are found along the northern and western Gulf of Mexico, eastern Yucatán Peninsula, at Cay Sal Bank in the eastern Bahamas, off the southwestern coast of Cuba, and along the coasts of Central America, Colombia, Venezuela, and the eastern Caribbean Islands (Addison and Morford, 1996; Addison, 1997; Gavilan, 2001). From a global perspective, the loggerhead nesting aggregation in the southeastern U.S. is second in size only to the nesting aggregations in the Arabian Sea off Oman, making it one of the most important nesting areas for the species.

Non-nesting, adult female loggerheads are reported in nearshore and offshore waters throughout the U.S. and Caribbean Sea (Foley et al., 2008) and recent tagging studies conducted in the Gulf of Mexico suggest that sea turtles nesting along the Gulf coast of Florida and the Florida Panhandle generally do not leave the region for extended periods throughout the year [Turtle Expert Working Group (TEWG, 2009)]. Significant numbers of male and female loggerheads forage in shallow water habitats with large expanses of open ocean access (such as Florida Bay) year-round while juveniles are also found in enclosed, shallow water estuarine environments (Epperly et al., 1995a).

In terms of population structure for the Northwest Atlantic Ocean DPS, NMFS and USFWS (2008) identified and evaluated five separate recovery units (i.e., nesting subpopulations): the Northern U.S. (Florida/Georgia border to southern Virginia); Peninsular Florida (Florida/Georgia border south through Pinellas County, excluding the islands west of Key West, Florida); Dry Tortugas (islands west of Key West, Florida); Northern Gulf of Mexico (Franklin County, Florida, west through Texas); and Greater Caribbean (Mexico through French Guiana, The Bahamas, Lesser and Greater Antilles). All Northwest Atlantic recovery units are reproductively isolated from populations occurring within the Northeast Atlantic, South Atlantic, and Mediterranean Sea. For the purposes of this consultation, we assume that all sea turtles targeted by the researchers would be members of the Northern Gulf of Mexico and/or Peninsular Florida nesting subpopulations based on the study areas.

*Life History Information*

Loggerhead sea turtles reach sexual maturity between 20 and 38 years of age, although this varies widely among populations (Frazer and Ehrhart, 1985; NMFS, 2001). The annual mating season for loggerhead sea turtles occurs from late March to early June, and eggs are laid throughout the summer months. Female loggerheads deposit an average of 4.1 nests within a nesting season (Murphy and Hopkins, 1984) and have an average remigration interval of 3.7 years (Tucker, 2010). Mean clutch size varies from 100 to 126 eggs for nests occurring along the southeastern U.S. coast (Dodd, 1988). Sand temperatures prevailing during the middle third of the incubation period often determine the sex of hatchlings (Mrosovsky and Yntema, 1980). Incubation temperatures near the upper end of the tolerable range produce only female hatchlings while incubation temperatures near the lower end of the tolerable range produce only male hatchlings. The pivotal temperature (i.e., the incubation temperature that produces equal numbers of males and females) in loggerheads is approximately 29$^{o}$C (Limpus et al., 1983; Mrosovsky, 1988; Marcovaldi et al., 1997).

As post-hatchlings, loggerheads hatched on U.S. beaches migrate offshore and become associated with *Sargassum spp.* habitats, driftlines, and other convergence zones (Carr, 1986; Witherington, 2002). They are believed to lead a pelagic existence in the North Atlantic Gyre for a period as long as 7-12 years (Bolten et al., 1998) although Snover (2002) suggests a much longer oceanic juvenile stage duration with a range of 9-24 years and a mean of 14.8 years. Stranding records indicate that when immature loggerheads reach 40-60 centimeters SCL, they then travel to coastal inshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico (Witzell et al., 2002). Other studies, however, have suggested that not all loggerhead sea turtles follow the model of circumnavigating the North Atlantic Gyre as pelagic juveniles, followed by permanent settlement into benthic environments (Laurent et al., 1998; Bolten, 2003). These studies suggest some turtles may either remain in the pelagic habitat in the North Atlantic longer than hypothesized or move back and forth between pelagic and coastal habitats interchangeably (Witzell et al., 2002).

After departing the oceanic zone, neritic juvenile loggerheads in the Northwest Atlantic inhabit continental shelf waters from Cape Cod Bay, Massachusetts, south through

Florida, The Bahamas, Cuba, and the Gulf of Mexico (neritic refers to the inshore marine environment from the surface to the sea floor where water depths do not exceed 200 meters). Benthic, immature loggerheads foraging in northeastern U.S. waters are also known to migrate southward in the fall as water temperatures cool and then migrate back northward in spring (Epperly et al., 1995a; Keinath, 1993; Morreale and Sandora, 1998; Shoop and Kenney, 1992). Juveniles are omnivorous and forage on crabs, mollusks, jellyfish and vegetation at or near the surface (Dodd, 1988). Sub-adult and adult loggerheads are primarily found in coastal waters and prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

*Listing Status*

The loggerhead sea turtle was originally listed as threatened throughout its range on July 28, 1978. On September 22, 2011, NMFS published a final rule to list nine separate DPSs under the ESA with four listed as threatened (i.e., Northwest Atlantic Ocean, South Atlantic Ocean, Southeast Indo-Pacific Ocean, and Southwest Indian Ocean DPSs) and five listed as endangered (i.e., Mediterraenean Sea, North Indian Ocean, North Pacific Ocean, South Pacific Ocean, and Northeast Atlantic Ocean DPSs). All sea turtles affected by this proposed action are expected to be members of the threatened Northwest Atlantic Ocean DPS. Critical habitat has not been designated for loggerhead sea turtles at the time of this consultation.

*Abundance and Trends*

For nesting subpopulations occurring in the Northwest Atlantic, the Peninsular Florida and Northern U.S. units support the greatest numbers of nesting females (i.e. over 10,000 for the Peninsular Florida unit and over 1,000 for the Northern U.S. unit) while the other three nesting subpopulations (i.e. Northern Gulf of Mexico, Dry Tortugas, and Greater Caribbean units) contain fewer than 1,000 nesting females based on count data (Baldwin et al., 2003; Ehrhart et al., 2003; Kamezaki et al., 2003, Limpus and Limpus, 2003; Margaritoulis et al., 2003; TEWG, 2009).

According to the most recent status reviews for the species, all nesting subpopulations occurring in the Northwest Atlantic Ocean show declining trends in the annual number of nests for which they were adequate data (NMFS and USFWS, 2008; Conant et al, 2009; TEWG, 2009). The Peninsular Florida nesting subpopulation, which represents approximately 87 percent of all nesting effort in the Northwest Atlantic Ocean DPS has declined 26 percent over a recent 20 year study period (1989–2008) with a greater decline (41 percent) occurring in the latter 10 years of the study (NMFS and USFWS, 2008; Witherington et al., 2009). The second largest nesting subpopulation (i.e. Northern U.S.) also saw annual declines of 1.3 percent since 1983 (NMFS and USFWS, 2008) while the third largest recovery unit (i.e. Greater Caribbean) saw annual declines of over 5 percent occurring over the period 1995-2006 (TEWG, 2009). The two smallest nesting subpopulations (i.e., Northern Gulf of Mexico and Dry Tortugas) have also seen declines in nest counts since the mid 1990's; however, these units represent only a small fraction in loggerhead nesting and are not considered to be good indicators of the overall trend. In addition, a detailed analysis of Florida's long-term loggerhead nesting data (1989-2011) revealed that following a 24 percent increase between 1989 and 1998, nest counts for Florida beaches declined 16 percent between 1998 and 2011. The most recent nest counts in 2011 were close to the average for the preceding five-year period suggesting the recent trend may be stabilizing [Florida Fish and Wildlife Conservation Commission (FWC), 2011a].

At present, there are no reliable estimates of population size of loggerheads occurring in the pelagic and oceanic environments (Bjorndal and Bolten, 2000); however, recent data collected from in-water studies reveal some patterns of abundance and/or size composition of loggerheads occurring in the Northwest Atlantic. The 2009 TEWG report summarized in-water capture and strandings data[8] spanning over four decades from the late 1970's through the late 2000's. Data from the southeastern U.S. (from central North Carolina through central Florida) indicated a possible increase in the abundance of neritic loggerheads captured over the past one to two decades while aerial surveys and one other in-water study conducted in the northeastern U.S. (north of Cape Hatteras, N.C.) indicate a decrease in abundance over similar periods (TEWG, 2009). This increase in catch rates for the southeastern U.S. was not consistent with the declines in nesting seen over the same time period. The authors suggested that the apparent increase in in-water catch rates in the southeastern U.S. coupled with a shift in median size of captured juveniles may indicate there is a relatively large cohort that will be reaching sexual maturity in the near future. However, additional data from the review suggests that any increase in adults may be temporary because in-water studies throughout the entire eastern U.S. also indicated a substantial decrease in the abundance of smaller sized juveniles which would, in turn, indicate possible recruitment failure. The authors stated these trends should be viewed with caution given the limited number and size of studies dedicated to assessing in-water abundance of loggerheads and that more research conducted over a longer time series needs to be completed to determine what impact, if any, these trends have on recruitment and/or survival rates.

Also, the loggerhead sea turtle biological review team recently conducted two independent analyses using nesting data (including counts of nesting females or nests) to assess extinction risks for the identified DPS using methods developed by Snover and Heppell (2009). The analysis performed for the status review indicated that the Northwest Atlantic Ocean DPS had a high likelihood of quasi-extinction over a wide range of quasi-extinction threshold values, suggesting that the DPS is likely to continue to decline in future years (Conant et al., 2009).

*Current Threats*

Loggerhead sea turtles face numerous natural and anthropogenic threats that help shape its status and affect the ability of the species to recover. As many of the threats affecting loggerheads are either the same or similar in nature to threats affecting other listed sea

8 Data was compiled from turtle captures recorded for the St. Lucie Power Plan in Florida since 1976 (see Bresette et al., 2003), entanglement surveys conducted in the Indian River in Florida since 1982 (see Ehrhart et al., 2007), fishery-independent trawl surveys off the southeastern U.S. (see SCMRI, 2000), pound-net captures off North Carolina (see Epperly et al., 2007) and off New York (see Morreale and Standora, 1998; Morreale et al., 2005), and strandings data maintained by the Sea Turtle Stranding and Salvage Network.

turtle species, many of the threats identified in this section below are discussed in a general sense for all listed sea turtles rather than solely for loggerheads. Threats specific to a particular species are then discussed in the corresponding status sections where appropriate.

Sea turtles have been impacted historically by domestic fishery operations that often capture, injure, and even kill sea turtles at various life stages. In the U.S., the bottom trawl, sink gillnets, hook and line gear, and bottom longline managed in the Northeast Multispecies Fishery are known to capture sea turtles during normal fishery operations (Watson et al., 2004; Epperly et al., 1995a; Lewison et al., 2003, Lewison et al., 2004; Richards, 2007) while the lines used for pot gear for the U.S. Lobster and Red Crab fisheries cause entanglement resulting in injury to flippers, drowning, and increased vulnerability to boat collisions (Lutcavage et al., 1997). In addition, various trawl, gillnet, longline, and hook gears used for the Monkfish, Spiny Dogfish, Summer Flounder, Scup, Black Sea Bass, and Atlantic Highly Migratory Species fisheries managed in the U.S. impact sea turtles at various degrees. The Southeast U.S. Shrimp Fishery (which uses otter trawl gear) has historically been one of the largest threats to sea turtles in the southeastern U.S. (Murray, 2006), and continues to interact with (and kill) large numbers of sea turtles each year. Although loggerhead sea turtles are most vulnerable to pelagic longlines during their immature life history stage, there is some evidence that benthic juveniles may also be captured, injured, or killed by pelagic fisheries as well (Lewison et al., 2004) (refer to the *Environmental Baseline* section of this Opinion for more specific information regarding federal and state managed fisheries affecting sea turtles operating in and around the action area).

In addition to domestic fisheries, sea turtles are subject to direct as well as incidental capture in numerous foreign fisheries, further exacerbating the ability of sea turtles to survive and recover on a more global scale. For example, pelagic, immature loggerhead sea turtles circumnavigating the Atlantic are exposed to international longline fisheries including the Azorean, Spanish, and various other fleets (Aguilar et al., 1995; Bolten et al., 1994; Crouse, 1999). Bottom set lines in the coastal waters of Madeira, Portugal, are reported to take an estimated 500 pelagic immature loggerheads each year (Dellinger and Encamacao, 2000) and gillnet fishing is known to occur in many foreign waters, including (but not limited to) the northwest Atlantic, western Mediterranean, South America, West Africa, Central America, and the Caribbean. In addition to the reported takes, there are many unreported takes or incomplete records by foreign fleets, making it difficult to characterize the total impact that international fishing pressure is having on listed sea turtles. Nevertheless, international fisheries represent a continuing threat to listed sea turtles' survival and recovery throughout their respective ranges.

There are also many non-fishery impacts affecting the status of sea turtle species, both in the marine and terrestrial environment. In nearshore waters of the U.S., the construction and maintenance of Federal navigation channels has been identified as a source of sea turtle mortality. Hopper dredges, which are frequently used in ocean bar channels and sometimes in harbor channels and offshore borrow areas, move relatively rapidly and can entrain and kill sea turtles (NMFS, 1997a). Sea turtles entering coastal or inshore areas have been affected by entrainment in the cooling-water systems of electrical generating plants. Other neashore threats include harassment and/or injury resulting from private and commercial vessel operations, military detonations and training exercises, and scientific research activities.

Coastal development can deter or interfere with nesting, affect nesting success, and degrade nesting habitats for sea turtles. Structural impacts to nesting habitat include the construction of buildings and pilings, beach armoring and renourishment, and sand extraction (Lutcavage et al., 1997; Bouchard et al., 1998). These factors may directly, through loss of beach habitat, or indirectly, through changing thermal profiles and increasing erosion, serve to decrease the amount of nesting area available to females and may evoke a change in the natural behaviors of both adults and hatchlings (Ackerman, 1997; Witherington et al., 2003; Witherington et al., 2007). In addition, coastal development is usually accompanied by artificial lighting which has been known to alter the behavior of nesting adults (Witherington, 1992) and is often fatal to emerging hatchlings that are drawn away from the water (Witherington and Bjorndal, 1991). Predation by various land predators is a threat to developing nests and emerging hatchlings. Additionally, direct harvest of eggs and adults from beaches in foreign countries continues to be a problem for various sea turtle species throughout their ranges.

Multiple municipal, industrial and household sources as well as atmospheric transport introduce various pollutants such as pesticides, hydrocarbons, organochlorides (e.g. DDT and PCBs), and other pollutants that may cause adverse health effects to listed species including sea turtles (Iwata et al., 1993; Grant and Ross, 2002; Garrett, 2004; Hartwell, 2004). Loggerheads may be particularly affected by organochlorine contaminants as they were observed to have the highest organochlorine contaminant concentrations in sampled tissues (Storelli et al., 2008). It is thought that dietary preferences were likely to be the main differentiating factor among species. Storelli et al. (1998) analyzed tissues from twelve loggerhead sea turtles stranded along the Adriatic Sea (Italy) and found that mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals and porpoises (Law et al., 1991). Recent efforts have led to improvements in regional water quality, although the more persistent chemicals are still detected and are expected to endure for years (Mearns, 2001; Grant and Ross, 2002). Acute exposure to hydrocarbons from petroleum products released into the environment via oil spills and other discharges may directly injure individuals through skin contact with oils (Geraci, 1990), inhalation at the water's surface and ingesting compounds while feeding (Matkin and Saulitis, 1997). Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability in the action area (for more information on the effects of present and past oil spills affecting populations in the Gulf of Mexico region, refer to the *Environmental Baseline* section of this Opinion).

Climate change and variability are identified as major causes of changing marine productivity and may therefore influence sea turtle prey abundance in foraging areas throughout the globe (Mantua et al., 1997; Francis et al., 1998; Beamish et al., 1999; Hare et al., 1999; Benson and Trites, 2002). For example, decade-scale climatic regime shifts have been related to changes in zooplankton in the North Atlantic (Fromentin and Planque, 1996) and decadal trends in the North Atlantic Oscillation (NAO) (Hurrell, 1995) can affect the position of the Gulf Stream (Taylor et al., 1998) and other circulation patterns in the North Atlantic that act as important migratory pathways for various life stages of sea turtles. All reptiles including sea turtles have a tremendous dependence on their thermal environment for regulating physiological processes and for driving behavioral adaptations (Spotila et al., 1997). Atmospheric warming creates habitat alteration which in turn may change sex ratios and affect reproductive periodicity for nesting sea turtles. Climate variability may also increase hurricane activity leading to an increase in debris in nearshore and offshore waters, thereby resulting in increased entanglement, ingestion, or drowning as well as increased physical destruction of sea turtle nests. However, gaps in information and the complexity of climatic interactions complicate the ability to predict the effects that climate variability may have to these species from year to year.

The demand for both nourishment and the placement of hardened structures on the beach as management options for beach erosion are likely to increase in the future in the face of projected sea level rise and more intense storm activity associated with global climate change. The construction of beachfront armoring (i.e., rigid structures placed parallel to the shoreline on the upper beach to prevent both landward retreat of the shoreline and inundation or loss of upland property by flooding and wave action) includes bulkheads, seawalls, soil retaining walls, rock revetments, sandbags, and geotextile tubes. These structures can greatly impact nesting opportunities and hatching success of loggerhead turtles as well as other species. Mosier (1998) reported that fewer loggerheads made nesting attempts on beaches fronted by seawalls and found that when turtles did emerge in the presence of armoring structures, more returned to the water without nesting than those on non-armored beaches. Armoring structures can also eliminate a turtle's access to upper regions of the beach/dune system and subsequently cause turtles to nest at lower elevations which increases the risk of repeated tidal inundation and impact thermal regimes that can influence sex ratios.

Although numerous efforts are underway to reduce loggerhead bycatch in fisheries, and many positive actions have been implemented, it is unlikely that this source of mortality can be sufficiently reduced across the range of the DPS to positively benefit recovery potential in the near future because of the diversity and magnitude of the fisheries operating in the North Atlantic, the lack of comprehensive information on fishing distribution and effort, limitations on implementing demonstrated effective conservation measures, geopolitical complexities, limitations on enforcement capacity, and lack of availability of comprehensive bycatch reduction technologies (75 FR 12598). In addition, Heppell et al. (2003) showed that the growth of loggerhead sea turtle populations were particularly sensitive to changes in annual survival of both juvenile and adult sea turtles, and Crouse (1999) concluded that relatively small changes in annual survival rates of both juvenile and adult loggerhead sea turtles may adversely affect large segments of the total loggerhead sea turtle population. These studies suggest the species is particularly vulnerable to new sources of mortality as well as demographic and environmental stochasticity all of which are often difficult to predict with any certainty.

## ***Green Sea Turtle***

*Species Description, Distribution, and Population Structure*

Green sea turtles have a smooth carapace with four pairs of lateral (or costal) scutes and a single pair of elongated prefrontal scales between the eyes. They typically have a black dorsal surface and a white ventral surface although the carapace of green sea turtles in the Atlantic Ocean has been known to change in color from solid black to a variety of shades of grey, green, brown and black in starburst or irregular patterns (Lagueux, 2001).

Green sea turtles are distributed circumglobally, mainly in waters between the northern and southern $20^{o}$ C isotherms (Hirth, 1971) and nesting occurs in more than 80 countries worldwide (Hirth, 1997). The two largest nesting populations are found at Tortuguero, on the Caribbean coast of Costa Rica, and Raine Island, on the Great Barrier Reef in Australia. The complete nesting range of green sea turtles within the southeastern U.S. includes sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands between Texas and North Carolina as well as the U.S.V.I. and Puerto Rico (NMFS and USFWS, 1991). Principal U.S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard through Broward counties. Regular nesting is also known to occur on St Croix, U.S.V.I., and on Vieques, Culebra, Mona, and the main island of Puerto Rico (Dow et al., 2007). For more information on green sea turtle nesting in other ocean basins, refer to the 1991 Recovery Plan for the Atlantic Green Turtle (NMFS and USFWS, 1991) or the 2007 Green Sea Turtle 5-Year Review (NMFS and USFWS, 2007a).

In U.S. Atlantic and Gulf of Mexico waters, green turtles are found in inshore and nearshore waters from Texas to Massachusetts. Important feeding areas in Florida include the Indian River Lagoon System, the Florida Keys, Florida Bay, Homosassa, Crystal River, Cedar Key, St. Joseph Bay, and the Atlantic Ocean off Florida from Brevard through Broward counties (Wershoven and Wershoven, 1992; Guseman and Ehrhart, 1992). Additional important foraging areas in the western Atlantic include the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean coast of Panama, scattered areas along Colombia and Brazil (Hirth, 1971), and the northwestern coast of the Yucatan Peninsula. Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs (Hays et al., 2001) and, like loggerheads, are also known to migrate from northern areas in the summer back to warmer southern waters to the south in the fall and winter to avoid cold stunning.

The most recent status review (NMFS and USFWS, 2007a) assessed the nesting success of the species by evaluating 46 different nesting concentrations separated by ocean basin. The main ocean regions include: Western Atlantic, Central Atlantic, Eastern Atlantic, Mediterranean Sea, Western Indian, Northern Indian, and Eastern Indian, Southeast Asia, Western Pacific, Central Pacific, and Eastern Pacific. The genetic substructure of the green sea turtle regional subpopulations shows distinctive mitochondrial DNA properties for each nesting rookery (Bowen et al., 1992; Fitzsimmons et al., 2006). Despite the genetic differences, turtles from separate nesting origins are commonly found mixed together on foraging grounds throughout the species' range. However, such mixing occurs at extremely low levels in Hawaiian foraging areas and this central Pacific population stands out as perhaps the most isolated of all green turtle populations worldwide (Dutton et al., 2008).

*Life History Information*

Green sea turtles exhibit particularly slow growth rates [about 1-5 cenimeters per year (Green, 1993; McDonald-Dutton and Dutton, 1998)] and also have one of the longest age to maturity of any sea turtle species [i.e. 20-50 years (Chaloupka and Musick, 1997; Hirth, 1997)]. The slow growth rates are believed to be a consequence of their largely herbivorous, low-net energy diet (Bjorndal, 1982). Upon reaching sexual maturity, females begin returning to their natal beaches (i.e., the same beaches where they were born) to lay eggs (Balazs, 1982; Frazer and Ehrhart, 1985) and are capable of migrating significant distances (hundreds to thousands of kilometers) between foraging and nesting areas. While females lay eggs every 2-4 years, males are known to reproduce every year (Balazs, 1983).

The nesting season varies depending on location. In the southeastern U.S., females generally nest between June and September, while peak nesting occurs in June and July (Witherington and Ehrhart, 1989). During the nesting season, females nest at approximately two-week intervals, laying an average of 3-4 clutches (Johnson and Ehrhart, 1996). Mean clutch size is highly variable among populations, but averages 110-115 eggs. In Florida, green sea turtle nests contain an average of 136 eggs (Witherington and Ehrhart, 1989), which will incubate for approximately two months before hatching.

After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to live for several years, feeding close to the surface on a variety of marine algae associated with drift lines and other debris. This early oceanic phase remains one of the most poorly understood aspects of green turtle life history (NMFS and USFWS, 2007a). However, growth studies using skeletochronology indicate that green sea turtles in the Western Atlantic shift from this oceanic phase to nearshore development habitats (protected lagoons and open coastal areas rich in sea grass and marine algae) after approximately 5-6 years (Zug and Glor, 1998; Bresette et al., 2006). As adults, they feed almost exclusively on sea grasses and algae in shallow bays, lagoons, and reefs (Rebel, 1974) although some populations are known to also feed heavily on invertebrates (Carballo et al., 2002). While in coastal habitats, green sea turtles exhibit site fidelity to specific foraging and nesting grounds and it is clear they are capable of "homing in" on these sites if displaced (McMichael et al., 2003).

Reproductive migrations of Florida green turtles have been identified through flipper tagging and/or satellite telemetry. Based on these studies, the majority of adult female Florida green turtles are believed to reside in nearshore foraging areas throughout the Florida Keys from Key Largo to the Dry Tortugas and in the waters southwest of Cape Sable, Florida, with some post-nesting turtles also residing in Bahamian waters as well (NMFS and USFWS, 2007a).

*Listing Status*
The green sea turtle was listed as threatened under the ESA on July 28, 1978, except for the Florida and Pacific coast of Mexico breeding populations which were listed as endangered. Due to difficulties in distinguishing between individuals from the Florida breeding population from other populations, green sea turtles are considered endangered wherever they occur in U.S. waters and are treated as such in this Opinion. Critical habitat for the green sea turtle has been designated on September 2, 1998, for the waters surrounding Isla Culebra, Puerto Rico, and its associated keys.

*Abundance and Trends*
A summary of current nesting trends[9] is provided in the most recent status review for the species (i.e., NMFS and USFWS, 2007a) in which the authors collected and organized abundance data from 46 individual nesting concentrations organized by ocean region (i.e. Western Atlantic Ocean, Central Atlantic Ocean, Eastern Atlantic Ocean, Mediterranean Sea, Western Indian Ocean, Northern Indian Ocean, Eastern Indian Ocean, Southeast Asia, Western Pacific Ocean, Central Pacific Ocean, and Eastern Pacific Ocean). The authors found it was possible to determine trends at 23 of the 46 nesting sites and found that 10 appeared to be increasing, 9 appeared to be stable, and 4 appeared to be decreasing. With respect to regional trends, the Pacific, the Western Atlantic, and the Central Atlantic regions appeared to show more positive trends (i.e., more nesting sites increasing than decreasing) while the Southeast Asia, Eastern Indian Ocean, and possibly the Mediterranean Sea regions appeared to show more negative trends (i.e., more nesting sites decreasing than increasing). We must note that these regional determinations should be viewed with caution since trend data was only available for about half of the total nesting concentration sites examined in the review and that site specific data availability appeared to vary across all regions.

The western Atlantic region (focus of this Opinion) was one of the best performing in terms of abundance in the entire review as there were no sites that appeared to be decreasing based on the data collected. Positive trends were reported for the Florida nesting concentration in the U.S., Cuyo and Holbox nesting concentrations in Mexico, Tortuguero nesting concentration in Costa Rica, and Galibi Reserve nesting concentration in Suriname while the other two nesting concentrations included in the review (i.e., Aves Island off Venezuela and Isla Trindade off Brazil) were reported to be stable. More information about site specific trends for the other major ocean regions can be found in the most recent five year status review for the species (see NMFS and USFWS, 2007a).

By far, the largest known nesting assemblage in the western Atlantic region occurs at Tortuguero, Costa Rica. According to monitoring data on nest counts as well as documented emergences (both nesting and non-nesting events), there appears to be an increasing trend in this nesting assemblage since monitoring began in the early 1970's. For instance, from 1971-1975 there were approximately 41,250 average emergences

9 Estimates of abundance were largely based on annual numbers of nesting females or deposited nests at each site. In some cases, abundance was based on egg production or egg harvest rates (see NMFS and USFWS, 2007a).

documented per year and this number increased to an average of 72,200 emergences documented per year from 1992-1996 (Bjorndal et al., 1999). Troëng and Rankin (2005) collected nest counts from 1999-2003 and and also reported increasing trends in the population consistent with the earlier studies.

In the continental U.S., green turtle nesting occurs along the Atlantic coast, primarily along the central and southeast coast of Florida where an estimated 200-1,100 females nest each year (Meylan et al., 1994; Weishampel et al., 2003). Occasional nesting has also been documented along the Gulf coast of Florida as well as the beaches on the Florida Panhandle. According to data collected from Florida's Index Nesting Beach Survey from 1989-2011, green turtle nest counts across Florida have increased approximately tenfold from a low of 267 in the early 1990's to a high of 10,701 measured most recently in 2011 (FWC, 2011a). While the increase in nest counts seen across Florida beaches is encouraging, these numbers only reflect one segment of the population (nesting females) and thus should not be taken to reflect the true population trend for the region. Although there are several research projects in Florida that involve monitoring of incidental captures of green sea turtles, few studies have time series that would lead to sufficient analyses of trends in offshore abundance and, therefore, we cannot make any conclusions regarding in-water trends for green sea turtles at the time of this consultation.

*Current Threats*

Currently, anthropogenic impacts to the green sea turtle are similar to those facing other sea turtle species including interactions with domestic and international fisheries, destruction of nesting and foraging habitat, ship strikes, oil spills, and climate change and/or variability (refer to the loggerhead sea turtle status and trends section above for more general information on these threats affecting green sea turtles).

The principal cause of the historical, worldwide decline of the green sea turtle was long-term harvest of eggs and adults on nesting beaches and juveniles and adults on feeding grounds. Egg removal and poaching of nesting females continues to be a problem for the greater threatened populations nesting throughout the south Pacific, Eastern Atlantic, Indian Ocean and some areas in the Caribbean (as summarized in Seminoff, 2004). Removal of eggs each nesting season can severely impact juvenile cohorts that would have recruited from the post-hatchling phase while poaching of nesting females reduces the abundance of reproductive adults as well as potential for annual egg production. Both these impacts lead to declines in overall survival and reproduction for these respective populations. In addition to illegal poaching, direct harvest of adult and juveniles occurs heavily in the Caribbean Sea, Southeast Asia, Eastern Pacific, and Western Indian Ocean (NMFS and USFWS, 2007a). Despite substantial declines in the population of green sea turtles in these respective regions, intentional harvest remains legal in many countries occupying these regions and remains a threat to the green sea turtle populations worldwide.

Green turtles depend on shallow foraging grounds with sufficient benthic vegetation. Therefore, direct destruction of foraging areas due to dredging, boat anchorage, deposition of spoil, and siltation may have considerable effects on the distribution of foraging green turtles (Coston-Clements and Hoss, 1983; Williams, 1988). Eutrophication, heavy metals, radioactive elements, and hydrocarbons all may reduce the extent, quality, and productivity of foraging grounds as well (Frazier, 1980; McKenzie et al., 1999; Storelli and Marcotrigiano, 2003). Various types of marine debries such as plastics, oil, and tar tends to collect on pelagic drift lines that young green turtles inhabit (Carr, 1987; Moore et al., 2001) and can lead to death through injestion (Balazs, 1985; Bjorndal et al., 1994). Another major threat from man-made debris is the entanglement of turtles in discarded monofilament fishing line and abandoned netting (Balazs, 1985).

Fibropapillomatosis, an epizootic disease producing lobe-shaped tumors on the soft portion of a turtle's body, has been found to infect green sea turtles, most commonly juveniles (Williams et al., 1994). The occurrence of fibropapilloma tumors may result in impaired foraging, breathing, or swimming ability possibly leading to death in some cases making it a serious threat to the survival and recovery of the species.

Another growing problem affecting green sea turtles is the increasing female bias in the sex ratio of green sea turtle hatchlings, likely related to global climate change and imperfect egg hatchery strategies (Tiwol and Cabanban, 2000; Hays et al., 2003a; Baker et al., 2006). Atleast one site (i.e. Ascension Island) has had an increase of mean sand temperature in recent years (Hays et al., 2003a). It is expected that similar rises in sand temperatures on nesting beaches may alter sex rations towards a highly female bias and significantly impact the ability of the species to survive and recover in the wild.

***Hawksbill Sea Turtle***

*Species Description, Distribution, and Population Structure*

Hawksbill sea turtles are small to medium-sized (45 to 68 kilograms on average) although nesting females are known to weigh up to 80 kilograms in the Caribbean (Pritchard et al., 1983). The carapace is usually serrated and has a "tortoise-shell" coloring, ranging from dark to golden brown, with streaks of orange, red, and/or black. The plastron of a hawksbill turtle is typically yellow. The head is elongated and tapers to a point, with a beak-like mouth that gives the species its name. The shape of the mouth allows the hawksbill turtle to reach into holes and crevices of coral reefs to find sponges, their primary food source as adults, and other invertebrates. The shells of hatchlings are 42 mm long and are mostly brown and somewhat heart-shaped (Hillis and Mackay, 1989; van Dam and Sarti, 1989; Eckert, 1995).

Hawksbill turtles have a circumtropical distribution and usually occur between latitudes 30° N and 30° S in the Atlantic, Pacific, and Indian Oceans. In the western Atlantic, Hawksbills are widely distributed throughout the Caribbean Sea, off the coasts of Florida and Texas in the continental U.S., in the Greater and Lesser Antilles, and along the mainland of Central America south to Brazil (Lund, 1985; Plotkin and Amos, 1988; Amos, 1989; Groombridge and Luxmoore, 1989; Plotkin and Amos, 1990; NMFS and USFWS, 1998; Meylan and Donnelly, 1999). They are highly migratory and use a wide range of habitats during their lifetimes (Musick and Limpus, 1997; Plotkin, 2003). Adult hawksbill turtles are capable of migrating long distances between nesting beaches and foraging areas, which are comparable to migrations of green and loggerhead turtles. For instance, a female hawksbill sea turtle tagged in BIRNM in the U.S.V.I. was later identified 1,160 miles (1,866 kilometers) away in the Miskito Cays in Nicaragua (Spotila, 2004).

Hawksbill sea turtles nest on insular and sandy beaches throughout the tropics and subtropics. Nesting occurs in at least 70 countries, although much of it now only occurs at low densities compared to other sea turtles (NMFS and USFWS, 2007b). It is believed that the dispersed nesting and low densities are most likely a result of overexploitation of previously large colonies (Meyland and Donnelly, 1999). The most significant nesting within the U.S. occurs in Puerto Rico and the U.S. Virgin Islands, specifically on Mona Island and BIRNM, respectively. Although nesting within the continental U.S. is typically rare, it can also occur along the southeast coast of Florida and the Florida Keys. In addition to nesting beaches in the U.S. Caribbean, the largest hawksbill nesting population in the Western Atlantic occurs in the Yucatán Península of Mexico, where several thousand nests are recorded annually in the states of Campeche, Yucatán, and Quintana Roo (Spotila, 2004; Garduño-Andrade et al., 1999). In the U.S. Pacific, hawksbills nest on main island beaches in Hawaii, primarily along the east coast of the island. Hawksbill nesting has also been documented in American Samoa and Guam. More information on nesting in other ocean basins may be found in the five year status review for the species (NMFS and USFWS, 2007b).

Mitochondrial DNA studies show that reproductive populations are effectively isolated over ecological time scales (Bass et al., 1996). Substantial efforts have been made to determine the nesting population origins of hawksbill sea turtles assembled in foraging grounds, and genetic research has shown that hawksbills of multiple nesting origins commonly mix in foraging areas (Bowen et al., 1996). The fact that hawksbills exhibit site fidelity to their natal beaches suggests that if subpopulations become extirpated they may not be replenished by recruitment from other nesting rookeries (Bass et al., 1996).

*Life History Information*

Hawksbill sea turtles exhibit slow growth rates although they are know to vary within and among populations from a low of 1-3 cm per year measured in the Indo-Pacific (Chaloupka and Limpus, 1997; Whiting, 2000; Mortimer et al., 2002; Mortimer et al., 2003) to a high of 5 cm or more per year measured at some sites in the Caribbean (Leon and Diez, 1999; Diez and van Dam, 2002). Differences in growth rates are likely due to differences in diet and/or density of turtles at foraging sites and overall time spent foraging (Bjorndal et al, 2000; Chaloupka et al., 2004). Consistent with slow growth, age to maturity for the species is also long, taking between 20 and 40 years depending on the region (Chaloupka and Musick, 1997; Limpus and Miller, 2000). Hawksbills in the western Atlantic are known to mature faster (i.e. 20 more years) than turtles found in the Indo-Pacific (i.e. 30-40 years) based on studies performed in these areas (Boulon, 1983; Boulan, 1994; Limpus and Miller, 2000; Diez and van Dam, 2002). Males are typically mature when their length reaches 69 cm while females are typically mature at 75 cm (Limpus, 1992; Eckert, 1992). Female hawksbills return to their natal beaches every 2-3 years to nest (Witzell 1983; Van Dam et al., 1991) and generally lay 3-5 nests per season

(Richardson et al., 1999). Compared with other sea turtles, clutch size for hawksbills can be quite high (up to 250 eggs per clutch) (Hirth, 1980).

Hawksbills may undertake developmental migrations (migrations as immatures) and reproductive migrations that involve travel over hundreds or thousands of kilometers (Meylan, 1999a). Post-hatchlings (oceanic stage juveniles) are believed to occupy the "pelagic" environment, taking shelter in floating algal mats and drift lines of flotsam and jetsam in the Atlantic and Pacific oceans (Musick and Limpus, 1997) before recruiting to more neritic, coastal foraging grounds. In the Caribbean, hawksbills are known to exclusively feed on sponges (Meylan, 1988; van Dam and Diez, 1997) although at times they have been seen foraging on other food items, notably corallimorphs and zooanthids (van Dam and Diez, 1997; Mayor et al., 1998; Leon and Diez, 2000).

Reproductive females undertake periodic (usually non-annual) migrations to their natal beach to nest and exhibit a high degree of fidelity to their nest sites. Movements of reproductive males are less certain, but are presumed to involve migrations to the nesting beach or to courtship stations along the migratory corridor. Hawksbills show a high fidelity to their foraging areas as well (van Dam and Diez, 1998). Foraging sites are typically areas associated with coral reefs although hawksbills are also found around rocky outcrops and high energy shoals which are optimum sites for sponge growth. They can also inhabit seagrass pastures in mangrove-fringed bays and estuaries, particularly along the eastern shore of continents where coral reefs are absent (Bjorndal, 1997; van Dam and Diez, 1998).

*Listing Status*

The hawksbill sea turtle was listed as endangered under the ESA on June 2, 1970. Critical habitat was designated On June 2, 1998 in coastal waters surrounding Mona and Monito Islands in Puerto Rico.

*Abundance and Trends*

There are currently no reliable estimates of population abundance and trends for non-nesting hawksbills at the time of this consultation; therefore, nesting beach data is currently the primary information source for evaluating trends in global abundance. Most hawksbill populations around the globe are either declining, depleted, and/or remnants of larger aggregations (NMFS and USFWS, 2007b). The largest nesting population of hawksbills appears to occur in Australia where approximately 2,000 hawksbills nest off the northwest coast and about 6,000 to 8,000 nest off the Great Barrier Reef each year (Spotila, 2004). Additionally, about 2,000 hawksbills nest each year in Indonesia and 1,000 nest in the Republic of Seychelles (Spotila, 2004). In the U.S., about 500-1,000 hawksbill nests are laid on Mona Island, Puerto Rico (Diez and van Dam, 2007) and another 100-150 nests on Buck Island Reef National Monument off St. Croix in the U.S. Virgin Islands (Meylan, 1999b).

Mortimer and Donnelly (2008) reviewed nesting data for 83 nesting concentrations organized among 10 different ocean regions (i.e. Insular Caribbean, Western Caribbean Mainland, Southwestern Atlantic Ocean, Eastern Atlantic Ocean, Southwestern Indian

Ocean, Northwestern Indian Ocean, Central Indian Ocean, Eastern Indian Ocean, Western Pacific Ocean, Central Pacific Ocean, and Eastern Pacific Ocean). Historic trends (i.e., 20-100 year time period) were determined for 58 of the 83 sites while recent abundance trends (i.e., within the past 20 years) were also determined for 42 of the 83 sites. Among the 58 sites where historic trends could be determined, all showed a declining trend during the long term period although among the 42 sites where recent trend data was available, 10 appeared to be increasing, 3 appeared to be stable, and 29 appeared to be decreasing. With respect to regional trends, nesting populations in the Atlantic (especially in the Insular Caribbean and Western Caribbean Mainland) are generally doing better than those in the Indo-Pacific regions as 9 of the 10 sites showing recent increases were located in these two Caribbean regions. Nesting concentrations in the Pacific Ocean appear to be performing the worst of all regions despite the fact that the region currently supports more nesting hawksbills than in either the Atlantic or Indian Oceans (Mortimer and Donnelly, 2008). More information about site specific trends for can be found in the most recent five year status review for the species (see NMFS and USFWS, 2007b).

*Current Threats*

Hawksbills are currently subject to the same suite of threats on both nesting beaches and in the marine environment that affect other sea turtles (e.g. interaction with fishing gear, coastal construction, oil spills, climate change affecting sex ratios, etc.) although the historical decline of the species is primarily attributed to centuries of exploitation for the beautifully patterned shell which made it a highly attractive species to target (Parsons, 1972). The fact that reproductive females exhibit a high fidelity for nest sites and the tendency of hawksbills to nest at regular intervals within a season made them an easy target for capture on nesting beaches. The tortoiseshell from hundreds of thousands of turtles in the western Caribbean region was imported into the United Kingdom and France during the 19th and early 20th centuries (Parsons, 1972) and additional hundreds of thousands of turtles contributed to the region's trade with Japan prior to 1993 when a zero quota was imposed (Milliken and Tokunaga, 1987 *as cited in* Bräutigam and Eckert, 2006).

The continuing demand for the hawksbill's shell as well as other products (leather, oil, perfume, and cosmetics) represents an ongoing threat to recovery of the species. The British Virgin Islands, Cayman Islands, Cuba, Haiti, and the Turks and Caicos Islands (U.K.) all permit some form of legal take of hawksbill turtles. In the northern Caribbean, hawksbills continue to be harvested for their shells, which are often carved into hair clips, combs, jewelry, and other trinkets (Marquez, 1990; Stapleton and Stapleton, 2006). Additionally, hawksbills are harvested for their eggs and meat while whole stuffed turtles are sold as curios in the tourist trade. Also, hawksbill sea turtle products are openly available in the Dominican Republic and Jamaica despite a prohibition on harvesting hawksbills and their eggs (Fleming, 2001). While the international trade in the shell of this species is prohibited between those countries that have signed the CITES convention, illegal trade is still occurring and remains a threat.

Due to their preference to feed on sponges associated with coral reefs, hawksbill sea turtles are particularly sensitive to losses of coral reef communities. Coral reefs are vulnerable to destruction and degradation caused by human activities (e.g. nutrient pollution, sedimentation, contaminant spills, vessel groundings and anchoring, recreational uses, etc.) and are also highly sensitive to the effects of climate change (e.g. higher incidences of disease and coral bleaching) (Wilkinson, 2004; Crabbe, 2008). Continued loss of coral reef communities (especially in the greater Caribbean region) is expected to impact foraging and represents a major threat to recovery of the species.

Hawksbill sea turtles are also susceptible to capture in nearshore artisanal fishing gear such as drift-netting, long-lining, set-netting, and trawl fisheries with gill nets and artisanal hook and line representing the greatest impact to the species in the greater Caribbean region [National Research Council (NRC), 1990; Lutcavage et al., 1997; Epperly, 2003)].

### *Kemp's Ridley Sea Turtle*

*Species Description, Distribution, and Population Structure*

The Kemp's ridley sea turtle is among the smallest of all extant sea turtles with adults generally weighing less than 45 kilograms and having a SCL of around 60-65 centimeters (Heppell et al, 2005). Adults have an almost circular carapace with a grayish green color while the plastron is often pale yellow. There are two pairs of prefrontal scales on the head, five vertebral scutes, and five pairs of costal scutes. In the bridge adjoining the plastron to the carapace, there are four scutes, each of which is perforated by a pore. Hatchlings are usually grayish-black in color, range from 42-48 mm SCL, and weigh between 15-20 grams (Chavez et al., 1967; Marquez, 1972; Pritchard and Marquez, 1973; Marquez, 1990).

This species has a very restricted range relative to other sea turtle species with most adults occurring in shallow, nearshore waters from the Gulf of Mexico in the U.S. north to the Grand Banks and Nova Scotia (Bleakney, 1955; Watson et al., 2004; NMFS et al., 2011). Some individuals have also been identified to a lesser degree near the Azores and eastern north Atlantic (Deraniyagala, 1938; Brongersma, 1972; Fontaine et al., 1989; Bolten and Martins, 1990) as well as the Mediterranean region (Pritchard and Marquez, 1973, Brongersma and Carr 1983, Tomas and Raga 2007, Insacco and Spadola, 2010).

Nesting is essentially limited to the beaches of the western Gulf of Mexico, primarily in the Mexican state of Tamaulipas at a stretch of beach known as Rancho Nuevo (Hildebrand, 1963; Carr, 1963; Heppell et al., 2005) as well as south shores of Texas (especially South Padre Island) (Shaver and Plotkin, 1998; Shaver, 2002; Shaver, 2005). Nests have also been recorded in Veracruz and Campeche in Mexico and other east coast states in the U.S. (i.e., Florida, Alabama, Georgia, South Carolina, and North Carolina) although nesting is much less frequent in these areas. Kemp's ridley sea turtles display a unique mass nesting behavior where females emerge together onto the beach, usually during daylight hours. These synchronized emergences are known as arribadas and are frequently seen at Rancho Nuevo each year from April to July (Hildebrand, 1963; Carr, 1963; Marquez, 1994; Jimenez et al., 2005).

Dutton et al. (2006) examined mitochondrial DNA collected from Kemp's ridley females nesting at Padres Island between 2002 and 2004 and compared haloptype frequencies to those from the Rancho Nuevo population. The researchers found no significant differences suggesting genetic homogeneity between both populations.

*Life History Information*
The mean growth rate for Kemp's ridley sea turtles is between 5.5-7.5 cm per year (± 6.2 cm per year) with turtles tagged in the Gulf of Mexico exhibiting faster growth than those tagged in the Atlantic (Schmid and Woodhead, 2000). Sexual maturity is reached at approximately 10-16 years of age (Chaloupka and Zug, 1997; Schmid and Witzell, 1997; Zug et al., 1997; Schmid and Woodhead, 2000). The mean remigration interval for females is 2 years although intervals or 1 and 3 years have also been measured and are not uncommon (Marquez et al., 1982; TEWG, 1998; TEWG, 2000). Nesting generally occurs from April to July and females lay approximately 2.5 nests per season (TEWG, 1998) with each nest containing approximately 100 eggs (Marquez, 1994)

Studies have shown that the time spent in the post-hatchling pelagic stage can vary from 1-4 years time, while the benthic immature stage typically lasts approximately 7-9 years (Schmid and Witzell, 1997). Little is known of the movements of the post-hatching, planktonic stage within the Gulf of Mexico although the turtles during this stage are assumed to associate with floating seaweed (e.g. *Sargassum spp.*) similar to loggerhead and green sea turtles. During this stage, they presumably feed on the available seaweed and associated infauna or other epipelagic species found in the Gulf of Mexico. While many post-hatchlings remain in the Gulf of Mexico, some are transported eastward on the Florida Current into the Gulf Stream transporting them up the east coast of the U.S. (Collard and Ogren, 1990; Putman et al., 2010).

Atlantic juveniles/subadults travel northward with vernal warming to feed in the productive, coastal waters of Georgia through New England, returning southward with the onset of winter to escape the colder conditions (Lutcavage and Musick, 1985; Henwood and Ogren, 1987; Ogren, 1989). Upon leaving Chesapeake Bay in autumn, juvenile ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus, 1997). These larger juveniles are joined there by juveniles of the same size from North Carolina and smaller juveniles from New York and New England to form one of the densest concentrations of Kemp's ridleys outside of the Gulf of Mexico (Musick and Limpus, 1997; Epperly et al., 1995b; Epperly et al., 1995c).

Those that remained in the Gulf of Mexico during their early oceanic stage apparently move into coastal waters, mainly along the northern and eastern shorelines of the Gulf (Landry and Seney, 2008). Date obtained through satellite telemetry reveal a south to southwestern winter migration by Kemp's ridleys in the northwestern Gulf of Mexico, a west to east migration in the northern Gulf, and a southern winter migration in the eastern Gulf (Renaud and Williams, 2005). Schmid (1998) reported that neritic juveniles may continue this pattern of seasonal migrations and foraging site fidelity for a number of years until maturing into the adult stage.

Adult Kemp's ridleys primarily occupy nearshore neritic habitats, typically containing muddy or sandy bottoms where their preferred prey can be found. In the post-pelagic stages, Kemp's ridley sea turtles are largely cancrivorous (crab eating), with a preference for portunid crabs (Bjorndal, 1997). Stomach contents of Kemp's ridleys along the lower Texas coast consisted of a predominance of nearshore crabs and mollusks, as well as fish, shrimp and other foods considered to be bycatch discards from the shrimping industry (Shaver, 1991).

*Listing Status*

The Kemp's ridley sea turtle was listed as endangered under the ESA on December 2, 1970. No critical habitat has been designated for the species at the time of this consultation.

*Abundance and Trends*

The global population of Kemp's ridley sea turtles is the lowest of all the extant sea turtle species and a review of nesting data collected since the late 1940's suggest that species has drastically declined in abundance over the past 50 years. When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand, 1963; Carr, 1963). By the early 1970s, the world population estimate of mature female Kemp's ridleys had reduced to 2,500-5,000 individuals (i.e., 88-94 percent decline from 1940's levels) and this trend continued through the mid-1980s with the lowest nest count of 702 recorded for Rancho Nuevo in the year 1985. The severe decline in the Kemp's ridley population was likely caused by a combination of factors including direct egg removal, direct harvest of females on beaches, and impacts from Gulf of Mexico fishery operations during that time (notaby shrimp trawling) (NMFS et al., 2011).

Despite these drastic declines in abundance, recent nesting data collected from the National Institute of Fisheries in Mexico as well as data from the USFWS has suggested the population may be showing signs of recovery. For instance, the number of nests at Rancho Nuevo grew from a low of 702 nests in 1985, to 1,940 nests in 1995, to over 20,000 nests in 2009 which was the highest nest counts seen in over 55 years. Similar increases were documented for Texas beaches as the 911 nests documented from 2002-2010 represented an eleven-fold increase from the 81 nests counted over the period 1948-2001 (Shaver and Caillouet, 1998; Shaver, 2005). Results for the 2010 nesting season were not as encouraging as nest counts were recorded at levels lower than the previous three years for Rancho Nuevo and the previous two years for Texas beaches (Conant, personal communication, 2010) although they remain at levels significantly higher than those recorded over the previous five decades.

The TEWG (2000) developed a population model to evaluate trends in the Kemp's ridley population through the application of empirical data and life history parameter estimates chosen by the investigators. Model results identified three trends over time in benthic immature Kemp's ridley sea turtles. Increased production of hatchlings from the nesting beach beginning in 1966 resulted in an increase in the population of benthic Kemp's ridleys (defined as 20-60 cm in length and approximately 2-9 years of age) that leveled off in the late 1970s. A second period of increase followed by leveling occurred between 1978 and 1989 as hatchling production was further enhanced by the cooperative program between the U.S. Fish and Wildlife Service and Mexico's Instituto Nacional de Pesca to increase nest protection and relocation. A third period of steady increase has occurred since 1990 likely due to increased hatchling production and survival of immature turtles. The original model projected that population levels could theoretically reach the Recovery Plan's intermediate recovery goal of 10,000 nesters by the year 2015 if the assumptions of age to sexual maturity and age specific survivorship rates used are correct.

More recent models developed by Heppell et al. (2005) predict that the population is expected to increase at least 12-16 percent per year [19 percent using updated models utilized for the 2011 five year status review for the species (NMFS et al., 2011)] and that the population could attain at least 10,000 females nesting on Mexico beaches in this decade [by 2015 for (Heppel et al., 2005) and by 2011 for updates to the model developed for the 2011 five year status review (NMFS et al., 2011)]. Of course, this updated model assumes that current survival rates within each life stage remain constant. The recent increases in Kemp's ridley sea turtle nesting seen in the last two decades is likely due to a combination of management measures including elimination of direct harvest, nest protection, the use of TEDs, reduced trawling effort in Mexico and the U.S., and possibly other changes in vital rates (TEWG, 1998; TEWG, 2000). While these results are encouraging, the species limited range as well as low global abundance makes it particularly vulnerable to new sources of mortality as well as demographic and environmental stochasticity all of which are often difficult to predict with any certainty.

*Current Threats*

Kemp's ridleys are currently subject to the same suite of threats on both nesting beaches and in the marine environment that affect other sea turtles (e.g. interaction with fishing gear, coastal construction, oil spills, climate change affecting sex ratios, etc.) although they are particularly affected by actions occurring in the Gulf of Mexico where essentially all nesting occurs and where the majority of offshore juveniles and adults reside throughout the year.

Direct harvest of eggs and nesting adults was common in Mexico before 1967 and represented a major threat to the species causing declines in both adult survival and reproductive success. The fact that the species nests in only a few key areas as well as the mass arribadas formed during the nesting season made them particularly vulnerable to capture based on their predictability. While direct harvest no longer occurs, illegal poaching continues to be an issue affecting Kemp's ridleys nesting in Mexico and Texas although the presence of field biologists and enforcement personnel on nesting beaches has minimized the threat in recent decades.

Of all commercial fisheries operating in the Gulf of Mexico and along the east coast of the U.S., shrimp trawling has had the greatest impact on sea turtle populations, including Kemp's ridleys. The National Academy of Sciences estimated that between 500 and

5,000 Kemp's ridley sea turtles were killed annually by the offshore shrimping fleet in the southeastern U.S. and Gulf of Mexico (Magnuson et al., 1990). While direct harvest on beaches affected eggs and adults, incidental mortalities in trawls and other commercial fisheries impacted offshore and neritic juveniles as well as adults. Before the use of TEDs, shrimp trawling was estimated to cause 10 times the mortality of any other antropogenic factors combined. Under current TED requirements, the estimated annual mortality of Kemp's ridleys in U.S. waters was estimated to be up to 4,208 individuals based on shrimping effort for the year 2001 (NMFS, 2002). However, by 2009, shrimp trawl effort had declined by 61 percent and 38 percent in the Gulf of Mexico and U.S. Atlantic, respectively, meaning that the adjusted mortality of Kemp's ridley mortalities was significantly lower in 2009 (1,717 Kemp's ridleys) than what was in the early part of the decade (NMFS-SEFSC, 2011). NMFS believes that the increase in neritic juveniles as a result of increased nesting seen over the last 10 years will expose more neritic juveniles to shrimp trawling in future years meaning that estimates for 2009 may be on the low side (NMFS et al., 2011). Shrimp trawls in addition to other fisheries operating in the Gulf of Mexico remains a major source of mortality that will affect the ability of the species to survive and recover in the wild.

Due to their limited range, Kemp's ridleys are also severely impacted by hurricanes and other major events such as pollution (e.g. oil spills) occurring in the Gulf of Mexico. Hurricanes and strong storm events are more frequent along the east coast of Mexico and Gulf of Mexico during August and September when hatchlings and eggs are particularly vulnerable. These storms can uncover eggs and manipulate dunes or create wash over channels that reduce suitable habitat for egg deposition and incubation (NMFS et al., 2011). The Gulf of Mexico is also an area of high-density offshore oil exploration and extraction with chronic, low-level spills as well as occasional massive spills that affect nesting and foraging habitat for all life stages of Kemp's ridleys.

In the spring of 2010, The *Deepwater Horizon* offshore deepwater rig sank in the Gulf as a result of an explosion that lead to an uncontrolled and continuous release of oil from the well. The explosion occurred at the beginning of the nesting season for Kemp's ridley sea tutles and lasted for approximately three months before the well was capped. While the oil did not reach the nesting beaches in Mexico and Texas, the oil did affect nesting beaches in Alabama as well as the Florida Panhandle (including the action area for this proposed action). As a result, five Kemp's ridley nests were relocated to unaffected beaches and 125 hatchlings were subsequently released in adjacent waters to minimize egg and hatchling mortality (NMFS, unpublished data). According to the preliminary data available from NMFS at the time of this consultation, there were 481 confirmed deaths of Kemp's ridley sea turtles in the vicinity of the *Deepwater Horizon* oil spill site and this number is considered a conservative one (NMFS, unpublished data[10]). While the cause of death is not certain for many of the carcasses recovered, these numbers represent the highest total mortality by far of any of the extant sea turtle species occurring in the Gulf since the blowout first occurred (approximately 83 percent of all identified sea turtle deaths). It is expected that the acute and chronic events of the *Deepwater Horizon* oil

10 Sea turtle mortality and nest relocation data associated with the *Deepwater Horizon* Oil spill event is available at: http://www.nmfs.noaa.gov/pr/health/oilspill/turtles.htm.

spill as well as other historical spills will continue to threaten the survival and recovery of Kemp's ridley sea turtles for years to come although more research will need to be done to determine the long term effects these past spills have on survival and/or reproduction (see the *Environmental Baseline* section of this Opinion for more information on oil spill effects specific to the action area).

Strandings events observed over the years illustrate the vulnerability of Kemp's ridley turtles to the impacts of human activities in nearshore Gulf of Mexico waters and these threats are expected to continue for years to come (TEWG, 1998). Since March 15, 2011, a notable increase in sea turtle strandings has occurred in the Gulf (primarily in Mississippi) according to data collected by the Sea Turtle Stranding and Salvage Network (NMFS, unpublished data[11]). As of October 6, 2011, 398 Kemp's ridleys (approximately 95 percent of the identified carcasses) have stranded along beaches off Alabama, Louisiana, and Mississippi. Efforts are underway to examine the carcasses to try to determine the cause of death although fishing activities as well as acute toxicosis as a result of harmful algal blooms are traditionally the main culprits. Stranding events like these directly reduce the abundance of sea turtle populations in the Gulf and can significantly impact the ability of the species to recover given other stressors occurring as a result or in conjunction with strandings.

### *Gulf Sturgeon*

*Species Description, Distribution, and Population Structure*

The Gulf sturgeon is a nearly cylindrical primitive fish embedded with bony plates or scutes. It has a flattened extended snout with four barbels in front of a protrusible, inferior mouth. Adults range in length from 1.8-2.4 m, with adult females known to grow larger than adult males. The Gulf sturgeon is a subspecies of Atlantic sturgeon and is distinguished from the geographically disjunct Atlantic coast subspecies by its longer head, pectoral fins, and spleen (Vladykov, 1955; Wooley, 1985).

The Gulf sturgeon is an anadromous fish, spending cool months (primarily October through March) in estuarine bays or in the greater Gulf of Mexico waters (Odenkirk, 1989; Foster, 1993; Clugston et al., 1995) and spending warmer months (i.e., March through May) in freshwater coastal streams and rivers (Huff, 1975; Carr, 1983; Wooley and Crateau, 1985; Odenkirk, 1989; Clugston et al., 1995; Foster and Clugston, 1997; Fox and Hightower, 1998; Sulak and Clugston, 1999; Fox et al., 2000). Historically, the Gulf sturgeon occurred from the Mississippi River to Tampa Bay in Florida (Wooley and Crateau, 1985) with sporadic occurrences recorded as far west as the Rio Grande River between Texas and Mexico, and as far east and south as Florida Bay (Wooley and Crateau, 1985; Reynolds, 1993). Its present range extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi east to the Suwannee River in Florida (USFWS and NMFS, 2009).

11 Sea Turtle stranding data for the Gulf of Mexico is available at: http://www.nmfs.noaa.gov/pr/species/turtles/Gulfofmexico.htm

Stabile et al (1996) analyzed genetic diversity of Gulf sturgeon populations from eight different drainages along the Gulf of Mexico and identified the following five river-specific stocks: (1) Lake Pontchartrain and Pearl River, (2) Pascagoula River, (3) Escambia and Yellow rivers, (4) Choctawhatchee River, and (5) Apalachicola, Ochlockonee, and Suwannee rivers (Stabile et al., 1996). The recent five year status review for the species (see USFWS and NMFS, 2009) lists the following seven reproducing populations based on updated data: (1) Pearl River, (2) Pascagoula River, (3) Escambia River, (4) Yellow River, (5) Choctawatchee River, (6) Apalachicola River, and (7) Suwannee River. Mark-recapture studies have confirmed the general fidelity of individual Gulf sturgeon returning to particular rivers, presumably their natal rivers (68 FR 13370), although some mixing of populations and overlap of winter habitat utilization is also known to occur (Edwards et al., 2007; Ross et al., 2009).

*Life History Information*

Gulf sturgeon can grow up to 8 ft (2.4 m) in length and weigh as much as 200 pounds (90.7 kg). Females reach sexual maturity anywhere from 8-17 years in age while males become mature from 7-12 years of age (Huff, 1975). Females spawn every 3-5 years, and males every 1-5 years (Smith 1985, Fox et al. 2000). Chapman et al. (1993) reported average fecundity of mature Gulf sturgeon to be 20,652 eggs per kg.

Adults and sub-adults begin moving from the estuaries, bays, and Gulf of Mexico into the coastal rivers in early spring (i.e., March through May) when river water temperatures range from 16°C to 23°C (Huff, 1975; Carr, 1983; Wooley and Crateau, 1985; Odenkirk, 1989; Clugston et al., 1995; Foster and Clugston, 1997; Fox and Hightower, 1998; Sulak and Clugston, 1999; Fox et al., 2000). Demersal eggs are deposited in hard-bottom areas (comprised of some limestone, cobble, gravel, sand matrix) where the eggs probably adhere to the substrate almost immediately after spawning (Marchant and Shutters, 1996; Sulak and Clugston, 1999; Fox et al., 2000). Fall downstream migration (both subadults and adults) begins in September (at water temperatures around $23^{o}$C) and continues through November when the sturgeon return to the estuaries and/or offshore Gulf of Mexico waters (Huff, 1975; Wooley and Crateau, 1985; Foster and Clugston, 1997).

Young-of-the-year individuals forage in freshwater on aquatic invertebrates and detritus (Mason and Clugston, 1993; Sulak and Clugston, 1999) while juveniles forage throughout the river on aquatic insects (e.g., mayflies and caddisflies), worms (oligochaetes), and bivalves (Huff, 1975; Mason and Clugston, 1993). Adult Gulf sturgeon are known to fast while in the river systems and only forage when they enter marine habitats in the winter months (Carr, 1983; Wooley and Crateau, 1985; Clugston et al., 1995; Morrow et al., 1998; Heise et al., 1999; Sulak and Clugston, 1999; Ross et al., 2000). Adults are often located on seagrass and sandy bottom habitats in depths from 1.5-5.9 m (Fox and Hightower, 1998; Parauka et al. 2001) which supports a variety of potential prey items including estuarine crustaceans, small bivalve mollusks, and lancelets (Menzel, 1971; Abele and Kim, 1986; AFS, 1989). Stable carbon isotope ratios indicate that they rely almost entirely on marine prey for growth making these sources of prey essential to survival of mature adults (Gu et al., 2001).

*Listing Status*

The Gulf sturgeon was listed as threatened under the ESA on September 30 1991, and is under the joint jurisdiction of NMFS and the USFWS. On March 19, 2003, NMFS and the USFWS jointly designated critical habitat for the species which includes the following 14 geographic units (developed sites such as dams, marinas, bridges, oil rigs, pipelines, and public swimming areas are not included in critical habitat):

1) Pearl River system in St. Tammany and Washington Parishes in Louisiana,, LA and Walthall, Hancock, Pearl River, Marion, Lawrence, Simpson, Copiah, Hinds, Rankin, and Pike Counties in Mississippi.
2) Pascagoula River system in Forrest, Perry, Greene, George, Jackson, Clarke, Jones, and Wayne Counties, Mississippi.
3) Escambia River system in Santa Rosa and Escambia Counties in Florida,and Escambia, Conecuh, and Covington counties in Alabama.
4) Yellow River system in Santa Rosa and Okaloosa counties in Florida, and Covington County, Alabama.
5) Choctawhatchee River system in Holmes, Washington, and Walton counties in Florida, and Dale, Coffee, Geneva and Houston counties in Alabama.
6) Apalachicola River system in Franklin, Gulf, Liberty, Calhoun, Jackson, and Gadsen counties, Florida.
7) Suwannee River system in Hamilton, Suwannee, Madison, Lafayette, Gilchrist, Levy, Dixie, and Columbia counties, Florida.
8) Lake Pontchartrain, Lake St. Catherine, The Rigolets, Little Lake, Lake Borgne, and Mississippi Sound in Jefferson, Orleans, St. Tammany, and St. Bernard Parishes in Louisiana, and Hancock, Jackson, and Harrison counties, in Mississippi, and Mobile County, Alabama.
9) Pensacola Bay system in Escambia and Santa Rosa counties, Florida.
10) Santa Rosa Sound in Escambia, Santa Rosa, and Okaloosa counties, Florida.
11) Florida Nearshore Gulf of Mexico in Escambia, Santa Rosa, Okaloosa, Walton, Bay and Gulf counties, Florida.
12) Choctawhatchee Bay in Okaloosa and Walton counties, Florida.
13) Apalachicola Bay in Gulf and Franklin counties, Florida.
14) Suwannee Sound in Dixie and Levy counties, Florida.

As discussed in the *Listed Species Not Likely to be Adversely Affected* section of this Opinion, researchers are proposing to conduct research activities in unit 6 (i.e., Apalachicola River system, unit 11 (i.e., Florida nearshore Gulf of Mexico), and unit 13 (i.e., Apalachicola Bay); however, the research activities to be conducted under the proposed permit modification are not likely to adversely affect critical habitat designated for Gulf sturgeon.

*Abundance and Trends*
While little is known about the abundance of Gulf sturgeon through most of its range, researchers have used mark-recapture studies to estimate abundance for many of the specific rivers supporting a reproducing population. The following abundance estimates were taken from the most recent five year status review for the species: 323-605 for the Pearl River (Rogillio et al., 2001), 124-429 for the Pascagoula River (Ross et al., 2001), 338-656 for the Escambia River (USFWS, 2007), 487-1507 spring estimate and 550-1550 fall estimate in the Yellow River (Berg et al., 2007), 2,000 for the Apalachicola River (Pine and Martell, 2009), and an estimate of 14,000 individuals for the Suwannee River (Sulak et al., 2009). It must be noted that methods of capture, time of year, and target ages of sturgeon varies across these research projects. Nevertheless, these numbers represent the best available abundance estimates at the time of this consultation.

Trends associated with catch per unit effort and mark-recapture studies conducted over the past three decades show that most populations appear to be relatively stable with the Suwannee River supporting the most viable population among coastal rivers of the Gulf of Mexico (USFWS and NMFS, 2009). For instance, Sulak et al., (2009) reported an analysis of mark-recapture data for the Suwannee River that suggests this population is regaining a semblance of its pre-exploitation age structure, with a shift from 10 percent mature individuals in 1996 to 40 percent in 2007.

Despite these encouraging trends, recent population models suggest that Gulf sturgeon life history characteristics render the species slow to recover in abundance within its current range. Working with data from the Suwannee River population, Pine et al. (2001) identified three parameters (i.e., egg-to-age-1 mortality, the percentage of females that spawn annually, and adult mortality) as those most sensitive in determining the trajectory of population size. The researchers predicted that slight increases in estimated annual adult mortality (from 16 percent to 20 percent) would shift the population from an increasing trend into a decline. Flowers (2008) used an age-structured model to conclude that the Apalachicola population is probably slowly recovering, but still needs many years before returning to anywhere near its pre-exploitation abundance.

*Current Threats*
Gulf sturgeon populations have been impacted over the years through direct harvest, habitat degradation from various pollutant sources and the construction of dams that reduced its historical range. Access to historic Gulf sturgeon spawning habitat continues to be blocked by existing dams and the ongoing operations of these dams also effect downstream and nearshore marine foraging habitat important to the species (USFWS and NMFS, 2009). Dredging activities can pose significant impacts to aquatic ecosystems by: 1) direct removal/burial of organisms; 2) turbidity/siltation effects; 3) contaminant re-suspension; 4) noise/ disturbance; 5) alterations to hydrodynamic regime and physical habitat; and 6) loss of riparian habitat (Chytalo, 1996; Winger et al., 2000). Dredging and disposal to maintain navigation channels, and removal of sediments for beach renourishment occurs frequently throughout the range of the Gulf sturgeon and represents an ongoing threat to the species and its critical habitat.

Hydraulic dredges (e.g., hopper) can lethally harm sturgeon directly by entraining sturgeon in dredge drag arms and impeller pumps. Mechanical dredges have been documented to kill Gulf sturgeon in addition to shortnose and Atlantic sturgeon. For example, Dickerson (2006) summarized observed takings of 2 Gulf sturgeon, 11 shortnose sturgeon, and 11 Atlantic sturgeon from dredging activities conducted by the U.S. Army Corps of Engineers between 1990 and 2005.

Several characteristics of the Gulf sturgeon (i.e., long lifespan, extended residence in riverine and estuarine habitats, opportunistic feeder) predispose the species to long-term and repeated exposure to environmental contamination and potential bioaccumulation of heavy metals and other toxicants (USFWS and NMFS, 2009). Pollution from industrial, agricultural, and municipal activities is believed responsible for a suite of physical, behavioral, and physiological impacts to sturgeon worldwide (Karpinsky, 1992; Barannikova, 1995; Barannikova et al., 1995; Khodorevskaya et al., 1997; Bickham et al., 1998; Khodorevskaya and Krasikov, 1999; Billard and Lecointre, 2001; Kajiwara et al., 2003; Agusa et al., 2004). Although little is known about specific contaminant effects on Gulf Sturgeon, some potential effects include muscle atrophy, abnormality of gonad, sperm and egg development, morphogenesis of organs, tumors, and disruption of hormone production (Berg, 2006). Chemicals and heavy metals such as chlordane, DDE, DDT, dieldrin, PCBs, cadmium, mercury, and selenium settle to the river bottom and are later incorporated into the food web after being consumed by benthic feeders. Gulf sturgeon collected from a number of rivers between 1985 and 1991 were analyzed for pesticides and heavy metals and showed sufficiently high levels of these types of contaminants to warrant concern (Bateman and Brim, 1994). Twenty juvenile Gulf sturgeon analyzed from the Suwannee River, Florida, showed an increase in contaminant concentrations with an increase in length, suggesting that contaminants were bioaccumulating as a result of large adults feeding at higher trophic levels (Alam et al., 2000). Pollutant contamination continues to impede the fitness of Gulf sturgeon throughout its range and it is expected that the effects from prior and ongoing contamination will continue in the near future.

While fisheries targeting Gulf sturgeon have been closed since 1990 for all Gulf States, the species continues to feel the effects of past exploitation as life history characteristics and population models indicate the species will be slow to recover to its pre-exploitation abundance. Fisheries directed at other species (especially those employing trawl and other entanglement gear) continue to incidentally catch sturgeon and these effects, while not as extensive as they are for sea turtles, will continue to affect the ability of the species to survive and recover throughout its range.

Gulf sturgeon are known to be affected by red tide events when they occur in the Gulf of Mexico. Red tide is the common name for a harmful algal bloom of marine algae known as *Karenia brevis* which produces a brevetoxin that is absorbed directly across the gill membranes of fish or through ingestion of algal cells and was the probable cause of death for at least 20 Gulf sturgeon in Choctawhatchee Bay in 1999 (USFWS, 2000). More frequent or prolonged algal blooms may result from increasingly warmer conditions expected in the Gulf in the near future as a result of climate change (FWC, 2009) which would increase mortality throughout the species range and impede recovery efforts.

Boat strikes and/or collisions between jumping Gulf sturgeon and fast-moving boats on the Suwannee River and elsewhere are a relatively recent source of sturgeon mortality according to the recent five year status review for the species (USFWS and NMFS, 2009). The FWC has reported 32 incidents between boaters and Gulf sturgeon in the Suwannee River from 2006-2011 with the highest number of incidents occurring in 2011 (i.e, 11 incidents as of September 6, 2011) (FWC, 2011b). The reason why sturgeon jump and expend energy is unknown athlough one hypothesis is that jumping is a form of group communication that serves to maintain group cohesion (Sulak et al., 2002). Edwards et al. (2007) note that sturgeon jump in marine waters as well making the threat of ship strikes not exclusive to river systems. As sturgeon populations recover, it is expected that these types of boating interactions will increase in the near future although the extent that these interactions impact recovery remains unknown.

## ENVIRONMENTAL BASELINE

By regulation, environmental baselines for biological opinions include the past and present impacts of all state, federal 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 that are contemporaneous with the consultation in process (50 CFR §402.02).

The purpose of the *Environmental Baseline* section is to step down from the species level discussion in the *Status of the Species* section and establish the current and projected viability or fitness of individuals and populations within the action area so that the effects of the proposed research activities can be measured and assessed. The following sections summarize the natural phenomena as well as the anthropogenic activities that have affected and continue to affect listed listed sea turtles and Gulf sturgeon within the action area (i.e., St. Andrews Bay, St. Joseph Bay, Apalachicola Bay, and nearshore Gulf of Mexico waters).

### Natural Sources of Stress and Mortality

*Disease and Red Tide*

A disease known as fibropapilloma is a major threat to listed turtles in many areas of the world including the action area. The disease is characterized by tumorous growths, which can range in size from very small to extremely large, and are found both internally and externally. Large tumors can interfere with feeding and essential behaviors, and tumors on the eyes can cause permanent blindness (Foley et al., 2005). It was first described in green turtles in the Florida Keys in the 1930's. Since then it has been recorded in many green turtle populations around the world as well as other sea turtle species, such as loggerheads (Huerta et al., 2002).

Harmful algal blooms, such as a red tide, impact both sea turtles and Gulf sturgeon in the action area. During four red tide events along the west coast of Florida, sea turtle stranding trends indicated that these events were acting as a mortality factor (Redlow et al., 2003). Gulf sturgeon have also been shown to be impacted by red tide events in the past and remain a threat to populations occurring in the action area (USFWS, 2000)

*Predation and Invasive Species*
Predation of sea turtle eggs and hatchlings by native and introduced species occurs on almost all sea turtle nesting beaches throughout the Gulf of Mexico. The most common predators at the primary nesting beaches in the southeastern United States are ghost crabs (*Ocypode quadrata*), raccoons (*Procyon lotor*), feral hogs (*Sus scrofa*), foxes (*Urocyon cinereoargenteus* and *Vulpes vulpes*), coyotes (*Canis latrans*), armadillos (*Dasypus novemcinctus*), and red fire ants (*Solenopsis invicta*) (Stancyk, 1982; Dodd, 1988). In the absence of well managed nest protection programs, predators may take significant numbers of eggs.

The invasive Australian pine (*Casuarina equisetifolia*) is also particularly harmful to sea turtles throughout the state of Florida because they out compete native species and cause excessive shading of the beach that would not otherwise occur. Studies in Florida suggest that nests laid in shaded areas are subjected to lower incubation temperatures, which may alter the natural hatchling sex ratios (Marcus and Maley, 1987; Schmelz and Mezich, 1988; Hanson et al., 1998).

*Hurricanes*
Hurricanes and tropical storms are common in the Gulf of Mexico and have the potential to directly injure or kill targeted species and/or modify habitat in the action area. Degradation of the estuarine and riverine habitat as a result of high hurricane activity may result in loss of spawning and foraging habitat important to Gulf sturgeon or indirectly affect habitat through increased erosion. Sea turtle nests may also be unearthed during storm events and cause mortality of sea turtle hatchlings. Sand accretion, rainfall, and wave action that result from these storms can also reduce hatchling success. Additionally, with more intense storms expected in the coming years based on climate modeling, it is expected that sea turtle nesting habitat will be further impacted [Goldenburg et al., 2001; Webster et al., 2005; Intergovernmental Panel on Climate Change (IPCC), 2007] and may result in a decrease in hatching success and hatchling emergence in the action area (Martin, 1996; Ross, 2005; Pike and Stiner, 2007; Prusty et al., 2007; Van Houton and Bass, 2007).

*Climate Variability*
Naturally occurring climatic patterns, such as the El Niño and La Niña events, as well as longer time-scale climate variability are identified as major causes of changing marine productivity and may therefore influence listed species' prey abundance in the action area (Mantua et al., 1997; Francis et al., 1998; Beamish et al., 1999; Hare et al., 1999; Benson and Trites, 2002). For example, decade-scale climatic regime shifts have been related to changes in zooplankton in the North Atlantic (Fromentin and Planque, 1996) and decadal trends in the North Atlantic Oscillation (NAO) (Hurrell, 1995) can affect the position of

the Gulf Stream (Taylor et al., 1998) and other circulation patterns in the North Atlantic that act as important migratory pathways for various life stages of sea turtles and marine fish. Alteration of climate due to anthropogenic activities may also increase hurricane activity within the Gulf of Mexico leading to an increase in debris in nearshore and offshore waters, thereby resulting in increased entanglement, ingestion, or drowning as well as increased physical destruction of sea turtle nests and further degradation of river and estuarine habitat important to Gulf sturgeon. However, gaps in information and the complexity of climatic interactions complicate the ability to predict the effects that climate variability may have to these species from year to year.

Increasing air temperatures are a particular concern for nesting sea turtles in the action area as sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25-35°C (Ackerman, 1997). Based on modeling done for loggerhead sea turtles, a 2°C increase in air temperature would be expected to result in production of 100 percent females while a 3°C increase in air temperature would likely exceed the thermal threshold of turtle clutches, resulting in death (Hawkes et al., 2007). Glen et al. (2003) also reported that incubation temperatures for green sea turtles appeared to affect hatchling size with smaller turtles produced at higher incubation temperatures; however, it is unknown whether this effect is species specific or what impact this has on offspring survival. Thus, changes in air temperature as a result of global climate change may alter sex ratios and may reduce hatchling production for nesting beaches throughout the action area (Hawkes et al., 2007; Hamann et al., 2007).

Anthropogenic Sources of Stress and Mortality

*Fishery Interactions*

Entrapment and entanglement in fishing gear is a frequently documented source of stress, injury, and/or mortality in listed species, especially sea turtles, within the action area (NMFS-SEFSC, 2001; Dietrich et al., 2007). Gillnet, longline, other types of hook-and-line gear, trawl gear, and pot fisheries all interact with sea turtles and marine fish at various degrees in nearshore Gulf of Mexico waters.

Sea turtles are frequently caught as bycatch in the following fisheries occurring atleast in part within the action area for the proposed action: Gulf of Mexico reef fish, Southeast shrimp, Gulf of Mexico spiny lobster, Gulf of Mexico stone crab, coastal migratory pelagics, and red drum fisheries. While sea turtle bycatch varies depending on the fishery, the Southeast shrimp trawl fishery affects more sea turtles than all other activities combined (NRC, 1990). Although participants in these fisheries are required to use Turtle Exclusion Devices (TEDs) that reduce the number of sea turtle captures by an estimated 97 percent, these fisheries are still expected to capture about 185,000 sea turtles each year, of which 5,000 end up dead (NMFS, 2002). Loggerhead and Kemp's ridley sea turtles account for the majority of the annual take with 163,160 loggerheads (3,948 mortalities) and 155,503 Kemp's ridleys (4,208 mortalities) captured on an annual basis followed by 18,757 greens (514 mortalities) and 640 hawksbills (all mortalities) (NMFS, 2002). In addition to direct mortality and serious injury, entanglements increase sea turtles' vulnerability to predation and ship strikes as well as increase their susceptibility to disease.

In recent years, low shrimp prices, rising fuel costs, competition with imported products, and impacts from hurricanes in the Gulf of Mexico have all impacted shrimp fleets. In some cases, fishing effort reduced by as much as 50 percent for offshore waters (GMFMC, 2007). As a result, interactions and mortalities in the Gulf of Mexico, notably for loggerheads, have been substantially less than projected in the 2002 Opinion, with 61,299 loggerheads (1,451 mortalities) reported taken during the 2009 fishing season (NMFS-SEFSC, 2011). While the numbers reported by NMFS-SEFSC appear to show decreased levels of interaction with loggerheads and possibly other species affected by the proposed action, there is concern that many sea turtles that die from entanglement in commercial fishing gear tend to sink rather than strand ashore thus making it difficult to accurately determine the extent of such mortalities. Also, on August 16, 2010, NMFS reinitiated formal section 7 consultation on the shrimp trawl fishery in the southeastern U.S. to reanalyze its effects on sea turtles primarily due to the after-effects of the *Deepwater Horizon* oil spill event. For instance, NMFS has documented extraordinarily high numbers of sea turtle strandings in the Gulf of Mexico since the spill occurred and NMFS suspects that much of the increased level of strandings is attributable to shrimp fishing (NMFS, 2010b).

Sea turtles and marine fish are also caught as bycatch in other state-managed fisheries throughout the action area such as weakfish, horseshoe crabs, whelk, shad, blue crab, stone crab, lobster (e.g., pots), and flounder (e.g., pound nets). While little is known about the level of take in fisheries that operate strictly in state waters, many state permit holders also hold Federal licenses; therefore, ESA Section 7 consultations on Federal action in those fisheries address some state-water activity. In the past, Gulf sturgeon were incidentally caught in the shrimp and gillnet fisheries in Apalachicola Bay (Wooley and Crateau, 1985) although the threat of bycatch in the action area has significantly decreased with implementation of Florida's net ban in 1995 which made unlawful the use of entangling nets (i.e., gill and trammel nets) in Florida waters (USFWS and NMFS, 2009). NMFS is actively participating in a cooperative effort with the Atlantic States Fisheries Management Commission (ASFMC) to standardize and/or implement programs to collect information on level of effort and bycatch in state fisheries in Atlantic waters. When this information becomes available, it can be used to refine take reduction plan measures in state waters.

*Habitat Loss and Modification*
Coastal habitat in the action area has undergone extensive modification due to urbanization and it is expected that sea turtles and Gulf sturgeon are going to continue to feel the effects as cities grow and the human population in the southeastern U.S. increases. Stedman and Dahl (2008) estimated that the Gulf of Mexico region of the U.S. lost an average of 60,000 acres of wetland habitat annually from 1998 to 2004. These losses have been attributed to commercial and residential development, port construction (dredging, blasting, and filling activities), construction of water control structures, modification to freshwater inflows, and oil and gas related activities (SAFMC, 1998).

Riverine systems throughout the Gulf sturgeon's historical range have been altered or dammed thus limiting the species' ability to expand its current range. Dredging operations may also destroy benthic feeding areas, disrupt spawning migrations, and re-suspend fine sediments causing siltation over required substrate in spawning habitat.

Sub-optimal sea turtle nesting habitat due to beach armoring (e.g., bulkheads, seawalls, soil retaining walls, rock revetments, sandbags, and geotextile tubes) and artificial lighting in the action area may cause decreased nesting success, place an increased energy burden on nesting females, result in abnormal nest construction, and reduce the survivorship of eggs and hatchlings (Mann, 1977; Ackerman, 1980; Mortimer, 1990). Beach armoring can impede a turtle's access to upper regions of the beach/dune system, thereby limiting the amount of available nesting habitat (Mazaris et al., 2009). Artificial lighting may deter adult female turtles from emerging from the ocean to nest and can disorient or misorient emerging hatchlings away from the ocean (Ehrhart, 1983, Salmon and Witherington, 1995). Hatchlings have a tendency to orient toward the brightest direction, which on natural, undeveloped beaches is commonly toward the broad open horizon of the sea. However, on developed beaches, the brightest direction is often away from the ocean and toward lighted structures. Hatchlings unable to find the ocean, or delayed in reaching it, are likely to incur high mortality from dehydration, exhaustion, or predation (Peters and Verhoeven, 1994; Salmon and Witherington, 1995).

*Coastal Pollution*

Water quality changes from dredging, land use practices, and point and non-point source pollution may impact the fitness of Gulf sturgeon (Bateman and Brimm, 1994) and sea turtles (Iwata et al., 1993; Grant and Ross, 2002; Garrett, 2004; Hartwell, 2004) in the action area through introduction of waterborne contaminants. Contaminants such as chlordane, DDE, DDT, dieldrin, PCBs, cadmium, mercury, and selenium settle to the river bottom and are later consumed by benthic feeders, such as macroinvertebrates, and then work their way higher into the food web. These compounds may enter the aquatic environment via wastewater treatment plants, agricultural facilities, as well as runoff from farms (Folmar et al., 1996, Culp et al., 2000, Wildhaber et al., 2000, Wallin et al., 2002).

The primary concentration of intensive land use and apparent non-point source pollution in the St. Andrew Bay watershed occurs in and around the Panama City metropolitan area. Additional concentrations of transportation and associated land uses occur on Tyndall Air Force Base. In the St. Joseph Bay basin, the primary concentration of intensive land use is in and around the city of Port St. Joe. Residential and commercial development also occurs around Mexico Beach, St. Joe Beach, and scattered along the peninsula north of Cape San Blas [Northwest Florida Water Management District (NWFWMD), 2000).

*Oil Spills*

Sea turtles and marine fish in the Gulf of Mexico are located in an area of high-density offshore oil extraction with chronic, low-level spills and occasional massive spills (such as the recent *Deepwater Horizon* oil well blowout, *Ixtoc I* oil well blowout and fire in the

Bay of Campeche in 1979, and the explosion and destruction of a loaded supertanker, the *Mega Borg*, near Galveston in 1990). Oil spills impact sea turtles and other wildlife directly through three primary pathways: ingestion – when animals swallow oil particles directly or consume prey items that have been exposed to oil, absorption – when animals come into direct contact with oil, and inhalation – when animals breath volatile organics released from oil or from "dispersants" applied by response teams in an effort to increase the rate of degradation of the oil in seawater.

At the time of this consultation, NMFS has reported that 481 Kemp's ridley, 67 loggerheads, 29 green, and 32 unspecified sea turtles have been found dead in the vicinity of the *Deep Horizon* spill event that occurred in the northcentral Gulf of Mexico from April-October, 2010, although the cause of death is not immediately certain for all caracasses recovered (NMFS, unpublished data[12]). The cumulative oil footprint encompassed nearshore Gulf of Mexico waters surrounding all three bays included in the action area (i.e., St. Andrews, St. Joseph, and Apalachicola bays) although Natural Resource Damage Assessment (NRDA) data available online for the oil spill event (http://gomex.erma.noaa.gov) did not indicate oil actually entering the bays themselves. Kemp's ridley sea turtles appear to be the most affected due to their high death totals since the blowout occurred, their low population numbers to begin with, and their limited range compared with other sea turtle species.

Since March 15, 2011, a notable increase in sea turtle standings has occurred in the Northern Gulf of Mexico although the cause of this increase is unknown. The Sea Turtle Stranding and Salvage Network is currently investigating the cause of this increase in strandings although two primary considerations for the cause of death are forced submergence (fishing related) and acute toxicosis (from algal blooms or related to the oil spill) based on necropsies that have been performed thus far (NMFS, unpublished data[13]). While no Gulf sturgeon deaths have been documented as a result of the spill event, it is expected that foraging adults were most likely exposed to oil in the nearshore Gulf of Mexico waters in the late summer and fall months following the spill as adults migrated to foraging grounds offshore. More research needs to be done to determine the short and long term effects of the Deepwater Horizon oil spill event; however, the sections below provide a summary of the possible effects to both sea turtles and Gulf sturgeon based a review of the literature.

When large quantities of oil enter a body of water, direct mortality of wildlife and chronic conditions such as various forms of cancer becomes more likely (Lutcavage et al., 1997). Oil spills in the vicinity of nesting beaches just prior to or during the nesting season could place nesting females, incubating egg clutches, and hatchlings at significant risk (Fritts and McGehee, 1982; Lutcavage et al., 1997; Witherington, 1999). Continuous low-level exposure to oil in the form of tarballs, slicks, or elevated background concentrations also challenge animals facing other natural and anthropogenic stresses. Types of trauma can

12 Sea turtle mortality and nest relocation data associated with the *Deepwater Horizon* Oil spill event is available at: http://www.nmfs.noaa.gov/pr/health/oilspill/turtles.htm.

13 Sea Turtle stranding data for the Gulf of Mexico is available at: http://www.nmfs.noaa.gov/pr/species/turtles/Gulfofmexico.htm

include skin irritation, altering of the immune system, reproductive or developmental damage, and liver disease (Keller et al., 2004; Keller et al., 2006). In addition, chronic exposure may impair a turtle's overall fitness so that it is less able to withstand other stressors throughout the species life history (Milton et al., 2003).

The earlier life stages are usually at greater risk from an oil spill than adults since they usually spend a greater portion of their time at the sea surface, thereby increasing their risk of exposure to floating oil slicks (Lutcavage et al., 1995). Most reports of oiled hatchlings originate from convergence zones where currents meet to form collection points for material at or near the surface of the water. For example, 65 of 103 post-hatchling loggerhead sea turtles in convergence zones off Florida's east coast were found with tar in the mouth, esophagus, or stomach (Loehefener et al., 1989). Thirty-four percent of post-hatchlings captured in Sargassum off the Florida coast had tar in the mouth or esophagus and more than 50 percent had tar caked in their jaws (Witherington, 1994). Tarballs in a turtle's gut are likely to have a variety of effects – starvation from gut blockage, decreased absorption efficiency, absorption of toxins, effects of general intestinal blockage (such as local necrosis or ulceration), interference with fat metabolism, and buoyancy problems caused by the buildup of fermentation gases (floating prevents turtles from feeding and increases their vulnerability to predators and boats), among others. Lutz and Lutcavage (1989) reported hatchlings found with their beaks and esophagi blocked with tarballs, apparently dying of starvation.

Frazier (1980) suggested that olfactory impairment from chemical contamination could represent a substantial indirect effect in sea turtles, since a keen sense of smell apparently plays an important role in navigation and orientation. A related problem is the possibility that an oil spill impacting nesting beaches may affect the locational imprinting of hatchlings, and thus impair their ability to return to their natal beaches to breed and nest (Milton et al., 2003).

Oil cleanup activities, such as the use of dispersants, may also be harmful to sea turtles although such impacts are difficult to predict in the absence of direct testing. While inhaling petroleum vapors can irritate turtles' lungs, dispersants can interfere with lung function through their surfactant (detergent) effect. Dispersant components absorbed through the lungs or gut may affect multiple organ systems and interfere with digestion, respiration, excretion, and/or salt-gland function which can be similar to effects deriving from the oil itself (Hoff and Shigenaka, 2003). Other oil cleanup activities such as the use of earth-moving equipment on beaches can dissuade females from nesting and destroy nests while the use of containment booms has the possibly of entrapping young hatchlings (Witherington, 1999).

Gulf sturgeon and other marine and anadromous fish species can be impacted by oil contamination directly through uptake by the gills, ingestion of oil or oiled prey, effects on eggs and larval survival, and through contamination of foraging and spawning sites. Studies after the Exxon Valdez oil spill demonstrated that fish embryos exposed to low levels of PAHs in weathered crude oil develop a syndrome of edema and craniofacial and body axis defects (Incardona et al., 2005). Increased hydrocarbon concentrations are known to cause cardiovascular and other abnormalities in developing embryos (Anderson et al., 2009). Crude oil can also impact survival, physiological, and haematological parameters of juvenile fish, although embryos are more severely affected than juveniles (Kazlauskiene et al., 2008).

*Acoustic Impacts*
Increases in underwater sound generated from various man-made sources such as on-shore construction, pile driving, and bridge construction have the potential to affect listed species in the action area at various times throughout the year. Acoustic impacts to sea turtles can include temporary or permanent injury, habitat exclusion, habituation, and disruption of other normal behavior patterns (NMFS-SEFSC, 2001). Short-term exposure to high-energy sound sources such as underwater explosions, pile driving and other marine construction have the potential to result in direct injury or even death to listed species located near the sound source.

Sea turtles and marine fish in the action area are affected by military activities including vessel operations and various training operations. Recently, NMFS evaluated The U.S. Navy Atlantic Fleet's active sonar training along the Atlantic Coast of the United States and in the Gulf of Mexico from January 22, 2011 to January 21, 2012 as well as research, development, testing, and evaluation (RDT&E) activities in the Gulf of Mexico Range Complex from March 18, 2011 to March 17, 2012. Based on the biological opinions for the respective training activities, sea turtles are expected to be exposed to mid-frequency active sonar, vessel traffic, and explosions associated with the active sonar training although both opinions reached conclusions that the activities would not jeopardize the continued existence of any listed sea turtle species. NMFS and the U.S. Navy have been working cooperatively to establish a policy for monitoring and managing acoustic impacts from anthropogenic sound sources in the marine environment including any future operations occurring in the Gulf of Mexico.

*Vessel Interactions*
In addition to noise effects described earlier, vessels operating in the action area adversely affect listed sea turtles and marine fish through direct ship strikes and/or other physical and behavioral disturbance. Turtles and marine fish swimming or feeding at or just beneath the surface of the water are vulnerable to boat and vessel strikes, potentially resulting in serious propeller injuries and even death (Hazel et al., 2007). Vessel avoidance may cause sea turtles and marine fish in the action area to move away from important feeding areas or potential mates, both of which can affect the ability of the species to recover. As discussed in the *Status of the Species* section of this Opinion, boating interactions with Gulf sturgeon appears to be increasing in the Suwannee River and the most recent status review names boat strikes as a relatively new source of mortality for the species (USFWS and NMFS, 2009). Boat registrations have increased dramatically in Florida in recent years, and these interactions are expected to continue and may even increase throughout the Gulf sturgeon’s range including the action area (NMFS, 2009).

*Scientific Research Activities*
Listed sea turtles (and to a lesser extent Gulf sturgeon) have been the subject of scientific research activities occurring in whole or in part within the action area, as authorized by NMFS permits. Research activities for sea turtles include photographing, weighing, tagging, blood sampling, biopsy sampling, and performing laparoscopy. Research activities for Gulf sturgeon include net capture, photographing, measuring, tagging, tracking, and blood and tissue sampling. At the time of this consultation, there are currently 11 active research permits directed towards sea turtles and 2 active permits directed at Gulf sturgeon in the greater Gulf of Mexico region. The number of authorized takes varies widely depending on the research and species involved. Short term harassment and/or injury are expected to result from these research activities although no population level consequences are expected at this time (consistent with the corresponding biological opinions issued for the respective permits).

Before any research permit is issued, the proposal must be reviewed under the permit regulations (i.e., must show a benefit to the species). In addition, since issuance of the permit is a federal activity, issuance of the permit by the NMFS must also be reviewed for compliance with section 7(a)(2) of the ESA to ensure that issuance of the permit does not result in jeopardy to the species. All permits for sea turtles and Gulf sturgeon contain conditions requiring the permit holders to coordinate their activities with the NMFS regional offices and other permit holders and, to the extent possible, share data to avoid unnecessary duplication of research. While these measures help minimize the repeated exposure of individuals, our ability to detect long-term consequences from research activities will depend on several factors including improving our evaluation of sub-lethal effects as well as funding and prioritizing studies investigating long term survival and reproduction of individuals subjected to repeated exposures over time.

## EFFECTS OF THE PROPOSED ACTION

Pursuant to Section 7(a)(2) of the ESA, federal agencies are directed to insure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. In this section, we describe the potential physical, chemical, and biotic stressors associated with the proposed action, the probability of individuals of listed species being exposed to these stressors, and the probable responses of those individuals (given the probable exposures) based on the best scientific and commercial evidence available. As described in the *Approach to the Assessment* section, for any responses that would be expected to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, and lifetime reproductive success), the assessment would consider the risk posed to the viability of the population(s) those individuals comprise and to the listed species those populations represent. The purpose of this assessment is to determine if it is reasonable to expect the proposed research activites to have effects on listed species that could appreciably reduce their likelihood of surviving and recovering in the wild.

For this consultation, we are particularly concerned with behavioral disruptions that may result in animals that fail to feed or breed successfully or fail to complete their life history because these responses are likely to have population-level consequences. The proposed permits would authorize non-lethal "takes" in the form of capture, wounding, and harassment of four species of listed sea turtles (i.e., loggerhead, green, hawksbill, and Kemp's ridley) as well as incidental capture and harassment of Gulf sturgeon. For this Opinion, we define harassment as an intentional or unintentional human act or omission that creates the probability of injury to an individual animal by disrupting one or more behavioral patterns that are essential to the animal's life history or its contribution to the population the animal represents.

<u>Exposure Analysis</u>

Exposure analyses identify the co-occurrence of ESA-listed species with the action's effects in space and time, and identify the nature of that co-occurrence. The exposure analysis identifies, as possible, the number, age or life stage, and gender of the individuals likely to be exposed to the action's effects and the population(s) or subpopulation(s) those individuals represent. Our exposure analyses are based on the best information available to us including recent population estimates, expected growth rates over the life of the permits, the maximum survey effort expected over the remainder of the permit period, and past take numbers reported from permits authorizing similar types of research operating in and around the action area.

Under permit No. 10022-02, researchers will now be authorized to capture green sea turtles by hand and/or by dip net in St. Joseph bay and temporarily mark their carapace (new activity), attach satellite/sonic tags to two additional species (Kemp's ridleys and loggerheads), alter the method of satellite tag attachment for all tagged individuals [neoprene attached method consistent with (Seney et al., 2010)], obtain blood samples, and increase the numbers of loggerhead, green, and Kemp's ridley sea turtles captured in all bays. Previous activities such as flipper tagging, PIT tagging, satellite/acoustic tagging, tissue sampling, measuring, and weighing will continue to be authorized and researchers will continue to obtain sea turtles opportunistically from relocation trawlers operating in St. Andrews Bay and nearshore Gulf of Mexico waters. **Tables 3a**, **3b**, and **3c** display the exposure levels expected for listed species as a result of the ongoing and modified activities to be authorized in the proposed permit modification. Individuals may be of either sex and multiple exposures are expected for each individual over the remainder of the permit period.

**Table 3a. Annual Exposure of Listed Species to Modified Research Activities Proposed for Permit Modification No. 10022-02 to be Conducted in St. Joseph, St. Andrews, and Apalachicola Bays, Florida**

| Species (Life Stage) | First Level Exposure (Individuals Captured by Strike-net/ Entanglement Net) | Second Level Exposure (Individuals to be Weighed, Measured, Photographed, Skin Biopsied, Flipper Tagged, PIT tagged, and Blood Sampled) | Third Level Exposure (Individuals fitted with Satellite/Acoustic Tag using Neoprene Attachment Method and Tracked)*** |
|---|---|---|---|
| Loggerhead sea turtle (juvenile/sub-adult/adult) | 20 | 20 | 10 |
| Green sea turtle (juvenile/sub-adult/adult) | 250 | 250 | 12 |
| Kemp's ridley sea turtle (juvenile/sub-adult/adult) | 50 | 50 | 10 |
| Gulf Sturgeon (juvenile or adult) | 10* | 10** | 0 |

*Gulf sturgeon may be incidentally caught in entanglement nets in all three bays
**Second level exposure to Gulf sturgeon would include measuring, weighing, and checking for PIT tags only
***Only sea turtles greater than 40 cm SCL will be fitted with satellite/acoustic tags

**Table 3b. Annual Exposure of Listed Species to Additional Research Project (Foraging Study) Proposed for St. Joseph Bay Only**

| Species (Life Stage) | First Level Exposure (Individuals Captured by Hand and/or Dip Net) | Second Level Exposure (Individuals to be Weighed, Measured, Photographed, Flipper Tagged, and PIT tagged) | Third Level Exposure (Individuals to be Carapace-Marked and Released) |
|---|---|---|---|
| Green sea turtle (juvenile/sub-adult/adult) | 20 | 20 | 20 |

**Table 3c. Exposure of Listed Species Captured by Relocation Trawlers as Authorized under a Separate Authority For St. Andrews Bay and Nearshore Gulf of Mexico Waters**

| Species (Life Stage) | First Level Exposure (Individuals Captured by Relocation Trawler)* | Second Level Exposure (Individuals to be Weighed, Measured, Photograph, Skin Biopsied, Flipper Tagged, PIT tagged) | Third Level Exposure** (Individuals fitted with Satellite/Acoustic Tag using Neoprene Attachment Method and Tracked) |
|---|---|---|---|
| Loggerhead sea turtle (juvenile/sub-adult/adult) | 25 | 25 | 25 |
| Green sea turtle (juvenile/sub-adult/adult) | 25 | 25 | 25 |
| Kemp's ridley sea turtle (juvenile/sub-adult/adult) | 25 | 25 | 25 |
| Hawksbill sea turtle (juvenile/sub-adult/adult) | 25 | 25 | 25 |

*Incidental captures by relocation trawlers already authorized under separate authority

**Only 25 transmitters may be attached over the course of the entire permit period (not annually) and may be of any combination of loggerhead, green, hawksbill, or Kemp's ridley sea turtles. Therefore, only 25 cumulative exposures at all three levels are possible. Only sea turtles greater than 40 cm SCL will be fitted with satellite/acoustic transmitters.

As part of this exposure analysis, the ESA Interagency Cooperation Division reviewed monitoring reports submitted by the researchers under their original permit as well as information on catch rates conducted in St. Joseph Bay from 2001-2005 under a separate permit that utilized similar net types (i.e., permit No. 1299) in order to assist in estimating net capture rates expected for the targeted species. We also considered the increased effort expected for the remainder of the permit period (e.g., increased net soak times proposed by the researchers) to project exposure under higher levels of effort than what was analyzed under the original permit. As a result of this review, we determined that the level of exposure was consistent with the requested take numbers included in the initiation package, and these numbers are reflected in **tables 3a**, **3b**, and **3c** above. We organized exposure events sequentially by grouping the research activities into three main groups according to expected timing of their occurrence. For instance, sea turtles are first exposed to different forms of capture (i.e., strike-net, entanglement net, dipnet, hand capture, or opportunistic transport from relocation trawlers). After capture, sea turtles are brought on board where they are exposed to multiple sampling activities (e.g., measuring, weighing, flipper/PIT tagging, and blood/tissue sampling). Finally, a limited number of those sea turtle are then exposed to a third group of activities (i.e. satellite/acoustic tagging or carapace marking) before being released.

While researchers have sampled in St. Joseph Bay in the past under their previous permit (No. 1299), sampling has yet to be conducted in either St. Andrews or Apalachicola bays as all sampling activities were canceled the first two years of the researchers' current permit due to multiple logistical issues. Given this lack of catch data, we cannot accurately estimate exposure that is likely to occur in each bay separately although subsequent monitoring reports submitted by the researchers should further inform this analysis. Therefore, we provided exposure for a majority of research activities for all three bays combined.

In addition to sea turtles, the original permit included an Incidental Take Statement (ITS) that exempted 10 non-lethal takes of Gulf sturgeon per year based on conversations with sturgeon researchers operating in the southeast region. Gulf sturgeon would be exposed to capture in entanglement nets, as well as measuring, weighing, and handling by researchers to check for existing PIT tags before release. After reviewing the available information, NMFS is not aware of any additional studies conducted in and around the action area since the issuance of the original permit that would cause us to adjust this level of exposure. NMFS conducted a recent consultation in 2010 that evaluated research activities to be authorized by the Mississippi Department of Wildlife, Fisheries, and Parks as part of an ESA Section 6 grant for the Pascagoula River Estuary. The biological opinion for that action estimated 5-20 annual exposures of Gulf sturgeon to net capture. We do not have any updated catch data from the original permit as researchers were not able to sample during the first two years of the study and we are unaware of any other federal permits authorizing research on Gulf sturgeon that would help inform this analysis. Based on the fact that a reproducing population currently exists for the Apalachicola River, we expect that more Gulf sturgeon may be encountered during sampling conducted in Apalachicola Bay from March through May and September through November each year when adult sturgeon are migrating between spawning and foraging sites. However, we cannot accurately estimate exposure for each bay due to the variability in research effort expected to occur each year over the remainder of the permit period. Therefore, based on a review of the available information, we assessed exposure of Gulf sturgeon at the levels exempted in the original ITS with the expectation that future monitoring reports will help further refine these estimates.

<u>Response Analysis</u>
As discussed in the *Approach to the Assessment* section of this Opinion, response analyses determine how listed resources are likely to respond after being exposed to an action's effects on the environment or directly on listed animals themselves. For the purposes of consultation, our assessments try to detect potential lethal, sub-lethal, physiological or behavioral responses that might reduce the fitness of individuals. Ideally, response analyses would consider and weigh evidence of adverse consequences as well as evidence suggesting the absence of such consequences.

Stressors associated with the permit modification include possible injury and/or mortality from ship strikes; stress and/or injury from direct (netting and by hand) and indirect (relocation trawler) capture methods; and stress and/or injury associated with handling, measuring, weighing, PIT tagging, flipper tagging, blood sampling, tissue sampling, carapace marking, and acoustic and satellite tag attachments (using the neoprene satellite tag attachment method). Capture by relocation trawlers is covered under a separate authority and thus the effects were already analyzed in a separate biological opinion; therefore, we will not be evaluating the effects of direct capture of sea turtles by relocation trawlers and will only discuss the research activities to be conducted under this proposed action (i.e., sampling activities performed by sea turtles once they are transferred to the researchers operating under this permit as proposed).

*Responses to Vessels*
Sea turtles and Gulf sturgeon may be undergo injury and possible mortality as a result of direct ship strikes or contact with small boat propellers. Boat strikes and/or collisions between jumping Gulf sturgeon and fast-moving boats on the Suwannee River and elsewhere are a relatively recent source of sturgeon mortality according to the recent five year status review for the species (USFWS and NMFS, 2009). Turtles and marine fish swimming or feeding at or just beneath the surface of the water are vulnerable to boat and vessel strikes, potentially resulting in death (Hazel et al., 2007). We evaluated the potential for ship strikes and expect that based on the slow speeds of the vessels along with the experience of the researchers at spotting targeted species, it is extremely unlikely that a ship strike would occur over the remaining portion of the permit period. Also, researchers have not recorded any sea turtle or Gulf sturgeon strikes in the past in monitoring reports submitted under their previous permit. Therefore, we believe it is extremely unlikely that a ship strike would occur and would not expect these level of responses to be felt by listed species as a result of this proposed action.

Sea turtles and Gulf sturgeon may also respond behaviorally by avoiding the oncoming vessel. Behavioral responses by animals to human disturbance are similar to their responses to avoiding predators (Beale and Monaghan, 2004; Frid, 2003; Frid and Dill, 2002; Gill et al., 2001; Harrington and Veitch, 1992; Lima, 1998; Romero, 2004). The avoidance response to an oncoming vessel can interrupt essential behaviors such as foraging, resting, mating, etc. Increased stress from the presence of vessels can also increase an animal's susceptibility to disease and predation (Frid and Dill, 2002; Romero, 2004; Walker et al., 2006).

*Responses to Capture*
Hand capture and capture by strike-nets, entanglement nets, and dipnets can result in short term stress, injury, or even death to sea turtles depending on the type of capture and duration of exposure (Hays et al., 2003b; Watson et al., 2005; Gilman et al., 2007). Strike-nets, dipnets, and hand capture would target individuals directly, while entanglement nets would be placed in the water and passively capture sea turtles that swim into the net. The passive nature of entanglement nets typically result in a longer duration of exposure to capture since the entangled sea turtle would first need to be spotted before being released of the net whereas turtles caught by strike-net, dipnet, or by hand would be immediately brought on board the vessel at the direct moment of capture. We focused our analysis on entanglement netting as this capture method typically results in the greatest range of responses due to the typically longer duration of exposure. We

will assume that those turtles exposed to other direct forms of capture would either respond similarly or to a lesser degree than those exposed to entanglement.

Responses of entanglement range from increased stress and alteration of acid-base balance to physical effects of the line wrapping around the turtle to drowning as a result of forced submergence. The magnitude of the response varies depending on the length of time the turtle spends entangled and/or submerged. As a sea turtle becomes entangled, the netting often wraps around the turtle's appendages so as to prevent the turtle from swimming away. Constriction of appendages may cut off blood flow or cause deep gashes as the sea turtle tries to escape the net. Sea turtles that are forcibly submerged due to entanglement also undergo respiratory and metabolic stress that can lead to severe disturbance of their acid-base balance. For instance, most voluntary dives by sea turtles appear to cause only minor changes in acid-base status (pH level of the blood) (Lutz and Bentley, 1985). However, when a sea turtle is forcibly submerged, they often consume oxygen stores which trigger an activation of anaerobic glycolysis that alters the turtles' internal acid-base balance. With each forced submergence, lactate levels increase as well as the time it takes for the sea turtle to recover to normal conditions (as much as 20 hours after the initial exposure). Therefore, sea turtles are likely more susceptible to lethal metabolic acidosis if they experience multiple forced submergences in a short period of time (Lutcavage and Lutz, 1997). Adult sea turtles are capable of longer voluntary dives than small turtles, so juveniles may be more vulnerable to these types of stress responses than adults.

Hoopes et al. (2000) found that entanglement netting produced notable changes in blood chemistry in wild Kemp's ridley sea turtles, with plasma lactate concentrations showing a 6-fold increase at the time of capture compared with those those measured 6-10 hours post-capture. However, they note that the lactate response resulting from the stress of capture in entanglement netting was relatively slight compared with that reported for trawl capture. Although it appears that net capture can result in temporary changes in blood chemistry of sea turtles, it appears that animals that are immediately placed back into a marine environment after removal from the gear can recover from the short-term stress of capture (Hoopes et al., 2000). Researchers are expected to monitor entanglement nets both at the surface and underwater (by snorkelers swimming the length of the net) at intervals of less than 20 min, and more frequently whenever turtles or other organisms are observed in the net. Any sea turtles that have already been sampled may undergo multiple forced submergences, but the fact that nets will be constantly checked decreases the time that a recapture will spend in the net before being released. The short time that sea turtles will remain entangled should minimize the probability that sea turtles will be injured or reach lactate levels that will cause lethal acidosis. Researchers have not recorded mortalities of sea turtles for research conducted in the past in St. Josephs Bay. Therefore, we expect that responses of sea turtles to entanglement and other capture methods will be limited to short term stress responses manifested as a change in lactate concentrations in the blood that should subside a short time after being released consistent with responses recorded by Hoopes et al. (2000).

Gulf sturgeon are also likely to experience physiological stress responses as a result of being incidentally captured in entanglement nets. The consequences of those stress responses to each individual will depend on their condition prior to their capture, how long they remain entangled before they are released from the entangling gear, how long they are restrained and handled while the study protocols are completed, and their response to the study protocols. Entanglement has been shown to result in injury and mortality, reduced fecundity, and delayed or aborted spawning migrations of sturgeon species based on prior studies (Moser and Ross, 1995; Collins et al., 2000; Moser et al., 2000; Kahn and Mohead, 2010). However, conservative mitigation measures implemented by NMFS and other researchers since 2006 (e.g. reduced soak times at warmer temperatures or lower DO concentrations, and minimal holding or handling time, etc.) have reduced the effects of gillnetting on sturgeon significantly, with very few documented mortalities reported in recent years. Researchers are not proposing to utilize gillnets nor would they expect Gulf sturgeon to be handled for long periods of time so the probability of serious injury, death, or delayed or reduced spawning is not expected for the activities proposed.

Sturgeon are also known to inflate their swim bladder when held out of water (Moser et al. 2000) and if they are not returned to neutral buoyancy prior to release, they will float and be susceptible to sunburn and other stress (e.g. bird attacks). The permit would contain conditions to require researchers to address buoyancy (e.g., by “burping” the animal) prior to release to minimize this response. Based on the researchers’ prior experience and monitoring reports submitted under their previous permit, we do not expect any Gulf sturgeon to be seriously injured during capture and any individuals incidentally caught in entanglement nets are expected to undergo only short term stress that should quickly subside after release.

*Responses to Handling, Measuring, Weighing, and Photography*
Handling and restraining sea turtles may cause short term stress responses similar to those experienced during capture. The additional on-board holding time imposes an additional stressor on 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 cause heightened lactate production. Total handling time is expected to be no more than two hours for sea turtles caught by hand and/or by netting activities and no more than four hours for sea turtles obtained by relocation trawlers. Researchers would place a foam pad on the bottom of the tub and a cloth will be placed over the turtle's eyes to help calm the turtle and restrict movement. These mitigation measures will reduce serve to minimize the magnitude of the stress response.

NMFS expects that any short term stress response from both capture and handling activities to be conducted onboard would return to normal soon after release based on observations recorded in the past (Hoopes et al., 2000). The total handling time may increase for sea turtles held during periods of inclement weather but similar mitigation measures such as restricting the turtle’s movement as well as keeping a moist towel over its head and eyes should reduce the overall stress response from extended holding. As was the case for entanglement net capture, juvenile turtles are expected to be more susceptible to blood lacatate levels reaching sufficient levels to cause lethal acidosis; however, any recaptured turtles would be released as soon as possible in order to avoid repeated exposure to stress associated with handling and size measurements. Sea turtles would be identified by tags and would be released immediately upon being identified. Also, NMFS is unaware of any sea turtle mortalities resulting from onboard handling activities based on a review of previous monitoring reports. Therefore, we expect that sea turtles would undergo short term stress responses as a result of handling that should subside shortly after being released.

On board handling, measuring, and weighing of Gulf sturgeon before release could result in some minor additional stress to Gulf sturgeon, but the very short duration of the handling activities (expected to be about five minutes total for each individual) should prevent any significant increase in stress levels than what the sturgeon already experienced during entanglement net capture. Signs of handling stress are redness around the neck and fins and soft fleshy areas, excess mucus production on the skin, and a rapid flaring of the gills. In some cases, if pre-spawning adults are captured and handled, it is possible that they would interrupt or abandon their spawning migrations after being handled (Moser and Ross, 1995). Mitigation measures such as adhering to NMFS's sturgeon protocols (Moser et al., 2000; Kahn and Mohead, 2010) and avoiding keeping any individual out of the water longer more than a minute without having water run through its mouth and over its gills should help minimize these stress responses and avoid any long term fitness consequences. Based on these measures, NMFS expects that individuals handled for size measurements are expected to experience no more than short-term stress as a result of these activities that should subside shortly after the sturgeon is released.

*Responses to Tissue and Blood Sampling*

Effects to sea turtles of drawing blood samples with syringes and taking tissue samples include minimal discomfort and pain as well as possible hemorrhage or infection at the site of penetration. To mitigate these effects, the needle would be slowly advanced while applying gentle negative pressure to the syringe until blood freely flows into the syringe. Once the blood is collected, direct pressure would be applied to the site to ensure clotting and prevent subsequent blood hemorrhaging (Stoskopf, 1993). Bjorndal et al. (2010) found that turtles exhibited rapid healing at the tissue sampling site with no infection or scarring, and that the sampling did not adversely impact turtle physiology or health. Also, at the time of this consultation, NMFS is unaware of any mortalities or serious injuries resulting from this procedure. Researchers will ensure that the total volume of blood taken from each turtle will not exceed one milliliter (ml) per one kg of turtle weight and for turtles weighing less than one kg, a single blood sample will not exceed six percent of the turtle's total blood volume. The sample site for both blood and tissue sampling will be properly cleaned and disinfected to prevent infection. Based on these measures, we expect responses to skin and blood sampling to be minimal discomfort and minor wounding that should heal relatively quickly after release.

*Responses to Carapace Marking*
Up to 20 green sea turtles captured in St. Joseph Bay each year would be carapace-marked as part of a separate foraging study proposed in this permit modification. Non-toxic, white polyester resin paint will be used to mark the sea turtle with a specific number for identification and tracking. Carapace marking has been used extensively to identify individual turtles in the past and is non-invasive and temporary way to identify sea turtles without recapturing them (Hendrickson and Hendrickson, 1983; Balazs, 1989; Balazs, 1999; Pike et al., 2005). The paint to be used by researchers is expected to dry within 10 min and is expected to wear off after about a month. Permit conditions require that researchers not use paints with exothermic set-up reactions to avoid any effects from heat that could affect the turtle as the paint cures. The margins of the scutes, where keratin is thinnest, would be avoided for all green sea turtles marked with the paint. As a result of these measures, no additional stress beyond those described for capture and handling is expected to result from this procedure.

*Responses to Flipper and PIT Tagging*
Flipper tagging activities are minimally invasive although sea turtles can experience some discomfort during the application of the tag. The discomfort is usually short and highly variable between individuals based on past observations (Balazs, 1999). NMFS expects the stresses associated with flipper tags to be minimal and short-term and that the small wound-site resulting from a tag should heal relatively quickly after the sea turtle is released.

PIT tags have been used with a wide variety of animal species that include fish (Clugston, 1996; Skalski et al., 1998; Dare, 2003), amphibians (Thompson, 2004), reptiles (Cheatwood et al., 2003; Germano and Williams, 2005), birds (Boisvert and Sherry, 2000; Green et al., 2004), and mammals (Wright et al., 1998; Aguirre et al., 2002). PIT tags have the advantage of being encased in glass, which makes them inert, and are positioned inside the turtle where loss or damage due to abrasion, breakage, corrosion or age over time is virtually non-existent (Balazs, 1999). When PIT tags are inserted into animals that have large body sizes relative to the size of the tag, empirical studies have generally demonstrated that the tags have no adverse effect on the growth, survival, reproductive success, or behavior of individual animals (Skalski et al., 1998, Hockersmith et al., 2003).

The proposed tagging methods have been regularly employed in sea turtle research in the past with little lasting impact on the individuals tagged (Balazs, 1999). NMFS expects that sea turtles fitted with flipper and PIT tags will undergo minor discomfort and short term wounding resulting from insertion of the tag that would be expected to heal quickly after the sea turtle is released.

*Responses to Acoustic and Satellite Tagging*
Researchers expect to continue to attach satellite and acoustic tags to sea turtles although they are proposing to attach tags to Kemp's ridley and loggerhead sea turtles in addition to green sea turtles (authorized previously) and will utilize a neoprene satellite tag attachment method consistent with procedures developed by Seney et al. (2010). This

method differs slightly from what is currently authorized in that a piece of neoprene is attached to the carapace and the satellite transmitter affixed on top. The neoprene stretches as the turtle grows, allowing for a longer period of tag retention.

The attachment of transmitters as well as the subsequent biofouling of the tags themselves over time can increase hydrodynamic drag and affect lift and pitch in sea turtles undergoing this procedure. For example, Watson and Granger (1998) performed wind tunnel tests on a full-scale juvenile green turtle and found that at small flow angles representative of straight-line swimming, a transmitter mounted on the carapace increased drag by 27-30 percent, reduced lift by less than 10 percent, and increased pitch moment by 11-42 percent. These responses could impact movement and affect the sea turtle's ability to feed and avoid predators, both of which could have negative consequences for survival. To reduce the impact on the swimming ability of sea turtles, permit conditions require transmitters to not exceed five percent of the sea turtle's total body weight and be as hydrodynamic as possible. Based on the results of past tracking of hardshell sea turtles equipped with this tag set-up, NMFS is unaware of the transmitters resulting in any serious injury to this species. Subsequent monitoring reports submitted by the researchers as well as those operating under separate permits will help inform any additional short or long term responses from utilizing the Neoprene satellite tag attachment method developed by Seney et al. (2010) although given the information available, we expect that sea turtles attached with these types of tags would undergo short term stress similar to handling activities with a minimal effect on a sea turtle's swimming ability over the life of the tag (expected to be about a year).

Sonic tags emit an acoustic signal that can be received underwater with a hydrophone. Triangulation of the acoustic signal allows researchers to determine turtle locations. Sea turtles have low-frequency hearing sensitivity and are potentially affected by sound energy in the band below 1,000 Hz (Lenhardt, 2003). Bartol et al. (1999) found the effective bandpass of the loggerhead sea turtle to be between at least 250 and 1,000 Hz. Ridgeway et al. (1969) found the maximum sensitivity of green sea turtle hearing to fall within 300- 500 Hz with a sharp decline at 750 Hz. Since the sonic tags authorized for sea turtle tracking research would be well above this hearing threshold, these tags would not be heard by the turtles. NMFS would not expect the transmitters to interfere with turtles' normal activities after they are released.

Another important consideration is whether the sounds emitted by the sonic transmitters would attract potential predators, primarily sharks. Unfortunately, hearing data on sharks is limited. Casper and Mann (2004) examined the hearing abilities of the nurse shark, and results showed that this species detects low-frequency sounds from 100 to 1,000 Hz, with best sensitivity from 100 to 400 Hz. Although we do not have hearing information for all the sharks that could potentially prey on sea turtles, estimates for hearing sensitivity in available studies provided ranges of 25 to 1,000 Hz. In general, these studies found that shark hearing is not as sensitive as in other tested fishes, and that sharks are most sensitive to low-frequency sounds (Nelson, 1967; Casper et al., 2003). Thus, it appears that the sonic transmitters would not attract potential shark predators to the turtles, because the frequency of the sonic tags is well above the 1,000-Hz threshold.

Risk Analysis

Our risk analyses reflect relationships between listed species, the populations that comprise that species, and the individuals that comprise those populations. Our risk analyses begin by identifying the probable risks actions pose to listed individuals that are likely to be exposed to an action's effects. Our analyses then integrate those individual risks to identify consequences to the populations those individuals represent. Our analyses conclude by determining the consequences of those population-level risks to the species those populations comprise.

*Sea Turtles*

As described in the *Response Analysis* section above, the majority of exposures to the proposed research activities are expected to result in short term stress manifested as temporary increases in lactate levels from capture, handling, size measurements, carapace marking, and tagging (flipper, PIT, and satellite/acoustic tagging). Some discomfort and wounding would occur from tissue and blood sampling, and minimal effects to sea turtles' swimming ability from the drag created by the satellite/acoustic transmitters would occur for sea turtles fitted with those types of tags. No mortality or serious injury is expected to occur that would cause an absolute reduction in abundance or affect reproduction or nesting behavior.

Researchers are expected to monitor entanglement nets both from the surface and underwater to reduce the duration of exposure and minimize potential injuries associated with entanglement. Any recaptured sea turtles will be easily identified from tags and will be released immediately so as to minimize any additional stress to the turtle. While we expect that juveniles may be more susceptible to lethal acidosis from repeat exposures over a short time period (Lutcavage and Lutz, 1997), we do not find it likely that the increased research effort proposed by the researchers would result in juveniles of any species reaching levels sufficient as to cause lethal acidosis. The short term stress associated with capture and handling is not expected to result in any long term fitness consequencies to individuals as sea turtles are expected to return to normal lactate levels soon after release (Hoopes et al., 2000). Researchers have performed similar activities in the past and a review of their monitoring records did not indicate any deaths or serious injuries associated with these types of actions and these results are consistent with records on other similar actions that have been permitted in and around the action area in recent years.

Sea turtles obtained through direct capture methods will be released in the same general area as when they were captured in order to minimize interruptions to essential behaviors such as feeding that may have been occurring at the time of capture. While turtles obtained through relocation trawlers will be released in certain designated zones, we expect that sea turtles would resume normal behaviors soon after release and would not cause long term avoidance or abandonment of important foraging or nesting habitat in the action area. While some impacts to the swimming ability of sea turtles fitted with acoustic and satellite tags may occur due to the increased drag, researchers will only be fitting these types of tags on turtles over 40 cm SCL and the relative mass of the tagging apparatus will not exceed five percent of the turtles biomass. These methods are consistent with normal protocols as authorized by NMFS permits in the past. During a study of sonic tracked turtles by Seminoff et al. (2002), green turtles returned to areas of initial capture, suggesting that the transmitters and the tagging experience left no lasting effect on habitat use patterns. Based on the best available information, we expect that satellite and sonic tag attachment including the proposed neoprene attachment method proposed by the researchers are not expected to cause any long term fitness consequences for individuals. Subsequent monitoring reports submitted by the researchers should further inform this analysis.

Based on the best scientific information available, we expect that the research permit modifications as proposed are not likely to cause a reduction in an individual's growth, survival, annual reproductive success, or lifetime reproductive success (i.e. fitness). As a result, we do not expect activities authorized by the proposed permit to have an appreciable effect on the extinction risk of the population(s) these individuals represent or the species those populations comprise.

*Gulf Sturgeon*
Any incidentally caught Gulf sturgeon are expected to respond by way of short term stress associated with capture, measuring, and weighing activities that would occur incidental to the research activities as proposed under this permit modification. The short duration of the handling activities (expected to be about five minutes total for each individual) should prevent any significant increase in stress levels and would not be expected to interrupt spawning migrations or cause sturgeon to abandon important habitat areas. Mitigation measures such as utilizing specific sturgeon handling protocols and minimizing the time sturgeon spend out of the water should help minimize these stress responses and avoid any long term fitness consequences. Based on these measures, NMFS expects that individuals handled for size measurements are expected to experience no more than short-term stress as a result of these activities that should subside shortly after the sturgeon is released.

Based on the best scientific information available, we expect that the research permit modifications as proposed are not likely to cause a reduction in Gulf sturgeon's growth, survival, annual reproductive success, or lifetime reproductive success (i.e. fitness). As a result, we do not expect activities authorized by the proposed permits to have an appreciable effect on the extinction risk of the population(s) these individuals represent or the species those populations comprise (see ITS attached to this Opinion for more information).

## CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions, including research authorized under ESA Section 10(a)1(A), 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. Future cumulative effects from these and other types of federal actions will be investigated in future consultations, most notably in the *Status of the Species* and *Environmental Baseline* sections of Opinions which inform the effects analyses for specific federal actions. Other possible effects that may be acting in conjunction with federal actions and could possibly contribute to a cumulative impact on listed species are described below.

NMFS expects the natural phenomena in the action area (e.g., oceanographic features, storms, natural mortality) will continue to influence listed species as described in the *Environmental Baseline* section of this Opinion. Climatic variability has the potential to affect listed species in the action area in the future; however, the prediction of any specific effects leading to a decision on the future survival and recovery is currently speculative. Nevertheless, possible effects of climatic variability for listed sea turtles and marine fish include the alteration of community composition and structure, changes to migration patterns or community structure, changes to species abundance, increased susceptibility to disease and contaminants, alterations to prey composition, and altered timing of breeding. Atmospheric warming creates habitat alteration which may change sex ratios and affect reproductive periodicity for nesting sea turtles. Also, climate variability may increase hurricane activity leading to an increase in debris in nearshore and offshore waters, thereby resulting in increased entanglement, ingestion, or drowning as well as increased physical destruction of sea turtle nests or degradation of rivers and estuarine areas utilized by Gulf sturgeon.

We also expect anthropogenic effects described in the *Environmental Baseline* will continue, including habitat degradation, vessel traffic and risk of ship strikes, and interactions with fishing gear. Expected increases in vessel traffic would further increase collision risks for sea turtles by the increased traffic itself and/or through habituation of animals to the sounds of oncoming traffic making them more prone to being struck. The number of vessels and tonnage of goods shipped by the U.S. fleet are increasing (e.g. there has been nearly a 30 percent increase in volume between 1980 and 2000) (NRC, 2003) and will lead to more vessel traffic throughout the action area in the future.

For sea turtle species in the Atlantic, international activities, particularly fisheries, are significant factors impacting populations. NMFS estimates that, each year, thousands of sea turtles of all species are incidentally caught and a proportion of them killed incidentally or intentionally by international activities. The impact of international fisheries is a significant factor in the baseline inhibiting sea turtle recovery. Due to insufficient information on future management regimes associated with commercial and recreational fisheries, we cannot estimate the probability of future injuries or deaths of listed sea turtles due to interactions with these fisheries. However, given interactions with fisheries in the action area during the recent past, such interactions remains a major threat to the survival and recovery of sea turtles globally.

As the size of human communities increase, there is an accompanying increase in habitat alterations resulting from an increase in housing, roads, commercial facilities, and other infrastructure that result in increased discharge of sediments and pollution into the marine environment. These activities are expected to continue to degrade the habitat of listed species as well as that of the prey on which they depend. Pollutants may also affect prey populations which could impact food and habitat availability for marine fish and listed sea turtle species.

Additionally, unrelated factors may be acting together to affect listed species. For example, vessel effects combined with the stresses of reduced prey availability or increased contaminant loads may reduce foraging success and lead to chronic energy imbalances and poorer reproductive success which all may work to lower an animal's ability to suppress disease (Williams et al., 2002). The net effect of these disturbances is dependent on the size and percentage of the population affected, the ecological importance of the disturbed area to the animals, the parameters that influence an animal's sensitivity to disturbance or the accommodation time in response to prolonged disturbance (Geraci and St. Aubin, 1980). More studies need to be done to identify the long term effects to marine fish and sea turtles from current stressors as well as the potential additive effect that multiple stressors acting in conjunction over time will have on the survival and recovery of these species.

After reviewing the available information, NMFS is not aware of any additional future non-federal activities or potential stressors reasonably certain to occur in the action area that could contribute to a cumulative impact to ESA listed or ESA proposed species affected by the proposed action.

## INTEGRATION AND SYNTHESIS OF EFFECTS

The following text integrates and synthesizes the *Description of the Proposed Action*, *Approach to the Assessment*, *Action Area*, *Status of the Species*, *Environmental Baseline*, *Effects of the Proposed Action*, and *Cumulative Effects* sections of this Opinion.

The Permits Division proposes to issue permit modification No. 10022-02 to Dr. Raymond Carthy of the Florida Cooperative Fish and Wildlife Unit, University of Florida, for scientific research activities resulting in direct "takes" of listed loggerhead (*Caretta caretta*) (Northwest Atlantic Ocean DPS), green (*Chelonia mydas*) (Florida Breeding Population), Kemp's ridley (*Lepidochelys kempii*), and hawksbill (*Eretmochelys imbricata*) sea turtles as well as takes of Gulf sturgeon (*Acipenser oxyrinchus desotoi*) incidental to the research to occur off the northwest coast of Florida. Takes of sea turtles are expected to be in the form of capture, wounding, and harassment as a result of directed research activities while Gulf sturgeon would be incidentally captured and harassed as well. The proposed permit modification would be in effect for the remainder of the original permit duration which is set to expire April 30, 2013. The action area for this consultation includes St. Andrews, St. Joseph, and Apalachicola bays along the Florida Panhandle as well as nearshore Gulf of Mexico waters surrounding St. Andrews Bay, Florida.

Under the proposed permit modification, researchers will capture sea turtles by four different methods (i.e., strike nets, entanglement nets, dipnets, and hand capture). Annual captures by strike and/or entanglement nets will increase by the following amounts: loggerhead sea turtle captures will increase from 8 to 20, green sea turtle captures will increase from 120 to 250, and Kemp's ridley sea turtle captures will increase from 22 to 50. These numbers reflect annual captures to occur in all three bays (i.e., St. Andrews, St. Joseph, and Apalachicola bays) combined. Twenty of the 250 green sea turtles will be captured using two new capture methods (i.e., hand and/or dipnets) and will be carapace-marked as part of a separate foraging study to be conducted St. Joseph Bay only. Captures will occur year round. Some sea turtles will also obtained opportunistically from relocation trawlers operating in St. Andrews bay and nearshore Gulf of Mexico waters. All captured turtles would be measured, weighed, photographed, Flipper tagged, PIT tagged, and tissue sampled. A portion of these sea turtles will also be fitted with satellite and/or acoustic tags (i.e., 12 green, 10 loggerhead, and 10 Kemp's ridleys). All sea turtles caught in St. Josephs bay will be blood sampled and all sea turtles fitted with satellite tags will be blood sampled in St. Andrews and Apalachicola bays, respectively. Researchers are proposing to utilize a neoprene attachment method for satellite tags which involves affixing a neoprene layer between epoxy layers to allow for increased tag retention.

Mitigation measures to be included as permit conditions include taking precautions to minimize stress to captured animals, appropriately checking entanglement nets to monitor for entangled animals, limiting the amount of blood that can be drawn, avoiding repeated sampling of an individual, using trained and experienced personnel to minimize disturbance, using sterile or appropriately sanitized equipment, and remaining a safe distance from non-target protected species, among others.

As explained in the *Approach to the Assessment* section, risks to listed individuals are measured using changes to an individual's "fitness." When listed plants or animals exposed to an action's effects are not expected 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 (e.g., Brandon, 1978; Mills and Beatty, 1979; Stearns, 1992; Anderson, 2000). When individuals of listed plants or animals are expected to experience reductions in fitness in response to an action, those fitness reductions can reduce the abundance, reproduction, or growth rates of the populations that those individuals represent (see Stearns, 1992). If we determine that reductions in individual plants' or animals' fitness reduce a population's viability, we consider all available information to determine whether these reductions are likely to appreciably reduce the viability of the species as a whole. To conduct these analyses, we rely on all of the evidence available to us. When data are equivocal, or in the face of substantial uncertainty, our decisions are designed to avoid the risks associated with incorrectly concluding an action has no adverse effect on a listed species when, in fact, such adverse effects are likely.

Sea turtles have also been impacted historically most notably through direct harvest as well as domestic and international fishery operations that often capture, injure, and even kill sea turtles at various life stages. The Southeast U.S. Shrimp Fishery (which uses otter trawl gear) has historically been one of the largest fishery threats to sea turtles in the southeastern U.S. (Murray, 2006) and continues to interact with (and kill) large numbers of turtles each year. There are also many non-fishery impacts affecting the status of sea turtle species, including entrainment in Hopper dredges, water pollution from coastal areas and oil spills, degradation of nesting beaches, and harassment and/or injury resulting from private and commercial vessel operations, military detonations and training exercises, and scientific research activities. Atmospheric warming creates habitat alteration which may change sex ratios and affect reproductive periodicity for nesting sea turtles in the years to come. While many of the species targeted by this proposed action have been showing some signs of recovery based on recent nest counts in the southeastern U.S. and Caribbean regions, the population estimates are still drastically reduced compared to historical estimates and many other nesting populations occurring outside of the U.S. are still in a great state of decline putting these often highly migratory species at an increased risk of extinction. For Gulf sturgeon, trends associated with catch per unit effort and mark-recapture studies conducted over the past three decades show that most populations appear to be relatively stable with the Suwannee River supporting the most viable population among coastal rivers of the Gulf of Mexico; however, anthropogenic stressors such as damming rivers, loss of coastal wetlands, and life history characteristics render the species slow to recover in abundance within its current range.

Taken together, the components of the environmental baseline for the action area include sources of natural mortality – such as predation, disease, storm events, and climate variability – as well as human activities resulting in disturbance, injury, or mortality of individuals. Anthropogenic activities such as discharges from wastewater systems, dredging, aquaculture, and additional impacts from coastal development are known to degrade coastal waters utilized by sea turtles and Gulf sturgeon in the action area. Stedman and Dahl (2008) estimated that the Gulf of Mexico region of the U.S. lost an average of 60,000 acres of wetland habitat annually from 1998 to 2004. These losses have been attributed to commercial and residential development, port construction (dredging, blasting, and filling activities), construction of water control structures, modification to freshwater inflows, and oil and gas related activities (SAFMC, 1998). Riverine systems throughout the Gulf sturgeon's historical ranges have been altered or dammed thus limiting the species' abilities to expand its current range. Also, loss or degradation of nesting habitat resulting from erosion control through beach nourishment and armoring, beachfront development, artificial lighting, and non-native vegetation is a serious threat affecting nesting sea turtle adults in and around the action area.

At the time of this consultation, NMFS has reported that 481 Kemp's ridley, 67 loggerheads, 29 green, and 32 unspecified sea turtles have been found dead in the vicinity of the *Deep Horizon* oil spill although the cause of death is not immediately certain for all caracasses recovered (NMFS, 2011). Kemp's Ridley sea turtles appear to be the most affected due to their high death totals since the blowout occurred, their low population numbers to begin with, and their limited range compared with other sea turtle species. Since March 15, 2011, a notable increase in sea turtle standings has occurred in the Northern Gulf of Mexico although the cause of this increase is unknown. The Sea Turtle Stranding and Salvage Network is currently investigating the cause of this increase in strandings although two primary considerations for the cause of death are forced submergence (fishing related) and acute toxicosis (from algal blooms or related to the oil spill) based on necropsies that have been performed thus far (NMFS, 2011).

For the exposure analysis conducted for this Opinion, the ESA Interagency Cooperation Division reviewed prior monitoring reports and biological opinions conducted for similar actions. We also considered the increased effort proposed which was one of the main justifications for the increase in take numbers from the original permit. As a result of this review, we determined that the level of exposure was consistent with the requested take numbers included in the initiation package for both sea turtles and Gulf sturgeon. We organized exposure events sequentially by grouping the research activities into three main groups according to expected timing of their occurrence. For instance, sea turtles are first exposed to different forms of capture (i.e., strike-net, entanglement net, dipnet, hand capture, or opportunistic transport from relocation trawlers). After capture, sea turtles are brought on board where they are exposed to multiple sampling activities (e.g., measuring, weighing, flipper/PIT tagging, and blood/tissue sampling). Finally, a limited number of those sea turtle are then exposed to a third group of activities (i.e., satellite/acoustic tagging or carapace marking) before being released. We assessed the responses expected to occur at each stage and evaluated the risks those responses posed to the species affected by the proposed action.

Stressors associated with the permit modification include possible injury and/or mortality from ship strikes; stress and/or injury from direct (netting and by hand) and indirect (relocation trawler) capture methods; and stress and/or injury associated with handling, measuring, weighing, PIT tagging, flipper tagging, blood sampling, tissue sampling, carapace marking, and acoustic and satellite tag attachments (using the neoprene satellite tag attachment method). Capture by relocation trawlers is covered under a separate authority and thus the effects were already analyzed in a separate biological opinion.

The avoidance response to an oncoming vessel can interrupt essential behaviors such as foraging, resting, mating, etc. and increased stress from the presence of vessels can also increase an animal's susceptibility to disease and predation (Frid and Dill, 2002; Romero, 2004; Walker et al., 2006). Hand capture and capture by strike-nets, entanglement nets, and dipnets can result in short term stress, injury, or even death to sea turtles depending on the type of capture and duration of exposure (Hays et al., 2003b; Watson et al., 2005; Gilman et al., 2007). We expect that based on the methods proposed and the mitigation measures included in the proposed permit, responses of sea turtles to entanglement and other capture methods will be limited to short term stress responses manifested as a change in lactate concentrations in the blood that should subside a short time after being released consistent with responses recorded by Hoopes et al. (2000). Juvenile turtles are expected to be more susceptible to blood lacatate levels reaching sufficient levels to cause lethal acidosis; however, any recaptured turtles would be released as soon as possible in order to avoid repeated exposure to additional stress. The sample site for both blood and tissue sampling will be properly cleaned and disinfected to prevent infection. Based on these measures, we expect responses to skin and blood sampling to be minimal discomfort and minor wounding that should heal relatively quickly after release. Also, no additional stress beyond those described for capture and handling is expected to result from carapace marking.

The proposed tagging methods have been regularly employed in sea turtle research in the past with little lasting impact on the individuals tagged (Balazs, 1999). NMFS expects that sea turtles fitted with flipper and PIT tags will undergo minor discomfort and short term wounding resulting from insertion of the tag that would be expected to heal quickly after the sea turtle is released with no long term fitness consequences expected. The attachment of transmitters for acoustic and satellite tags as well as the subsequent biofouling of the tags themselves over time can increase hydrodynamic drag and affect lift and pitch in sea turtles undergoing this procedure (Watson and Granger, 1998) although permit conditions require transmitters to not exceed five percent of the sea turtle's total body weight and be as hydrodynamic as possible to minimize effects to a sea turtles' swimming ability. We expect that sea turtles attached with these types of tags would undergo short term stress similar to handling activities with minimal effects to their overall swimming ability over the life of the tag (expected to be about a year). Also, sonic signals emitted by the acoustic transmitters would not be expected to be heard by sea turtles or their predators, thereby avoiding acoustic impacts to these species from sonic tracking.

Gulf sturgeon are also likely to experience physiological stress responses as a result of being incidentally captured in entanglement nets. Entanglement has been shown to result in injury and mortality, reduced fecundity, and delayed or aborted spawning migrations of sturgeon species based on prior studies (Moser and Ross, 1995; Collins et al., 2000; Moser et al., 2000; Kahn and Mohead, 2010). Based on the researchers' prior experience and monitoring reports submitted under their previous permit, we do not expect any Gulf sturgeon to be seriously injured during capture and any individuals incidentally caught in entanglement nets are expected to undergo only short term stress that should quickly subside after release. On board handling, measuring, and weighing of Gulf sturgeon before release could result in some minor additional stress to Gulf sturgeon, but the very short duration of the handling activities (expected to be about five minutes total for each individual) should prevent any significant increase in stress levels than what the sturgeon already experienced during entanglement net capture. Sturgeon are also known to inflate their swim bladder when held out of water (Moser et al. 2000); however, researchers will make every effort to return any incidentally caught sturgeon to neutral buoyancy prior to release to minimize this response.

The short term stress associated with capture and handling is not expected to result in any long term fitness consequences for sea turtles or Gulf sturgeon as a result of the proposed action. Researchers have performed similar activities in the past and a review of their monitoring records did not indicate any deaths or serious injuries associated with these types of actions and these results are consistent with records on other similar actions that have been permitted in and around the action area in recent years. Sea turtles and Gulf sturgeon obtained through direct capture methods will be released in the same general area as when they were captured in order to minimize interruptions to essential behaviors such as feeding that may have been occurring at the time of capture. During a study of sonic tracked turtles by Seminoff et al. (2002), green turtles returned to areas of initial capture, suggesting that the transmitters and the tagging experience left no lasting effect on habitat use patterns. Based on the best scientific information available, we expect that the research permit modifications as proposed are not likely to cause a reduction in listed sea turtles' or Gulf sturgeon's growth, survival, annual reproductive success, or lifetime reproductive success (i.e. fitness). As a result, we do not expect activities authorized by the proposed permits to have an appreciable effect on the extinction risk of the population(s) these individuals represent or the species those populations comprise.

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion. NMFS expects the natural phenomena in the action area (e.g., oceanographic features, storms, natural mortality) will continue to influence listed species as described in the *Environmental Baseline* section of this Opinion. Climatic variability has the potential to affect listed species in the action area in the future; however, the prediction of any specific effects leading to a decision on the future survival and recovery is currently speculative. Nevertheless, possible effects of climatic variability for listed sea turtles and marine fish include the alteration of community composition and structure, changes to migration patterns or community structure, changes to species abundance, increased susceptibility to disease and contaminants, alterations to prey composition, and altered timing of breeding. Atmospheric warming creates habitat alteration which may change sex ratios and affect reproductive periodicity for nesting sea turtles. Also, climate variability may increase hurricane activity leading to an increase in debris in nearshore and offshore waters, thereby resulting in increased entanglement, ingestion, or drowning as well as increased physical destruction of sea turtle nests or degradation of rivers and estuarine areas utilized by Gulf sturgeon.

We also expect anthropogenic effects described in the *Environmental Baseline* will continue, including habitat degradation, vessel traffic and risk of ship strikes, and interactions with fishing gear. The net effect of these disturbances is dependent on the size and percentage of the population affected, the ecological importance of the disturbed area to the animals, the parameters that influence an animal's sensitivity to disturbance, or the accommodation time in response to the prolonged disturbance (Geraci and St. Aubin, 1980). More studies need to be done to identify the long term effects to listed sea turtles and Gulf sturgeon from current stressors as well as the potential additive effect that multiple stressors acting in conjunction over time have on the survival and recovery of these species.

## CONCLUSION

After reviewing the current status of listed species affected by the proposed action, the environmental baseline for the action area, the anticipated effects of the proposed research activities and the possible cumulative effects, it is the ESA Interagency Cooperation Division's opinion that the Permits Division's proposed action of issuing permit modification No. 10022-02 to Dr. Raymond Carthy, as proposed, is not likely to jeopardize the continued existence of loggerhead sea turtles (Northwest Atlantic Ocean DPS), green sea turtles (both the Florida breeding population and rangewide listing), Kemp's ridley sea turtles, hawksbill sea turtles, or Gulf sturgeon. In addition, the proposed permit modificiation is not likely to adversely affect any designated critical habitat under NMFS' authority.

## INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit the "take" of endangered and threatened species, respectively, without 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 NMFS to include significant habitat modification or degradation that results in death or injury to 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. Under the terms of sections 7(b)(4) and 7(o)(2), taking that is incidental and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

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

<u>Amount or Extent of Take Anticipated</u>
The section 7 regulations require NMFS to specify the impact of any incidental take of endangered or threatened species; that is, the amount or extent of that take (50 CFR 402.14(i)(1)(i)). The amount of take represents the number of individuals that are expected to be taken by proposed actions while the extent of take represents "the extent of land or marine area that may be affected by an action" if we cannot assign numerical limits for animals that could be incidentally taken during the course of an action (Federal Register 51, June 3, 1986, page 19953).

The ITS included in the previous biological opinion (permit No. 10022-01) exempted the non-lethal incidental take of 10 Gulf sturgeon annually after discussions with sturgeon researchers in the NMFS' Southeast Region in Florida regarding likely interactions with Dr. Carthy's gear given his expected research effort, and considering the area and habitat in which the research would occur. In the attached biological opinion, we determined that the exposure levels would remain the same for this permit modification as we could not find additional information that would change or further refine these incidental take estimates for the permit modification as proposed (see Exposure Analysis in the attached Biological Opinion for more information). As a result, we are exempting the **non-lethal incidental take of 10 Gulf sturgeon annually** for this action consistent with the original

ITS. All take is expected to be in the form of harassment resulting from capture in entanglement nets, measuring, weighing, and handling to check for existing PIT tags.

Effect of the Incidental Take

In the accompanying biological opinion, NMFS evaluated the species' expected responses as well as the risks those responses posed to individuals, populations, and the species as a whole. Gulf sturgeon are expected to undergo short term stress responses as a result of capture and handling. Based on the researchers' prior experience and monitoring reports submitted under their previous permit, we do not expect any Gulf sturgeon to be seriously injured during capture and any individuals incidentally caught in entanglement nets are expected to undergo only short term stress that should quickly subside after release. The short duration of the handling activities (expected to be about five minutes total for each individual) should prevent any significant increase in stress levels and would not be expected to interrupt spawning migrations or cause sturgeon to abandon important habitat areas. We expect that the research permit modifications as proposed are not likely to cause a reduction in Gulf sturgeon's growth, survival, annual reproductive success, or lifetime reproductive success (i.e. fitness). As a result, we do not expect activities authorized by the proposed permits to have an appreciable effect on the extinction risk of the population(s) these individuals represent or the species those populations comprise.

The following reasonable and prudent measures have been identified as ways to minimize the effects to Gulf sturgeon as a result of the proposed research activities. These measures are non-discretionary and must be implemented by NMFS.

Reasonable and Prudent Measures

In addition to the proposed and existing bycatch reduction measures contained in the proposed action, NMFS has determined that the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of Gulf sturgeon:

1. NMFS shall include guidelines to ensure that Gulf sturgeon are safely handled and released during research activities;

2. NMFS shall incorporate procedures to monitor and report takes of Gulf sturgeon during research activities as well as to monitor the effects of such take;

3. NMFS shall incorporate procedures to report when take has been exceeded;

4. NMFS shall assess the actual level of incidental take in comparison with the anticipated incidental take specified in this opinion;

5. NMFS shall assess the effectiveness of reasonable and prudent measures and their implementing terms and conditions.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, NMFS must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. NMFS shall condition the permit holder to observe his nets for Gulf sturgeon, and disentangle and return to the water, to the maximum extent practicable and with vigilante consideration of safety, any live Gulf sturgeon that is found in his nets during research. These conditions shall outline approved net checking and handling protocols;

2. NMFS shall require the permit holder to report any Gulf sturgeon interactions to NMFS' Assistant Regional Administrator for Protected Resources, Southeast Regional Office, within 14 days of the incident. This report must contain: the description of the take (including length and weight if possible), the PIT tag number, latitude and longitude of capture, water depth the animal was taken in, substrate type animal was in when captured, any other environmental conditions that are already being recorded (e.g., water salinity, temperature), and final disposition of the sturgeon (i.e., released in good health, etc.);

3. These reports must be forwarded on an annual basis to the Permits and Conservation Division of the Office of Protected Resources, National Marine Fisheries Service 1315 East-West Highway, Silver Spring, Maryland, 20910.

## 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 endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans or to develop information.

We recommend the following conservation recommendation, which would potentially minimize effects to sea turtles as a result of the activities proposed to be authorized:

1. *Applying Satellite/Acoustic Transmitters to Severely Injured or Compromised Sea Turtles*. The Permits Division should encourage researchers to avoid attaching satellite or acoustic transmitters to injured or compromised sea turtles unless the purpose of the research is to determine post-trauma survival. Further stress associated with these types of tagging methods as well as the minimal drag anticipated may further compromise the turtle if it is already in poor health.

## REINITIATION NOTICE

This concludes formal consultation on the proposal to issue scientific research permit modification No. 10022-02 for research on ESA listed sea turtles off the northwest coast of Florida in St. Andrews, St. Joseph, and Apalachicola bays. As provided in 50 CFR §402.16, 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 proposed take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or 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 listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of authorized take is exceeded, the Permits Division must immediately request reinitiation of section 7 consultation.

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