UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

NOAA National Marine Fisheries Service
Endangered Species Act Section 7 Consultation

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

Proposed Action: Issuance of Scientific Research Permit No. 10022-01 Under the Provisions of Section 10(a) of the ESA

Consultation Conducted by: NOAA's National Marine Fisheries Service (NMFS), Office of Protected Resources, Endangered Species Division

Approved by: _____

Date: APR 21 2010

This document constitutes the NMFS' biological opinion based on our review of the proposed issuance of scientific research Permit No. 10022-01 to Raymond Carthy, Florida Cooperative Fish and Wildlife Research Unit, U.S. Geological Survey and Department of Wildlife Ecology and Conservation, University of Florida, P.O. Box 110485, Gainesville, Florida 23611-0450.

The opinion covers research activities that would occur in the Gulf of Mexico waters of the southeastern United States of America and their effect on green (*Chelonia mydas*), loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempii*), and hawksbill (*Eretmochelys imbricata*) sea turtles, and Gulf sturgeon (*Acipenser oxyrinchus desotoi*) in accordance with section 7(a)(2) of the ESA of 1973, as amended (16 U.S.C. 1536). Permit No. 10022-01 would authorize researchers to determine the significance of Florida's northwest coastal bays to juvenile sea turtle development. The research would gather information regarding species assemblage, population abundance, size classes, growth, seasonal movements, natal origin, and overwintering behaviors. Data collected during this project would help to address the theory of developmental migration in turtles using the Gulf of Mexico. The permit would also allow study of current recommendations for relocation distances of turtles captured in relocation trawler pre-sweeping during nourishment dredging projects to explore if they are appropriate.

This biological opinion is based on information provided in the application for the proposed permit, published and unpublished scientific information on the biology and ecology of sea turtles, Gulf sturgeon, and other sources of information.

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Consultation History
On November 14, 2007, NMFS' Office of Protected Resources (NMFS PR) received a complete scientific research permit application from Dr. Carthy. As required by CFR 222.24 (a), NMFS published a notice of receipt in the Federal Register on November 26, 2007 15, 2005 (72 FR 65940). The public comment period closed on December 26, 2007. Formal consultation was initiated on January 2, 2008. After reviewing the status of the loggerhead, green, and Kemp's ridley sea turtles, and the Gulf sturgeon, the environmental baseline for the action area, the effects of the take authorized in the permit, and probable cumulative effects, it was NMFS' biological opinion that issuance of the permit would not reduce the likelihood of the survival and recovery of their populations in the wild by reducing their numbers, distribution, or reproduction, and therefore was not likely to jeopardize the continued existence of these species and was not likely to destroy or adversely modify designated critical habitat.

On September 23, 2009, NMFS' Office of Protected Resources (NMFS PR) received a complete scientific research permit modification application from Dr. Carthy. As required by CFR 222.24 (a), NMFS published a notice of receipt in the Federal Register on September 30, 2009 (74 FR 50172). The public comment period closed on October 30, 2009. Formal consultation was initiated on November 2, 2009.

Biological Opinion

Description of the Action Area and Proposed Action
NMFS proposes to issue a modification to scientific research Permit No. 10022 held by Dr. Raymond Carthy under the Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 *et seq*.), and the regulations governing the taking, importing, and exporting of endangered and threatened species (50 CFR Parts 222-226).

The objectives of the permitted activity would be to gather information regarding sea turtle species assemblage, population abundance, size classes, growth, seasonal movements, natal origin, and overwintering behaviors. Data collected during this project would help to address the theory of developmental migration in turtles using the Gulf of Mexico. The permit would also allow study of current recommendations for relocation distances of turtles captured in relocation trawler pre-sweeping during nourishment dredging projects to explore if they remain appropriate.

Action area
Researchers would target sea turtles utilizing the waters of St. Joseph Bay, Apalachicola Bay, and St. Andrews Bay along the Florida Panhandle in the northern Gulf of Mexico.

Number and Kind(s) of Protected Species, and Manner of Taking
Tables 1, 2, and 3 outline the number of protected species, by species, that would be taken, and the locations, manner, and time period in which they may be taken.

Table 1. Activities authorized under Permit No. 10022, Annually.						
Species	Life Stage	Sex	Number of Takes	Take Action	Location	Dates/Time Period
Loggerhead sea turtle (*Caretta caretta*)	juvenile, subadult or adult	M,F	8	Capture by strike net or entanglement net, weigh, measure, photograph, skin biopsy, flipper tag, PIT tag, release	St. Joseph, St. Andrews, Apalachicola Bays, Florida	year-round
Green sea turtle (*Chelonia mydas*)	juvenile, subadult or adult	M,F	108	Capture by strike net or entanglement net, weigh, measure, photograph, skin biopsy, flipper tag, PIT tag, release	St. Joseph, St. Andrews, Apalachicola Bays, Florida	year-round
Green sea turtle (*Chelonia mydas*)	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	St. Joseph, St. Andrews, Apalachicola Bays, Florida	year-round
Kemp's ridley sea turtle (*Lepidochelys kempii*)	juvenile, subadult or adult	M,F	22	Capture by strike net or entanglement net, weigh, measure, photograph, skin biopsy, flipper tag, PIT tag, release	St. Joseph, St. Andrews, Apalachicola Bays, Florida	year-round

* = Only 12 total transmitters may be attached over course of permit, not annually.

Table 2. Incidental Takes Authorized by the Incidental Take Statement of the Section 7 Biological Opinion for Permit No. 10022, Annually*						
Species	Life Stage	Sex	Number of Takes	Take Action	Location	Dates/Time Period
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)	juvenile, subadult or adult	M,F	10	Incidentally take by strike net or entanglement net, weigh, measure, scan for PIT tags, photograph, release	St. Joseph, St. Andrews, Apalachicola Bays, Florida	year-round

*These takes are not directed research, but are animals incidentally captured during sea turtle research and for which take coverage is provided through the section 7 biological opinion written for the issuance of Permit No. 10022-01.

Table 3. Activities authorized under Permit No. 10022.						
Species	Life Stage	Sex	Number of Takes	Take Action	Location	Dates/Time Period
Loggerhead sea turtle (*Caretta caretta*)	juvenile, subadult or adult	M,F	25*	Weigh, measure, photograph, tissue biopsy, flipper tag, PIT tag, satellite tag; release	St. Andrews Bay and surrounding waters of Gulf of Mexico, Florida	year-round
Green sea turtle (*Chelonia mydas*)	juvenile, subadult or adult	M,F	25*	Weigh, measure, photograph, tissue biopsy, flipper tag, PIT tag, satellite tag; release	St. Andrews Bay and surrounding waters of Gulf of Mexico, Florida	year-round
Hawksbill (*Eretmochelys imbricata*)	juvenile, subadult or adult	M,F	25*	Weigh, measure, photograph, tissue biopsy, flipper tag, PIT tag, satellite tag; release	St. Andrews Bay and surrounding waters of Gulf of Mexico, Florida	year-round
Kemp's ridley sea turtle (*Lepidochelys kempii*)	juvenile, subadult or adult	M,F	25*	Weigh, measure, photograph, tissue biopsy, flipper tag, PIT tag, satellite tag; release	St. Andrews Bay and surrounding waters of Gulf of Mexico, Florida	year-round

* = One transmitter may be attached to up to 25 animals, any species mix, over course of permit, not annually. I.e., researchers may attach 25 transmitters all on 25 animals of one species, or they may attach transmitters to each of the species, however the total is not to exceed attachment of 25 transmitters.
NO capture is authorized, animals are already legally captured by authorized relocation trawlers.

Experimental Procedures

Turtles would be taken by direct capture (strike nets, entanglement nets) and then measured and sampled as noted in Table 1. Additionally, researchers would obtain animals that have been legally captured during relocation trawling activities and conduct the activities listed in Table 3.

Capture

Research would be conducted from January through December. Within all three bays, turtles would be captured using standard strike-netting techniques or set-netting techniques. While strike netting, a 150 m x 2.4 m net (mesh = 20.3 cm x 20.3 cm, bottom lead-line, floating polypropylene top line equipped with float buoys at 10 m intervals) would be deployed from a 8 ft net-tender dinghy towed behind a 17 ft Boston whaler with a 90 hp outboard motor. Once a turtle becomes entangled, the net would be pulled aboard the boat and the turtle immediately removed. During set netting, the same net would be set in the water in a straight line, catching turtles as they run into the net and become entangled. The net would be inspected every 20 minutes and all turtles and non-target species removed.

Measuring, Weighing, Tagging, Photographing, and Sampling
All captured and recaptured turtles would be measured, weighed, and photographed. Straight carapace length (SCL; ± 0.1 cm) would be measured from the nuchal notch to the posterior-most portion of the rear marginals using a forester's caliper. Curved carapace length (CCL; ± 0.1 cm) would be measured using a flexible tape, and body weight (± 0.5 kg) using a hanging spring scale (35 kg maximum; PESOLA, Baar, Switzerland). All captured turtles would be fitted with Inconel flipper tags (Model No. 681, National Band and Tag Co., Newport, Kentucky), placed on the trailing edge of each fore flipper. All tagging equipment would be cleaned with isopropyl alcohol before each use and between turtles, and 10% povidine-iodine would be applied to the tag site before and post-tagging. Animals would be scanned for previous Passive Integrated Transponder (PIT) tags, and if none are present, new tags (Model TX1406L, Destron 125kHz, Biomark, Meridian, Idaho) for long-term identification would be inserted in the front flipper (*triceps superficialis* muscle). Tag insertion would be preceded and followed by cleansing of the site with 10% povidine-iodine, and any needed post-application hemostatic measures would be taken. Tissue samples would also be taken from captured animals for use in genetic analyses and stock determination. Following the procedures outlined in the draft NMFS/SEFSC Sea Turtle Research Techniques Manual (2008), standard 4 to 6 mm biopsy punches would be used to take 2 skin samples from the posterior edge of a rear flipper of each animal, following proper site preparation with 10% povidine-iodine and isopropyl alcohol. Samples would be stored in 70% 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% povidine-iodine until there is no visible bleeding. If necessary additional measures would be taken for hemostasis (cyanoacrylate tissue glue). Recaptured turtles would not be re-tagged unless flipper tag loss has occurred, and biopsies would not be taken on re-captured animals.

Turtles captured using netting techniques would be released at the capture site within 2 hours of capture (typically less, but not to exceed 2 hours). Sea turtles obtained from relocation trawlers would be released into designated safe release zones established by relocation trawler protocols within 4 hours from capture.

Mounting the Satellite Transmitter on the Carapace
At the initiation of satellite tagging, epibionts would be removed from the carapace at the site of transmitter attachment. Transmitters would be attached at the highest point of the carapace which is found where the first and second vertebral scutes meet. This would allow the tag's antenna to break the sea surface each time the turtle surfaces to breathe. Attachment media would also cover areas of the first and third vertebral scutes as well as the first and second costal scutes. These areas would be thoroughly scrubbed and rinsed with fresh water;then they would be dried and lightly sanded with sandpaper. When smooth, the entire area would be lightly wiped with an alcohol pad or a small amount of acetone. Transmitters would not exceed 5% 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. Based on tag configurations and battery life, researchers anticipate that tags would remain attached to turtles for approximately one year.

The entire transmitter, except the bottom, would be coated with anti-fouling paint. Tags would be attached to the carapace using a two-part epoxy. The tag and attachment materials would not exceed 5 % of the turtle's body weight. Tag attachment would follow standard techniques following Mitchell (1998) http://graysreef.noaa.gov/smitchellposter.html. The epoxy emits no odor and produces minimal heat when activated. It is commonly used among sea turtle researchers for tag attachment. Drying time would vary between 20 - 60 minutes, depending on ambient temperatures and humidity.

Mounting the Sonic Transmitter on the Carapace
Sonic transmitters would be attached to turtles at the base of the carapace, near the tail.. Sonic tagged turtles would be tracked using hand-held hydrophones from a 17-foot Boston Whaler. Relocation and tracking of the animals would take place daily following tag attachment. Small holes would be drilled through the outer edges of the marginal scutes and the instrument would then be wired and glued in place.

Holding and Transporting Turtles
Turtles held for transmitter attachment would be held in a rectangular tub that would be used to safely hold the turtle. The tub size would be approximately 2 feet wide x 3 feet long and at least one foot deep. Researchers would place a foam pad on the bottom of the tub to cushion the turtle. A cloth will be placed over the turtle's eyes to block vision, which typically calms turtle and reduces movement. Turtles would be sheltered from direct sunlight, wind, or rain during the attachment.

Turtles would not be transported unless severe weather conditions or an unforeseen emergency (i.e. physical injury to personnel, etc.) require transport. In the rare case turtles are onboard and researchers must return to shore, turtles would be held in individual plastic tubs with their heads covered with towels. When under transport, the entire carapace would be covered with a towel per Florida Fish and Wildlife Commission transport guidelines. Tubs holding turtles would be placed on the bottom of the boat and stabilized manually. Once onshore, turtles would remain inside their individual tubs, and tubs would be hand-carried to shore. As soon as conditions permit, the tub and turtle would be transported back to the release site.

Permit Precautions
The following information outlines the main mitigation measures researchers would employ to minimize the potential for any adverse impacts from the research. In addition to measures identified by applicants in their applications and otherwise considered “good practice or protocol,” all NMFS sea turtle permits contain conditions intended to minimize the potential adverse effects of the authorized activities. These conditions are based on the type of activities authorized, the species involved, and information in the literature and from the applicant about the effects of particular techniques and the responses of animals to these activities.

Turtles and Gulf sturgeon would be handled carefully and conscientiously so they are not injured during or after capture. Antiseptic methods would be standard protocol to prevent the transmittal of disease and prevent infection. Turtles found to have serious injuries would be evaluated for possible transport to a rehabilitation facility. The following specific conditions would be placed

on the authorized activities should the proposed permit be issued to ensure compliance with appropriate protocols-

a. Handling, Measuring, Weighing, PIT and Flipper Tagging

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

2. 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.

   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 also 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 shall have PIT tag readers capable of reading 125, 128, 134.2, and 400 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.

   e. PIT Tagging- New, sterile tag applicators (needles) shall be used on each animal. 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 shall be disinfected if it has been exposed to fluids from other animals.

3. General Handling and Releasing of Turtles:

   a. The Permit Holder, Principal Investigator, Co-investigator(s), 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 and provided adequate air flow 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, Principal Investigator, Co-investigator(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.

b. <u>Sampling</u>

1. 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 surgical iodine (e.g., 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, then the biopsy site and surrounding tissue must be treated to a surgical scrub. It must be cleansed with three alternating applications of 70% 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 to protect against infection.

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

2. 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.

a. Samples may be sent to: University of Florida.

c. <u>Capture/Survey Methods</u>

1. 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 minutes, 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.

2. Hand Capture: Researchers shall be aware of the increased stress that accompanies hand captures and do their best to minimize stress levels.

d. Transport and Holding

1. Turtles must be transported via a climate-controlled environment, protected from temperature extremes and kept moist. 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

2. Turtles transported to a facility and held (e.g., for rehabilitation) must be maintained and cared for 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).

3. *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 shall not exceed 1 hour (i.e., total combined time). Animals shall be returned to the water in 4 hours or less from time of initial capture.

   Researchers shall have a means for participating trawlers to contact them from the capture site. The trawlers shall 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 1 hour time restriction the turtle shall not be used by researchers and shall 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.

e. 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.

f. Non-Target Species

1. Gulf/Shortnose/Atlantic Sturgeon Handling Requirements:

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, Protected Resources, Southeast Regional Office, NMFS, at (727) 551-5768 (Fax: 727-824-5309). 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.*).

g. Instrument Tagging and Marking

1. TDRs, VHF, sonic or satellite tags:

   a. Total weight of transmitter attachments must not exceed 5% 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 shall make attachments as hydrodynamic as possible.

   b. 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.

   c. Drilling through marginal scutes. A separate drill bit shall used for each turtle. Bits may be reused if sterilized via the autoclave procedure before reuse.

Approach to the Assessment

NMFS approaches its section 7 analyses of research permits through a series of steps. The first step identifies those aspects of proposed actions that are likely to have direct and 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 results of this step define 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 – establishing the risks those responses pose to listed resources – are different for listed species and designated critical habitat (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 distinct population segments (DPSs) of vertebrate species. 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 are 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 of this Opinion) as our point of reference. If we conclude that reductions in individual fitness 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 of this Opinion) as our point of reference. Our final 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.

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 natural resource agencies in States, and other countries; reports from foreign and domestic nongovernmental organizations involved in marine conservation issues; the information provided by F/PR1 when it initiates formal consultation; information from commercial interests; and the general scientific literature.

Status of Listed Species and Critical Habitat

The following ESA listed species under the jurisdiction of NMFS may be affected under the proposed Section 10 research permit:

Common Name	Scientific Name	Status
Green sea turtle	*Chelonia mydas*	E/T[1]
Kemp's ridley sea turtle	*Lepidochelys kempii*	E
Loggerhead sea turtle	*Caretta caretta*	T
Hawksbill sea turtle	*Eretmochelys imbricata*	E
Leatherback sea turtle	*Dermochelys coriacea*	E
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	T

Species Not Likely to Be Adversely Affected

Leatherback (*Dermochelys coriacea*) sea turtles inhabit the waters off the coast of Florida. However, the researcher has previously conducted research in the proposed action and has not observed this species. Given the location of the research and the past experience of the researcher, NMFS considers the take of this other sea turtle as unlikely and discountable, and it will not be considered further in this analysis.

[1]Green sea turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered. Due to the inability to distinguish between the populations away from the nesting beaches, green turtles are considered endangered wherever they occur in U.S. Atlantic, Gulf of Mexico and Caribbean waters.

Critical Habitat
While critical habitat has been designated for three sea turtles: green (50 CFR Section 226.208), hawksbill (50 CFR Section 226.209) and leatherback (50 CFR Section 226.207), none would be affected by the proposed action. These habitats are not considered further in this biological opinion.

This scientific research could occur in Gulf sturgeon designated critical habitat (please refer to the Gulf sturgeon section).

Species Likely to Be Adversely Affected
The loggerhead, hawksbill, Kemp's ridley, and green sea turtles, and Gulf sturgeon are likely to be adversely affected by the activities conducted under the proposed action.

Background information on the range-wide status of these species can be found in a number of published documents including status reviews and recovery plans located at http://www.nmfs.noaa.gov/pr/publications/. Summary information on the biology and status of these species is provided below.

Green sea turtle (*Chelonia mydas*)

Description of the Species
Adult green sea turtles commonly reach a meter in carapace length and 150 kg in mass. The mean size of female green turtles nesting in Florida is 101.5 cm standard straight carapace length and 136.1 kg body mass. 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. Hatchling green sea turtles weigh approximately 25 g, and the carapace is about 50 mm long. The dorsal surface is black and the ventral surface is white. The plastron of Atlantic green turtles remains a yellowish white throughout life, but the carapace changes in color from solid black to a variety of shades of grey, green, brown, and black in starburst or irregular patterns.

Range and Life History
Green sea turtles are distributed around the world, mainly in waters between the northern and southern 20° C isotherms (Hirth 1971). The complete nesting range of the green sea turtle within the southeastern U.S. includes sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands between Texas and North Carolina and at the U.S. Virgin Islands (USVI) and Puerto Rico (NMFS and USFWS 1991b). Principal U.S. nesting areas for green turtles are in eastern Florida, predominantly Brevard through Broward counties. Regular green sea turtle nesting also occurs on the USVI and Puerto Rico.

Green sea turtle mating occurs in the waters off the nesting beaches. Each female deposits 1 to 7 clutches (usually 2 to 3) during the breeding season at 12 to 14 day intervals. Mean clutch size is highly variable among populations, but averages 110 to 115 eggs. After hatching, green sea turtles go through a post-hatchling pelagic stage where they are associated with drift lines of algae and other debris. Females usually have at least 2 to 4 years between breeding seasons, while males may mate every year (Balazs 1983). Age at sexual maturity is estimated to be between 20 to 50 years (Balazs 1982; Frazer and Ehrhart 1985).

The majority of a green sea turtle's life is spent on the foraging grounds. Green sea turtle foraging areas in the southeastern U.S. include any neritic waters having macroalgae or sea grasses near mainland coastlines, islands, reefs, or shelves, and any open-ocean surface waters, especially where advection from wind and currents concentrates pelagic organisms (NMFS and USFWS 1991b; Hirth 1997). Principal benthic foraging areas in the region include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Hildebrand 1982; Doughty 1984; Shaver 1994); the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957; Carr 1984); Florida Bay and the Florida Keys (Schroeder and Foley 1995); the Indian River Lagoon System, Florida (Ehrhart 1983); and the Atlantic Ocean off Florida from Brevard through Broward counties (Guseman and Ehrhart 1992; Wershoven and Wershoven 1992); and the northwestern coast of the Yucatan Peninsula. 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, and scattered areas along Colombia and Brazil (Hirth 1971). Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs.

Green sea turtles use mid-Atlantic and northern areas of the western Atlantic coast as important summer developmental habitat. Green sea turtles are found in estuarine and coastal waters as far north as Long Island Sound, Chesapeake Bay, and North Carolina sounds (Musick and Limpus 1997). Like loggerheads and Kemp's ridleys, green sea turtles that use northern waters during the summer must return to warmer waters when water temperatures drop, or face the risk of cold stunning. Cold stunning of green sea turtles may occur in southern areas as well (i.e., Indian River, Florida), because these natural mortality events are dependent on water temperatures and not solely on geographical location.

Population—Status and Trends

Seminoff (2004) estimated that analyses of subpopulation changes at 32 Index Sites distributed globally showed a 48 to 67 percent decline in the number of mature females nesting annually over the past 3 generations. These estimates are, however, based on a conservative approach; actual declines were thought to possibly exceed 70 percent. However, NMFS and USFWS (2007a) analyzed 23 threatened nesting concentrations among 11 ocean regions around the world that included both large and small rookeries and are believed to be representative of the overall trends for their respective regions. Of these 23 sites for which assessment of current trends was possible, 10 nesting populations are increasing, 9 are stable, and 4 are decreasing. Continuous datasets $\geq$ 20 years are available for 9 threatened population sites, all of which are either increasing or stable. However, the review cautioned that, despite the apparent global increase in numbers, the positive overall trend should be viewed cautiously since trend data are available for just over half of all sites examined. Nesting populations are doing relatively well in the Pacific, Western Atlantic, and Central Atlantic Ocean, but are doing relatively poorly in Southeast Asia, Eastern Indian Ocean, and perhaps the Mediterranean (NMFS and USFWS 2007a). NMFS and USFWS (2007a) also reviewed the endangered breeding populations' status and found that the nesting population of Florida appears to be increasing based on 18 years of index nesting data from throughout the state. Data for the largest nesting concentration in Pacific Mexico— where nesting beach monitoring has been ongoing every year since the 1981–1982 nesting season— shows an increase in nesting.

It is important to reiterate that (1) no trend data is available for almost half the important nesting sites, that (2) the numbers are based on recent trends and do not span a full green sea turtle generation, and (3) impacts occurring over more than four 4 decades ago that caused a change in juvenile recruitment rates may have yet to be manifested as a change in nesting abundance. In addition, these numbers are not compared to larger historical numbers. The numbers also only reflect one segment of the population, just nesting females. Nesting females are the only segment of the population for which we have reasonably good data, and are cautiously used as one measure of the possible trend of populations.

To characterize the quality of data used to estimate current abundance shown in Table 3, NMFS and USFWS (2007a) used a letter grading system (A, B, C). An 'A' was given to represent those data sources that are either published in peer-reviewed published literature or are based on unpublished data collected by highly dependable experts; a 'B' was given when represented data are from gray literature; and a 'C' was used when data come from personal communications for which the data precision is not fully verifiable, or when the estimate is imprecise. It should be noted that the grade given for confidence in data is independent of the time duration for which the estimate is based. In other words, i.e., a letter grade of 'A' was given for peer-reviewed data, even if it represented only a single nesting season.

Table 3. Estimates of current abundance for green turtle nesting rookeries with data confidence grades (G) and current trend statuses (T). Units of abundance include: AF = annual nesting females; AN = annual nests; EP = annual egg production; EH = annual egg harvest. ▲ = increasing population; ▼= decreasing population; ▬ = stable population; ? = unknown trend.

Location	Units	Years	Abundance	G	T	Reference
WESTERN ATLANTIC OCEAN						
1. Florida USA	AN	2001-2005	5,055	A	▲	Meylan *et al*. 2006
2. Cuyo and Holbox, Yucatán Peninsula, Mexico	AN	2000s	1,500	C	▲	I.N. Pesca, unpublished data
3. Tortuguero, Costa Rica	AF	1999-2003	17,402-37,290	A	▲	Troëng and Rankin 2005
4. Aves Island, Venezuela	AF	2005-2006	335-443	B	▬	Vera 2007
5. Galibi Reserve, Suriname	AF	1995	1,803	A	▲	Weijerman *et al*. 1998
6. Isla Trindade, Brazil	AF	1990s	1,500-2,000	B	▬	Moreira and Bjorndal 2006
CENTRAL ATLANTIC OCEAN						
7. Ascension Island, UK	AF	1999-2004	3,500	A	▲	Broderick *et al*. 2006
EASTERN ATLANTIC OCEAN						
8. Bijagos Archipelago, Guinea-Bissau	AN	2000	6,299-8,273	A	?	Catry *et al*. 2002
9. Bioko Island, Equatorial Guinea	AN	1996-1998	1,255-1,681	A	?	Tomas *et al*. 1999
MEDITERRANEAN SEA						
10. Turkey	AF	1990-2001	214-231	A	?	Broderick *et al*. 2002
11. Cyprus	AF	1995-2000	121-127	A	?	Broderick *et al*. 2002
12. Israel / Palestine	AF	1993-1998	1-3	B	?	Kuller 1999
13. Syria	AN	2004	100	B	?	Rees *et al*. 2005
WESTERN INDIAN OCEAN						
14. Eparces Islands (Tromelin and Europa)	AF	mid 1980s	2,000-11,000	B	?	Le Gall *et al*. 1986

15. Comoros Islands	AF	late 1990s	5,000	C	▲	S. Ahamada, pers. comm. 2001
16. Seychelles Islands (Aldabra and Assumption)	AF	1990s	3,535-4,755	A	▲	J. Mortimer, pers. comm. 2002
17. Kenya	AF	1999-2004	200-300	B	?	Okemwa and Wamukota 2006
NORTHERN INDIAN OCEAN						
18. Ras al Hadd, Oman	AN	2005	44,000	C	?	S. Al-Saady, pers. comm. 2007
19. Sharma, Peoples Dem. Republic of Yemen	NF	1999	15	B	?	Saad 1999
20. Karan Island, Saudi Arabia	AF	1991-1992	408-559	A	—	Pilcher 2000
21. Jana and Juraid Islands, Saudi Arabia	AN	1991	643	A	?	Pilcher 2000
22. Hawkes Bay and Sandspit, Pakistan	AN	1994-1997	600	A	▼	Asrar 1999
23. Gujarat, India	AN	2000	461	A	?	Sunderraj *et al*. 2006
24. Sri Lanka	AF	1996-2000	184	A	—	Kapurisinghe 2006
EASTERN INDIAN OCEAN						
25. Thamihla Kyun, Myanmar	EH	1999	<250,000	B	?	Thorbjarnarson *et al*. 2000
26. Pangumbahan, Indonesia	EH	mid 1980s	400,000	B	?	Schulz 1987
27. Suka Made, Indonesia	AN	1991-1995	395	C	▼	C. Limpus, pers. comm. 2002
28. Western Australia	AN	2001	3,000-30,000	C	?	R. Prince, pers. comm. 2001
SOUTHEAST ASIA						
29. Gulf of Thailand	AN	1992-2001	250	C	▼	Charuchinda pers. comm. 2001
30. Vietnam	AF	1995-2003	239	B	▼	Hamann *et al*. 2006
31. Berau Islands, Indonesia	AF	early 1980s	4,000-5,000	B	?	Schulz 1984
32. Turtle Islands, Philippines	EP	1998-1999	1.4 million	B	—	Cruz 2002
33. Sabah Turtle Islands, Malaysia	AN	1991-2000	8,000	A	▲	Chan 2006
34. Sipadan, Malaysia	AN	1995-1999	800	A	?	Chan 2006
35. Sarawak, Malaysia	AN	1970s-1990s	2,000	A	—	Liew 2002
36. Enu Island (Aru Islands)	AF	1997	540	C	?	Dethmers, in preparation
37. Terengganu, Malaysia	AN	1984-2000	2,200	A	—	Chan 2006
WESTERN PACIFIC OCEAN						
38. Heron Island, southern GBR, Australia	AF	1993-1998	560	A	▲	Limpus *et al*. 2002
39. Raine Island, northern GBR, Australia	AF	1990s-2000s	25,000	C	?	Limpus *et al*. 2003
40. Guam	AF	1995-2002	45	B	—	Cummings 2002
41. Ogasawara Islands, Japan	AF	2000-2005	500	A	▲	Chaloupka *et al*. 2007
CENTRAL PACIFIC OCEAN						
42. French Frigate Shoals, Hawaii, USA	AF	2002-2006	400	A	▲	Balazs and Chaloupka 2006
EASTERN PACIFIC OCEAN						
43. Revillagigedos Islands, Mexico	AN	1999-2002	90	B	—	Juarez-Ceron *et al*. 2003
44. Michoacan, Mexico	AF	2000-2006	1,395	A*	▲	C. Delgado, pers. comm. 2006
45. Central American Coast	AN	late 1990s	184-344	B	?	Lopez and Arauz 2003
46. Galapagos Islands, Ecuador	AF	2001-2006	1,650	B	—	Zárate *et al*. 2006

* An A is used for the personal communication from Carlos Delgado despite its pers. comm. status due to the fact that the authors of this report recognize this value data as being highly reliable.
Note- References listed appear in NMFS and USFWS (2007a).

There are no reliable estimates of the overall number of green sea turtles inhabiting foraging areas within the southeastern U.S., and it is likely that those foraging in the region come from multiple genetic stocks. However, information from some sites is available. A long-term in-water monitoring study in the Indian River Lagoon of Florida has tracked the populations of juvenile green sea turtles in a foraging environment and noted significant increases in catch -per -unit effort (more than doubling) between the years 1983–1985 and 1988–1990. An extreme, short-term increase in catch per unit effort of ~300 percent was seen between 1995 and 1996 (Ehrhart et al. 1996). Catches of benthic immature turtles at the St. Lucie Nuclear Power Plant intake canal, which acts as a passive turtle collector on Florida's east coast, have also been increasing since 1992 (Martin and Ernst 2000). During the period of 1977–1999, 2,578 green sea turtles were documented to be captured at the power plant (Florida Power and Light 2000; M. Bresette, unpublished data). The annual number of immature green sea turtle captures (minimum straight-line carapace length < 85 cm) captures has increased significantly during the 23 year period ($r^2 = 0.42$, $p < 0.001$). Mitochondrial DNA (mtDNA) analysis of 62 juveniles captured at the St. Lucie Nuclear Power Plant indicate that they originate from several nesting assemblages: 42 percent from Florida or Mexico, 53 percent from rookeries in Costa Rica, and 4 percent from Aves Island in Venezuela and Surinam (Witzell 2002).

Green sea turtles were once abundant enough in the shallow bays and lagoons of the Gulf to support a commercial fishery, which landed over one 1 million pounds of green turtles in 1890 (Doughty 1984). Doughty reported the decline in the turtle fishery throughout the Gulf of Mexico by 1902. Currently, green sea turtles are uncommon in offshore waters of the northern Gulf, but abundant in some inshore embayments. Shaver (1994) live-captured a number of green sea turtles in channels entering into Laguna Madre in south Texas. She noted the abundance of green sea turtle strandings in Laguna Madre inshore waters and opined that the turtles may establish residency in the inshore foraging habitats as juveniles. Coyne (1994) observed increased movements of green turtles during warm- water months in south Texas.

Listing Status and Critical Habitat

The green sea turtle was listed as threatened in 1978, except for the Florida and Pacific coast of Mexico breeding populations that were listed as endangered. Critical habitat for the green sea turtle has been designated for the waters surrounding Isla Culebra, Puerto Rico, and its associated keys.

Critical habitat for the green sea turtle includes the waters surrounding the island of Culebra, Puerto Rico, from the mean high water line seaward to 3 nautical miles (5.6 km). These waters include Culebra's outlying keys including Cayo Norte, Cayo Ballena, Cayos Geniqui, Isla Culebrita, Arrecife Culebrita, Cayo de Luis Pena, Las Hermanas, El Mono, Cayo Lobo, Cayo Lobito, Cayo Botijuela, Alcarraza, Los Gemelos, and Piedra Steven. Key physical or biological features essential for the conservation of the green sea turtle found in this designated critical habitat include important food resources and developmental habitat, water quality, and shelter.

Food Resources and Developmental Habitat: Sea grasses are the principal dietary component of juvenile and adult green turtles. The Culebra archipelago is important green sea turtle developmental and feeding habitat (e.g., sea grasses such as *Thalassia testudinum*).

Water Quality: Water quality plays both direct (e.g., water contamination and health) and indirect (e.g., support of food resources) roles in the health of green sea turtles.

Shelter: The coral reefs and other topographic features within these waters provide green sea turtles with shelter to rest during interforaging periods, as well as protection from predators.

Loggerhead Sea Turtle (*Caretta caretta*)

Description of Species
The carapace of adult and subadult loggerheads is reddish-brown. The dorsal and lateral head scales and the dorsal scales of the extremities are also reddish-brown, but with light yellow margins. The plastron is medium yellow. There are 5 pairs of costal scutes and 11 or 12 pairs of marginals. Mean straight carapace length of adult southeastern U.S. loggerheads is about 92 cm and corresponding mean body weight is approximately 113 kg. Hatchlings lack the reddish tinge and vary from light to dark brown dorsally. Both pairs of appendages are dark brown above and have distinct white margins. The plastron is dull yellowish tan. Hatchling mean body mass is about 20 g and mean straight carapace length is about 45 mm.

Range and Life History
Loggerheads occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans and inhabit continental shelves and estuarine environments. Developmental habitat for small juveniles includes the pelagic waters of the North Atlantic Ocean and the Mediterranean Sea.

Mating takes place in late March to early June, and eggs are laid throughout the summer. Female loggerheads deposit an average of 4.1 nests within a nesting season (Murphy and Hopkins 1984) and have an average remigration interval of 2.5 years. Mean clutch size varies from about 100 to 126 eggs along the southeastern U.S. coast. Loggerheads originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for as long as 7 to 12 years. Stranding records indicate that when pelagic immature loggerheads reach 40–60 cm straight carapace length they recruit to coastal inshore and nearshore waters of the continental shelf throughout the U.S. Atlantic Ocean and Gulf of Mexico.

Benthic immatures have been found from Cape Cod, Massachusetts, to southern Texas, and occasionally strand on beaches in northeastern Mexico (R. Márquez-M., Instituto Nacional De La Pesca, pers. comm.). Benthic immature loggerheads foraging in northeastern U.S. waters are known to migrate south in the fall as water temperatures cool (Shoop and Kenney 1992; Keinath 1993; Epperly et al. 1995c; Morreale and Standora 1999), and migrate north in spring. NMFS' Southeast Fisheries Science Center (NMFS SEFSC 2001) reviewed the literature and constructed growth curves from new data, estimating ages of maturity among the four models ranging from 20–38 years and benthic immature stage lengths from 14–32 years.

The loggerheads in the major different geographic areas represent differing proportions of the western Atlantic subpopulations. Although the northern nesting subpopulation produces about 9 percent of the loggerhead nests, they comprise more of the loggerheads found in foraging areas

from the northeastern United States to Georgia: 25 to 59 percent of the loggerheads in this area are from the northern subpopulation (Sears 1994; Norrgard 1995; Sears et al. 1995; Rankin-Baransky 1997; Bass et al. 1998). About 10 percent of the loggerheads in foraging areas off the Atlantic coast of central Florida are from the northern subpopulation (Witzell 2002). In the Gulf of Mexico, most of the loggerheads in foraging areas will be from the south Florida subpopulation, although the northern subpopulation may represent about 10 percent of the loggerheads in the Gulf. In the Mediterranean Sea, about 45 to 47 percent of the pelagic loggerheads are from the south Florida subpopulation and about 2 percent are from the northern subpopulation, while and about 51 percent originated from Mediterranean nesting beaches (Laurent et al. 1998). In the vicinity of the Azores and Madeiera Archipelagoes, about 19 percent of the pelagic loggerheads are from the northern subpopulation, about 71 percent are from the south Florida subpopulation, and about 11 percent are from the Yucatán subpopulation (Bolten et al. 1998). Analysis of samples collected from stranded loggerheads in the Carolinas, shows that the northern subpopulation makes up about 25 to 28 percent (NMFS SEFSC 2001; Bass et al. 1998 and 1999).

Adults have been reported throughout the range of this species in the United States and throughout the Caribbean Sea. Non-nesting, adult female loggerheads are reported throughout the United States and Caribbean Sea; however, little is known about the distribution of adult males who are seasonally abundant near nesting beaches during the nesting season. Aerial surveys suggest that loggerheads (benthic immatures and adults) in U.S. waters are distributed in the following proportions: 54 percent in the southeast U.S. Atlantic, 29 percent in the northeast U.S. Atlantic, 12 percent in the eastern Gulf of Mexico, and 5 percent in the western Gulf of Mexico (TEWG 1998).

Recent studies have suggested that not all loggerhead sea turtles follow the model of completely circumnavigating the North Atlantic Gyre as pelagic immatures, followed by permanent settlement into benthic environments. Some of these 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 (Witzell 2002).

Population—Status and Trends

Loggerheads are the most abundant species of sea turtle occurring in U.S. waters. They concentrate the majority of their nesting in the north and south temperate zones and subtropics (National Research Council 1990).

NMFS and USFWS (2007b) concludes that, in the Pacific, the eastern Australian population has declined 86 percent in the past 23 years, with a concurrent decline in New Caledonia nesting populations (based on oral histories). While in Japan a gradual increase in nesting populations is exhibited over the past 7 years, longer-term census data indicate a substantial decline (50–90 percent) in the annual nesting population in recent decades (NMFS and USFWS 2007b).

Previously unknown or unquantified nesting assemblages have been documented on the Cape Verde Islands, in the eastern Bahamas, and in Cuba. However, trends of these populations are currently unknown. Loggerhead nesting is no longer believed to occur in Jamaica, Haiti, the Dominican Republic, and Puerto Rico (NMFS and USFWS 2007b).

NMFS and USFWS (2008) designated five recovery units for the Northwest Atlantic population of the loggerhead. The first four recovery units represent nesting assemblages in the southeast U.S. The boundaries of these four recovery units were delineated based on geographic isolation and geopolitical boundaries. The fifth recovery unit includes all other nesting assemblages within the Northwest Atlantic. The Northern Recovery Unit is defined as loggerheads originating from nesting beaches from the Florida-Georgia border through southern Virginia (the northern extent of the nesting range). The Peninsular Florida Recovery Unit is defined as loggerheads originating from nesting beaches from the Florida-Georgia border through Pinellas County on the west coast of Florida, excluding the islands west of Key West, Florida. The Dry Tortugas Recovery Unit is defined as loggerheads originating from nesting beaches throughout the islands located west of Key West, Florida, because these islands are geographically separated from other recovery units. The Northern Gulf of Mexico Recovery Unit is defined as loggerheads originating from nesting beaches from Franklin County on the northwest Gulf coast of Florida through Texas (the western extent of U.S. nesting range). The Greater Caribbean Recovery Unit is composed of loggerheads originating from all other nesting assemblages within the Greater Caribbean (Mexico through French Guiana, The Bahamas, Lesser Antilles, and Greater Antilles). Additional rookeries of importance to loggerhead abundance and trend analysis in the Western North Atlantic occur in Cape Verde, Brazil, Greece, and Turkey (TEWG 2009).

Evaluation of the status and trends of the five identified recovery units revealed that the annual nest totals for the Northern Recovery Unit averaged 5,215 nests from 1989-2008. The number of loggerhead nests counted each year on 11 consistently surveyed beaches of the northern U.S. subpopulation each year during 1983 through 2006 has decreased by 1.6% annually during this period (TEWG 2009). Overall, there is strong statistical evidence to suggest the Northern Recovery Unit has experienced a long-term decline. Annual nest totals for the Peninsular Florida Recovery Unit (the largest nesting aggregation in the Atlantic) averaged 64,513 nests from 1989-2007. An analysis of index nesting beach survey data has shown a decline in nesting. Results of the analysis indicated that there has been a decrease of 28-31% from 1989 through 2007 and 43-44% decline between 1998 and 2007 (TEWG 2009). Trend analyses indicated an overall decline at a rate of 1.4 to 2.6% per year for the entire 19 year dataset, and a more rapid decline if only the last 10 years are considered (TEWG 2009). Annual nest totals for the Dry Tortugas Recovery Unit averaged 246 nests from 1995-2004 (surveys not conducted in 2002). The nesting trend data for the Dry Tortugas Recovery Unit are from beaches that are not part of the Florida index nesting beach survey program but are part of the statewide nesting beach survey program. TEWG (2009) suggested a high likelihood of a declining annual number of nests in the Dry Tortugas. Annual nest totals for the Northern Gulf of Mexico Recovery Unit averaged 906 nests from 1995-2007. Evaluation of long-term nesting trends for the Northern Gulf of Mexico Recovery Unit is difficult because of changed and expanded beach coverage. However, there are 12 years of Florida index nesting beach survey data for the Northern Gulf of Mexico Recovery Unit. A log-linear regression showed a significant declining trend of 4.7% annually. The majority of loggerhead nesting in the Greater Caribbean occurs in Quintana Roo Mexico and it appears that this nesting subpopulation is decreasing (TEWG 2009).

Loggerhead nesting could be as high as 10,000 nests per year in the Republic of Cape Verde, however more consistent and comprehensive nesting surveys are necessary; the trend in nesting numbers is currently unknown for this area; nesting in Greece is stable or increasing; in Turkey, nesting is decreasing; in Brazil, nesting appears to be increasing (TEWG 2009). In the Indian Ocean, there are few reliable assessments of population status and trends. The South African nesting assemblage showed an increasing trend over a 40 year period, but insufficient data are available on trends in Mozambique, Madagascar, Oman, Sri Lanka, western Australia, and Myanmar (NMFS and USFWS 2007b).

It is important to note that these trend analyses numbers are not compared to larger historical numbers, and only reflect one segment of the population (just nesting females). Nesting females are the only segment of the population for which we have reasonably good data and are cautiously used as one measure of the possible trend of populations.

The declines of these nesting female subpopulations are of great concern. Of particular concern (and another consideration and possible contributor to the vulnerability of the northern subpopulation), is that NMFS scientists estimate, using genetics data from Texas, South Carolina, and North Carolina in combination with juvenile sex ratios from those states, that the northern subpopulation produces 65 percent males, while the south Florida subpopulation is estimated to produce 80 percent females (NMFS SEFSC 2001). It is possible that the high proportion of males produced in the northern subpopulation is an important source to the entire southeast U.S. nesting population. Further declines or loss of the already proportionally (overall) small northern subpopulation and its disproportionately valuable share of males could contribute to a serious population decline over the entire region (NMFS SEFSC 2001).

From a global perspective, the southeastern U.S. nesting aggregation is critical to the survival of this species. It is second in size only to the nesting aggregations in the Arabian Sea off Oman, and represents about 35 percent to 40 percent of the nests of this species. The status of the Oman nesting beaches has not been evaluated recently, but because they are located in a part of the world that is vulnerable to extremely disruptive events (e.g. political upheavals, wars, and catastrophic oil spills), the resulting risk facing this nesting aggregation and these nesting beaches is cause for considerable concern (Meylan et al. 1995).

Several published reports have presented the problems facing long-lived species that delay sexual maturity in a world replete with threats from a modern human population (Crouse et al. 1987; Crowder et al. 1994; Crouse 1999). In general, these reports concluded that animals that delay sexual maturity and reproduction must have high annual survival as juveniles through adults to ensure that enough juvenile sea turtles survive to reproductive maturity and then reproduce enough times to maintain stable population sizes. This general rule applies to sea turtles, particularly loggerhead sea turtles, because the rule originated in studies of sea turtles (Crouse et al. 1987; Crowder et al. 1994; Crouse 1999). Heppell et al. (2003) specifically showed that the growth of the loggerhead sea turtle population was particularly sensitive to changes in the annual survival of both juvenile and adult sea turtles, and that the adverse effects of the pelagic longline fishery on loggerheads from the pelagic immature phase appeared critical to the survival and recovery of the species. Crouse (1999) concluded that relatively small

changes in annual survival rates of both juvenile and adult loggerhead sea turtles will adversely affect large segments of the total loggerhead sea turtle population.

Listing Status and Critical Habitat
The loggerhead was listed as a threatened species in 1978. Critical habitat has not been designated for the loggerhead.

On November 15, 2007, Oceana and the Center for Biological Diversity petitioned NMFS to designate the western North Atlantic subpopulations of the loggerhead sea turtle as a distinct population segment and to reclassify the western North Atlantic subpopulations as endangered. NMFS has accepted this petition (73 FR 11849) and has initiated a review of the status of the species to determine whether the petitioned action is warranted.

Kemp's ridley sea turtle (*Lepidochelys kempii*)

Description of the Species
This species and its congener, the olive ridley, are the smallest of all extant sea turtles. The weight of an adult is generally less than 45 kg and the straight carapace length around 65 cm. Hatchlings are grey-black in color on the dorsum and venter. Adults have a grey-olive carapace and cream-white or yellowish plastron. 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 generally range from 42–48 mm in straight line carapace length, 32–44 mm in width, and 15–20 g in weight.

Range and Life History
The age at maturity for Kemp's ridley sea turtles is estimated to be between 10 and 17 years (NMFS and USFWS 2007e). Nesting occurs from April into July and is essentially limited to the beaches of the western Gulf of Mexico, primarily in the Mexican state of Tamaulipas. Although some turtles nest annually, the weighted mean remigration rate is approximately 2 years. Kemp's ridley females lay approximately 3.075 nests per season (NMFS and USFWS 2007e), with about 100 eggs per nest.

It appears that adult Kemp's ridley sea turtles are restricted somewhat to the Gulf of Mexico in shallow near shore waters, although adult-sized individuals sometimes are found on the eastern seaboard of the United States. This species has a very restricted range relative to other sea turtle species. Kemp's ridleys nest in daytime aggregations known as arribadas, primarily at Rancho Nuevo, a stretch of beach in Mexico. Most of the population of adult females nests in this single locality (Pritchard 1969). Juvenile/subadult Kemp's ridleys have been found along the eastern seaboard of the United States and in the Gulf of Mexico. 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 cold (Lutcavage and Musick 1985; Henwood and Ogren 1987; Ogren 1989). In the Gulf, juvenile/subadult ridleys occupy shallow, coastal regions. The nearshore waters of the Gulf of Mexico are believed to provide important developmental habitat for juvenile Kemp's ridley sea turtles. Ogren (1988) suggests that the Gulf coast, from Port Aransas, Texas, through Cedar Key, Florida, represents the primary habitat for subadult ridleys in the northern Gulf of Mexico. Ogren (1989) suggested that

in the northern Gulf this species moves offshore to deeper, warmer water during winter. Studies suggest that subadult Kemp's ridleys stay in shallow, warm, nearshore waters in the northern Gulf of Mexico until cooling waters force them offshore or south along the Florida coast (Renaud 1995). Little is known of the movements of the post-hatching, planktonic stage within the Gulf. Studies have shown the post-hatchling pelagic stage varies from 1 year to 4 or more years, and the benthic immature stage lasts 7 to 9 years (Schmid and Witzell 1997).

Population—Status and Trends

Of the seven extant species of sea turtles of the world, the Kemp's ridley has declined to the lowest population level. 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). By the early 1970s, the world population estimate of mature female Kemp's ridleys had been reduced to 2,500–5,000 individuals. The population declined further through the mid-1980s.

The TEWG (1998) developed a population model to evaluate trends in the Kemp's ridley population, which identified three trends in benthic immature Kemp's ridleys. Benthic immatures are those turtles that are not yet reproductively mature but have recruited to feed in the nearshore benthic environment, where they are available to nearshore mortality sources that often result in strandings. Increased production of hatchlings from the nesting beach beginning in 1966 resulted in an increase in benthic ridleys (defined as 20–60 cm in length and approximately 2 to 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 the nest protection and relocation program in 1978. A third period of steady increase, which has not leveled off to date, has occurred since 1990 and appears to be due to the greatly increased hatchling production and an apparent increase in survival rates of immature turtles beginning in 1990 (likely a result, in part, of the introduction of turtle excluder devices (TEDs)).

The TEWG (1998) was unable to estimate the total population size and mortality rates for the Kemp's ridley population, but did identify a number of preliminary conclusions. The TEWG indicated that the Kemp's ridley population appeared to be in the early stage of exponential expansion. Over the period 1987 to 1995, the rate of increase in the annual number of nests accelerated in a trend that would continue with enhanced hatchling production and the use of TEDs. The increased recruitment of new adults was illustrated in the proportion of neophytes (or first- time nesters), which has increased from 6 to 28 percent from 1981 and 1989 and from 23 to 41 percent from 1990 to 1994. The TEWG (1998) identified an average Kemp's ridley population growth rate of 13 percent per year between 1991 and 1995. Total nest numbers have continued to increase. However, the 1996 and 1997 nest numbers reflected a slower rate of growth, while the increase in the 1998 nesting level was much higher, then decreased in 1999, and increased again strongly in 2000. The population model in the TEWG projected that Kemp's ridleys could reach the intermediate recovery goal identified in the Recovery Plan—of 10,000 nesters by the year 2020— if the assumptions of age to sexual maturity and age- specific survivorship rates used in their model are correct.

Recent observations of increased nesting suggest that the decline in the ridley population has stopped, and there is cautious optimism that the population is now increasing. The number of nests has grown from a low of approximately 702 nests in 1985, to greater than 1,940 nests in 1995, to approximately 5,800 nests in 2000, to approximately 8,300 nests in 2003, to approximately 10,300 nests in 2005. Approximately 12, 000 nests were recorded in 2006 (E. Possardt, USFWS, pers. comm. 2007), suggesting that the adult nesting female population is about 7,400 individuals.

Listing Status and Critical Habitat
The Kemp's ridley was listed as endangered on December 2, 1970. There is no designated critical habitat for the Kemp's ridley sea turtle.

Hawksbill Sea Turtle (*Eretmochelys imbricata*)

Description of Species
The hawksbill sea turtle has two pairs of prefrontal scales; thick, posteriorly overlapping scutes on the carapace; four pairs of costal scutes (the anterior- most not in contact with the nuchal scute); two claws on each flipper; and a beak-like mouth. In addition, when on land the hawksbill has an alternating gait, unlike the leatherback and green sea turtles. The carapace is heart-shaped in very young turtles and becomes more elongate or subovate with maturity. The lateral and posterior carapace margins are sharply serrated in all but very old individuals. The scutes are unusually thick and overlap posteriorly on the carapace in all but hatchlings and very old individuals. Carapacial scutes are often richly patterned with irregularly radiating streaks of brown and black on an amber background. The scutes of the plastron of Atlantic hawksbills are usually clear yellow, with little or no dark pigmentation. The soft skin on the hawksbill's' venter is cream or yellow and may be pinkish-orange in mature individuals. The scales of the head and forelimbs are dark brown or black and have sharply defined yellow borders. There are typically four pairs of inframarginal scales. The head is elongate and tapers sharply to a point. The hawksbill is a small to medium-sized marine turtle. Nesting females average about 87 cm in curved carapace length (Eckert 1992), with a record Caribbean weight of 127 kg (Carr 1952). Hatchlings in the U.S. Caribbean average about 42 mm in straight carapace length and range in weight from 13.5 to 19.5 g (Hillis and Mackay 1989; van Dam and Sarti 1989; Eckert 1992).

Range and Life History
The hawksbill sea turtle occurs in tropical and subtropical seas of the Atlantic, Pacific, and Indian Oceans. The species is widely distributed in the Caribbean Sea and western Atlantic Ocean, with representatives of at least some life history stages regularly occurring in southern Florida and the northern Gulf of Mexico (especially Texas); in the Greater and Lesser Antilles; and along the Central American mainland south to Brazil.

Within the United States, hawksbills are most common in Puerto Rico and its associated islands, and in the USVI. In the continental United States, hawksbill sea turtles have been recorded from all the Gulf States and from along the eastern seaboard as far north as Massachusetts, with the exception of Connecticut, but although sightings north of Florida are rare (Meylan and Donnelly 1999). They are closely associated with coral reefs and other hard-bottom habitats, but they are also found in other habitats including inlets, bays, and coastal lagoons.

In Florida, hawksbills are observed with some regularity on the reefs off Palm Beach County, where the warm Gulf Stream current passes close to shore, and in the Florida Keys. Texas is the only other state where hawksbills are sighted with any regularity. Most sightings involve post-hatchlings and juveniles. These small turtles are believed to originate from nesting beaches in Mexico.

The life history of hawksbills consists of a pelagic stage that lasts from the time they leave the nesting beach as hatchlings until they are approximately 22–25 cm in straight carapace length (Meylan 1988), followed by residency in developmental habitats (foraging areas where immatures reside and grow) in coastal waters. Adult foraging habitat, which may or may not overlap with developmental habitat, is typically coral reefs, although other hard-bottom communities and occasionally mangrove-fringed bays may be occupied. Hawksbills show fidelity to their foraging areas over periods of time as great long as several years (van Dam and Diez 1998).

Hawksbills may undertake developmental migrations (migrations as immatures) and reproductive migrations that involve travel over hundreds or thousands of kilometers (Meylan 1999a). Reproductive females undertake periodic (usually non-annual) migrations to their natal beach to nest. Movements of reproductive males are less well known, but are presumed to involve migrations to the nesting beach or to courtship stations along the migratory corridor. Females nest an average of 3 to 5 times per season, with some geographic variation in this parameter (see references on pp. 204-205 of in Meylan and Donnelly 1999; Richardson et al. 1999). Clutch size is higher on average (up to 250 eggs) than that of green turtles (Hirth 1980). Reproductive females may exhibit a high degree of fidelity to their nest sites. This, plus the tendency of hawksbills to nest at regular intervals within a season, makes them vulnerable to capture on the nesting beach.

Population—Status, and Trends

In the western Atlantic, the largest hawksbill nesting population occurs in the Yucatán Peniínsula of Mexico, where several thousand nests are recorded annually in the states of Campeche, Yucatán, and Quintana Roo (Garduño-Andrade et al. 1999). Important but significantly smaller nesting aggregations are documented elsewhere in the region in Puerto Rico, the USVI, Antigua, Barbados, Costa Rica, Cuba, and Jamaica (Meylan 1999b). Estimates of the annual number of nests for each of these areas are on the order of hundreds to a few thousand. Nesting within the southeastern United States and U.S. Caribbean is restricted to Puerto Rico (>650 nests/yr), the USVI (~400 nests/yr), and, rarely, Florida (0–-4 nests/yr) (Eckert 1995; Meylan 1999a, Florida Statewide Nesting Beach Survey database). At the two principal nesting beaches in the U.S. Caribbean where long-term monitoring has been carried out, populations appear to be increasing (Mona Island, Puerto Rico) or stable (Buck Island Reef National Monument, St. Croix, USVI) (Meylan 1999b).

NMFS and USFWS (2007f) provide the current nesting abundance of rookeries believed to be representative of the overall trends for their respective regions (Tables 4–7). There is a near total lack of long-term trend data at foraging sites, primarily because these data are logistically difficult and relatively expensive to obtain. The primary information source for evaluating

trends in global hawksbill populations is nesting beach data. However, one must use these data with caution, as they represent only one segment of the population.

As previously discussed, to characterize the quality of data used to estimate current hawksbill abundance, NMFS and USFWS (2007f) used a letter grading system (A, B, C). In addition to mean annual reproductive effort for these sites, NMFS and USFWS (2007f) estimated the change in reproductive effort based on published values of former versus current nesting levels. The evaluation focused on current abundance and population trends, including both recent population trends (within the past 20 years) and historic trends (when the current population size is compared to that of 20 to 100 years ago). Summaries of both recent and historic trends are given, where the symbols ▲, ▼, and ▬ are used to indicate whether a population is increasing, declining, or stable, respectively. The symbol "?" is used when data are insufficient to make a trend determination or the most "recent" values are not current (10 years or older).

Table 4. Estimates of current (or most recent) abundance for hawksbill nesting rookeries in the Atlantic Ocean with data confidence grades (G). Population trends, both recent (Rec T) within the past 20 years and historic (His T) comparing current nesting female abundance with that during a period >20 to 100 years ago are indicated. Data types include: AF = annual nesting females; AN = annual nests; AT = annual tracks; ▲ = increasing population; ▼= decreasing population; ▬ = stable population; ? = unknown trend. Information derived largely from review by Mortimer and Donnelly (in review).

Location	Data	Years	Number of nesting ♀ /season	G	RecT	His T	Reference
ATLANTIC: INSULAR CARIBBEAN							
1. Antigua (Jumby Bay)	AF	2002-2005	52	A	▲	?	Parish and Goodman 2006; McIntosh *et al.* 2003; Stapleton and Stapleton 2004, 2006
2. Antigua/ Barbuda (outside Jumby Bay)	AN	1999	50-75	B	▼	▼	Fuller *et al.* 1992, Meylan 1999
3. Bahamas	AN	2001-2005	100-333	B	?	▼	K. Bjorndal, University of Florida, in litt. To J. Mortimer, ICS, 2006
4. Barbados	AF	2003-2005	483	A	▲	?	Beggs *et al*. in press; J. Horrocks and B. Krueger, UWI, unpubl. Data
5. Bonaire	AT	2006	3-19	B	?	▼	WIDECAST unpubl. data from W. Dow, WIDECAST, in litt. to M. Donnelly, Caribbean Conservation Corporation (CCC), 2007
6. British Virgin Islands	AN	2005	no estimate	B	▼	▼	McGowan *et al.* in review
7. Cuba (Doce Leguas Cays)	AN	2002	400-833	B	?	▼	Cuban Turtle Group, in litt. to A. Abreu-Grobois, Unidad Academica Mazatlan, 2002
8. Dominican Republic	AT	2006	50-407	B	▼	▼	WIDECAST unpubl. data from W. Dow, WIDECAST, in litt. to M. Donnelly, CCC, 2007
9. French West Indies (Guadeloupean Archipelago)	AN	2003-2005	40-66	B	?	▼	Chevalier *et al.* 2003, 2005
10. French West Indies (Martinique)	AN	2006	50-100	B	?	▼	La Gazette de Karets 2006

11. Jamaica	AN	1991-1996	200-275	B	?	▼	R. Kerr, Duke University, pers. comm. to A. Meylan, Florida Fish and Wildlife Conservation Commission, 2001
12. Grenada	AT	2006	6-37	B	?	▼	WIDECAST unpubl. data from W. Dow, WIDECAST, in litt. to M. Donnelly, CCC, 2007
13. Puerto Rico (Culebra, Caja de Muertos, Humacao)	AN	2001-2005	51-85	A	▲	?	R.P. van Dam and C.E. Diez, Chelonia, Inc., unpubl. data; C.E. Diez, Chelonia, Inc., in litt. to J. Mortimer, ICS, 2006
14. Puerto Rico (Mona Island)	AN	2001-2005	199-332	A	▲	?	R.P. van Dam and C.E. Diez, Chelonia, Inc., unpubl. data; C.E. Diez, Chelonia, Inc., in litt. to J. Mortimer, ICS, 2006
15. St. Kitts	AT	2006	6-37	B	▼	▼	WIDECAST unpubl. data from W. Dow, WIDECAST, in litt. to M. Donnelly, CCC, 2007
16. Trinidad and Tobago (N. coast Trinidad)	AN	2000-2004	150	A	?	?	Livingstone 2006
17. U.S. Virgin Islands (Buck Island Reef NM)	AF	2001-2006	56	A	▲	?	Z. Hillis-Starr, National Park Service, unpubl. data, in litt. to J. Mortimer, ICS, 2006
18. U.S. Virgin Islands (sites outside Buck Island Reef NM)	AT	2006	30-222	B	?	▼	WIDECAST unpubl. data from W. Dow, WIDECAST, in litt. to M. Donnelly, CCC, 2007
ATLANTIC: WESTERN CARIBBEAN MAINLAND							
19. Belize (Manatee Bar, Sapodilla Cays, South Water Cay)	AT	2006	8-56	B	▼	▼	WIDECAST unpubl. data from W. Dow, WIDECAST, in litt. to M. Donnelly, CCC, 2007
20. Colombia (Isla Fuerte)	AT	2006	19-93	B	▼	▼	WIDECAST unpubl. data from W. Dow, WIDECAST, in litt. to M. Donnelly, CCC, 2007
21. Colombia (San Andres Archipelago)	AN	2006	no estimate	B	▼	▼	Carr *et al.* 1982, Cordoba *et al.* 1998
22. Costa Rica (Tortuguero National Park)	AF	2005	~10	A	▼	▼	CCC, unpubl. Data
23. Costa Rica (Cahuita and Erlin)	AT	2006	6-37	B	?	?	WIDECAST unpubl. data from W. Dow, WIDECAST, in litt. to M. Donnelly, CCC, 2007
24. Honduras (Bay Islands)		1982-1987	<10	A	?	▼	Cruz and Espinal 1987 as cited in Meylan 1999
25. Mexico (Entire Yucatan Peninsula: Campeche, Yucatan, and Quitana Roo)	AN	2001-2006	534-891	A	▲	?	Abreu-Grobois *et al.* 2005; A. Abreu-Grobois, Unidad Academica Mazatlan (UAM), in litt. to J. Mortimer, ICS, 20072
26. Nicaragua (El Cocal)	AN	2000	15-25	A	▼	▼	Lagueux and Campbell 2005

2 Based on unpublished data collected in: a) Yucatan and Quintana Roo by: Pronatura Península de Yucatán, SEMARNAT, CONANP, Secretaría de Ecología de Yucatán; and b) Campeche by: Conanp-APFFLT, SEMAR V Zona Naval, Secretaria de Ecologia Gob. del Estado, Enlaces con tu Entorno AC, Marea Azul AC, Desarrollo Ecologico Cd. del Carmen AC, Quelonios AC, UNACAR, Universidad Autónoma de Campeche, H. Ayuntamiento del Carmen, Pronatura PPY, Profepa.

27. Nicaragua (Pearl Cays)	AN	2000-2006	30-52	A	?	▼	Lagueux *et al.* 2003; C. Campbell, Wildlife Conservation Society (WCS), pers. comm. to J. Mortimer, ICS, 2007
28. Panama (Bastimentos Island National Marine Park)	AN	2003-2005	27-45	A	▲	▼	Meylan *et al.* 2006
29. Panama (Chiriqui Beach)	AN	2003-2005	84-150	A	▲	▼	Meylan *et al.* 2006
30. Venezuela (Los Roques and Paria region)	AN	2006	32-53	A	?	▼	H. Guada, Centro de Investigación y Conservación de Tortugas Marinas (CICTMAR), in litt. to J. Mortimer, ICS, 2006
ATLANTIC: SOUTH WESTERN							
31. Brazil	AN	2005	350-585	A	▲	▼	Marcovaldi 2005
ATLANTIC: EASTERN							
32. Equatorial Guinea (Bioko)	AF	1996-1998	7	A	▼	▼	Tomás *et al.* 2000
33. Sao Tomé and Principe	AN	1998-2001	14-27	A	▼	▼	J. Fretey (IUCN France) and A. Formia, Universita di Firenze, in litt. to J. Mortimer, ICS, 2001; J.-F. Dontaine, in litt. to J. Mortimer, ICS, 2001
TOTAL			**3,072-5,603**				

Table 5. Estimates of current abundance for hawksbill nesting rookeries in the Indian Ocean with data confidence grades (G). Population trends, both recent (Rec T) within the past 20 years and historic (Hist T) comparing current nesting female abundance with that during a period >20 to 100 years ago are indicated. Data types include: AF = annual nesting females; AN = annual nests; AT = annual tracks; ▲ = increasing population; ▼= decreasing population; ▬ = stable population; ? = unknown trend. Information derived largely from review by Mortimer and Donnelly (in review).

Location	**Data**	**Years**	**Number of nesting ♀ /season**	**G**	**Rec T**	**His T**	**Reference**
INDIAN OCEAN: SOUTH WESTERN							
34. Comoro Islands	AF	1996	25-50	A	?	▼	Ben Mojadji *et al.* 1996
35. France Iles Eparses (Europa, Tromelin, Juan de Nova, Glorieuses)	AN	2006	20-45	A	?	?	Gravier-Bonnet *et al.* 2006; J. Bourjea and S. Ciccione, CEDTM, in litt. to J. Mortimer, ICS, 2006
36. Kenya	AN	2004	<10	A	?	▼	Okemwa *et al.* 2004
37. Madagascar	AF	2001	~1,000	B	▼	▼	A. Cooke, Resolve Consulting, in litt. to J. Mortimer, ICS, 2001
38. Mauritius (including St. Brandon)	AF	1996	<50	A	?	▼	Mangar and Chapman 1996
39. Mayotte	AF	2006	10-50	B	?	▼	M. Quillard and S. Ciccione, CEDTM, in litt. to J. Mortimer, ICS, 2006; J. Bourjea, IFREMER, in litt to J. Mortimer, ICS,

							2006
40. Mozambique	AF	2006	<10	A	?	▼	A. Costa, WWF-Mozambique, in litt. to J. Mortimer, ICS, 2006; J. Garnier, Maluane Conservation, in litt. to J. Mortimer, ICS, 2007; I. Marques da Silva, Zoological Society London, in litt. to J. Mortimer, ICS, 2007
41. Seychelles (all 22 Inner Islands)	AF	2000-2003	625	A	▼	▼	Mortimer 2004, 2006
42. Seychelles (Outer Islands)	AN	2000-2006	800	A	?	▼	J. Mortimer unpubl. Data
43. Tanzania	AF	1996	<50	B	▼	▼	Howell and Mbindo 1996
INDIAN OCEAN: NORTH WESTERN							
44. Bahrain		2006	no estimate		?	?	
45. Egypt	AF	2006	50-100	A	?	▼	J.D. Miller, American University Cairo (AUC), in litt. to J. Mortimer, ICS, 2006
46. Eritrea		1996	no estimate	B	?	?	Hillman and Gebremariam 1996
47. Iran	AF	1970s	500-1,000	B	?	?	Ross and Barwani 1982
48. Kuwait	AF	1989	<20	B	?	?	Groombridge and Luxmoore 1989
49. Oman	AF	1990s	600-800	A	—	?	Salm *et al.* 1993, Baldwin and Al-Kiyumi 1997
50. Qatar	AN	2005	>100	A	—	?	Pilcher 2006
51. Saudi Arabia (Arabian Gulf)	AF	1990s	175-265	A	?	?	Pilcher 1999; J.D. Miller, AUC, in litt. to J. Mortimer, ICS, 2006
52. Saudi Arabia (Red Sea)	AN	2005	100-200	A	?	?	J.D. Miller, AUC, in litt. to J. Mortimer, ICS, 2006
53. Somalia		2006	no estimate		?	?	
54. Sudan	AN	1970s	300-350	B	?	?	Moore and Balzarotti 1977, Hirth and Abdel Latif 1980
55. United Arab Emirates	AF	2006	100-200	B	?	?	J.D. Miller, AUC, in litt. to J. Mortimer, ICS, 2006
56. Yemen	AF	1960s - 1970s	~500?	B	?	?	Ross and Barwani 1982
INDIAN OCEAN: CENTRAL and EASTERN							
57. Australia (Western Australia)	AF	2002	~2,000	B	?	?	Limpus 1997, 2002
58. British Indian Ocean Territory (Chagos Islands)	AF	1996	300-700	A	?	▼	Mortimer and Day 1999
59. India (Andaman and Nicobar)	AF	1990s	~250	B	?	▼	Andrews *et al.* 2006
60. Malaysia (Melaka)	AN	2005	50-85	A	?	▼	Malaysian Department of Fisheries Statistics
61. Maldives	AN	1988-1995	460-767	B	▼	▼	Zahir and Hafiz 1997
62. Myanmar	AF	1989	<5	B	?	▼	Groombridge and Luxmoore 1989
63. Sri Lanka (south coast)	AN	2006	~10	A	?	▼	T. Kapurusinghe, Turtle Conservation Project (TCP), pers. comm. to J. Mortimer, ICS, 2006

64. Thailand (Andaman Sea)	AF	2006	<10	A	▼	▼	M. Aureggi, NAUCRATES, in litt. to J. Mortimer, ICS, 2006
TOTAL			**<8,130 - 10, 052**				

Table 6. Estimates of current abundance for hawksbill nesting rookeries in the Pacific Ocean with data confidence grades (G). Population trends, both recent (Rec T) within the past 20 years and historic (His T) comparing current nesting female abundance with that during a period >20 to 100 years ago are indicated. Data types include: AF = annual nesting females; AN = annual nests; AT = annual tracks; ▲ = increasing population; ▼ = decreasing population; ▬ = stable population; ? = unknown trend. Information derived largely from review by Mortimer and Donnelly (in review).

Location	**Data**	**Years**	**Number of nesting ♀ /season**	**G**	**RecT**	**His T**	**Reference**
PACIFIC OCEAN: WESTERN							
65. Australia (Torres Strait-Northern Great Barrier Reef)	AF	2004	~4,000	A	▼	?	Limpus 2004
66. Australia (Northeastern Arnhem Land)	AF	2004	~2,500	A	?	?	Limpus 2004
67. Indonesia (entire country)	AN	2006	1,362-3,026	A B	▼	▼	J. Schulz in litt. to K. Bjorndal, University of Florida, 1995; Suganuma *et al.* 1999; H. Suganuma, ELNA, in litt. to J. Mortimer, ICS, 2006
68. Japan		1980s	rare	B	▼	▼	Groombridge and Luxmoore 1989
69. Malaysia (East) Sabah Turtle Islands	AN	1997-2005	69-116	A	▬	?	Sabah Parks unpubl. data; P. Basinthal, Sabah Parks, in litt. to J. Mortimer, ICS, 2006
70. Malaysia (West): Terengganu	AN	1992-2000	4-6	A	▼	▼	Liew 2002
71. Papua New Guinea	AF	2004	~500-1000	B	▼	▼	Wilson *et al.* 2004; B. Krueger, UWI, in litt. to J. Mortimer, ICS, 2007
72. Philippines	AF	1980s	<500	B	▼	▼	Groombridge and Luxmoore 1989
73. Thailand (Gulf of Thailand)	AN	1990-2005	~20	A	▼	▼	Charuchinda and Monanunsap 1998; M. Charuchinda, Thailand Department of Marine and Coastal Resources, unpubl. data; M. Aureggi, NAUCRATES, in litt. to J. Mortimer, ICS, 2006
74. Vietnam	AF	1980s	100	B	▼	▼	Groombridge and Luxmoore 1989
PACIFIC OCEAN: CENTRAL							
75. American Samoa and Western Samoa	AF	1991	<10-30	B	▼	▼	Tuato'o-Bartley *et al.* 1993; Grant *et al.* 1997; G. Balazs, NMFS, in litt. to J. Mortimer, ICS, 2007
76. Fiji	AN	2006	100-200	A	▼	▼	Batibasaga 2002
77. Guam	AF	2003	<5-10	B	▼	▼	G. Davis, NMFS, in litt. to J. Mortimer, ICS, 2007; G. Balazs, NMFS, in litt. to J. Mortimer, ICS, 2007
78. Hawaii	AF	2006	5-10	B	▲	▼	G. Balazs, NMFS, in litt. to J. Mortimer,

							ICS, 2007
79. Micronesia	AF	1998	~300	B	▼	▼	NMFS and FWS 1998
80. Palau Republic	AF	1998	20-50	A	?	▼	NMFS and FWS 1998
81. Solomon Islands	AN	2004	200-300	B	▼	▼	Ramohia and Pita 1996, Wilson *et al.* 2004
82. Vanuatu	AF	2004	>300	B	?	▼	Wilson *et al.* 2004; K. MacKay, University of the South Pacific (USP), pers. comm. to J. Mortimer, ICS, 2007
PACIFIC OCEAN: EASTERN							
83. Mexico (Baja California)	AF	2003	<15	A	?	▼	Seminoff *et al.* 2003b; J. Nichols unpubl. Data
TOTAL			**10,010 - 12,483**				

Table 7. Summary of hawksbill recent and historic trends for 83 nesting sites for which data are available. Key to trend symbols: ▲ = increasing population; ▼= decreasing population; ▬ = stable population; ? = unknown trend.

Ocean Basin	Number of Nesting Sites								
	Total Sites	Recent Trends (within past 20 years)				Historic Trends (during a period of >20 to 100 years)			
		▲	▬	▼	?	▲	▬	▼	?
Atlantic	33	9	0	11	13	0	0	25	8
Indian	31	0	2	5	24	0	0	17	14
Pacific	19	1	1	13	4	0	0	16	3
Total	**83**	**10**	**3**	**29**	**41**	**0**	**0**	**58**	**25**

NMFS and USFWS (2007f) suggest that some regions are doing better than others based on available trend data, and explain:

> "Although greatly depleted from historical levels, nesting populations in the Atlantic in general are doing better than in the Indo-Pacific. In the Atlantic, more population increases have been recorded in the Insular Caribbean than along the Western Caribbean Mainland or the Eastern Atlantic. In general, hawksbills are doing better in the Indian Ocean (especially the South Western and North Western Indian Ocean) than in the Pacific Ocean. In fact, the situation for hawksbills in the Pacific Ocean is particularly dire, despite the fact that it still has more nesting hawksbills than in either the Atlantic or Indian Oceans."

Although hawksbills are subject to the suite of threats that affect other marine turtles, the decline of the species is primarily attributed to centuries of exploitation for tortoise shell, the beautifully patterned scales that cover the turtle's shell (Parsons 1972).

Listing Status and Critical Habitat
The hawksbill sea turtle was listed as endangered under the ESA in 1970, and is considered "Critically Endangered" by the International Union for the Conservation of Nature (IUCN) based on global population declines of over 80 percent during the past three 3 generations (105 years) (Meylan and Donnelly 1999). Critical habitat for the hawksbill sea turtle is designated under 50 CFR 226.209. It includes the waters surrounding the islands of Mona and Monito, Puerto Rico, from the mean high water line seaward to 3 nautical miles (5.6 km).

Critical habitat for the hawksbill sea turtle includes the waters surrounding the islands of Mona and Monito, Puerto Rico from the mean high water line seaward to 3 nautical miles (5.6 km).

Key physical or biological features essential for the conservation of the hawksbill sea turtle found in this designated critical habitat include important foraging habitat, water quality, and shelter.

Foraging Habitat: The coral reefs of Mona and Monito provide a primary foraging habitat for hawksbill sea turtles. In particular, the sponges found on the reefs are a key food source for this species.

Water Quality: Water quality plays both direct (e.g., water contamination and health) and indirect (e.g., support of coral resources) roles in the health and survival of hawksbill sea turtles.

Shelter: The ledges and caves of the reefs provide shelter for resting and refuge from predators.

Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)
This species was listed as a threatened species under the Endangered Species Act in 1991, and is under the joint jurisdiction of FWS and NOAA Fisheries. Critical habitat for Gulf sturgeon was designated on March 19, 2003 (68 FR 13370).

Up to 10 Gulf sturgeon could be annually incidentally captured during the sea turtle research, and they would be weighed, measured, scanned for PIT tags, photographed, and released.

The Gulf sturgeon, also known as the Gulf of Mexico 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. The upper lobe of the caudal fin is longer than the lower lobe (heterocercal). Adults range in length from 1.8-2.4 m, with adult females growing larger than males. The Gulf sturgeon is a subspecies of Atlantic sturgeon (*Acipenser oxyrinchus* [=*oxyrhynchus*]) 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 (approximately October through March) in estuarine bays or in the Gulf of Mexico (Odenkirk 1989, Foster 1993, Clugston et al.

1995) and warmer periods (i.e., March through May) in coastal 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).

Migratory behavior of the Gulf sturgeon varies by sex, maturity, water temperature, and river flow. Male Gulf sturgeon generally enter the rivers earlier in the spring and move greater distances than females; ripe males and females enter the river earlier than non-ripe fish (Fox et al. 2000). 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 ca 23°C) and continues through November when the sturgeon return to the estuary or Gulf of Mexico (Huff 1975, Wooley and Crateau 1985, Foster and Clugston 1997). Some young Gulf sturgeon are known to remain at the river mouth during the winter and spring (Clugston et al. 1995).

Gulf sturgeon are known to lose up to 30% of their total body weight while in fresh water, and analysis of stable carbon isotope ratios indicate that they rely almost entirely on marine prey for growth (Gu et al. 2001), It has been concluded that the sturgeon fast while in the river systems and then subsequently compensate the loss during winter feeding in marine areas (Carr 1983, Wooley and Crateau 1985, Clugston et al. 1995, Morrow et al. 1998, Heise et al. 1999, Sulak and Clugston 1999, Ross et al. 2000). Adult Gulf sturgeon then likely overwinter in the Gulf of Mexico. Tagged adults absent from the rivers in the winter are presumed to have spent extended periods of time in either the nearshore waters or the Gulf of Mexico (Carr et al. 1996, Fox and Hightower 1998, Edwards et al. in prep.).

Gulf sturgeon have been found to concentrate in the area around the mouths of their natal rivers, presumable to forage. It's likely that these areas offer the first foraging opportunity to Gulf sturgeon as they have fasted for up to six months in the river–thereby making them extremely important. Specifically, Gulf sturgeon have been located on seagrass and sand in depths from 1.5-5.9 m (Fox and Hightower 1998, Craft et al. 2001, Parauka et al. in press) which supports a variety of potential prey items including estuarine crustaceans, small bivalve mollusks, and lancelets (Menzel 1971, Abele and Kim 1986, AFS 1989).

Ontogenetic changes in Gulf sturgeon diet and foraging area have been documented. Young-of-year forage in freshwater on aquatic invertebrates and detritus (Mason and Clugston 1993, Sulak and Clugston 1999); juveniles forage throughout the river on aquatic insects (e.g., mayflies and caddisflies), worms (oligochaetes), and bivalves (Huff 1975, Mason and Clugston 1993); and adults, which forage sparingly in freshwater and depend almost entirely on estuarine and marine prey for their growth (Gu et al. 2001), rely mainly on benthic marine invertebrates including amphiopods, lancelets, polychaetes, gastropods, shrimp, isopods, molluscs, and crustaceans (Huff 1975, Mason and Clugston 1993, Carr et al. 1996, Fox et al. 2000, Fox et al. in press).

Mature active females range in age (as determined from fin rays) from 8-17 years, and active males from 7-21 years (Huff 1975). Female Gulf sturgeon spawn every 3-5 years, and males every 1-5 years (Smith 1985, Fox et al. 2000). Limited data indicate that although male Gulf sturgeon may be capable of annual spawning, females are probably not (Huff 1975, Fox et al. 2000).

Additional detail regarding the life history, abundance, and distribution of Gulf sturgeon can be found in the Gulf Sturgeon Recovery/Management Plan (FWS, GSMFC, and NMFS 1995), and the Gulf sturgeon critical habitat rule (68 FR 13370, March 19, 2003).

Historically, the Gulf sturgeon occurred from the Mississippi River to Tampa Bay (Wooley and Crateau 1985). Its present range extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi east to the Suwannee River in Florida. Sporadic occurrences have been 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).

Gulf sturgeon populations from eight drainages along the Gulf of Mexico were analyzed for genetic diversity and five river-specific stocks have been identified : (1) Lake Pontchartrain and Pearl River, (2) Pascagoula River, (3) Escambia and Yellow rivers, (4) Choctawhatchee River, and (5) Apalachicola, Ochlockonee, and Suwannee rivers (Stabile et al. 1996). Tagging studies reveal both that Gulf sturgeon exhibit both a high degree of river fidelity, and that inter-river movements occur.

While little is known about the abundance of Gulf sturgeon through most of its range, population estimates have been calculated for the Apalachicola, Choctawhatchee, Yellow, Pascagoula, Pearl, and Suwannee rivers. An estimated 292 fish (based on fish greater than age three) are in the Pearl River (Morrow et al. 1998). An estimated population size of 193-206 (based on fish in summer holding are >95 cm) was calculated for the Pascagoula River (Heise et al. 2002), 319-1550 (includes only fish >100 cm) in the Yellow River (Berg 2004), 2000-3000 (based on fish over 61 cm) in the Choctawhatchee River (USFWS 2001), 62-218 (includes only fishes below the Jim Woodruff Lock and Dam) in the Apalachicola River (Zehfuss et al. 1999), and 5500-7650 (based on fish about 2 (>60 cm) or more years old in the Suwanee River (Sulak and Clugston 1999).

Critical Habitat

The research could occur in Gulf sturgeon critical habitat. Critical habitat for the Gulf sturgeon was designated under the ESA based on the abundance of prey items, spawning sites, resting areas, and migratory pathways. Critical habitat in Louisiana, Mississippi, Alabama, and Florida waters has been classified into 14 units as follows (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 pParishes 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.

Environmental Baseline

The environmental baseline analyzes the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the action area. It includes the past and present impacts of all state, tribal, local, private, and other human activities in the action area, including impacts of these activities that will occur contemporaneously with this consultation. Unrelated Federal actions affecting the same species or critical habitat that have completed formal or informal consultation are also part of the environmental baseline, as are Federal and other actions within the action area that may benefit listed species or critical habitat. It clearly identifies how actions affect the status and trend of the listed species or critical habitat of the opinion. Due to the great distances sea turtles travel other activities may impact them when they migrate out of the action area. To provide the reader with a more comprehensive discussion of all the activities affecting the species found in the action area, we have included activities occurring in areas to which these species could migrate during the course of their life cycle.

The details of the wide variety of human activities and natural phenomena that may affect the resources within the action area are documented in the various recovery plans for target species listed under the ESA (http://www.nmfs.noaa.gov/pr/publications/), and numerous biological opinions under the ESA prepared on Federally-permitted fisheries and vessel operations, including dredging and disposal operations.

Activities Potentially Contributing to Sea Turtles' Current Condition

Research

Sea turtles have been the focus of field studies for decades. The primary purposes of most studies are to monitor populations and gather data for behavioral and ecological studies. Over time, NMFS has issued dozens of permits for takes of sea turtles in the proposed action area for a variety of activities, examples of which include surveys, photo-identification, capture, handling, biopsy sampling, lavage, laparoscopy, attachment of scientific instruments, and release. The number of permits and associated takes indicate that a portion of the populations of turtle species in the proposed action area have been subject to varying levels of stress due to research activities. This research is due to interest in developing appropriate management and conservation measures to recover these species.

Research on sea turtles in the United States is carefully controlled and managed so that it does not operate to the disadvantage of the species. In addition to permits issued by NMFS for the scientific research of sea turtles in the marine environment, similar Section 10 Federal permits are issued by the United States Fish and Wildlife Service for the taking of endangered and threatened sea turtles on land for activities and efforts that aid the conservation and recovery of these species.

Despite the oversight involved with issuing sea turtle research permits, repeated disturbance of individual sea turtles can occur in some instances given the number of permits, associated takes and research vessels and personnel present in the environment. It is difficult to assess the effects of such disturbance. However, NMFS has taken steps to limit repeated harassment of individual turtles and avoid unnecessary duplication of research efforts by requiring coordination among permit holders. All scientific research permits are also conditioned with mitigation measures to ensure that the research impacts target and non-target species as minimally as possible.

List of Relevant Permits Authorizing Directed Takes for the Target Sea Turtle Species In or Near the Action Area

Permit Number	Permit Holder	Expiration Date
1506	Blair Witherington, Florida Fish and Wildlife Conservation Commission	March 31, 2010
1522	Kenneth Lohmann	June 1, 2010
1494	St. George's School	December 31, 2009
1501	Florida Marine Research Institute	March 31, 2010
1507	Ehrhart	March 31, 2010
1418	Larry Wood	December 30, 2009
1526	Andre Landry	August 1, 2010
1518	Carlos Diez	August 31, 2010
1540	State of South Carolina	April 1, 2011
1527	Jack Musick	April 1, 2011
1544	East Coast Observers	December 31, 2010
1552	NMFS SEFSC	June 30, 2011
1570	NMFS SEFSC	December 31, 2011
1571	NMFS SEFSC	December 31, 2011
1576	NMFS NEFSC	September 30, 2011
1599	Inwater Research Group Inc.	June 30, 2012
13306	Karen Holloway-Adkins	June 30, 2013

13307	Kristen Hart	June 30, 2013
13544	Jeff Schmid	April 30, 2014

NMFS currently authorizes mortality in a limited number of permits. Permit No. 1576 authorizes the lethal take of up to 23 loggerhead, 1 green, 1 leatherback, 1 Kemp's ridley sea turtles annually, and up to 1 loggerhead and 1 Kemp's ridley over the course of the permit, through 2011. Permit No. 1540 authorizes the lethal take of 7 loggerhead, 2 green, 1 leatherback, 2 Kemp's ridley, and 2 hawksbill sea turtles over the course of the permit through 2010. Permit No. 1544 authorizes the lethal take of up to 5 loggerhead, 2 green, 2 Kemp's ridley, and 2 hawksbill sea turtles over the course of the permit through 2010. Permit No. 1570 authorizes the lethal take of up to 3 loggerhead, 2 green, 1 leatherback, 2 Kemp's ridley, 1 hawksbill, and 1 olive ridley sea turtle over the course of the permit through 2011.

Other ESA Permitted Activity

In addition to scientific research permits, NMFS issues permits under Section 10 (a)(1)(B) of the ESA for the incidental take of sea turtles during non-federal marine activities. Some marine activities, such as state fisheries, may require such permits if sea turtles are known to or expected to be caught during their activities. Permits usually authorize the capture and in some cases, the mortality of sea turtles. The following permits have been issued in the past.

Permit No. 1325 issued to the North Carolina Division of Marine Fisheries (NCDMF) authorized them to take up to 10 loggerhead sea turtles and 2 turtles in any combination of loggerhead, green, Kemp's ridley, hawksbill or leatherback. Of these, 2 turtles in any combination of loggerhead, green, Kemp's ridley, hawksbill or leatherback were authorized to be killed. This permit expired December 31, 2006.

The NCDMF also was authorized (under Permit No. 1348 (year 2001), 1398 (years 2002-2004), and 1528 (years 2005-2010)) to incidentally take sea turtles for certain periods and in specific areas under a Section 10 incidental take permit during otherwise lawful commercial fall gill net fisheries for flounder operating in Pamlico Sound, NC. Permit No. 1348 (expired) allowed for the take of 164 Kemp's, 164 green, 164 loggerhead estimated live takes, and 24 estimated lethal takes of each of these species. It also allowed for the take of 2 actual, observed live or dead hawksbill and leatherback sea turtles (in combination). Permit No. 1398 (expired) authorized the annual take of 160 green, 80 Kemp's ridley, 80 loggerhead estimated live takes, and 50 green, 25 Kemp's ridley, and 25 loggerhead estimated lethal takes. It also authorized the annual observed live or dead take of 2 hawksbill and 2 leatherback sea turtles. Permit No. 1528 authorizes the annual take of 27 Kemp's ridley, 120 green, and 38 loggerhead estimated live takes and 14 Kemp's ridley, 48 green, and 3 lethal takes of each species. It also allows for the take of 2 actual, observed live or dead hawksbill or leatherback sea turtles and 6 actual, observed live or dead Kemp's ridley, green, and loggerhead sea turtles (in combination). The permit is valid through December 31, 2010.

Permit No. 1417, issued to Jack Rudloe in Florida, authorizes an incidental take of up to a total of 3 sea turtles, all live, in any combination, of loggerhead, green, Kemp's ridley or leatherback sea turtles for the life of the permit. The permit is valid through May 1, 2012.

Direct Harvest of Sea Turtles – Historic Fisheries

The historic harvest of sea turtles and/or sea turtle eggs has been documented as far back as the 18th century for sea turtle species in the U.S. or U.S. territories (Witzell 1994). From the early

1800's to the passage of the ESA in 1973, turtle populations were affected through a directed, commercial harvest or 'turtling.' Turtling was one of the first commercial fisheries in the southeastern U.S. (Witzell 1994). Most of the fishery consisted of the incidental take of turtles via other commercial fisheries; however, there was directed take of turtles through gillnetting, seining, harpooning, and diving. These fisheries affected mainly green and loggerhead turtles. Landings averaged 10,000 kg until the passage of the ESA in 1973. This figure is a minimum harvest estimate due to problems with accurate species identification and lack of reporting landings (Witzell 1994). The illegal domestic harvest of eggs and turtles still continues at low levels in the United States, especially in Caribbean. Turtles are still legally harvested in some countries (e.g., in the Caribbean).

Natural Mortality

A variety of natural and introduced predators, (e.g., hogs, mongooses, foxes, ghost crabs, herons, and ants), prey on sea turtle eggs and hatchlings. In addition to the destruction of eggs, certain predators may take considerable numbers of hatchlings just prior to or upon emergence from the sand. Once they leave the beach, the hatchlings are preyed upon by sharks, fish, and seabirds. Predation may be the most important hatchling mortality factor, but is one which is difficult to quantify.

Disease and Strandings

A disease known as fibropapillomatosis (FP), originally identified in green turtles, has emerged as a serious threat to green sea turtle recovery. The disease is most notably present in green turtles of Hawaii, Florida, and the Caribbean. The disease can also occur in other species. FP is expressed as tumors which occur primarily on the skin and eyes, and the disease can be fatal. The presence of tumors can reduce vision, provide a physical obstruction to swimming and foraging, and increase the turtle's susceptibility to parasites.

Sea turtle strandings occur each year along the Atlantic coastline of the United States. The strandings can be the result of natural cold stunning, mortality or interaction with human activities (e.g., entanglement in fishing gear or boat collisions). Occasionally, high level unusual mortality or cold stun events occur.

Loss of Nesting Beach Habitat

Habitat loss can occur on nesting beaches from natural and man-induced causes, as well as in the nearshore marine environment. Loss of nesting beach habitat and turtle mortality due to exotic vegetation as well as indigenous vegetation can lead to hatchling mortality because turtles develop to full term in the egg and then fail to successfully emerge (Eckert and Eckert 1990). A portion of this mortality is due to entanglement in beach vine roots that have grown into or over the nest cavity since egg deposition. Exotic vegetation may form impenetrable root mats which can prevent proper nest cavity excavation, invade and desiccate eggs, or trap hatchlings. Non-native vegetation can lead to increased erosion and degradation of suitable nesting habitat.

Loss of nesting beach habitat due to erosion or inundation and accretion of sand above incubating nests appears to be a principal abiotic factor that may negatively affect incubating egg clutches at some locations. While these factors are often widely perceived as contributing to nest mortality or lowered hatching success, few quantitative studies have been conducted (Mortimer

1989). Erosion control methods (e.g., seawalls, riprap) can result in the degradation of suitable nesting habitat or the permanent loss of a dry nesting beach by accelerated erosion and preventing natural beach and dune accretion. It may prevent or hamper nesting females from reaching suitable nesting sites and trap hatchlings and nesting turtles. Beach nourishment (pumping, trucking, or scraping sand onto the beach to rebuild what has been lost to erosion) can affect turtles by burying nests and, if conducted during the nesting season, by disturbing nesting turtles. Significant reductions in nesting success have been documented on severely compacted nourished beaches (Raymond 1984).

Sand mining for construction aggregate or renourishment of other beaches is a serious threat to nesting beaches throughout the Caribbean. Mined beach sand will not be replaced until offshore supplies build in quantity, a process that could take decades.

Another threat currently resulting in the loss of nesting beach habitat and potential mortality is artificial lighting**.** Artificial beachfront lighting from buildings, streetlights, dune crossovers, vehicles, and other sources has been documented as causing the disorientation and misorientation of hatchling turtles (McFarlande 1963; Philibosian 1976; Mann 1977; Erhart 1983). The results of disorientation or misorientation are often fatal for hatchlings and can misorient adults. Carr et al. (1978), Mortimer (1982), and Witherington (1986) found that adult green turtles avoided bright areas on nesting beaches.

Beach cleaning methods include mechanical raking, hand raking and hand picking up debris. Large expanses of open sand may be cleaned with mechanical devices to a depth of several inches. Mann (1977) suggested that mortality within nests may increase when external pressure from beach cleaning machinery is common on soft beaches with large grain sands. Mechanically pulled rakes and hand rakes can penetrate the surface and disturb the sealed nest or may actually uncover pre-emergent hatchlings near the surface of the nest. Disposal of debris near the dune line or on the high beach can cover incubating egg clutches and subsequently hinder and entrap emergent hatchlings and may alter natural nest temperatures.

Coastal development can also deter or interfere with nesting, affect nest success, and degrade nesting habitats for sea turtles. The residential and tourist use of, development, and driving on developed (and developing) nesting beaches generally negatively affect nesting turtles, incubating egg clutches, and hatchlings.

Marine Debris, Pollution and Contaminants

The ingestion of marine debris can be a serious threat to sea turtles. When feeding, sea turtles can mistake debris for natural food items. Some types of marine debris, such as oil, may be directly or indirectly toxic to sea turtles in the action area. Other types of marine debris, such as discarded or derelict fishing gear, may entangle and drown sea turtles. Eutrophication, heavy metals, radioactive elements, and hydrocarbons all may reduce the extent, quality, and productivity of foraging grounds (Frazier 1980). Chemical pollutants, such as petroleum, sewage, pesticides, solvents, industrial discharges, and agricultural runoff are responsible for an unquantified level of sea turtle mortality each year (NMFS and USFWS 1998a). Oil exploration and development pose direct and indirect threats to sea turtles. A rise in transport traffic increases the amount of oil in the water from bilge pumping and disastrous oil spills. Oil spills

resulting from blow-outs, ruptured pipelines, or tanker accidents, can result in death to sea turtles.

Vessel Activities
Private and commercial vessel operations have the potential to interact with sea turtles resulting in direct injury or death through collision impact (boat strike) or propeller wounds. In addition to commercial traffic and recreational pursuits, private vessels participate in high speed marine events concentrated in the southeastern United States that are a particular threat to sea turtles. The magnitude of these marine events is not currently known.

Federal activities that may affect turtles include military operations and military ordnance detonations. Federal agencies operating in the southeastern United States include the United States Navy (USN) and United States Coast Guard (USCG), which maintain the largest Federal vessel fleets; the Environmental Protection Agency, the National Oceanic and Atmospheric Administration (NOAA), and the Army Corps of Engineer (ACOE). NMFS has conducted formal consultations with the USCG, the ACOE, the USN and other Federal agencies on their vessel operations. Through the ESA Section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. However, the operation of any vessel in the action area represents a potential for some level of interaction.

Other Military Activities that may adversely Affect Sea Turtles
Past and ongoing USN aerial bombing training in the ocean off the southeast United States coast, involving drops of live ordnance (500 and 1,000 lb. bombs) is estimated to have the potential to annually injure or kill sea turtles (NMFS 1997a). In addition to the threat of injury or death to sea turtles, underwater explosions may destroy or damage habitat. Similarly, the Minerals Management Service (MMS) (although non-military) activities may also adversely affect sea turtles. MMS activities include oil and gas exploration, development, production, abandonment, and removal activities. These activities are anticipated to result in the annual incidental take (by injury or mortality) of sea turtles.

Navigation Channel Construction and Maintenance
The construction and maintenance of Federal navigation channels has also been identified as a source of turtle mortality. Hopper dredges, which are frequently used in ocean bar channels and sometimes in harbor channels and offshore borrow areas, move relatively rapidly (compared to sea turtle swimming speeds) and can entrain and kill sea turtles, presumably as the drag arm of the moving dredge overtakes the slower moving turtle.

Power Plant Entrapment/Entrainment
Researchers have recorded accounts of green, hawksbill, loggerhead, and Kemp's ridley sea turtles entrained in the intake canals to the cooling systems of power plants (TEWG 2000). The cumulative effect of mortality due to entrainment is not known. In an effort to minimize the number of sea turtles caught in the canals, some power plants have put screens over the mouths of the intake areas. Often turtles pass unharmed through the intake pipes and into a holding pond. At the St. Lucie Nuclear Power Plant annual capture rates of loggerheads have exceeded 200 turtles (TEWG 2000).

Fisheries

Commercial and recreational fisheries, including fisheries deploying gillnets, longlines, trawl gear, pots, pound nets and dredges, are known to capture and kill sea turtles and represent the largest known threat to turtles in the marine environment. Many fisheries in the affected area are managed under Federal Fisheries Management Plans (FMPs), others operate under state jurisdiction, and some are unmanaged. Fishery mortality accounts for the largest known proportion of annual human-caused mortality of sea turtles outside the nesting beaches.

Federal Fisheries: A number of Federally managed fisheries occur in the U.S. Atlantic Ocean and Gulf of Mexico and turtles could potentially migrate into areas where these fisheries occur. These include the Northeast Multispecies sink gillnet fishery (NMFS 1997c), the American Lobster pot fishery (NMFS 2002b), the Red Crab fishery (NMFS 2002c), the Monkfish Fishery (NMFS 2003c), the Atlantic Highly Migratory Species (HMS) and associated fisheries (NMFS 2004; NMFS 2003a), the Summer Flounder, Scup and Black Sea Bass fisheries (NMFS 2001b), the Atlantic Mackerel/Squid/Butterfish fishery, the Atlantic Bluefish fishery, the Spiny Dogfish fishery, the Scallop Fishery (NMFS 2008b), the Southeast United States Shrimp Fishery (NMFS 2002a), the Tilefish Fishery, the Atlantic Herring Fishery, the Horseshoe Crab Fishery, and the Skate Fishery. Some of these fisheries annually take small numbers of turtles, others take substantial numbers reaching into the thousands (e.g., shrimp fishery and longline fisheries). These fisheries incidentally capture sea turtles during the course of the fishing activities. Each fishery adversely affects the sea turtle species taken. The exact nature and extent of the effects varies from fishery to fishery. For example, the longline gear used in the HMS fishery is known to capture animals through entanglement in line or direct hooking of animals, sometimes resulting in severe injury or death due to forced submergence or the effects of the hooking. The lines of the pot gear (e.g., lobster pot fishery) are known to entangle sea turtles, which can result in severe injury (e.g., flipper loss) or death (forced submergence). Trawl gear (e.g., the shrimp fishery) is known to catch thousands of turtles, resulting in stress and possible death (those animals that are unable to escape through the turtle excluders and are forcibly submerged). For more detailed information on these fisheries, please refer to the referenced biological opinions.

Table 5. The anticipated Incidental Take of loggerhead, leatherback, Kemp's ridley and green sea turtles as currently determined in the most recent Biological Opinion's for NOAA Fisheries implementation of the Bluefish, Herring, Multispecies, Mackerel/Squid/Butterfish, Red Crab, Monkfish, Skate, Spiny Dogfish, Summer Flounder/Scup/Black Sea Bass, Tilefish, and Highly Migratory Species fishery management plans as well as for the American Lobster fishery operating in Federal waters, and hopper dredging projects of the ACOE and USN operating off of Virginia. Takes are represented as anticipated annual take unless otherwise noted.

FISHERY	SEA TURTLE SPECIES			
	LOGGERHEAD	LEATHERBACK	KEMP'S RIDLEY	GREEN
BLUEFISH	6-NO MORE THAN 3 LETHAL	NONE	6 LETHAL OR NON-LETHAL	NONE
HERRING	6-NO MORE THAN 3 LETHAL	1 LETHAL OR NON-LETHAL	1 LETHAL OR NON-LETHAL	1 LETHAL OR NON-LETHAL
HMS	1869 FOR 2004-2006 AND 1905 FOR EACH SUBSEQUENT 3-YEAR PERIOD	1981 FOR 2004-2006 AND 1764 FOR EACH SUBSEQUENT 3-YEAR PERIOD	105 TOTAL FOR EACH 3-YEAR PERIOD BEGINNING 2004-2006 (KEMP'S RIDLEYS, GREEN, OLIVE RIDLEY OR HAWKSBILL IN COMBINATION)	
LOBSTER	2 LETHAL OR NON-LETHAL	4 LETHAL OR NON-LETHAL	NONE	NONE
MACKEREL/SQUID/ BUTTERFISH	6-NO MORE THAN 3 LETHAL	1 LETHAL OR NON-LETHAL	2 LETHAL OR NON-LETHAL	2 LETHAL OR NON-LETHAL
MONKFISH (GILLNET)	3	1 LEATHERBACK, KEMP'S RIDLEY OR GREEN		
MONKFISH (TRAWL)	1 LOGGERHEAD, LEATHERBACK, KEMP'S RIDLEY OR GREEN			
MULTISPECIES	1 LETHAL OR NON-LETHAL	1 LETHAL OR NON-LETHAL	1 LETHAL OR NON-LETHAL	1 LETHAL OR NON-LETHAL
RED CRAB	1 LETHAL OR NON-LETHAL	1 LETHAL OR NON-LETHAL	NONE	NONE
SKATE	1 (EITHER A LOGGERHEAD, LEATHERBACK, KEMP'S RIDLEY OR GREEN) - LETHAL OR NON-LETHAL			
SPINY DOGFISH	3-NO MORE THAN 2 LETHAL	1 LETHAL OR NON-LETHAL	1 LETHAL OR NON-LETHAL	1 LETHAL OR NON-LETHAL
SUMMER FLOUNDER/SCUP/ BLACK SEA BASS	19-NO MORE THAN 5 LETHAL (TOTAL - EITHER LOGGERHEADS OR KEMP'S RIDLEY)	NONE	SEE LOGGERHEAD ENTRY	2 LETHAL OR NON-LETHAL
TILEFISH	6-NO MORE THAN 3 LETHAL OR HAVING INGESTED THE HOOK	1 LETHAL OR NON-LETHAL TAKE (INCLUDES HAVING INGESTED THE HOOK)	NONE	NONE
(ACOE) SANDBRIDGE PROTECTION PROJECT	5	NONE	1 KEMP'S RIDLEY OR GREEN	
(USN) DAM NECK NOURISHMENT PROJECT	4 PER DREDGE CYCLE	NONE	1 KEMP'S RIDLEY OR GREEN PER DREDGE CYCLE	

Shrimp trawling in the southeastern United States is authorized to incidentally take up to 18,757 green, 163,160 loggerhead, 155,503 Kemp's ridley, and 3,090 leatherback sea turtles annually. Up to 515 green, 3,948 loggerhead, 4,208 Kemp's ridley, 640 hawksbill, and 80 leatherback sea turtles are expected to die as a result of interactions with the shrimp fishery (NMFS 2002a).

The scallop fishery also takes a substantial number of sea turtles. Based on data from observer reports for the scallop fishery, and the distribution and abundance of turtles in the action area, NMFS anticipates that the continued implementation of the Scallop FMP may result in the taking of sea turtles as follows:

-for scallop *dredge* gear, NMFS anticipates the biennial take of up to 929 loggerheads of which up to 595 will be lethal takes (includes serious injuries), as well as the annual take of 1 leatherback sea turtle (non-lethal), 2 Kemp's ridley sea turtles (lethal or non-lethal), and 2 green sea turtles (lethal or non-lethal); and,

-for scallop *trawl* gear, NMFS anticipates the annual take of up to 154 loggerhead sea turtles of which up to 20 will be lethal takes, as well as 1 leatherback, 1 Kemp's ridley, and 1 green sea turtle, all of which may be lethal or non-lethal takes.

The number of loggerhead sea turtles expected to be killed or suffer serious injuries as a result of interactions with scallop dredge gear is based on data collected in the 2003 fishing year, prior to the use of chain mats. Therefore, while the estimated 595 loggerhead takes, biennially, resulting in immediate death or serious injury is based on the best currently available information, it is also likely a worst case scenario.

State Managed Fisheries: The level of take in fisheries that operate strictly in state waters is largely unknown. Depending on the fishery in question, many state permit holders also hold Federal licenses; therefore, Section 7 consultations on Federal action in those fisheries address some state-water activities. NMFS is also actively participating in a cooperative effort with Atlantic States Marine Fisheries Commission (ASMFC) to standardize and/or implement programs to collect information on level of effort and bycatch in state fisheries. When this information becomes available, it can be used to refine take reduction plan measures in state waters. However, the state managed fisheries for which there is some reason for concern include the fisheries targeting weakfish, horseshoe crabs, whelk, shad, blue crab, stone crab, lobster (e.g., pots), and flounder (e.g., pound nets).

International Fisheries: In addition to domestic fisheries, sea turtles are subject to incidental capture in numerous foreign fisheries. Although international fisheries do not occur within the action area, it is important to recognize the existence of fisheries outside U.S. waters due to the highly migratory nature of sea turtles. It is hard to fully evaluate the exact effects of international fisheries on sea turtles, however they are substantial.

Sea Turtle Conservation and Recovery Activities

A number of activities are in progress that may ameliorate some of the threat that various activities pose to threatened and endangered sea turtles including the Sea Turtle Stranding and Salvage Network (STSSN), implementation of Federal regulations aimed at reducing the potential for incidental mortality of sea turtles in commercial fisheries (e.g., turtle excluder devices), and fishing gear bycatch reduction research. NMFS is also working closely with the USFWS to develop revised recovery plans designed to help guide recovery management of sea turtle species.

Activities Contributing to Gulf Sturgeons' Current Condition

The wide variety of activities that may affect Gulf sturgeon are documented in the recovery plan and other sources (see http://www.nmfs.noaa.gov/pr). The following provides a brief summary of the past and present activities affecting this species.

In the late 19th and early 20th century, the Gulf sturgeon supported an important commercial fishery, providing eggs for caviar, flesh for smoked fish, and swim bladders for isinglass (Carr 1983). Gulf sturgeon numbers declined due to over fishing during most of the 20th century. The decline was exacerbated with the construction of water control structures (e.g., dams and sills) that obstructed sturgeon access to historic migration routes and spawning areas (Boschung 1976, Wooley and Crateau 1985, McDowell 1988). While recreational and subsistence fisheries may have contributed to population declines; this threat was eliminated in 1984 when the state of Florida enacted protective measures and in 1991 when the species was listed under the ESA. Incidental take in fisheries and habitat loss have been identified as the major current threats to the recovery of Gulf sturgeon. Incidental catch of Gulf sturgeon in both federally- and state-regulated fisheries has been documented. For example, there have been incidental captures of Gulf sturgeon in the shrimp and gillnet fisheries in Apalachicola Bay (Swift et al. 1977, Wooley and Crateau 1985).

The operation of hydropower plants is a Federal action by FERC that has impacts on Gulf sturgeon. Sturgeon migrating up or down rivers and entering coastal and inshore areas can be affected by entrainment in the cooling-water systems; larvae may be adversely affected by heated water discharges. Dredging and dredged material disposal, and military activities including training exercises and ordnance detonation, have the potential to impact both the species and designated critical habitat.

Federally-regulated stormwater and industrial discharges, and chemically treated discharges from sewage treatment systems, may impact Gulf sturgeon critical habitat. NMFS and FWS consult with EPA to minimize the effects of these activities on both listed species and designated critical habitat. In addition, construction activities, such as beach restoration, have the potential to impact Gulf sturgeon critical habitat.

A number of state controlled activities that may indirectly affect Gulf sturgeon and its critical habitat include discharges from wastewater systems, dredging, ocean dumping and disposal, and aquaculture. The impacts from these activities are difficult to measure.

Increasing coastal development and ongoing beach erosion result in demands by coastal communities, especially beach resort towns, for periodic privately-funded or federally-sponsored beach renourishment projects. These activities may affect Gulf sturgeon and its critical habitat by burying macroinvertebrates that occur in nearshore habitats that serve as foraging areas, in addition to the potential direct effect to the species by entrainment in dredge suction dragheads at the sand mining sites.

Recent droughts in the Apalachicola River basin have aggravated the loss of cool-water refugia; and spring-water intrusion into the Suwannee River during drought conditions changes ionic conductivity and water temperature unfavorably for embryonic development and larval success (Sulak and Clugston 1999).

Sturgeon Conservation and Recovery Actions
Commercial harvesting of Gulf sturgeon has been banned. State actions eliminating or limiting gillnetting also benefit the Gulf sturgeon.

Federal Essential Fish Habitat consultation requirements pursuant to the Magnuson-Stevens Fishery Management and Conservation Act also minimize and mitigate for losses of wetlands, and preserve valuable foraging and developmental habitat for Gulf sturgeon.

In 2003, NMFS, along with USFWS, designated Gulf sturgeon critical habitat. Utilizing section 7 of the ESA**,** NOAA Fisheries consults with Federal Agencies on actions that may affect Gulf sturgeon or its designated critical habitat.

NMFS continues to fund a number of research projects to increase existing knowledge of how the Gulf sturgeon utilizes habitat. NMFS continues to relocate tagged fishes during the winter months along the coastal Gulf shores and recently initiated a study that will examine habitat utilization as the Gulf sturgeon enters the estuarine environment following months of fasting:

Effects of the Action
The following sections will assess the types of effects that are expected from the proposed action, the extent of those effects, and the overall impact of those effects on sea turtle populations.

Standards Used in Effects Analysis
The analyses in this Opinion are based on an implicit understanding that the listed species considered in this Opinion are threatened or endangered with local or global extinction by a wide array of human activities and natural phenomena. We have outlined many of those activities in the *Status of the Species and the Environmental Baseline* section of this Opinion. NMFS also recognizes that some of these other human activities and natural phenomena pose serious threats to the survival of these listed species (and other flora and fauna). Further, NMFS recognizes that turtle species will not recover without addressing the full range of human activities and natural phenomena affecting them. As an example, for turtles, these include patterns of beach erosion, predation on turtle eggs, and turtle captures, injuries, and deaths in domestic and international fisheries and other State, federal, and private activities that could cause these animals to become extinct in the foreseeable future (USFWS and NMFS 1995).

The sea turtles discussed in this opinion are listed worldwide. However, given the vulnerability of Pacific populations the loss of sea turtle populations in the Atlantic basin would result in a significant gap in the distribution of each turtle species, which makes these populations biologically significant and would dramatically reduce the distribution and abundance of these species. This by itself would appreciably reduce the entire species' likelihood of surviving and recovering in the wild.

Conservative Decisions- Providing the Benefit of the Doubt to the Species
The analysis in this section is based upon the best available commercial and scientific data on sea turtle biology and the effects of the proposed action. However, there are instances where there is limited information upon which to make a determination. In those cases, 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)], we will generally make determinations which provide the most conservative outcome for listed species.

Sea Turtles

Effects of Capture
Any capture of a turtle by netting methods could result in stresses due to interaction with the gear, and drowning could potentially occur as a result of forced submergence. The mitigation measures that would be incorporated into research permits for capture techniques should minimize the more serious effects of netting turtles and subjecting them to a continued submerged state. Researchers would be required to monitor all capture techniques and activities.

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 at capture elevated up to 6-fold above those measured 6 to 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 from trawl capture of sea turtles. Although it appears that entanglement netting 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). Animals captured during the proposed research analyzed in this analysis would typically be removed immediately from the nets, and any blood acidosis could be ameliorated by animal hyperventilation after removal from the net. Hoopes et al. (2000) conclude that entanglement netting is an appropriate "low-stress" method for researchers working on turtles in shallow, coastal areas. Capturing sea turtles in nets is stressful to the turtle, however this stress does not appear to be life threatening. Since animals would be removed from the net and water sooner than if they were captured in an entanglement net, strike net capture would result in equivalent or less stress to the animals as entanglement netting. Although netting activities cause temporary physiological stress to turtles, NMFS believes the long-term benefits the research may provide to species survival justify the methodology.

Effects of Handling, Standard Morphometrics (Weighing and Measuring), and Photography
NMFS does not expect that individual turtles would experience more than short-term stresses during the handling, measuring, weighing, or photography process. No injury would be expected from these activities. Turtles would be worked up as quickly as possible to minimize stresses resulting from their capture. During the > 15 years that the NMFS Southeast Fisheries Science Center has been conducting sea turtle research, they have had no injuries or mortalities to turtles as a result of the handling. NMFS has authorized handling, measuring, photography for dozens of research projects off the Atlantic U.S. coast with no reported harm or injury to sea turtles.

Researchers have taken measurements on thousands of turtles with no apparent ill effects. The applicant would also be required to follow procedures designed to minimize the risk of either introducing a new pathogen into a population or amplifying the rate of transmission from animal to animal of an endemic pathogen when handling animals.

Flipper Tagging and Injection of PIT Tags

These tagging activities are minimally invasive. All tag types have negatives associated with them, especially concerning tag retention. Plastic tags can become brittle, break, and fall off underwater, and titanium tags can bend during implantation and thus not close properly, leading to tag loss; tag malfunction can result from rusted or clogged applicators or applicators that are worn from heavy use (Balazs 1999). Turtles whose tags have failed are re-tagged if captured again at a later date, which subjects them to additional effects of tagging. 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). Turtles may experience some discomfort during the application of external and/or internal tagging procedures, and these procedures would likely produce some level of pain. The discomfort appears highly variable between individuals (Balazs 1999). Most seem to barely notice, while whereas some exhibit a marked response. NMFS expects the stresses to be minimal and short-term, and that the small wound -site resulting from a tag applied to the flipper would heal completely in a short period of time. NMFS does not expect that individual turtles would experience more than short-term stresses during the application of the PIT tags. These tags have been used for cattle and pets for years without any adverse effects. The proposed tagging methods have been regularly employed in sea turtle research with little lasting impact on the individuals tagged and handled (Balazs 1999). No problems with tagging have been reported by any of the NMFS permit holders. The NMFS Southeast Fisheries Science Center Galveston Laboratory has flipper-tagged and PIT- tagged up to 56 loggerheads per year from since 1999 to present holding the animals for approximately 3 years after tagging. Turtles were held in a laboratory setting, remained healthy, did fine, and were later released. This suggests that if a turtle is tagged using proper techniques and protocol and released back into a suitable environment, the chances for problems associated with the tagging are negligible (NMFS SEFSC, pers. comm. 2007). Additionally, in the 17 years that the NMFS Southeast Fisheries Science Center has used Inconel (metal) in flipper- tagging turtles, all turtles exhibited normal behavior shortly after being tagged and swam normally once released. Of the close to 1,000 tag recaptures encountered by the NMFS Southeast Fisheries Science Center Beaufort Laboratory, no turtles show any adverse effects of being tagged in this manner (NMFS 2006). In the 9 years that the NMFS Southeast Fisheries Science Center has been PIT- tagging turtles, turtle discomfort was observed to be temporary, as the turtles exhibit normal behavior shortly after tagging and swim normally after release. Of the close to 1,000 tag recaptures that the NMFS Beaufort Laboratory has encountered, none show any adverse effects of being tagged in this manner (NMFS 2006). The applicant would be required to follow procedures designed to minimize the risk of either introducing a new pathogen into a population or amplifying the rate of transmission from animal to animal of an endemic pathogen when handling animals.

Tissue Sampling

It is not expected that individual turtles will experience more than short-term stresses during tissue sampling. Researchers who examined turtles caught two 2 to three 3 weeks after sample

collection noted the sample collection site was almost completely healed (Witzell, pers. comm. and Braun-McNeill, pers. comm. in NMFS, 2006). During the more than 5 years of tissue biopsying using sterile techniques, NMFS Southeast Fisheries Science Center researchers have encountered no infections or mortality resulting from this procedure (NMFS 2006). The permit would contain conditions to mitigate adverse impacts to turtles. The applicants would be required to follow procedures designed to minimize the risk of either introducing a new pathogen into a population or amplifying the rate of transmission from animal to animal of an endemic pathogen when during handling and sampling animals.

NMFS expects that the collection of a tissue sample would cause minimal additional stress or discomfort to the turtle beyond that experienced during capture, collection of measurements, tagging, etc.

Transmitters
Transmitters attachments, as well as biofouling that can occur on them, increase hydrodynamic drag and can affect lift and pitch. For example, Watson and Granger (1998) performed wind tunnel tests on a full-scale juvenile green turtle and found that at small flow angles representative of straight-line swimming, a transmitter mounted on the carapace increased drag by 27-30%, reduced lift by less than 10% and increased pitch moment by 11-42%. However, based on the study results of hardshell sea turtles equipped with this and other tag setups NMFS is unaware of transmitters resulting in any serious injury to sea turtle species. Attachment of satellite, sonic, or radio transmitters with epoxy is a commonly used and permitted technique by NMFS. Transmitters attached directly to the scutes are unlikely to become entangled and would eventually be shed, posing no long-term risks to the turtle.

Sonic Tag Tracking
Tracking would be conducted from a distance that the sea turtle would not detect the presence of the researchers. Tracking would not affect sea turtle behavior or harm them in any manner.

Acoustic Energy
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 1000 Hz. Ridgeway et al. (1969) found the maximum sensitivity of the green sea turtle hearing range to fall within 300-500 Hz with a sharp decline at 750 Hz. Since the frequencies that would be authorized would be well above this hearing threshold they would not be heard by the turtles.

Studies found that shark hearing is not as sensitive as in other tested fishes and that sharks are most sensitive to low frequency sounds (Kritzler and Wood 1961; Banner 1967; Casper et al., 2003). No increased predatory risks for sea turtles would be expected, as sharks would not be expected to hear the sonic tag and would not be attracted to sea turtles.

In summary, NMFS believes that unintentional mortality or serious injury would not be likely to occur as a result of the proposed action. Any effects of the proposed research activities are not expected to adversely affect the survival, longevity, or lifetime reproductive success of any age class of species. Therefore, NMFS does not expect that the proposed individual activities would

adversely affect any species at the population or species levels or have significant effects on them.

Gulf Sturgeon

The use of tangle nets to capture sea turtles could result in the incidental capture of Gulf sturgeon. This species could become entangled in the net while the researcher is sampling for sea turtles. In the event this species is captured, NMFS believes that a Gulf Sturgeon could survive capture in the net and could be returned to the water unharmed. Animals would be promptly removed from the nets. Measuring, weighing, photographing, and scanning for PIT tags before release could result in some minor additional stress, but would be incrementally insignificant to what the animal had already experienced, and those responses are not likely to result in pathologies because of the short duration of the handling. Safe handling conditions would be included as part of the permit and no mortalities are expected as a result of the proposed action. It is highly unlikely that the research would have more than a negligible effect on this species. Sturgeon may 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 bird attacks. The permit would contain conditions to require researchers to address buoyancy (e.g., by "burping" the animal) during release (please refer to mitigation section).

Fish have low-frequency hearing sensitivity and are potentially affected by sound energy in the band below 1,000 Hz (Southall, pers. comm. 2004). Since the frequencies that would be authorized for sonic tags attached to sea turtles would be well above this hearing threshold the sonic tags would not be heard by Gulf sturgeon.

The research would occur in Gulf sturgeon critical habitat. Critical habitat Primary Constituent Elements (PCEs) of concern in the proposed action area include water quality, migratory pathways, sediment quality, and abundance of prey items. Research would be limited to activities that minimally impact the habitat (e.g., entanglement nets that have minimal bottom drag).

(1) Water Quality – Impacts on water quality resulting from research were considered. Impacts from sediment disturbance as a result of the proposed action (e.g., placement of nets and anchors) are expected to be minimal and temporary, with suspended particles settling out within a short time frame. These sediment disturbance impacts would be minimal in nature and would not have a measurable effect on water quality. No changes in salinity or tidal amplitude would be expected. NMFS would not expect measurable impacts to Gulf sturgeon critical habitat as a result of water quality impacts related to the authorization of the research permit.

(2) Sediment Quality – This analysis considered whether the proposed research would alter sediment quality within the designated critical habitat such that it is appreciably impaired for normal Gulf sturgeon behavior, reproduction, growth, or viability. No dredged material disposal, channelization, impoundment, in-stream mining, or activities that cause excessive sedimentation would occur during research. While the net anchors and portions of nets would touch the bottom substrate, they are unlikely to resuspend significant quantities of contaminants that may be present in the benthos. No sediment would be removed or destroyed.

(3) Migratory Pathways –This analysis examined the potential for research to obstruct migratory pathways between adjacent riverine, estuarine, and marine critical habitat units. A tangle net presents a small barrier when in place (this is a small amount of barrier relative to the size of the area available for the sturgeon), are checked a minimum of every 20 minutes when in use (or immediately if something is caught), and are not a permanent structures. NMFS does not believe that the proposed research would affect the ability of the critical habitat to provide a migratory pathway for Gulf sturgeon.

(4) Abundance of Prey – NMFS examined if whether research activities would appreciably reduce the abundance of riverine prey for larval and juvenile sturgeon, or of estuarine and marine prey for juvenile and adult Gulf sturgeon within the designated critical habitat unit. NMFS examined whether foraging method, prey items, or benthic community structure would be affected by the proposed action. Research activities would have minimal interaction with the bottom habitat and its associated prey organisms in the estuarine and marine habitat. None of the experimental activities would occur in riverine habitat.

NMFS concludes that water quality, migratory pathways, sediment quality, and the abundance of Gulf sturgeon prey would not be impacted, by the proposed research activities.

Population Response to Effects of the Proposed Action

Actions that result in mortality affect listed species through the impact of the loss of individual animals and also through the loss of the reproductive potential of each animal to its respective population. Similarly, serious injuries to listed species due to an action that result in an animal's inability to reproduce affects a listed species due to the loss of that animal's reproductive potential. These effects have the potential to reduce the likelihood of survival and recovery of species.

Mortality and serious injury are not expected under research Permit No. 10022-01. The effects of the proposed research activities discussed above (and for which we have experience from other existing permits) have been determined to have the potential to elicit short-term changes in sea turtle behavior and Gulf sturgeon, but are not likely to result in long-term effects on individuals or populations. Therefore, NMFS does not expect the research procedures that would be authorized under the proposed action to result in more than short-term effects on individual animals due to the conditions concerning research procedures and placed on the applicant. In addition, NMFS does not expect any delayed mortality of turtles following their release based on past research efforts by other researchers and adherence to certain protocols identified in the proposed action. Similarly, NMFS does not expect any delayed mortality of sturgeon following their release based on adherence to certain protocols identified in the proposed action. The data generated by the applicants over the duration of these studies will provide beneficial information that will be important to the management and recovery of threatened and endangered species. The information collected as a direct result of permit issuance will be available to implement the goals identified in Recovery Plans. Based on the above, NMFS believes it is reasonable to assume that issuance of the proposed permit will have beneficial effects for sea turtles and indirectly to Gulf sturgeon. Issuance of this permit is not likely to appreciably reduce the numbers, distribution, or reproduction of the loggerhead sea

turtle, Kemp's ridley sea turtle, hawksbill sea turtle, green sea turtle, and Gulf sturgeon in the wild that would appreciably reduce the likelihood of survival and recovery of these species.

Cumulative Effects

Cumulative Effects include the effects of future State, Tribal, local, or private actions that are reasonably expected to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The actions and their effects described as occurring within the action area (in the *Environmental Baseline* above) are expected to occur in the future. NMFS is unaware of any proposed or anticipated changes in these actions that would substantially change the impacts that each of them has on the sea turtles covered by this Opinion. Thus, the presently occurring activities in the action area are expected to continue at the present levels of intensity in the near future.

Integration and Synthesis of Effects

This section provides an integration and synthesis of the information presented in the Status of the Species, Environmental Baseline, Cumulative Effects, and Effects of the Action sections of this Opinion. The intent of the following discussion is to provide a basis for determining the additive effects of the take authorized in the permit on loggerhead, green, hawksbill, Kemp's ridley sea turtles, and Gulf sturgeon, in light of their present and anticipated future status.

The Status of the Species and Environmental Baseline discussion describes how listed sea turtles and Gulf sturgeon have been adversely affected by human-induced factors such as commercial fisheries, direct harvest, and modification or degradation of habitat. Effects occurring in terrestrial habitats for turtles have generally resulted in the loss of eggs or hatchling turtles, or nesting females, while those occurring in aquatic habitat have caused the mortality of juvenile, subadult and adult sea turtles or sturgeon (e.g., through entanglement or capture in fishing gear, ingestion of debris or pollution). Similarly, the actions discussed in the baseline, as well as those considered under Cumulative Effects all pose the potential to result in take of sea turtles and Gulf sturgeon resulting in stress or possible mortality.

While the loss of all these turtles and Gulf sturgeon has likely adversely affected the ability of all sea turtle and Gulf sturgeon populations considered in this Opinion to maintain or increase their numbers by limiting the number of individuals in these populations, the loss of reproductive adults results in reductions in future reproductive output.

Species with delayed maturity such as sea turtles and Gulf sturgeon are demographically vulnerable to increases in mortality, particularly of juveniles, subadults, or adults, those stages with higher reproductive value. As discussed in the Status of the Species, the age of sexual maturity of most species of sea turtles is currently unknown, although the sexual maturity of loggerhead turtles may be as high as 35 years, and green turtles may not reach maturity until as late as 50 years. Mature active Gulf sturgeon females range in age (as determined from fin rays) from 8-17 years. The potential for an egg to develop into a juvenile, and finally into a sexually mature adult varies among species, populations, and the degree of threats faced during each life stage. However, the journey from egg to adult is an arduous one.

Each juvenile turtle or Gulf sturgeon that does not survive to produce will be unable to contribute to the maintenance or improvement of the species' status. Reproducing females that are prematurely killed due the threats mentioned in the above sections, while possibly having contributing something before being removed from the population, will not be allowed to realize their reproductive potential. Similarly, reproductive males prematurely removed from the population will be unable to make their reproductive contribution to the species' population.

Fortunately, as described in the Effects of the Action section of this Opinion, the research activities are not expected to result in mortality or injury to any of the sea turtles or Gulf sturgeon. The additional activities will only result in temporary stress to live animals and are not expected to have more than short-term effects on individual threatened or endangered animals. The research activities of this permit will not affect the turtles' or Gulf sturgeon's ability to reproduce and contribute to the maintenance or recovery of the species. Effects are expected to be short-term since the take is non-lethal and previous experience with the type of proposed research activities has demonstrated that it is reasonable to expect that effects will be minimal. This research will affect the turtles and Gulf sturgeon by harassing individual animals during the research thus raising levels of stressor hormones, and the animals may experience some discomfort during research activity procedures. Based on past observations of similar research, these effects are expected to dissipate rapidly (e.g., within approximately a day or two for sea turtles).

Based on prior information and experience, and conditions placed on the Permit Holder, NMFS does not expect the applicant's proposal to conduct the research as described above to result in more than short-term effects on the individual populations of sea turtles or Gulf sturgeon.

NMFS does not expect the proposed research activities to appreciably reduce the green, loggerhead, hawksbill, Kemp's ridley sea turtles', or the Gulf sturgeon's likelihood of survival and recovery in the wild by adversely affecting their birth rates, death rates, or recruitment rates. In particular, NMFS does not expect the proposed research permit to affect adult, female animals in a way that appreciably reduces the number of animals born in a particular year; the reproductive success of adults; the survival of young turtles; or the number of young turtles that annually recruit into the adult, breeding populations of any population of green, loggerhead, hawksbill, or Kemp's ridley sea turtles, or Gulf sturgeon.

The proposed action is not expected to have effects on listed sea turtle or Gulf sturgeon populations. The data generated by the applicant over the duration of this study will provide beneficial information that will be important to the management and recovery of threatened and endangered species. The information collected as a direct result of permit issuance will be used to implement the goals identified in the Recovery Plans for the U.S. Atlantic Populations of sea turtles. As discussed above, NMFS believes it is reasonable to assume that issuance of the proposed permit will have beneficial effects for the Gulf of Mexico/Atlantic Ocean populations of green, loggerhead, hawksbill, and Kemp's ridley sea turtles.

Conclusion

After reviewing the current status of the loggerhead, green, hawksbill, and Kemp's ridley sea turtles, and the Gulf sturgeon, the environmental baseline for the action area, the effects of the take authorized in this permit, and probable cumulative effects, it is NMFS' biological opinion that issuance of the permit will not reduce the likelihood of the survival and recovery of their populations in the wild by reducing their numbers, distribution, or reproduction, and therefore is not likely to jeopardize the continued existence of these species and is not likely to destroy or adversely modify designated critical habitat.

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 attempt to engage in any such conduct. 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 section 7(b)(4) and section 7(o)(2), taking that is incidental to 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 reasonable and prudent measures and terms and conditions of this Incidental Take Statement.

Section 7 of the ESA requires that when an agency action is found to comply with section 7(a)(2) of the ESA and the proposed action may incidentally take individuals of listed species, NMFS will issue a statement specifying the impact of any incidental taking. It also states that reasonable and prudent measures necessary to minimize impacts, and terms and conditions to implement those measures must be provided and must be followed to minimize those impacts. Only incidental taking by the federal agency or applicant that complies with the specified terms and conditions is authorized.

Extent of Take

After discussions with the sturgeon expert and lead for this species in the NMFS SER 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, NMFS anticipates the **non-lethal incidental take of 10 Gulf sturgeon annually** by researchers while they are using nets to capture sea turtles. This take is not expected to result in mortality and the animals will be released alive. In the accompanying Opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the Gulf sturgeon.

Reasonable and Prudent Measures

NMFS believes the following reasonable and prudent measures, as implemented by the terms and conditons, are necessary and appropriate to minimize impacts to Gulf sturgeon and monitor levels of incidental take. The measures described below are non-discretionary and must be undertaken in order for the exemption in section 7(o)(2) to apply.

1. The proposed activities will incorporate procedures to observe for takes of Gulf sturgeon during the course of the research.

2. The proposed action (and activities authorized under it) will include guidelines to ensure that Gulf sturgeon are safely handled and released.
3. All Gulf sturgeon interactions shall be reported to and evaluated by NMFS.

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 and outline required reporting and monitoring requirements. 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 protocol.
(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) NMFS shall require the permit holder to submit a yearly report to the NMFS' Office of Protected Resources, Silver Spring, MD, to report the information pertaining to (2).

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. No additional Conservation Recommendations have been placed on this permit.

Reinitiation of Consultation
This concludes formal consultation on the proposed issuance of an ESA section 10 permit to Dr. Carthy (Permit No. 10022-01). 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 take, specified in the permit as limited by relevant fishery incidental take statements and incidental take permits, is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; (4) a new species is listed or critical habitat designated that may be affected by the identified action.

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