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

Agency: Permits and Conservation Division of the Office of Protected Resources, National Marine Fisheries Service

Proposed Action: Proposal to issue permit No. 18069 to Jeffrey Schmid and permit modification No. 14726-02 to Blair Witherington to conduct sea turtle research activities in the Gulf of Mexico and Atlantic waters off Florida, pursuant to Section 10(a)(1)(A) of the Endangered Species Act of 1973

Prepared by: Endangered Species Act, Interagency Cooperation Division
Office of Protected Resources, National Marine Fisheries Service

Approved by: Donna S. Wieting
Director, Office of Protected Resources

Date: JUN 06 2014

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA) (16 U.S.C. 1536(a)(2)) requires that each federal agency shall ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When the action of a federal agency "may affect" a listed species or critical habitat designated for them, that agency is required to consult with either National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service, depending upon the listed resources that may be affected. For the action described in this document, the action agency is the NMFS Office of Protected Resources, Permits and Conservation Division (Permits Division). The consulting agency is the NMFS Office of Protected Resources' ESA Interagency Cooperation Division.

This document provides NMFS' biological opinion (Opinion) of the effects of the proposed research permit and permit modification on endangered green (both the Florida breeding population and range-wide listing), Kemp's ridley, hawksbill, leatherback, and threatened loggerhead sea turtles (Northwest Atlantic Ocean DPS) in coastal waters of the Gulf of Mexico and Florida, and has been prepared in accordance with Section 7 of the ESA. This Opinion is based on our review of the Permits Division's draft Environmental Assessments, draft permit 18069 and modification 14726-01, the permit applications from Drs. Schmid and Witherington, annual reports of similar past research, recovery plans for listed species, scientific and technical reports from government agencies, peer-reviewed literature, biological opinions on similar research, and other sources of information.

BIOLOGICAL OPINION

Consultation History

NMFS' Permits Division requested consultation with NMFS' ESA Interagency Cooperation Division on the proposal to issue a scientific research permit and a permit modification authorizing studies on green (both the Florida breeding population and rangewide listing), Kemp's ridley, hawksbill, leatherback, and loggerhead (Northwest Atlantic Ocean DPS) sea turtles. Issuance of the permits constitutes a federal action, which may affect marine species listed under the ESA.

On October 24, 2013, the Permits Division requested initiation of Section 7 consultation to issue new permit 18069 to Dr. J. Schmid (Conservancy of Southwest Florida), and a permit modification 14726-02 to Dr. B. Wirtherington (Florida Fish and Wildlife Conservation Commission). The ESA Interagency Cooperation Division formally initiated consultation with the Permits Division on November 1, 2013.

The ESA Interagency Cooperation Division previously concluded consultations on the original permit issued to Dr. Wirtherington (permit 14726) on August 30, 2010, and the first permit modification to the original permit (14726-01) on April 7, 2011. Both consultations concluded that the activities authorized by the proposed issuance of the scientific research permit were not likely to jeopardize the continued existence of listed sea turtle species nor likely to destroy or adversely modify critical habitat designed for those sea turtles species.

Description of the Proposed Action

NMFS' Permits Division proposes to issue a scientific research permit, and a permit modification, pursuant to section 10(a)(1)(A) of the ESA.

Issuance of permit 18069 to Dr. Jeffrey Schmid, of the Conservancy of Southwest Florida, authorizes research to determine the species composition, relative abundance, size-class distribution, genetic structure, trophic status, health, seasonality, habitat use, and migrations of marine turtles inhabiting the coastal waters of Charlotte Harbor and the Ten Thousand Islands in southwest Florida.

The research activities as proposed by the applicant include capture; weighing/measure; photograph/video; tissue sampling; blood sampling; scute scrapping; tagging; and fecal sampling. No research-related mortalities are proposed for authorization. *Permit 18069* authorizes the capture of juvenile, subadult and adult green (*Chelonia mydas*), Kemp's ridley (*Lepidochelys kempii),* hawksbill (*Eretmochelys imbricate*), leatherback (*Dermochelys coriacea*), and loggerhead (*Caretta caretta*) sea turtles. The proposed annual number of sea turtles taken during specific research activities are summarized in Table 1. The new permit, if issued, will authorize the proposed research over a five-year period starting from the date of approval.

The objective of the permit modification 14726-02 to Dr. Blair Witherington, of the Florida Fish and Wildlife Conservation Commission (FWC), is to locate and describe areas of the Atlantic Ocean and Gulf of Mexico that serve as developmental habitat for pelagic-stage neonate and

juvenile sea turtles; quantify threats to pelagic sea turtles; and gather information on their life history, genetics, movements, behavior and diet. The permit modification will modify the current permit to authorize the expansion of the action area to the Gulf of Mexico; the method for satellite tag attachments; change the sea turtle species, life stages and number of animals that may be biologically sampled and satellite tagged; and scute and blood sampling; and conduct vessel surveys for counts of leatherback and loggerhead sea turtles. No research-related mortalities are authorized.

Permit 14726-02 authorizes the capture; weighing/measure; photograph/video; flipper and PIT tagging; tissue sampling; blood sampling; scute sampling; satellite tagging; a subset for swabbing prior to lavage; of neonate, juvenile, subadult and adult green (*Chelonia mydas*), Kemp's ridley (*Lepidochelys kempii),* and hawksbill (*Eretmochelys imbricate*), leatherback (*Dermochelys coriacea*), and loggerhead (*Caretta caretta*) sea turtles. The proposed annual take activities is summarized in Table 2.

Table 1. Proposed annual take for permit 18069, capture methods include encircle or strike/tangle net.

No. of Sea Turtles	Species	Life Stage	Takes/ animal	In-water Take Activities	Details
40	Kemp's Ridley	Juvenile/subadult/adult	1	Capture, Measure, Weigh, Photograph/Video, PIT tag, Flipper tag, Blood sample, Scute sample, Tissue sample	
30	Kemp's Ridley	Juvenile/subadult/adult	1	Capture, Measure, Weigh, Photograph/Video, PIT tag, Flipper tag, Blood sample, Scute sample, Tissue sample, Fecal sample	hold for 24-48hrs fecal sampling
15	Kemp's Ridley	Juvenile/subadult/adult	2	Capture, Measure, Weigh, Photograph/Video, PIT tag, Flipper tag, Blood sample, Scute sample, Tissue sample, Fecal sample, Satellite tag (epoxy attachment), Tracking, Opportunistic recapture for gear removal	Satellite tag
15	Kemp's Ridley	Juvenile/subadult/adult	2	Capture, Measure, Weigh, Photograph/Video, PIT tag, Flipper tag, Blood sample, Scute sample, Tissue sample, Fecal sample, radio and sonic tag (drill carapace attachment), Tracking, Recapture for gear removal	Radio and Sonic tag; hold for 24-48hrs fecal
10	Loggerhead Northwest Atlantic DPS	Juvenile/subadult/adult	1	Capture, Measure, Weigh, Photograph/Video, PIT tag, Flipper tag, Blood sample, Scute sample, Tissue sample	
10	Loggerhead Northwest	Juvenile/subadult/adult	2	Capture, Measure, Weigh, Photograph, PIT tag, Flipper tag, Tissue sample, Satellite tag (epoxy attach); Tracking,	Satellite tag

	Atlantic DPS			Opportunistic recapture for gear removal	
10	Loggerhead Northwest Atlantic DPS	Juvenile/subadult/adult	2	Capture, Measure, Weigh, Photograph/Video, PIT tag, Flipper tag, Blood sample, Scute sample, Tissue sample, Fecal sample, radio and sonic tag (drill carapace attachment), Tracking	Radio and Sonic tag;
20	green (Florida Pop)	Juvenile/subadult/adult	1	Capture, Measure, Weigh, Photograph/Video, PIT tag, Flipper tag, Blood sample, Scute sample, Tissue sample	
20	Hawksbill	Juvenile/subadult/adult	1	Capture, Measure, Weigh, Photograph/Video, PIT tag, Flipper tag, Blood sample, Scute sample, Tissue sample	

Table 2. Proposed annual take for permit modification 14726-02, capture method: dip net.

No. of Sea Turtles	Species	Life Stage	Takes/ animal	In-water Take Activities	Details
140	Loggerhead Northwest Atlantic DPS	Post-hatchlings (4-10 cm SCL)	1	Count/survey; lavage; Measure; Sample, oral swab; Weigh	
10	Loggerhead Northwest Atlantic DPS	Juvenile	1	Count/survey; Instrument, soft attachment of satellite tag; Lavage; flipper tag; PIT tag; Measure; oral swab; Sample, tissue, fecal, scute, and blood; Weigh	Surface-pelagic (10-45 cm SCL)
85	Loggerhead Northwest Atlantic DPS	Juvenile/subadult/adult	2	Count/survey; Lavage; flipper tag; PIT tag; Measure; oral swab; Sample, tissue, fecal, scute, and blood; Weigh	
15	Loggerhead Northwest Atlantic DPS	Juvenile/subadult/adult	2	Count/survey; Instrument, epoxy attachment, satellite tag; Lavage; flipper tag; PIT tag; Measure; oral swab; Sample, tissue, fecal, scute, and blood; Weigh, Opportunistic recapture for gear removal	Satellite tag
30	Kemp's Ridley	Juvenile	1	Count/survey; Lavage; flipper tag; PIT tag; Measure; oral swab; Weigh; Sample, tissue, fecal, scute, and blood	Surface-pelagic (10-45 cm SCL)

20	Kemp's Ridley	Juvenile/subadult/adult	2	Count/survey; Instrument, soft attachment of satellite tag; Lavage; flipper tag; PIT tag; Measure; Sample, tissue, fecal, scute, and blood; oral swab; Weigh, Opportunistic recapture for gear removal	Surface-pelagic (10-45 cm SCL)
60	green (Florida Pop)	Post-hatchlings (4-10 cm SCL)	1	Count/survey; lavage; Measure; Sample, oral swab; Weigh	
20	green (Florida Pop)	Juvenile	1	Count/survey; Lavage; flipper tag; PIT tag; Measure; oral swab; Sample, tissue, fecal, scute, and blood; Weigh	Surface-pelagic (10-45 cm SCL)
20	green (Florida Pop)	Juvenile	1	Count/survey; Instrument, soft attachment of satellite tag; Lavage; Mark, flipper tag; Mark, PIT tag; Measure; Sample, oral swab; Sample, tissue, fecal, scute, and blood; Weigh	Surface-pelagic (10-45 cm SCL)
40	Hawksbill	Juvenile	1	Capture, Measure, Weigh, Photograph/Video, PIT tag, Flipper tag, Blood sample, Scute sample, Tissue sample	Surface-pelagic (10-45 cm SCL)
10	Hawksbill	Juvenile	1	Count/survey; Instrument, soft attachment of satellite tag; Lavage; flipper tag; PIT tag; Measure; oral swab; Sample, tissue, fecal, scute, and blood; Weigh	Surface-pelagic (10-45 cm SCL)
10	Leatherback	Juvenile	1	Count/survey; Lavage; Mark, flipper tag; Mark, PIT tag; Measure; Sample, oral swab; Weigh	Surface-pelagic (10-45 cm SCL)
490	Leatherback	Juvenile/subadult/adult	1	Count/survey	Vessel survey
450	Loggerhead Northwest Atlantic DPS	Juvenile/subadult/adult	1	Count/survey	Vessel survey

Turtle Capture, Experimental Procedures and Minimization of Impacts

The following sections describe how turtles will be captured and handled as well as the experimental procedures that will be carried out under the proposed actions. The descriptions of the methods and procedures are common to both permits except where specified.

This section also notes actions that will be taken to minimize the impact of these activities.

Capture
Turtles will be captured by various methods including: entanglement net capture and dip net capture from a slow moving boat in nearshore and coastal waters, (Seminoff *et al.* 2002, Blumenthal *et al.* 2010). Turtles will be released at or very close to the capture site.

Permit 18069 - In-water surveys will be conducted from a 7-m tunnel hull skiff either one week monthly or biweekly to collect sea turtles foraging in nearshore waters. Turtles will be captured using either method below.

Entanglement Net – Per established protocols (Ehrhart and Ogren, 1999; Witzell and Schmid, 2004), turtles will be captured with a 200-300 m strike net with 36 cm stretch-mesh nylon webbing, 4 m depth, braided polyfoam float line, and braided leadcore line. When a turtle is sighted, the net will be deployed off the stern of the research vessel at relatively high speed, encircling the turtle, and held closed until the turtle is either observed entangled in the net or until 20 min has elapsed without sighting the animal. The strike is not deployed if marine mammals are in the area or the net is immediately retrieved if marine mammals are sighted after a strike. Netting activities are either moved to a different location or resumed after marine mammals have left the area. Measures are taken to retrieve netted turtles and any non-targeted bycatch (stingrays and sharks) will be removed from the nets and released immediately. Webbing is cut from animals to minimize any adverse effects of entanglement and to aid in their removal from the net. Entangled turtles will be promptly removed from the net and placed inside the boat (Balazs *et al.* 1987; Ehrhart and Ogren 1999).

Dip Net – Dip netting will be when a turtle is spotted at or near the surface in shallow water, a net will be placed under the turtle and it will be carefully and safely lifted or "scooped" out of the water and onto the deck of the research vessel.

Permit 14726-02- Researchers will access neonate sea turtles and their habitat with vessels launched from ports along Florida's Gulf and Atlantic coasts. Turtles observed along the transect centerline will be captured using long-handled dip nets. All turtles will be released at a similar habitat type as the original capture locations within one hour of capture. Sampling along transects will be opportunistic based on weather. Ideal weather conditions will be needed for successful captures. No sampling will be conducted when the marine forecast calls for directed winds greater than 10 knots.

Handling, Measuring, and Weighing
Researchers will use care when handling animals to minimize any possible injury. During all measurements and sampling, sea turtles will be sheltered from direct sunlight, wind, or rain. Under severe weather conditions or an unforeseen emergency (e.g., physical injury to personnel, etc.) requiring a return to shore, researchers will secure tubs carrying sea turtles to the bottom of the boat and transport them to shore. During transport and holding on land, sea turtles will remain in the tubs with towels over their heads. As soon as conditions allow, researchers will return each turtle near the capture site. Turtles will be released at the capture site within two hours of capture.

All captured and recaptured turtles will be measured, weighed, and photographed on board. Straight carapace length (SCL) will be measured from the nuchal notch to the posterior-most portion of the rear marginals using a forester's caliper while curved carapace length (CCL) will be measured using a flexible tape. Each turtle will also be weighed using a hanging spring scale (35 kilogram maximum). Researchers will exercise caution so as to ensure that turtles are not dropped or injured during the weighing activities. Turtles will also be photographed/ video and carefully examined by the researcher.

Turtles with fibropapilloma (FP) will be kept separate from other turtles and separate sets of measuring, weighing and tagging gear will be used. Each set of equipment will be used to measure and weigh turtles will be cleaned and disinfected with a mild disinfectant solution before each turtle is measured. The turtles will be monitored to ensure that it is breathing, and examined for injuries, barnacles or any abnormalities.

Flipper and Passive Integrated Transponder (PIT) Tagging
All sea turtles captured in the study will be checked for existing flipper tags and scanned for existing internal PIT tags. Tagging activities are minimally invasive and 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. Double tagging with PIT and flipper tags minimizes the probability of complete tag loss of sampled turtles during the study. If any captured turtles larger than 25 cm SCL has not been previously tagged, they will be externally tagged using oxidation and corrosion resistant metal tags (Inconel) to the trailing edge of each front flipper, using an applicator, which will be cleaned with a mild disinfectant solution prior to use The metal tag (Inconel) will be applied to the trailing edge of a front flipper typically in either the first (closest to the body) or second scale, using this standard technique (NMFS SEFSC 2008). These tags are expected to last several years. Recaptured turtles will not be retagged unless tag loss has occurred.

If the recommended tagging site is damaged or is unsuitable for tag application, then an alternative site will be used along the trailing edge of the flipper. All tagging equipment will be cleaned with an antiseptic solution (betadine povidone-iodine or isopropyl alcohol) before each use and between turtles, and gauze with antiseptic will be applied to the tag site pre and post inserting the tag to prevent infection.

A separate set of applicators will be used with turtles afflicted with FP. The researcher will make certain that the locking mechanisms are correctly aligned and that the tag locks in place. However, care would be taken to ensure tags are not cinched too tight against the flipper without room to move freely, and that the tag is not applied too far into the edge of the flipper and are strategically located to accommodate future growth in young turtles. Ideally, 25-33% of the tag should extend beyond the edge of the flipper after application. Tag applicators (pliers) will be cleaned and disinfected between turtles to avoid cross contamination. Tag applicators will also be routinely inspected and discarded when they cease to function properly.

Should a turtle >10 cm SCL not have a PIT tag one will be inserted subcutaneously into the right front shoulder area per established protocols (Wyneken *et al.* 2010) using a pre-sterilized PIT tag and disposable pre-sterilized needle applicator to eliminate the possibility of cross contamination. Prior to the insertion of any tag, the skin in the target area will be scrubbed with an antiseptic. PIT needles are then disposed of after each application. PIT tags are read with a scanner, and are designed to last the life of the turtle. If a previously tagged turtle is missing any of its original tags, replacement tags will be inserted.

Tissue Sampling

Tissue samples will be collected, preserved and archived for future genetic analysis, and foraging ecology studies using stable isotope analysis. All sea turtles will be sampled once and researchers will make sure that recaptures are not sampled a second time in any given year. Following established procedures (NMFS SEFSC 2008), researchers will obtain tissue samples using a new sterile biopsy punch (standard four to six millimeter) from the posterior edge of a rear flipper of each turtle. *Permit 14726*-02 will also obtain an additional tissue sample from the shoulder area on turtles greater than 10 cm SCL. The sample site will be properly cleaned and disinfected to prevent infection. Samples will then be stored and analyzed at a later date. After the tissue sample is taken, slight pressure will be applied to the area using gauze and a disinfectant until there is no visible bleeding. A new sterile biopsy punch will be used on each animal.

Blood Sampling

Blood samples from all turtles will be taken for genetic analysis and sex ratios. Blood samples will be taken from the dorsal cervical sinus immediately after sea turtles are safely secured on deck (Owens 1999). The skin at the sampling site will be scrubbed for a minimum of 30 seconds with 91% isopropyl alcohol to avoid infection. To facilitate bleeding of the cervical sinus, turtles will be positioned so that their head is lower than the body. The blood sample will be taken using a 21 gauge, 1-1.5 inch vacutainer needle, researchers will use smaller needles (25 gauge, 0.5 in) to obtain samples from smaller turtles. Researchers will ensure that the total volume of blood taken from each turtle will not exceed one milliliter per one kilogram (kg) of turtle weight and for turtles weighing less than one kg, a single blood sample will not exceed six percent of the turtle's total blood volume. Due to permit conditions, attempts (needle insertions) to extract blood from the neck must be limited to a total of four with two attempts allowed for either side of the neck. During blood sampling, precautions will be taken to prevent a back and forth, or rocking movement of the needle once it is inserted. No blood sample will be taken should conditions on the boat preclude the safety and health of the turtle. No more than 3mL of blood per 1kg of animal will be collected (SEFSC 2008).

Scute Sampling

A scute sample will be collected for stable isotope analysis using the method of Reich et al. (2007) to sample the full depth of the scute from the surface (oldest scute) to the origin (newest scute). The sample site will be properly cleaned and disinfected to prevent infection prior to sample collection. The collection site on the second costal scute will be scrubbed and rinsed with ethanol. A 6 mm (4 mm for *permit 14726-02* on turtles greater than 10 cm SCL) biopsy punch will be used to collect a sample encompassing the full depth of the scute, ensuring that all

layers of the scute are removed. A new biopsy tool is used for each individual.

Gastric Lavage and Oral Swab (permit 14726-02 only)
Prior to gastric lavage, any debris will be removed from the turtle's mouth with a sterile oral swab. Researchers will extract dietary samples to provide insight into feeding habits, consumption levels, and diet selection (Legler 1977). Dietary samples will be carefully extracted from the captured turtles using gastric lavage or stomach flushing as described in several previous studies, including Forbes and Limpus (1993) and Makowski et al. (2006). The lavage process flushes food items that are in the esophagus and mouth areas (Legler, 1977; Balazs, 1980; Forbes and Limpus, 1993). Captured turtles greater than 5 cm SCL will be lavaged using the methods outlined by Forbes (1999), with modification for lavaging small turtles (Witherington 2002).

Turtles will be held on their back with their posterior end slightly elevated. After the turtle's mouth was opened, a standard veterinary canine oral speculum or similar mouth gag (small or medium, depending on the size of the turtle) will be inserted just posterior to the anterior tip of the rhamphotheca to keep the jaws from closing. A soft plastic veterinarian's stomach tube will be lubricated with vegetable oil and cautiously inserted into the mouth and down the length of the esophagus. Tube sizes will vary with the size of the individual turtle to avoid esophageal damage. Two sizes of surgical tubes will be available, as well as a set for FP turtles and a set for non-FP turtles. Seawater will be pumped through the tube, and the tube will then be gently moved back and forth along the length of the esophagus. The returning flow of injected water carrying food particles out of the mouth will be collected in a sampling container held below. Modified techniques include the use of small-diameter (3-10 mm) silicone tubing, and a hand-pumped rubber bulb in lieu of a larger (overly powerful) stomach pump. Items from each lavage will be collected, strained from the water, and identified through microscopy to the lowest possible taxon. Special attention will be placed on the identification of marine debris.

The gastric lavage procedure will not exceed 3 minutes in order to reduce the chance of the turtle inhaling during the process. After food samples are collected, the use of the pump will be ceased and water and food then allowed to drain, until flow ceases. To assist with drainage, the anterior end of the turtle will be placed lower than the rest of the body. The tube will be removed first followed by the removal of the gag and the head will be elevated to allow for drainage of any remaining water towards the esophagus. Turtles will be held in this position until regular breathing resumes. Only one sample will be obtained per individual. All lavage equipment will be disinfected between animals.

Fecal Sampling
For *permit 18069,* a subset of Kemp's ridley turtles (60 annually) will be transported to a given field station via research vessel for collection of fecal samples as part of diet studies. Estimated travel time to the shore-side facilities is approximately one hour. Turtles will be placed in shaded 1.5-2 m diameter polyethylene holding tanks filled with 0.75 liters of ambient seawater and held for 24-48 hours per established protocol (Witzell and Schmid, 2005; FFWCC, 2007). One turtle will be held per tank and 2-3 tanks will be maintained on site. The water will be changed twice daily with seawater pumped from local waterways and all solid defecated

materials will be removed, placed in individually-marked plastic bags, transported on ice, and stored in a freezer at the Conservancy for later processing. Turtles will not be fed during the 24-48 hr. period of captivity. Given the short-term captivity and frequent water changes, a filtering system will not be used with the holding tanks. After the sample collection period, turtles will be measured, weighed, tagged, and released near the original capture site. Holding tanks will be cleaned with a bleach-water solution, thoroughly rinsed, and dried before the next turtle is placed inside.

For *permit 14726-02,* fecal samples will be collected opportunistically from the water when observed floating or after turtles have defecated during biological sampling.

Satellite Transmitter Attachment

A subset of captured turtles will be fitted with transmitters. For Permit *18069* satellite telemetry will be used to investigate movements, migrations, and connectivity among foraging grounds for 15 Kemp's ridley and 10 loggerhead turtles annually. Turtles will be selected so that the mass of the transmitters is less than 5% the mass of the turtle, a common standard in marine turtle telemetry studies. Turtles will be transported to a field station via research vessel for satellite transmitter attachment (< 1 hr. travel time). All turtles will be measured, weighed, flipper and PIT tagged and biopsy/blood samples collected prior to instrumentation. Furthermore, Kemp's ridley turtles may be held for < 48 hrs for fecal sample collection.

During transmitter attachment, the turtle will be restrained within an empty holding tank with a towel draped over its head to keep the turtle relaxed. The precise location is dependent on each turtle's carapace shape and condition. The carapace will be cleaned of any epibiota, rinsed with alternating washes of freshwater and ethanol, and then dried prior to transmitter attachment. For loggerheads and Kemp's ridleys > 40 cm carapace length, a base of slow cure two-part epoxy adhesive will be applied to attach the transmitter directly to the vertebral scutes (Girard et al. 2009; Tucker 2010). Additional thin layers of epoxy are built up along the sides, top, and extending away from the transmitter to provide secure attachment. The neoprene attachment technique of Seney et al. (2010) will be used for turtles 25 - 40 cm. A silicone bead will be applied to the suture lines of the anterior vertebral scutes and adjacent carapace scutes, epoxy will be applied within the boundaries of the silicone, a piece of 1.5 mm neoprene will be placed on top of the epoxy, and the transmitter attached to the neoprene with epoxy. However, recent efforts employing these epoxy attachment methods have resulted in satellite tracking durations for Kemp's ridleys of 3-5 months (Schmid and Tucker, unpubl. Data) which is shorter than the expected 6 month battery life and the observed duration of 12+ months for the same tags applied to nesting loggerheads.

By comparison, Schmid and Witzell (2006) using the elastomer/fiberglass resin attachment method of Balazs et al. (1996) had track durations of 8-9 months. Premature detachment is one possible cause for the shorter tracking durations with epoxy attachment and these durations may not be adequate to document the full extent of migrations and movements. Therefore, the elastomer/fiberglass resin method may be used as an alternative for attaching satellite transmitters. The transmitter will be mounted on a base of silicone applied to the vertebral scutes and strips of fiberglass cloth with polyester resin are used to bond the transmitter to the carapace.

These application processes take 1to 2 hours to complete. Anti-foulant paint will be applied to the surface of the respective attachment technique in a well-ventilated area and turtles will be released near the capture location. Total holding time from capture to release is up to 4 hours for turtles not held for fecal sampling. Retention times for telemetric tags applied to the carapace of wild turtles are not well-documented or altogether unknown. Experiments with captive turtles demonstrated retention times of at least 16 months using fiberglass resin attachment (Renaud et al. 1993) and 7 months using two-part epoxy (Seney et al. 2010); however, these times represent the duration of the respective experiments, not the full duration of carapace attachment. Detachment was observed with the epoxy method but not the fiberglass resin method. Renaud et al. (1993) suggested retention times with the fiberglass resin method will be shorter for wild animals given the harsher environment than that encountered under laboratory conditions and gave examples of detachment in 2-8 months. Accordingly, it is expected that satellite tags will detach within 1 year for both methods.

For *permit 14726-02:* Satellite tracking will allow for an analysis of sea turtle movements relative to remotely sensed oceanographic features, including modeling of Sargassum habitat locations in the Gulf of Mexico. Turtles will be >15 cm SCL for satellite tag attachment:

- 10 loggerheads (pelagic juvenile; 10 - 45 cm SCL[1])
- 15 loggerheads (juvenile/subadult/adult)
- 20 green (pelagic juvenile)
- 10 hawksbill (pelagic juvenile)
- 20 Kemp's ridley (pelagic juvenile)

The researcher proposes to tag animals with one of the smallest archival pop-up (PTT) tags available. The transmitter with antenna will weigh approximately 32 g. The small size of transmitters will allow tags to be attached with epoxy glue to a single carapacial scute. Prior to tag attachment, adjacent scutes will be covered with masking tape so that no silicone extends to other scutes. The transmitter site will be prepared by sanding, cleaning (isopropanol and acetone), and a base application of acrylic (human) nail base. The PTT will be attached by sealing it to the carapace with non-toxic silicone exclusively to the third vertebral scute. Elements of the attachment technique will come from Seney et al. (2010), which recommend attachments that do not bridge scute seams with hard adhesive. Four, small, hand-rolled balls of epoxy putty placed near the bottom corners of the transmitter will allow the transmitter to be positioned correctly over the uneven scute surface (the putty will not contact scute seams). Maximum time required for transmitter attachment will be two hours, and expected attachment life is 60 days. Total weight of the PTT with sealant will be approximately 42 g, which in turn is approximately 1.7 to 2.8 percent of the turtle's mass.

Transmitters will not exceed five percent of the turtle's body weight and attachment materials will be configured and stream-lined, with all of the edges and corners of the tag application smoothed to minimize any potential for entanglement (NMFS SEFSC 2008) and to help maintain as much of a hydrodynamic surface (least drag) as possible (Jones et al. 2011) to minimize effects of buoyancy and drag on the turtle's swimming ability. The cool setting epoxy putty emits no odor and produces minimal heat when activated. Precautions will be taken to avoid any

[1] Pelagic juveniles are defined by the researcher as individuals 10-45 cm SCL.

epoxy drippings onto or otherwise coming in contact with the skin of the turtle. Tag attachment will be conducted in a well-ventilated area and adequate ventilation provided around the head of the turtle during the attachment, in order to avoid fumes in holding box or use of solvents or solvent rags close to the head to ensure that any fumes are not inhaled. The turtle's head will also be protected using a towel, and researchers will wipe off any materials that might be dripping. Once the epoxy is properly cured (< 30 min), turtles are released back into the water at the point of capture.

Handling time during capture activities should be minimized to reduce the potential for additional stress. At the conclusion of the studies, turtles that are tagged with transmitters may be recaptured to remove the transmitter gear. Removal of the transmitters at the end of the experiments is a non-invasive procedure. These animals will not be re-sampled to minimize impacts to the animals. Should these turtles not be recaptured, the transmitters will eventually be shed by normal surface flaking of the carapace scutes. Satellite tags generally remain on a turtle from 4 to 6 months to less than 2 years.

Radio/Sonic tagging

Only *permit 18069* will attach radio/sonic tags to a subset of turtles captured. Radio/sonic tracking will be conducted to provide information on site fidelity, activity patterns, and habitat preferences of 15 Kemp's ridley and 10 loggerhead turtles annually. After measuring and tagging, each turtle will be instrumented with a radio and sonic transmitter per established protocols (Schmid, 2000, 2003, 2004; Schmid et al., 2002, 2003). Ultrasonic transmitters (9.0cm x 1.8cm dia.) and buoyant VHF transmitters (5.6cm x 1.7cm dia.) with a TA-7 antenna were used by the researcher in previous telemetric studies and comparable transmitters will be used in these studies. The antenna and upper portion of the transmitter are threaded through a "football-shaped" syntactic foam float. Turtles will be selected so that the mass of the transmitters (approx. 105 g dry weight) is less than 5% the mass of the turtle. Sonic transmitters will be attached to posterior marginal scutes of telemetered turtles. Steel wire will be looped through the ends of the transmitter and plastic ties will be inserted through the loops and through holes drilled in the scutes. If bleeding occurs during the drilling process, the procedure will cease, sterile gauze will be applied with pressure to the area of bleeding until it stops. A new autoclaved drill bit will be used for each turtle.

Buoyant radio transmitters will be attached to one of the postcentral marginal scutes by a monofilament tether with a breakaway link looped through a drill hole in the scute. Tether length will be approximately one-half the carapace length of a turtle, so that the tether will not tangle in the fore flippers and the turtle is unable to bite the transmitter. The breakaway link consists of two lengths of monofilament line threaded through a 1-inch piece of surgical tubing with crimps on the end of the lines on opposite sides of the tubing. The researcher is not aware of any information on the breaking strength of the link, but the crimped monofilament lines can be pulled through the tubing by hand. Furthermore, the rubber surgical tubing degrades in the marine environment, thus weakening the link over time. Measuring, tagging, and transmitter attachment are performed within 1-2 hours of capture except for Kemp's ridleys held < 48 hr. for fecal sampling. Instrumented turtles will be released in the capture area, and tracking will begin after a 24-hour acclimation period. Radio telemetry will be used to monitor surface times and durations of turtles and to obtain bearings for long distance tracking. Sonic telemetry will be

used to pinpoint the location of turtles and to track their movements. Turtle locations will be recorded hourly by homing-in on the sonic signal and maneuvering the tracking vessel within 10 - 20 m of the turtle. Turtle locations will be estimated from the coordinates of the tracking vessel using a global positioning system with differential corrections. The vessel is then anchored at a distance from the telemetered animal and sonic contact is maintained. Tethered radio tags detach within 4 weeks of deployment. Sonic transmitters have been monitored for up to 4 months with detachment observed during this timeframe.

Transport and Holding
Holding time for each animal will not exceed the amount of time necessary to measure, weigh, tag, examine, and collect samples, normally less than an hour. When acoustic/satellite instruments are attached, holding time will increase to a maximum of 2 hours, the exception is the subset of 60 Kemp's ridleys held for a maximum of 48 hours for fecal sampling for *permit 18069*. Turtles will be transported by boat (held under the same conditions as mentioned above), with estimated travel time to the shore-side facilities is approximately one hour. Turtles will be moved from the boat to the dock using a NMFS-designed sea turtle stretcher consisting of non-abrasive vinyl cloth and velcro closures. This system ensures that the turtle cannot slide out or drop out while being transferred to shore. If an animal is captured that requires veterinary treatment, it will be transported to the veterinary facility in a certified large animal carrier with a wet absorbent pad covering it to keep it cool.

Release
Turtles will be released where they were captured. During release turtles will be lowered as close to the water's surface as possible to prevent potential injuries (Epperly et al. 2004). All newly released turtles will be observed by researchers and researchers will record observations on the turtle's apparent ability to swim and dive in a normal manner.

Boat Surveys
Boat surveys (*Permit 14726-02*) will be conducted in Florida and Gulf of Mexico waters as stand-alone surveys. Researchers would survey sea turtles and their habitat with vessels launched from ports along Florida's Gulf and Atlantic coasts. Sampling along transects would be opportunistic based on weather. Ideal weather conditions would be needed for successful captures. No sampling would e conducted when the marine forecast calls for directed winds greater than 10 kts.

Permit Conditions

The following information outlines the main mitigation measures researchers will employ to minimize the potential for any adverse impacts to the target species (green and hawksbill sea turtles) as well as any other listed species in the action area. The research project is designed to minimize the potential of any stress, pain or suffering. All the investigators and personnel involved are experienced in capturing sea turtles and will undertake the following precautions. Turtles will be handled carefully so they do not incur additional injury during or after research procedures. Antiseptic methods such as sterilizing equipment with bleach solution and the use of antiseptic solutions such as 10% povidone-iodine at tag sites will be standard protocol to prevent

the transmittal of disease and prevent infection. Turtles found to have serious injuries will be evaluated for possible transport to a rehabilitation facility.

The following specific conditions will be placed in *permit 18069* and *permit modification 14726-02* to ensure compliance with appropriate research protocols:

1. The Permit Holder would be responsible for all activities of any individual who is operating under the authority of the proposed permit. The Principal Investigator (PI) would share this responsibility. Other researchers operating under the specified Permit and conducting the activities authorized herein, must be approved by NMFS. Alternatively, there must be a NMFS approved individual present to supervise these activities until such time that the other individuals have been approved by NMFS.

2. Accidental Mortality of Authorized Sea Turtles: If a turtle is seriously injured or dies during sampling, the Permit Holder must cease research immediately and notify the Chief, Permits and Conservation Division by phone (301-427-8401) as soon as possible, but no later than two days following the event. The Permit Holder must re-evaluate the techniques that were used and those techniques must be revised accordingly to prevent further injury or death. The Permit Holder must submit a written report describing the circumstances surrounding the event. The Permit Holder must send this report to the Chief, Permits and Conservation Division, F/PR1, 1315 East-West Highway, Silver Spring, MD 20910. Pending review of these circumstances, NMFS may suspend authorization of research activities or amend the Permit in order to allow research activities to continue.

3. An annual report would be submitted and reviewed by NMFS for each year the permit is valid. In addition to an account of actual 'take' that occurred, the reports would include detailed descriptions of the animals' reactions, measures taken to minimize disturbance, research plans for the forthcoming year, and an indication as to when or if any results have been published or otherwise disseminated during the year. At the end of the proposed permit, the Permit Holder would submit a final report that includes: (1) a reiteration of the objectives and summary of results of the research and how they pertain to or further the research goals stated in the Permit application and NMFS conservation plan; and (2) an indication of where and when the research results would be published.

4. Instruments and equipment that are used for invasive procedures must be sterilized or disinfected with an appropriate disinfectant (e.g., mild bleach solution or 10% povidone-iodine) between animals, and shall be the appropriate weight/size ratio to the receiving animal.

5. When handling and/or tagging turtles displaying fibropapilloma tumors and/or lesions, researchers would use the following procedures:

    - Clean all equipment that comes into contact with the turtle (tagging equipment, tape measures, etc.) with a mild bleach solution, between the processing of each turtle, and

- Maintain a separate set of sampling equipment for handling animals displaying fibropapilloma tumors and/or lesions.

- Limit procedures conducted on compromised turtles.

6. All turtles shall be examined for existing tags, including PIT tags, before attaching or inserting new ones.

7. Flipper Tagging with Metal Tags – All tags shall be cleaned (e.g., oil residue) and disinfected before being used.

8. Netting Special Conditions

    - Nets used to catch turtles must be large enough to diminish bycatch of other species.

    - Highly visible buoys shall be attached to the float line of each net such that they are spaced at an interval of every 10 yards or less. Each float shall be attached to the net as it is being deployed.

    - Nets must be checked at least every 30 minutes, and more frequently whenever turtles or other bycatch organisms are observed in the net. The float line of all nets shall 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 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. If water temperatures are equal to or less than 10°C or equal to or greater than 30°C, nets must be checked at least every twenty minutes.

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

    - 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.

- If a marine mammal is entangled, researchers must stop netting activities and immediately free the animal; notify the appropriate NMFS Regional Stranding Coordinator as soon as possible; and report the incident as specified.

9. Blood sampling:

    - Blood samples must be taken by experienced personnel.

    - New disposable needles must be used on each animal.

    - Collection sites must always be scrubbed with alcohol or another antiseptic prior to sampling.

    - Care should be taken to ensure no injury results from the sampling. If an animal cannot be adequately immobilized for blood sampling or conditions on the boat preclude the safety and health of the turtle, samples must not be taken.

    - Attempts (needle insertions) to extract blood from the neck must be limited to a total of four, two on either side.

    - A single sample must not exceed 3 milliliter per 1 kilogram of animal.

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

    - Research coordination. Researchers must, to the maximum extent practicable, attempt to determine if any of the turtles they blood sample may have been sampled within the past 3 months or would be sampled within the next 3 months by other researchers. The permit holder must contact the other researchers working in the area that could capture the same turtles to ensure that none of the above limits are exceeded.

10. Biopsy (tissue-scute) Sampling:

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

    - Sterile techniques must be used at all times. Samples must be collected from the trailing edge of a flipper if possible and practical (preference should be given to a rear flipper if practical). The tissue surface must be thoroughly swabbed once with both Betadine and alcohol, sampled, and then thoroughly swabbed again with just Betadine. The procedure area and researcher's hands must be clean.

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

11. Lavage:

- The actual lavaging of an individual turtle must not exceed 45 seconds. Once the samples have been collected, water must be turned off and water and food allowed to drain until all flow has stopped. The posterior of the turtles will be elevated slightly to assist in drainage.

- Equipment (e.g., lavage tubes) that will come in contact with sea turtles must be disinfected between animals. Additionally, a separate set of sampling equipment for handling animals displaying fibropapilloma tumors and/or lesions. Disinfection can be compromised (incomplete) if items are contaminated with debris and/or have rough or porous surfaces. Researchers shall clean items prior to disinfection and increase the exposure time for rough and/or porous items.

- Disinfectants shall be used according to directions, however researchers shall ensure that contact time with disinfectant is sufficient (according to label directions; a dip and rinse is not sufficient) and lavage tubes shall be thoroughly physically cleaned prior to disinfection (viruses can remain protected in organic matter, the disinfectant can't get to them if they're protected in this matter).

- Care shall be taken that disinfecting solutions are clean and active and that proper rinsing occurs after disinfection.

12. Sonic/Acoustic Tagging:

- Great care shall be taken to ensure that no resin, silicone, or epoxy drips onto the skin of the turtle.

- 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. The epoxy chosen should cure releasing only minimal heat not injurious to animals. To prevent skin or eye contact with harmful chemicals used to apply tags, turtles must not be held in water during the application process.

- The weight of the transmitters would not exceed 5 percent of the turtle's body mass.

- 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. The lanyard length (if used) must be less than 1/2 of the carapace

length of the turtle. It must include a corrodible, breakaway link that would corrode and release the tag-transmitter after the tag-transmitter life is finished.

- Researchers must make attachments as hydrodynamic as possible.

13. General Handling and Releasing of Turtles: All researchers (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, stressed or 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. All turtles must be handled according to procedures specified in 50 CFR 223.206(d)(1)(i).

14. Turtles are to be protected from temperature extremes of heat and cold, and kept moist during sampling. The turtle would be placed on pads for cushioning and this surface would be disinfected between turtles. The area surrounding the turtle may not contain any materials that could be accidentally ingested.

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

16. Transport and Holding:

    - Turtles are to be transported via a climate-controlled environment, protected from temperature extremes of heat and cold, and kept moist. The turtle would be placed on pads for cushioning. The area surrounding the turtle may not contain any material that could be accidentally ingested.
    - Turtles transported to a facility and held (e.g. for rehabilitation) must be maintained and cared for under the "Care and Maintenance Guidelines for Sea Turtles Held in Captivity" issued by the U.S. Fish and Wildlife Service.

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

18. For any listed sturgeon species encountered:

    - 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.
    - Sturgeon tend to inflate their swim bladder when stressed and in air. If the fish has air in its bladder, it would float and be susceptible to sunburn or bird attacks. Efforts must be made to return the fish to neutral buoyancy prior to and during

release. Air must be released by gently applying ventral pressure in a posterior to anterior direction. The specimen must then be propelled rapidly downward during release. For help with any questions relating to sturgeon researchers should contact Stephania Bolden, of NMFS' Southeast Regional Office. The Permit Holder must report any sturgeon interactions to NMFS' Assistant Regional Administrator for Protected Resources, Southeast Regional Office, within 14 days of the incident. This report must contain: the description of the take (including length and weight if possible), the PIT tag number, latitude and longitude of capture, water depth the animal was taken in, substrate type animal was in when captured, any other environmental conditions that are already being recorded (e.g., water salinity, temperature), and final disposition of the sturgeon (Le., released in good health, etc.).

19. Researchers must take all practicable steps to identify submerged aquatic vegetation (SAV), coral communities, and live/hard bottom habitats and avoid setting gear in such areas. Researchers must use strategies to identify SAV, coral and live or hard bottom types and avoid adverse impacts to Essential Fish Habitat (EFH), including the use of tools such as charts, GIS, sonar, fish finders, or other electronic devices to help determine characteristics and suitability of bottom habitat prior to using gear. If research gear is lost, diligent efforts must be made to recover the lost gear to avoid further damage to benthic habitat and impacts related to ghost fishing.

20. Coral and hard/live bottom. No gear may be set, anchored on, or pulled across coral or hard/live bottom habitats.

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

    - In order to reduce the potential for sea grass damage, anchors would be set by hand when water visibility is acceptable. Anchors must be placed in unvegetated areas within seagrass meadows or areas having relatively sparse vegetation coverage. Anchor removal must be conducted in a manner that would avoid the dragging of anchors and anchor chains.
    - Researchers would take great care to avoid damaging any sea grass species and if the potential for anchor or net drag is evident researchers would suspend research activities immediately.
    - Researchers must be careful not to tread or trample on seagrass and coral reef habitat.

Approach to the Assessment

The NMFS approaches its section 7 analyses of agency actions 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 result of this step includes defining the action area for the consultation. The second step of our analyses identifies the listed resources that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (these represent our exposure analyses). In this step of our analyses, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to an action's effects and the populations or subpopulations those individuals represent. Once we identify which listed resources are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to determine whether and how those listed resources are likely to respond given their exposure (these represent our response analyses).

The final steps of our analyses – 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 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, grow, mature, migrate, reproduce (or fail to do so), and die.

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 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 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., Anderson 2000; Brandon 1978; Mills and Beatty 1979; Stearns 1992). As a result, if we conclude that listed animals are not likely to experience reductions in their fitness, we conclude our assessment.

Although reductions in fitness of individuals is a necessary condition for reductions in a population's viability, reducing the fitness of individuals in a population is not always sufficient to reduce the viability of the population(s) those individuals represent. Therefore, if we conclude that listed 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 listed resources 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 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 listed resources 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 the evidence available to us. This evidence consists 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 non-governmental organizations involved in marine conservation issues, the information provided by the Permits Division when it initiates formal consultation, and the general scientific literature.

During the consultation, we conducted electronic searches of the general scientific literature using search engines, including Agricola, Ingenta Connect, Aquatic Sciences and Fisheries Abstracts, JSTOR, Conference Papers Index, First Search (Article First, ECO, and WorldCat), Web of Science, Oceanic Abstracts, Google Scholar, and Science Direct.

These searches specifically tried to identify data or other information that supports a particular conclusion (for example, a study that suggests turtles would exhibit a particular response to close vessel approach) as well as data that do not support that conclusion. When data were equivocal or when faced with substantial uncertainty, our decisions are designed to avoid the risks of incorrectly concluding that an action would not have an adverse effect on listed species when, in fact, such adverse effects are likely (i.e., Type II error).

The analyses used in this Opinion include several assumptions. As far as we are able to determine, field researchers cannot generally identify specific individuals in the field and, therefore, have no mechanism to know what previous exposure an individual has had to proposed activities or other natural or anthropogenic stressors. Based upon descriptions in past annual monitoring reports from the applicant and documentation provided by the Permits Division, we assume that proposed activities would be similar to those that the applicant has conducted in the past and the level of "effort" (magnitude of time and asset resources dedicated to the proposed action) would be roughly similar to that which has previously occurred. We assume that free-ranging sea turtles range over wide areas and although they likely occupy restricted regions for relatively brief periods (hours to days), individuals are expected to move widely and, as far as we can predict, broadly within an oceanographic region. Although we expect that variability in reporting exists within the applicant's annual reports and other specific information provided, these reports accurately document the number of "takes" that occurred under the ESA.

Action Area

The action area is defined in 50 CFR 402.2 as "all areas to be affected directly or indirectly by the Federal Action and not merely the immediate area involved in the action." The action area under these proposed activities would be as follows for the next five years.

Permit No. 18069: The proposed research activities would occur in the inshore waters of Charlotte Harbor and the Ten Thousand Islands, which are located on the southwest coast of Florida in the eastern Gulf of Mexico. Charlotte Harbor estuary (Fig. 1) is subdivided into Charlotte Harbor proper in the upper region and Pine Island Sound, Matlacha Pass, and San Carlos Bay in the lower region. The entire area is part of the Charlotte Harbor National Estuary and includes the Cape Haze, Gasparilla Sound-Charlotte Harbor, Matlacha Pass, and Pine Island Sound Aquatic Preserves. The Island Bay, Pine Island Sound, Matlacha Pass, and J. N. "Ding" Darling National Wildlife Refuges are also located in this study area.

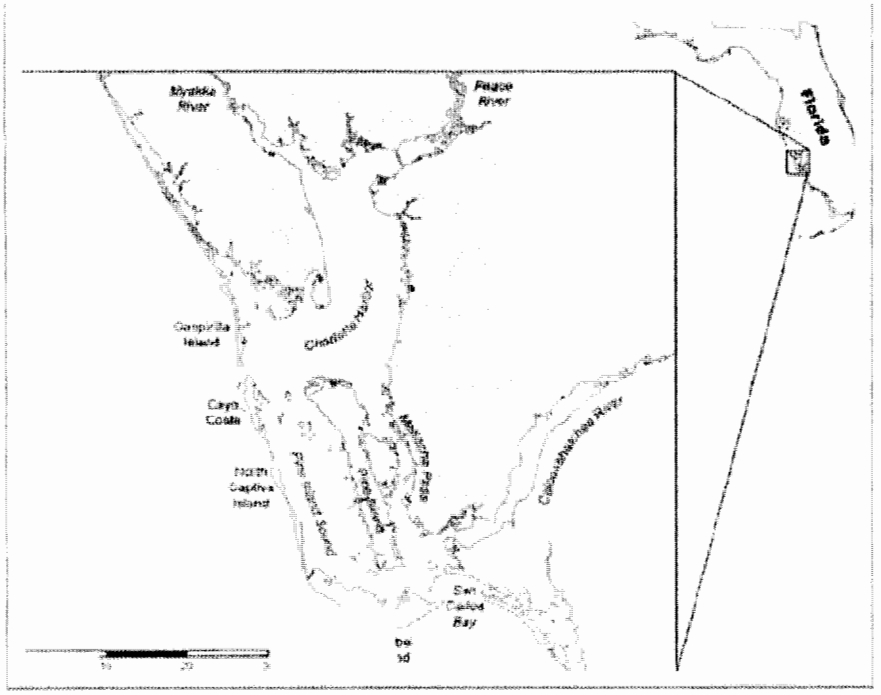

Figure 1. Map of southwest Florida showing the Charlotte Harbor estuarine complex.

The Ten Thousand Islands archipelago (Fig. 2) extends from Cape Romano to Pavilion Key and is comprised of numerous mangrove islands, backwater bays, and freshwater tributaries. Tidal exchange through the island passes mixes marine waters of the Gulf with freshwater from the Big Cypress Swamp watershed to create an expansive estuarine system. This provides a starting point for research activities proposed herein. The applicant will be permitted to conduct research throughout the year, for a five-year period starting from the date of approval.

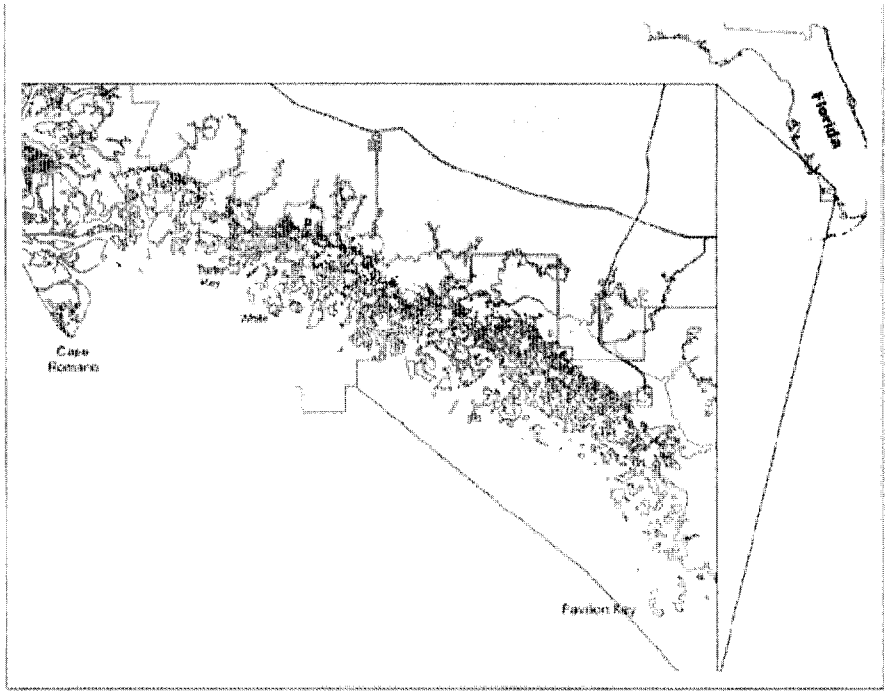

Figure 2. Map of southwest Florida showing the Ten Thousand Islands archipelago.

Permit No. 14726-02: The research will take place in Gulf waters (Fig. 3) and in Atlantic waters off the coast of Florida (Fig. 4). Researchers will search for sea turtles in epipelagic habitat where Gulf and Atlantic surface waters converge (convergence lines) along lines of consolidated floating materials (weedlines).

Figure 3. Google map of the Gulf of Mexico area.

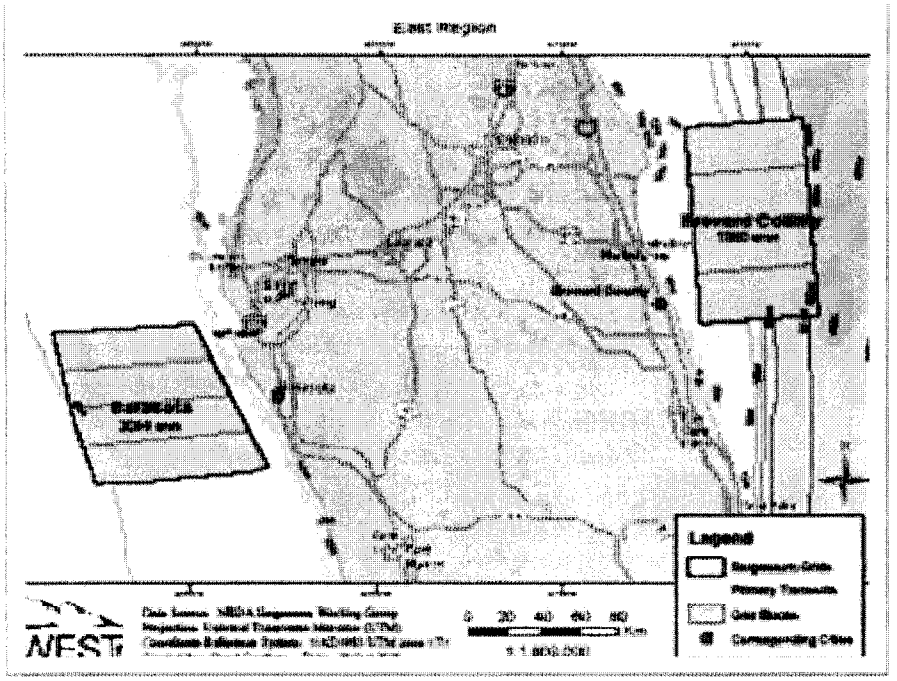

Figure 4. Turtle/Sargassum Sampling Grid and Transect Site, East Region: Brevard County, FL.

Sargassum, a free-floating seaweed found offshore in mats throughout the South Atlantic region, can be found in these weedlines. These mats of vegetation provide crucial habitat for a wide variety of marine animals in the open ocean, including economically important pelagic species as well as sea turtles and marine birds, as the seaweed provides shelter within its abundant fronds, along with a hiding place from predators and a source of food. The action area includes all coastal waters in the Gulf and Atlantic waters off the coast of Florida.

Status of the Species

The following listed species under the jurisdiction of NMFS occur in the action areas and may be affected by the proposed issuance of permit 18069 and permit modification 14726-02:

LISTED RESOURCE	SCIENTIFIC NAME	LISTING STATUS
Cetaceans		
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered
Sperm whale	*Physeter macrocephalus*	Endangered
N. Atlantic right whale	*Eubalaena glacialis*	Endangered

Sea Turtles		
Green sea turtle	*Chelonia mydas*	Endangered[2]
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Loggerhead sea turtle	*Caretta caretta*	Threatened
Northwest Atlantic Ocean DPS[3]		
Marine and Anadromous Fish		
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	Threatened
Largetooth sawfish	*Pristis perotteti*	Endangered
Smalltooth sawfish		
U.S. DPS	Pristis pectinata	Endangered
Marine Plants		
Johnson's seagrass	*Halophilia johnsonii*	Threatened
Marine Invertebrates		
Elkhorn coral	Acropora palmate	Threatened[4]
Staghorn coral	Acropora cervicornis	Threatened[4]
Pillar Coral	Dendrogyra cylindrus	Proposed Endangered
Boulder star coral	Montastraea annularis	Proposed Endangered
Mountainous star coral	Montastraea faveolata	Proposed Endangered
Star coral	Monastraea franksi	Proposed Endangered
Critical Habitat		
North Atlantic Right Whale		Designated
Gulf Sturgeon		Designated
Smalltooth sawfish		Designated
U.S. DPS		
Loggerhead sea turtle		Proposed
Northwest Atlantic Ocean DPS		
Elkhorn and staghorn coral		Designated
Johnson's seagrass		Designated

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

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

[4] Elkhorn and staghorn coral are currently listed as threatened species but have been proposed for listing as endangered (77 FR 73219).

No critical habitat has been designated in the action areas for any listed sea turtles species under NMFS jurisdiction; therefore, no sea turtle critical habitat will be affected. There is however, designated critical habitat for the North Atlantic right whale, gulf sturgeon, smalltooth sawfish, Johnson's seagrass and elkhorn and staghorn corals and proposed critical habitat for the Northwest Atlantic Ocean loggerhead sea turtle.

Analysis of Species and Critical Habitats Not Likely to be Adversely Affected

To refine the scope of this Opinion, NMFS used two criteria (risk factors) to determine whether any endangered or threatened species or critical habitat are not likely to be adversely affected by activities associated with the proposed actions. The first criterion was *exposure*: if we conclude that particular endangered or threatened species or designated critical habitat are not likely to be exposed to activities associated with the proposed actions, we must also conclude that those listed species or designated critical habitat are not likely to be adversely affected by the proposed action. The second criterion is *susceptibility* upon exposure: species or critical habitat may be exposed to activities associated with the proposed actions, but may be unaffected by those activities—either because of the circumstances associated with the exposure or the intensity of the exposure —are also not likely to be adversely affected. This section summarizes the results of our evaluations.

Cetaceans

The directed focus of the research will avoid exposing any listed cetacean in the action areas to disturbance and the potential for a ship strike during transit is highly unlikely given the experience of the observers at spotting listed species and avoiding any non-targeted species as they are encountered. The permits will be conditioned so that larger nets will not be set if marine mammals are observed in the area, which minimizes the effects to other non-target species. If a whale is observed in the action area, it will be avoided and the vessel will operate at a reduced speed while maintaining a minimum distance of 100 yards. Following marine mammal viewing guidelines, cetaceans are not likely to be exposed to activities associated with the proposed research, therefore any effects from the proposed action would be insignificant and discountable. Therefore, the proposed action is not likely to adversely affect listed whales and they will not be considered further in this Opinion.

Critical habitat is designated for the North Atlantic right whale within the Brevard county, FL survey area. However, sampling methods as proposed by the applicant are not expected to affect the essential features critical for calving success (i.e., calm waters, suitable water temperatures). Any effects from the proposed action are likely to be discountable and, therefore, the proposed action is not likely to adversely affect North Atlantic right whale critical habitat. This critical habitat will not be considered further in this Opinion.

Largetooth Sawfish

Largetooth sawfish historically occupied waters in the Gulf of Mexico off Texas and Florida and therefore have the possibility of being present during research activities. However, sightings of largetooth sawfish in the Panhandle region of Florida are extremely rare and the last reported sighting of the species in Florida waters occurred in 1941 (NMFS, 2010a). In monitoring reports submitted since 2008, researchers did not report any sightings of largetooth sawfish. While the

possibility exists that transient fish may enter Florida's waters, NMFS believes it is highly unlikely that these species would be exposed to effects from the proposed actions. Therefore, any effects from the proposed activities are discountable and therefore, the proposed action is not likely to adversely affect largetooth sawfish. This species will not be considered further in this Opinion.

Smalltooth Sawfish

Smalltooth sawfish can be found in Florida waters primarily in the southern tip of the state, around Charlotte Harbor, Evergaldes National park and Florida Bay. For the first three years of life, juveniles reside in shallow, red mangrove estuaries with salinities between 18 and 24 ppt. Adults remain in warm coastal waters at shallow depths. It is believed that sawfish number less than 5 percent of its pre-European settlement abundance. Historically common in coastal waters from Texas to North Carolina, the range of the DPS is restricted to southwestern Florida (68 FR 15674).

The proposed research activities for permit 18069 would occur in the inshore waters of Charlotte Harbor and the Ten Thousand Islands, where smalltooth sawfish are known to occur. Permit 18069 would use entanglement nets and dip nets to capture turtles, while permit 14726-02 would only use dip nets. NMFS believes it unlikely that a smalltooth sawfish could be incidentally captured by a dip net; however, there is some possibility that a smalltooth sawfish could be captured during entanglement netting. Researchers are specifically targeting sea turtles and would only deploy an entanglement net when a turtle is sighted. The net would be tended constantly and would stay in the water for no more than 20 minutes. Any effects from the proposed action are likely to be discountable and, therefore, the proposed action is not likely to adversely affect smalltooth sawfish. This species will not be considered further in this Opinion.

Critical habitat for smalltooth sawfish was designated in the Charlotte Harbor Estuary Unit, which comprises approximately 221,459 acres of coastal habitat; and the Ten Thousand Islands/Everglades Unit (TTI/E), which comprises approximately 619,013 acres of coastal habitat. The physical and biological features essential to the conservation of smalltooth sawfish, which provide nursery area functions are: red mangroves and shallow euryhaline habitats characterized by water depths between the Mean High Water line and 3 ft (0.9 m) measured at Mean Lower Low Water.

Researchers are not expected to have a measurable impact on red mangroves and shallow euryhaline habitats. Permit conditions require researchers must take all practicable steps to identify submerged aquatic vegetation and other benthic habitat to avoid any potential adverse effects. Permit conditions also require researchers to remove anchors and gear in a manner that avoids dragging them across the bottom to avoid disturbing sediments and any turbidity from placing set nets on the seabed is expected to be minimal. The research team has experience performing similar types of surveys and would be expected to take all proper precautions to avoid any physical disturbance. NMFS believes that exposure of smalltooth sawfish critical habitat to the proposed research activities would not be expected to impact the quality, quantity, and/or availability of the essential features of critical habitat nor would it impact the conservation value of that habitat. Any effects from the proposed action are likely to be insignificant and,

therefore, the proposed action is not likely to adversely affect smalltooth sawfish critical habitat. This critical habitat will not be considered further in this Opinion.

Gulf Sturgeon

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

While the possibility exists that fish may be encountered in Florida's waters, NMFS believes it is highly unlikely that these species would be exposed to effects from the proposed action. Any effects from the proposed action are likely to be insignificant and, therefore, the proposed action is not likely to adversely affect Gulf sturgeon. This species will not be considered further in this Opinion.

Critical habitat is designated for Gulf sturgeon in 14 geographic areas (units) including rivers and tributaries and nearshore Gulf of Mexico waters utilized by the species for spawning and foraging habitat. Researchers are not expected to conduct proposed activities in riverine areas, therefore, only estuarine and marine habitats may be affected by the proposed action. The primary constituent elements or essential features identified in the estuarine ad marine portions of critical habitat include the following: abundant prey items within estuarine and marine habitats for juvenile, subadult, and adult life stages; water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages; sediment quality, including texture and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages; and safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats.

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

Johnson's Seagras

One listed plant species occurs within the action area and could, therefore, be subject to physical disturbance from the research vessel. However, because the research is directed offshore and because the vessel used would transit to and from designated port areas, the researchers are not expected to impact the sediment or bottom habitat for Johnson's seagrass. Also, the research team has experience performing similar types of surveys and would be expected to take all proper precautions to minimize or avoid disturbance. Johnson's seagrass is highly unlikely to be exposed to effects from the proposed action and any potential threats are discountable. Therefore, the proposed action is not likely to adversely affect Johnson's seagrass, or its critical habitat and will not be considered further in this Opinion.

Critical habitat has been designated for Johnson's seagrass to include substrate and water in a portion of the Indian River Lagoon, north of the Sebastian Inlet Channel; a portion of the Indian River Lagoon, south of the Sebastian Inlet Channel; a portion of the Indian River Lagoon near the Fort Pierce Inlet; a portion of the Indian River Lagoon, north of the St. Lucie Inlet; a portion of Hobe Sound; a site on the south side of Jupiter Inlet; a site in central Lake Worth Lagoon; a site in Lake Worth Lagoon, Boynton Beach; a site in Lake Wyman, Boca Raton; and a portion of Biscayne Bay.

Researchers must take all practicable steps to identify submerged aquatic vegetation (SAV) including Johnson's seagrass and avoid setting gear in such areas. Researchers must use strategies to identify SAV including the use of tools such as charts, GIS, sonar, fish finders, or other electronic devices to help determine characteristics and suitability of bottom habitat prior to using gear. If research gear is lost, diligent efforts must be made to recover the lost gear to avoid further damage to benthic habitat and impacts related to ghost fishing. Johnson's seagrass critical habitat is highly unlikely to be exposed to effects from the proposed action and any potential threats are discountable. Therefore, the proposed action is not likely to adversely affect this critical habitat and it will not be considered further in this Opinion.

Corals

Elkhorn, staghorn, pilar bounder mountainous star and star coral may occur in the areas of the proposed activities. Staghorn and elkhorn critical habitat has been designated in four specific areas marine areas: the Florida area; the Puerto Rico area; the St. John/St. Thomas area; and the St. Croix area. The physical feature essential to the conservation of elkhorn and staghorn corals is: substrate of suitable quality and availability to support larval settlement and recruitment, and reattachment and recruitment of asexual fragments. "Substrate of suitable quality and availability" is defined as natural consolidated hard substrate or dead coral skeleton that is free from fleshy or turf macroalgae cover and sediment cover.

Researchers must take all practicable steps to identify corals and hard/live bottom habitat and avoid setting gear in such areas. No gear may be set, anchored on, or pulled across coral or hard/live bottom habitats. Researchers must use strategies to identify corals and hard/live bottom habitats using tools such as charts, GIS, sonar, fish finders, or other electronic devices to help

determine characteristics and suitability of bottom habitat prior to using gear. If research gear is lost, diligent efforts must be made to recover the lost gear to avoid further damage to benthic habitat and impacts related to ghost fishing. Neither corals nor their designated critical habitat are likely to be exposed to effects from the proposed action and any potential threats are discountable. Therefore, the proposed action is not likely to adversely affect corals or their designated critical habitat and they will not be considered further in this Opinion.

Analysis of Species Likely to be Adversely Affected

The rest of this section of our Opinion consists of narratives for each of the threatened and endangered species that occur in the action area and that may be adversely affected by the activities *permit 18069* and *permit modification 14726-02* propose to conduct. In each narrative, we present a general species description and a summary of information on the distribution and population structure of each species to provide a foundation for the exposure analyses that appear later in this Opinion. Then we summarize information on the threats to the species and the species' status given those threats to provide points of reference for the determinations we make later in this Opinion. That is, we rely on a species' status and trend to determine whether or not an action's direct or indirect effects are likely to increase the species' probability of becoming extinct.

Green sea turtle

Species description and distribution

The green sea turtle is the largest of the hardshell marine turtles, growing to a weight of 350 lb (159 kg) and a straight carapace length of greater than 3.3 ft (1 m). It has a circumglobal distribution, occurring throughout nearshore tropical, subtropical, and, to a lesser extent, temperate waters. The species was listed under the ESA on July 28, 1978 (43 FR 32800). The species was separated into two listing designations: endangered for breeding populations in Florida and the Pacific coast of Mexico, and threatened in all other areas throughout its range. On August 1, 2012, NMFS found that a petition to identify the Hawaiian population of green turtle as a DPS, and to delist the DPS, may be warranted (77 FR 45571). We used information available in the 2007 5-Year Review (NMFS & FWS 2007) to summarize the status of the species, as follows.

Life history

Age at first reproduction for females is 20 - 40 years. They lay an average of three nests per season with an average of 100 eggs per nest. The remigration interval (i.e., return to natal beaches) is 2 – 5 years. Nesting occurs primarily on beaches with intact dune structure, native vegetation, and appropriate incubation temperatures during summer months. After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to live for several years. During this life stage, green sea turtles feed close to the surface on a variety of marine algae and other life associated with drift lines and debris. Adult turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green sea turtles spend the majority of their lives in coastal foraging grounds, which include open coastlines and protected bays and lagoons. Adult green turtles feed primarily on seagrasses and algae, although they also eat jellyfish, sponges, and other

invertebrate prey. Important neritic habitats include: Mosquito and Indian River Lagoons, Port Canaveral, St. Lucie Inlet, and Biscayne Bay.

Population dynamics
Nesting data at 46 sites from 1990-2006 indicate that 108,761 to 150,521 females nest each year. At the 23 sites for which nesting trend data are available, ten are increasing, nine are stable, and four are decreasing. Where long term data ($\geq$ 20 years) are available (nine sites), nesting populations are stable or increasing in abundance. Nesting populations are doing relatively well in the Pacific, Western Atlantic, and Central Atlantic Ocean; whereas, populations are doing poorly in Southeast Asia, Eastern Indian Ocean, and Mediterranean. Along the central and southeast coast of Florida, an estimated 200 – 1,100 females nest each year (Meylan et al. 1994; Weishampel et al. 2003). According to data collected from Florida's index nesting beach survey from 1989-2012, green sea turtle nest counts across Florida have increased approximately ten-fold from a low of 267 in the early 1990s to a high of 10,701 in 2011. In the Pacific Mexico, surveys from 2000 to 2006 indicate an average of 6,050 nests, and a 25-year dataset reveals an increasing trend for the largest nesting site (Colola).

Status
Once abundant in tropical and subtropical waters, globally, green sea turtles exist at a fraction of their historical abundance, as a result of over-exploitation. Egg harvest, the harvest of females on nesting beaches, and directed hunting of turtles in foraging areas remain the three greatest threats to their recovery. In addition, bycatch in drift-net, long-line, set-net, pound-net, and trawl fisheries kill thousands of green sea turtles annually. Increasing coastal development (including construction, beach erosion and renourishment, and artificial lighting) threatens nesting success and hatchling survival. Apparent increases in recent years are optimistic but must be viewed cautiously, as the datasets represent a fraction of a green sea turtle generation, up to 50 years. While the threats of harvest, coastal development, and fisheries bycatch continue, the species appears to be somewhat resilient to future perturbations.

Recent increases in nesting on Florida beaches are likely a result of a Florida statute prohibiting the killing of green sea turtles, ESA listing, the 1994 Florida State ban on gillnets and other entangling nets, CITES Appendix I listing, and turtle protections in other nations. Recent increases in the Mexican breeding populations are likely the result of nesting beach protection (1979) and a 1990 presidential decree protecting all sea turtles. However, the threats of harvest, coastal development, and fisheries bycatch continue. The populations' resilience to future perturbations is low but increasing with population size increases.

Critical habitat
On September 2, 1998, NMFS designated critical habitat for green sea turtles (63 FR 46694), which include coastal waters surrounding Culebra Island, Puerto Rico. Seagrass beds surrounding Culebra provide important foraging resources for juvenile, subadult, and adult green sea turtles. Additionally, coral reefs surrounding the island provide resting shelter and protection from predators. This area provides important developmental habitat for the species.

Hawksbill sea turtle

Species description and distribution
The hawksbill sea turtle has a sharp, curved, beak-like mouth. It has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical oceans. The species was first listed under the Endangered Species Conservation Act (35 FR 8491) and listed as endangered under the ESA since 1973. We used information available in the 5-year reviews (NMFS 2007 and NMFS 2013) to summarize the status of the species, as follows.

Life history
Hawksbill sea turtles reach sexual maturity at 20 – 40 years of age. Females return to their natal beaches every 2 – 5 years to nest (an average of 3 – 5 times per season). Clutch sizes are large (up to 250 eggs). Sex determination is temperature dependent, with warmer incubation producing more females. Hatchlings migrate to and remain in pelagic habitats until they reach approximately 22 – 25 cm in straight carapace length. As juveniles, they take up residency in coastal waters to forage and grow. As adults, hawksbills use their sharp beak-like mouths to feed on sponges and corals.

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

Status
Long-term data on the hawksbill sea turtle indicate that 63 sites have declined over the past 20 to 100 years (historic trends are unknown for the remaining 25 sites). Recently, 28 sites (68 percent) have experienced nesting declines, 10 have experienced increases, three have remained stable, and 47 have unknown trends. The greatest threats to hawksbill sea turtles are overharvesting of turtles and eggs, degradation of nesting habitat, and fisheries interactions. Adult hawksbills are harvested for their meat and carapace, which is sold as tortoiseshell. Eggs are taken at high levels, especially in Southeast Asia where collection approaches 100 percent in some areas. In addition, lights on or adjacent to nesting beaches are often fatal to emerging hatchlings and alters the behavior of nesting adults. The species' resilience to additional perturbation is low.

Critical habitat
On September 2, 1998, NMFS established critical habitat for hawksbill sea turtles around Mona and Monito Islands, Puerto Rico (63 FR 46693). Aspects of these areas that are important for hawksbill sea turtle survival and recovery include important natal development habitat, refuge from predation, shelter between foraging periods, and food for hawksbill sea turtle prey.

Kemp's ridley sea turtle

Species description and distribution

The Kemp's ridley is the smallest of all sea turtle species and considered to be the most endangered sea turtle, internationally (Zwinenberg 1977; Groombridge 1982; TEWG 2000). Its range extends from the Gulf of Mexico to the Atlantic coast, with nesting beaches limited to a few sites in Mexico and Texas. The species was first listed under the Endangered Species Conservation Act (35 FR 8491) and listed as endangered under the ESA since 1973. We used information available in the revised recovery plan (NMFS 2011) to summarize the status of the species, as follows.

Life history

Adult Kemp's ridley sea turtles have an average straight carapace length of 2.1 ft (65 cm). Females mature at 12 years of age. The average remigration is 2 years. Nesting occurs from April to July in large arribadas, primarily at Rancho Nuevo, Mexico. Females lay an average of 2.5 clutches per season. The annual average clutch size is 97 – 100 eggs per nest. The nesting location may be particularly important because hatchlings can more easily migrate to foraging grounds in deeper oceanic waters, where they remain for approximately 2 years before returning to nearshore coastal habitats. Juvenile Kemp's ridley sea turtles use these nearshore coastal habitats from April through November, but move towards more suitable overwintering habitat in deeper offshore waters (or more southern waters along the Atlantic coast) as water temperature drops. Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 ft (37 m) deep, although they can also be found in deeper offshore waters. As adults, Kemp's ridleys forage on swimming crabs, fish, jellyfish, mollusks, and tunicates.

Population dynamics

Of the seven species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Nesting aggregations at a single location (Rancho Nuevo, Mexico) were estimated at 40,000 females in 1947. By the mid-1980s, the population had declined to an estimated 300 nesting females. From 1980 to 2003, the number of nests increased 15 percent annually. In 2009, an estimated 8,000 nesting females produced over 20,000 nests. In addition, a total of 911 nests were recorded on the Texas coast from 2002 – 2010.

Status

The Kemp's ridley was listed as endangered in response to a severe population decline, primarily the result of egg collection. In 1973, legal ordinances prohibited the harvest of sea turtles from May to August, and in 1990, the harvest of all sea turtles was prohibited by presidential decree. In 2002, Rancho Nuevo was declared a Sanctuary. A successful head-start program has resulted in the reestablishment of nesting at Texan beaches. While fisheries bycatch remains a threat, the use of turtle excluder devices mitigates take. Fishery interactions and strandings, possibly due to forced submergence, appear to be the main threats to the species. It is clear that the species is steadily increasing; however, the species' limited range and low global abundance make it vulnerable to new sources of mortality as well as demographic and environmental randomness, all of which are often difficult to predict with any certainty. Therefore, its resilience to future perturbation is low.

Leatherback sea turtle

Species description and distribution

The leatherback sea turtle is unique among sea turtles for its large size, wide distribution (due to thermoregulatory systems and behavior), and lack of a hard, bony carapace. It ranges from tropical to subpolar latitudes, worldwide. The species was first listed under the Endangered Species Conservation Act (35 FR 8491) and listed as endangered under the ESA since 1973. We used information available in the 5-year review (NMFS 2007) and the critical habitat designation (77 FR 61573) to summarize the status of the species, as follows.

Life history

Age at maturity remains elusive, with estimates ranging from 5 to 29 years (Spotila et al. 1996; Avens et al. 2009). Females lay up to seven clutches per season, with more than 65 eggs per clutch and eggs weighing >80 g (Reina et al. 2002; Wallace et al. 2007). The number of leatherback hatchlings that make it out of the nest on to the beach (i.e., emergent success) in approximately 50% worldwide (Eckert et al. 2012). Females nest every 1 – 7 years. Natal homing, at least within an ocean basin, results in reproductive isolation between five broad geographic regions: eastern and western Pacific, eastern and western Atlantic, and Indian Ocean. Leatherback sea turtles migrate long, transoceanic distances between their tropical nesting beaches and the highly productive temperate waters where they forage, primarily on jellyfish and tunicates. These gelatinous prey are relatively nutrient-poor, such that leatherbacks must consume large quantities to support their body weight. Leatherbacks weigh ~33 percent more on their foraging grounds than at nesting, indicating that they probably catabolize fat reserves to fuel migration and subsequent reproduction (James et al. 2005; Wallace et al. 2006). Sea turtles must meet an energy threshold before returning to nesting beaches (Rivalan et al. 2005; Sherrill-Mix and James 2008; Casey et al. 2010). Therefore, their remigration intervals (the time between nesting) are dependent upon foraging success and duration (Hays 2000; Price et al. 2004).

Population dynamics

The global population of adult females has declined over 70 percent in less than one generation, from an estimated 115,000 adult females in 1980 to 34,500 adult females in 1995 (Pritchard 1982; Spotila et al. 1996). There may be as many as 34,000 – 94,000 adult leather backs in the North Atlantic, alone (TEWG 2007), but dramatic reductions (> 80 percent) have occurred in several populations in the Pacific, which was once considered the stronghold of the species (Sarti Martinez 2000).

Status

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

tracts leading to death. Climate change may alter sex ratios (as temperature determines hatchling sex), range (through expansion of foraging habitat), and habitat (through the loss of nesting beaches, as a result of sea-level rise. The species' resilience to additional perturbation is low.

Critical habitat

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

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

Loggerhead sea turtle (Northwest Atlantic Ocean)

Species description and distribution

The loggerhead sea turtle is distinguished from other turtles by its large head and powerful jaws. The Northwest Atlantic Ocean DPS inhabits continental shelf and estuarine environments throughout tropical and temperate waters in the North Atlantic to 40° W. The species was first listed as threatened under the Endangered Species Act in 1978 (43 FR 32800). In 2011, the Northwest Atlantic Ocean DPS was listed as threatened under the ESA (76 FR 58868). We used information available in the 2009 Status Review (Conant et al. 2009) and the final listing rule (76 FR 58868) to summarize the status of the species, as follows.

Life history

Adult loggerhead sea turtles have a mean straight carapace length of 3 ft (92 cm). Mean age at first reproduction for female loggerhead sea turtles is 30 years (*SD* = 5). Mating occurs in the spring, and eggs are laid throughout the summer. Northwest Atlantic females lay an average of five clutches per season. The annual average clutch size is 115 eggs per nest. The average remigration interval is 3.7 years (Tucker 2010). Nesting occurs primarily on beaches along the southeastern coast of the United States, from southern Virginia to Alabama. Additional nesting occurs on beaches throughout the Gulf of Mexico and Caribbean Sea. Temperature determines the sex of the turtle during the middle of the incubation period. Post- hatchling loggerheads from southeast U.S. nesting beaches may linger for months in waters just off the nesting beach or become transported by ocean currents within the Gulf of Mexico and North Atlantic, where they become associated with *Sargassum* habitats, driftlines, and other convergence zones. The juvenile stage is spent first in the oceanic zone (e.g., waters around the Azores, Madeira,

Morocco, and the Grand Banks off Newfoundland) and later in the neritic zone (i.e., continental shelf waters) from Cape Cod Bay, Massachusetts, south through Florida, the Caribbean, and the Gulf of Mexico. Neritic stage juveniles often inhabit relatively enclosed, shallow water estuarine habitats with limited ocean access. Juveniles are omnivorous and forage on crabs, mollusks, jellyfish and vegetation at or near the surface (Dodd 1988). Adults inhabit shallow water habitats with large expanses of open ocean access, as well as continental shelf waters. Sub-adult and adult loggerheads prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom, coastal habitats.

Population dynamics

There are nine loggerhead DPSs, which are geographically separated and genetically isolated, as indicated by genetic, tagging, and telemetry data. The Northwest Atlantic Ocean DPS is further divided into five recovery units or nesting subpopulations: Northern, Peninsular Florida, Dry Tortugas, Northern Gulf of Mexico, and Greater Caribbean. Using a stage/age demographic model, the adult female population size of the DPS is estimated at 20,000 – 40,000 females (NMFS-SEFSC 2009). Peninsular Florida hosts more than 10,000 females nesting annually, which constitutes 87 percent of all nesting effort in the DPS. A 23 percent increase in nest counts from 1989 until 1998 was followed by a sharp decline in the subsequent decade (http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/); large fluctuations in population size often indicate the loss of resilience and susceptibility to population collapse (Dai et al. 2012; Scheffer et al. 2012). Nesting aggregations from Georgia to North Carolina host 1,000 to 9,999 females nesting annually. The other recovery units are much smaller but are still considered essential to the continued existence of the species.

Status

The loggerhead sea turtle Northwest Atlantic Ocean DPS was listed as threatened under the ESA as a result of bycatch mortality, resulting from domestic and international commercial fishing, particularly in gillnet, longline, and trawl fisheries. Turtle excluder devices on shrimp trawlers and the use of circle hooks in the longline fishery have reduced bycatch significantly; however bycatch remains the most significant threat to the DPS. The rangewide nesting trend of the DPS from 1989 until 2010 is slightly negative but not significantly different from zero. We conclude that, as a result of its relatively large abundance (20,000 – 40,000 females), the DPS is not currently at risk of extinction; however, its large fluctuations in population size indicates loss of resilience, such that it is likely to become endangered within the foreseeable future.

Proposed critical habitat

On July 18, 2013, NMFS proposed critical habitat for the Northwest Atlantic Ocean loggerhead DPS within the Atlantic Ocean and the Gulf of Mexico. Specific areas proposed for designation include 36 occupied marine areas within the range of the Northwest Atlantic Ocean DPS. These areas contain one or a combination of nearshore reproductive habitat, winter area, breeding areas, and migratory corridors.

Environmental Baseline

The environmental baseline for this Opinion includes the effects of several activities that affect the survival and recovery of threatened and endangered species and its habitat (including designated critical habitat), and ecosystem, within the action area. As noted above, sea turtles found in the action areas may travel widely throughout the Atlantic, Gulf of Mexico, and Caribbean Sea. Therefore, individuals found in an action area can potentially be affected by multiple activities with multiple incidents, anywhere within this wide range (Moore et al. 2009).

The environmental baseline 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 which 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 within the action area.

A number of human activities have contributed to the current status of listed sea turtle species in the action area. Some of those activities, (e.g. commercial harvesting of individuals as well as eggs) no longer occur in the U.S., yet are still a problem in other countries. Other human activities are ongoing and appear to be directly or indirectly affecting these species. Additionally, unrelated factors may be acting together to affect listed species, such as global warming.

Taken together, the components of the environmental baseline for the action area include sources of natural mortality as well as influences from natural oceanographic and climatic features in the action areas. Circulation and productivity patterns influence food distribution and habitat quality for listed species. The effects of climatic variability on these species in the action areas and the availability of food remain largely undetermined; however, it is likely that any changes in weather and oceanographic conditions resulting in effects on population dynamics (i.e. sex-ratios) as well as food availability would have dire consequences for sea turtle species.

Federal Activities

NMFS has undertaken a number of Section 7 consultations to address the effects of federally- permitted fisheries and other federal actions on threatened and endangered sea turtle species, and when appropriate, has authorized the incidental taking of these species. Each of those consultations sought to minimize the adverse effects of the action on sea turtles. The summary below of federal actions and the effects these actions have had on sea turtles includes only those federal actions in the action areas that have already undergone formal or early section 7 consultation.

Fisheries. Threatened and endangered sea turtles are adversely affected by several types of fishing gears used throughout the action area. Gillnet, longline, other types of hook-and-line gear, trawl gear, and pot fisheries have all been documented as interacting with sea turtles (Finkbeiner et al. 2011). Available information suggests sea turtles can be captured in any of these gear types when the operation of the gear overlaps with the distribution of sea turtles. For

all fisheries for which there is a fisheries management plan (FMP) or for which any federal action is taken to manage that fishery, impacts have been evaluated under Section 7. The fisheries listed below occur within the habitat range of sea turtles found in the action area, and have had formal Section 7 consultations conducted on them. These fisheries were found likely to adversely affect threatened and endangered sea turtles, and an incidental take statement (ITS) has been issued for the take of sea turtles in each. A brief summary of each fishery is provided, but more detailed information and corresponding ITS can be found in the respective Opinions.

The *Atlantic Bluefish Fishery* has been operating in the U.S. Atlantic for at least the last half century, although its popularity did not heighten until the late 1970s and early 1980s (MAFMC and ASMFC 1998). The majority of commercial fishing activity in the North Atlantic and Mid-Atlantic occurs in the late spring to early fall, when bluefish (and sea turtles) are most abundant in these areas (NEFSC 2005a). This fishery is known to interact with loggerhead sea turtles, given the time and locations where the fishery occurs. Gillnets and bottom otter trawls are the predominant gear types used in the commercial bluefish fishery (MAFMC 2009). In 2006, gillnet gear accounted for 32.4 percent of the total commercial trips targeting bluefish, and landed 72 percent of the commercial catch for that year (MAFMC 2007). Bottom otter trawls accounted for 44 percent of the total commercial trips targeting bluefish and landed 20.4 percent of the catch (MAFMC 2007).

The most recent formal consultation on the bluefish fishery was completed on October 29, 2010. An Incidental Take Statement was provided with the 2010 opinion along with non-discretionary reasonable and prudent measures (RPMs) to minimize the impacts of incidental take. The incidental take estimates in the 2010 opinion were based on observed interactions from Sea Sampling data for gear types targeting or capable of catching bluefish (NMFS 1999a). The anticipated incidental take of loggerhead sea turtles was estimated from annual bycatch reports published by Murray (2006, 2008). At the time of the 2010 opinion, the bluefish fishery was believed to interact with these species given the time and locations where the fishery occurred. Although no incidental takes of listed sea turtles had been reported in bottom otter trawl gear for trips that were 'targeting' bluefish[5], incidental takes of loggerhead and Kemp's ridley sea turtles were observed in bottom otter trawl gear where bluefish were caught but constituted less than 50 percent of the catch (NMFS 1999a).

Although NMFS was not aware until 2003 that sea turtle interactions with fishing gear targeting bluefish were likely to occur, there is no information to suggest that sea turtle interactions with bluefish fishing gear are a new event or are occurring at a greater rate than what has likely occurred in the past. To the contrary, the methods used to detect any sea turtle interactions with bluefish fishing gear were insufficient prior to increased observer coverage in recent years. The number of incidental takes anticipated in 2010 Opinion for bluefish bottom otter trawl gear has been exceeded; this represents new information on the effects of the bluefish fishery on listed sea turtles. Formal consultation on the bluefish fishery was reinitiated on February 6, 2012, to reevaluate the effects of the fishery on listed whales and sea turtles, and the newly listed Atlantic sturgeon. The consultation is ongoing.

[5] Bluefish trips were defined as trips were greater than 50% of the catch was bluefish.

The *Atlantic Sea Scallop Fishery* has a long history of operation in Mid-Atlantic, as well as New England waters (NEFMC 1982, 2003). The fishery operates in areas and at times that it has traditionally operated and uses traditionally fished gear (NEFMC 1982, 2003). Landings from Georges Bank and the Mid-Atlantic dominate the fishery (NEFSC 2007a). On Georges Bank and in the Mid-Atlantic, sea scallops are harvested primarily at depths of 30-100 m, while the bulk of landings from the Gulf of Maine are from relatively shallow nearshore waters (<40 m) (NEFSC 2007).

It was previously believed that the fishery was unlikely to take sea turtles given differences in depth and temperature preferences for sea turtles and the optimal areas where the fishery occurs. However, after the reopening of a closed area in the mid-Atlantic, and the accumulation of more extensive observer effort, NMFS conducted a formal section 7 consultation on the fishery (NFMS 2012b). NMFS concluded that operation of the fishery may adversely affect but was not likely to jeopardize the continued existence loggerhead, Kemp's ridley, green, and leatherback sea turtles as a result of capture in scallop dredge and/or trawl gear.

NMFS' consultation on the *Atlantic Herring Fishery* FMP concluded that the federal herring fishery may adversely affect loggerhead, leatherback, Kemp's ridley, and green sea turtles as a result of capture in gear used in the fishery (NMFS 1999b), but not jeopardize their continued existence. NMFS currently authorizes the use of purse seines, mid-water trawls (single), and pair trawls are the three primary gears involved in the Atlantic herring fishery (NEFMC 2006) (64 FR 4030). Since 2000, pair trawl gear has accounted for the majority of herring landed each year (NEFMC 2006). There is no direct evidence of takes of listed species in the herring fishery from the NMFS sea sampling program. However, observer coverage of this fishery has been minimal. An ITS for sea turtles was provided with the Opinion, based on the observed capture of sea turtles in other fisheries using comparable gear. Consultation on the Atlantic herring fishery was reinitiated on March 23, 2005, and concluded informally.

The *Northeast Multispecies, Monkfish, Spiny Dogfish, Atlantic Bluefish, Northeast Skate Complex, Mackerel/Squid/Butterfish, and Summer Flounder/Scup/Black Sea Bass Fisheries* are now managed under a single FMP. The most recent biological opinion concluded that the continued authorization of the FMP was likely to adversely affect sea turtles, but not jeopardize their continued existence (NMFS 2013). Trawl gear is the primary fishing gear for these fisheries, but several other types of gear may also be used, including hook-and-line, pot/trap, dredge, pound net, and bandit gear. Entanglements or entrapments of sea turtles have been recorded in one or more of these gear types. Significant measures have been developed to reduce the take of sea turtles in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which would include fisheries for other species like scup and black sea bass). Turtle excluder devices (TEDs) are required throughout the year for trawl nets fished from the North Carolina/South Carolina border to Oregon Inlet, North Carolina, and seasonally (March 16-January 14) for trawl vessels fishing between Oregon Inlet, North Carolina, and Cape Charles, Virginia.

The *Atlantic Highly Migratory Species* (HMS) are known to take sea turtles via pelagic longline, pelagic driftnet, bottom longline, hand line (including bait nets), and/or purse seine gear (NMFS 2004). A permanent prohibition on the use of driftnet gear in the swordfish fishery was published in 1999. The Opinion analyzed the effects of proposed regulatory modifications to the HMS FMP that address the impacts of the HMS pelagic longline fishery on endangered green, hawksbill, Kemp's ridley, and leatherback sea turtles and on threatened loggerhead and olive ridley sea turtles. However, the proposed action was not expected to jeopardize the continued existence of any of these.

The commercial *HMS Atlantic Shark Fisheries* (NMFS 2012a) uses bottom longline and gillnet gear. The recreational sector of the fishery uses only hook-and-line gear. To protect declining shark stocks the proposed action seeks to greatly reduce the fishing effort in the commercial component of the fishery. These reductions are likely to greatly reduce the interactions between the commercial component of the fishery and sea turtles. The consultation concluded the proposed action was not likely to jeopardize the continued existence of sea turtles.

NMFS completed a consultation on the *Caribbean Reef Fish Fishery*, on October 4, 2011. The reef fish fishery in waters around Puerto Rico and the USVI uses pots and traps, hook and line, longline, and spearguns. The fishery targets snapper and groupers, as well as herbivorous fish (i.e., parrotfish and surgeonfish). The Opinion concluded that the fishery was likely to adversely affect green, hawksbill, and leatherback sea turtles via vessel strikes and entanglements in fishing gear, but would not jeopardize their continued existence.

In 2007, NMFS completed a Section 7 consultation on the continued authorization of the coastal migratory pelagic resources fishery in the Gulf of Mexico and South Atlantic (NMFS 2007). Commercial fishermen target king and Spanish mackerel with hook-and-line (i.e., handline, rod-and-reel, and bandit), gillnet, and cast net gears. Recreational fishermen use only rod-and-reel. Trolling is the most common hook-and-line fishing technique used by both commercial and recreational fishermen. A winter troll fishery operates along the east and south Gulf coast. Although run-around gillnets accounted for the majority of the king mackerel catch from the late 1950s through 1982, in 1986, and in 1993, handline gear has been the predominant gear used in the commercial king mackerel fishery since 1993 (NMFS 2007a). The gillnet fishery for king mackerel is restricted to the use of "run-around" gillnets in Gulf to Monroe and Collier Counties in January. Run-around gillnets are still the primary gear used to harvest Spanish mackerel, but the fishery is relatively small because Spanish mackerel are typically more concentrated in state waters where gillnet gear is prohibited. The 2007 Opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected only by the gillnet component of the fishery. The continued authorization of the fishery was not expected to jeopardize the continued existence of any of these species and an ITS was provided.

The South Atlantic FMP for the *Dolphin-Wahoo Fishery* was approved in December 2003. The stated purpose of the Dolphin and Wahoo FMP is to adopt precautionary management strategies to maintain the current harvest level and historical allocations of dolphin (90 percent recreational) and ensure no new fisheries develop. NMFS' consultation concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by

the longline component of the fishery, but it was not expected to jeopardize their continued existence (NMFS 2003a). In addition, pelagic longline vessels can no longer target dolphin-wahoo with smaller hooks because of hook size requirements in the pelagic longline fishery.

The *Gulf of Mexico Reef Fish Fishery* uses two basic types of gear: spear or powerhead, and hook-and-line gear. Hook-and-line gear used in the fishery includes both commercial bottom longline and commercial and recreational vertical line (e.g., handline, bandit gear, rod-and-reel). Prior to 2008, the reef fish fishery was believed to have relatively moderate level of sea turtle bycatch attributed to the hook-and-line component of the fishery (i.e., approximately 107 captures and 41 mortalities annually, all species combined, for the entire fishery) (NMFS 2005c). In 2008, SEFSC observer programs and subsequent analyses indicated that the overall amount and extent of incidental take for sea turtles specified in the incidental take statement of the 2005 Opinion on the reef fish fishery had been severely exceeded by the bottom longline component of the fishery (approximately 974 captures and at least 325 mortalities estimated for the period July 2006-2007).

In response, NMFS published in May 2009 an emergency rule prohibiting the use of bottom longline gear in the reef fish fishery shoreward of a line approximating the 50-fathom depth contour in the eastern Gulf of Mexico, essentially closing the bottom longline sector of the reef fish fishery in the eastern Gulf of Mexico for six months pending the implementation of a long-term management strategy. The Gulf of Mexico Fishery Management Council developed a long-term management strategy via a new amendment (Amendment 31 to the Reef Fish FMP). The amendment included a prohibition on the use of bottom longline gear in the Gulf of Mexico reef fish fishery, shoreward of a line approximating the 35-fathom contour east of Cape San Blas, Florida, from June through August; a reduction in the number of bottom longline vessels operating in the fishery via an endorsement program and a restriction on the total number of hooks that may be possessed onboard each Gulf of Mexico reef fish bottom longline vessel to 1,000, only 750 of which may be rigged for fishing.

The new biological opinion analyzed the expected effects of the continued operation of the Gulf of Mexico reef fish fishery under the changes proposed in Amendment 31 (NMFS-SEFSC 2009). The Opinion concluded that sea turtle takes would be substantially reduced compared to the fishery as it was previously prosecuted, and that operation of the fishery would not jeopardize the continued existence of any sea turtle species. In August 2011, consultation was reinitiated to address the DWH oil release event and potential changes to the environmental baseline. Reinitiation of consultation was not related to any material change in the fishery itself, violations of any terms and conditions of the 2009 Opinion, or exceeding the incidental take statement. The resulting September 30, 2011 Opinion concluded the continued operation of the Gulf of Mexico reef fish fishery is not likely to jeopardize the continued existence of any listed sea turtles (NMFS 2011c).

The *Monkfish Fishery* occurs from Maine to the North Carolina/South Carolina border and is jointly managed by the New England Fishery Management Council (NEFMC) and MAFMC, under the Monkfish FMP (NEFSC 2005b). The current commercial fishery operates primarily in the deeper waters of the Gulf of Maine, Georges Bank, and southern New England, and in the

Mid-Atlantic. Monkfish have been found in depths ranging from the tide line to 900 meters with concentrations between 70 and 100 meters and at 190 meters. The directed monkfish fishery uses several gear types that may entangle protected species, including gillnet and trawl gear.

Gillnet gear used in the monkfish fishery is known to capture listed sea turtles. Two unusually large stranding events occurred in April and May 2000 during which 280 sea turtles (275 loggerheads and 5 Kemp's ridleys) washed ashore on ocean facing beaches in North Carolina. Although there was not enough information to specifically determine the cause of the sea turtle deaths, there was information to suggest that the turtles died as a result of entanglement with large-mesh gillnet gear. The monkfish gillnet fishery, which uses a largemesh gillnet, was known to be operating in waters off of North Carolina at the time the stranded turtles would have died. As a result, on December 3, 2002, NMFS published a Final Rule on, that established the restrictions on an annual basis.

In 2006, Northeast Fisheries Science Center (NEFSC) released a reference document that reported on the annual estimated taking of loggerhead sea turtles in bottom-otter trawl gear fished in Mid-Atlantic waters during the period of 1996-2004 (Murray 2006). This new report on the capture of loggerhead sea turtles in the monkfish fishery led to reinitiation of consultation. The rule was subsequently modified on April 26, 2006, by modifying the restrictions to the use of gillnets with greater than or equal to 7-inch stretched mesh when fished in federal waters from the North Carolina/South Carolina border to Chincoteague, Virginia. The resulting biological opinion, issued on October 29, 2010, concluded the continued operation of the monkfish fishery under the proposed changes was likely to adversely affect green, Kemp's ridley, loggerhead and leatherback sea turtles, but was not likely to jeopardize their continued existence (NMFS 2010a).

The *Skate Fishery* has typically been composed of both a directed fishery and an indirect fishery. Otter trawls are the primary gear used to land skates in the United States, with some landings also coming from sink gillnet, longline, and other gear (NEFSC 2007b). Section 7 consultation on the skate FMP was completed July 24, 2003 (NMFS 2003b), and concluded that authorization of the skate fishery may adversely affect listed sea turtles as a result of interactions with gillnet and trawl gear.

The anticipated incidental take of loggerhead, leatherback, Kemp's ridley, and green sea turtles in skate fishing gear authorized by the 2003 biological opinion was based on observed captures of sea turtles in analogous trawl and gillnet fisheries (NMFS 2003b). From 2006-2009, the NMFS' NEFSC released a number of reference documents and reports (i.e., Murray 2006, 2008, and 2009a) that allowed for an estimate of sea turtles takes that were specific to skate gillnet and trawl gears. The Northeast Region considered these bycatch estimates to be new information on the effects of the skate fishery on listed sea turtles and reinitiated consultation to reconsider the effects of the skate fishery on listed species. Reinitiation of consultation was completed on October 29, 2010, and concluded that operation of the skate fishery may adversely affect listed sea turtles as a result of interactions with (capture in) gillnet and trawl gear, but that the continued authorization of the fishery would not jeopardize the continued existence of green, hawksbill, Kemp's ridley leatherback, and loggerhead sea turtles. (NMFS 2010b).

The *South Atlantic Snapper-Grouper Fishery* (NMFS 2006) uses spear and powerhead, black sea bass pot, and hook-and-line gear. Hook-and-line gear used in the fishery includes commercial bottom longline gear and commercial and recreational vertical line gear (e.g., handline, bandit gear, and rod-and-reel). The consultation found only hook-and-line gear likely to adversely affect, green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles. The consultation concluded the proposed action was not likely to jeopardize the continued existence of any of these species.

The North Carolina inshore fall *Southern Flounder Gillnet Fishery* was identified as a source of large numbers of sea turtle mortalities in 1999 and 2000, especially loggerhead sea turtles. In 2001, NMFS issued an ESA section 10 permit to North Carolina with mitigative measures for the southern flounder fishery. Subsequently, the sea turtle mortalities in these fisheries were drastically reduced.

The *Spiny Dogfish Fishery* primary gear types are sink gillnets, otter trawls, bottom longline, and driftnet gear (NEFSC 2003). The predominance of any one gear type has varied over time (NEFSC 2003). Sea turtles can be incidentally captured in spiny dogfish gear, which can lead to injury and death as a result of forced submergence in the gear. Section 7 consultation on the continued operation of the fishery under the Spiny Dogfish FMP was reinitiated by NMFS on April 2, 2008. Section 7 consultation on the Spiny Dogfish FMP was completed October 29, 2010, and concluded that operation of the spiny dogfish fishery may adversely affect listed sea turtles as a result of interactions with (capture in) gillnet and trawl gear (NMFS 2010c).

The commercial *Gulf of Mexico/South Atlantic Spiny Lobster Fishery* (NMFS 2009a) consists of diving, bully net and trapping sectors; recreational fishers are authorized to use bully net and hand-harvest gears. Of the gears used, only traps are expected to result in adverse effects on sea turtles. The consultation determined that the continued authorization of the fishery would not jeopardize the continued existence of green, hawksbill, Kemp's ridley leatherback, and loggerhead sea turtles. Fishing activity is limited to waters off south Florida and, although the FMP does authorize the use of traps in federal waters, historic and current effort is very limited. Thus, potential adverse effects on sea turtles are believed to also be very limited (e.g., no more than a couple sea turtle entanglements annually).

The *Caribbean Spiny Lobster Fishery* in waters around Puerto Rico and the USVI occurs with pots and traps, and hand-harvest. Due to the predominance of fishable habitat in state waters, it is assumed that most of the commercial harvest occurs in state waters, but fishery statistics do not allow accurate separation of harvest in the exclusive economic zone (EEZ) from harvest in state waters (Matos-Caraballo 2002). NMFS completed a formal consultation on the fishery on December 12, 2011 (NMFS 2011b). The Opinion concluded that the continued operation of the fishery was likely to adversely affect leatherback, green, and hawksbill sea turtles; those effects were not likely to jeopardize the continued existence of any species.

The *Gulf of Mexico Stone Crab Fishery* (NMFS 2009b) is unique in that only the claws of the crab are harvested (Muller *et al.* 2006). The fishery operates primarily nearshore and fishing techniques have changed little since the implementation of the federal Stone Crab Fishery

Management Plan. The commercial and recreational fishery consists of trap/pot, and recreational hand harvest. Stone crab traps are known to adversely affect sea turtles via entanglement and forced submergence. The fishery is currently management through spatio-temporal closures, effort limitations, harvest limitations, permit requirements, trap construction requirements, and a passive trap limitation program managed by the State of Florida. Recreational fishers must follow the same guidelines as commercial fishers unless otherwise noted. The consultation determined the continued authorization of the fishery would not jeopardize the continued existence of green, hawksbill, Kemp's ridley leatherback, and loggerhead sea turtles.

The *Southeastern Shrimp Trawl Fisheries* target primarily brown, white, and pink shrimp in inland waters and estuaries through the state-regulated territorial seas and in federal waters of the EEZ. Various types of gear are used to capture shrimp including otter trawls, wing nets (butterfly nets), skimmer trawls, pusherhead trawls (chopstick rigs), stationary butterfly nets, beam trawls, roller-frame trawls, cast nets, channel nets, haul seines, traps, and dip nets. The otter trawl, with various modifications, is the dominant gear used in offshore waters and essentially the sole gear used in the federal fisheries. However, authorized gear types listed for the Gulf of Mexico FMP are trawl, butterfly net, skimmer, and cast net for commercial use and trawl only for the recreational use. As sea turtles rest, forage, or swim on or near the bottom, they are captured by shrimp trawls pulled along the bottom.

Shrimp trawling is believed to have had the greatest adverse effect on sea turtles in the action area in the past. By the late 1970s, there was evidence thousands of sea turtles were being killed annually in the Southeast (Henwood and Stuntz 1987). In 1990, the National Research Council (NRC) concluded the Southeast shrimp trawl fishery affected more sea turtles than all other activities combined and was the most significant anthropogenic source of sea turtle mortality in the U.S. waters, in part due to the high reproductive value of turtles taken in this fishery (NRC 1990). The level of annual mortality described in NRC (1990) is believed to have continued until 1992-1994, when U.S. law required all shrimp trawlers in the Atlantic and Gulf of Mexico to use TEDs, which allowed some turtles to escape nets before drowning (NMFS 2002).

Despite the apparent success of TEDs for some species of sea turtles (e.g., Kemp's ridleys), it was later discovered that TEDs were not adequately protecting all species and size classes of sea turtles. Analyses by Epperly and Teas (2002) indicated that the minimum requirements for the escape opening dimension in TEDs in use at that time were too small for some sea turtles and that as many as 47 percent of the loggerheads stranding annually along the Atlantic and Gulf of Mexico were too large to fit the existing openings. On December 2, 2002, NMFS completed an Opinion on shrimp trawling in the southeastern United States (NMFS 2002c) under proposed revisions to the TED regulations requiring larger escape openings (68 FR 8456, February 21, 2003). This Opinion determined that the shrimp trawl fishery under the revised TED regulations would not jeopardize the continued existence of any sea turtle species. The determination was based in part, on the opinion's analysis that shows the revised TED regulations are expected to reduce shrimp trawl related mortality by 94 percent for loggerheads and 97 percent for leatherbacks. In February 2003, NMFS implemented the revisions to the TED regulations.

NMFS has completed several consultations on Southeastern shrimp fisheries including regulations governing the use of TEDs. On May 8, 2012, NMFS completed issued a biological opinion entitled: "*Reinitiation of Endangered Species Act (ESA) Section 7 Consultation on the Continued Implementation of the Sea Turtle Conservation Regulations, as Proposed to Be Amended, and the Continued Authorization of the Southeast U.S. Shrimp Fisheries in Federal Waters under the Magnuson- Stevens Act*. Thats Opinion was the culmination of several requests for reinitiation of consultation on different shrimp fisheries and listed species as the various triggers for reinitiation were met. With each reinitiation request and determination made, the scope of the proposed action and the species subject to reinitiation of Section 7 consultation were expanded. The scope of the action and species subject to reinitiation of Section 7 consultation were also expanded as triggered by a proposed change to the sea turtle conservation regulations and the listing of the two DPS of Atlantic sturgeon. The Opinion concluded that operation of the fishery would not jeopardize the continued existence of any sea turtle species. Since the completion of this Opinion, NMFS has reinitiated consultation due to the withdrawal of the proposed rule to require TEDs in the skimmer trawl fishery. The most recent opinion titled "Reinitiation of Endangered Species Act (ESA) Section 7 Consultation on the Continued Implementation of the Sea Turtle Conservation Regulations under the ESA and the Continued Authorization of the Southeast U.S. Shrimp Fisheries in Federal Waters under the Magnuson-Stevens Fishery Management and Conservation Act (MSFMCA)" was completed on April 18, 2014. This Opinion supersedes all previous determinations and Opinions on southeastern shrimp trawl fisheries and concluded that operation of the fishery would not jeopardize the continued existence of any sea turtle species..

Indirect effects of shrimp trawling on sea turtles would include the disturbance of the benthic habitat by the trawl gear. The effect bottom trawls have on the seabed is mainly a function of bottom type. In areas where repeated trawling occurs, fundamental shifts in the structure of the benthic community have been documented (Auster *et al.* 1996) which may affect the availability of prey items for foraging turtles. The overall effects to benthic communities that may result from long-term and chronic disturbance from shrimp fishing needs further evaluation.

Vessel Activity. Watercraft have the potential to interact with sea turtles though direct impacts with propellers and are the greatest contributors to overall noise in the sea. Sound levels and tones produced are generally related to vessel size and speed. Larger vessels generally emit more sound than smaller vessels, and vessels underway with a full load, or those pushing or towing a load, are noisier than unladen vessels. Vessels operating at high speeds have the potential to strike sea turtles. Potential sources of adverse effects from federal vessel operations in the action area include operations of the U.S. Department of Defense (DOD), Navy (USN), Air Force and Coast Guard (USCG), the Environmental Protection Agency, the National Oceanic and Atmospheric Administration (NOAA), and the USACE.

Private and commercial vessel operations also have the potential to interact with sea turtles. For example, shipping traffic in Massachusetts Bay is estimated at 1,200 ship crossings per year with an average of three per day. Similar traffic may exist in many other areas where sea turtles occur. 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. The sea turtle stranding network (STSSN) also reports many records of vessel interaction (propeller injury) with sea turtles off coastal states such as and Florida, where there are high levels of vessel traffic.

Military Operations. USN conducts military readiness activities, which can be categorized as either training or testing exercises, throughout the action area. During training, existing and established weapon systems and tactics are used in realistic situations to simulate and prepare for combat. Activities include: routine gunnery, missile, surface fire support, amphibious assault and landing, bombing, sinking, torpedo, tracking, and mine exercises. Testing activities are conducted for different purposes and include at-sea research, development, evaluation, and experimentation. USN performs testing activities to ensure that its military forces have the latest technologies and techniques available to them. USN activities are likely to produce noise and harass sea turtles throughout the action area. Formal consultations on overall USN activities in the southeastern United States have been completed, including: Atlantic Fleet Training and Testing (AFTT) Activities (2013-2018) (November 14, 2013); Atlantic Fleet Sonar Training Activities (AFAST) (January 20, 2011); and AFAST LOA 2012-2014: Active sonar training along the Atlantic Coast and Gulf of Mexico (December 19, 2011); and Atlantic Fleet Testing and Training completed in 2013. These opinions concluded that although there is a potential from some USN activities to result in fitness consequences for individual sea turtles, those consequences were not expected to impact sea turtles on a population level. Therefore, the activities were determined not likely to jeopardize the continued existence of any listed sea turtle species.

Oil and Gas Exploration and Extraction. Although oil and gas exploration, production, and development do not occur within the action area, oil and gas activities may indirectly impact protected sea turtles located there. Oil spills and marine debris from nearby oil and gas activities do occur within the action area and could affect protected turtles . Many Section 7 consultations have been completed on MMS (now BOEM) oil and gas lease activities. Opinions issued on July 11, 2002 (NMFS 2002b), November 29, 2002 (NMFS 2002c), August 30, 2003 [Lease Sales 189 and 197, (NMFS 2003)], and June 29, 2007 [2007-2012 Five-Year Lease Plan, (NMFS 2007c)] have concluded that sea turtle takes may result from vessel strikes, marine debris, and oil spills.

NMFS' June 29, 2007, Opinion issued to MMS concluded that the five-year leasing program for oil and gas development in the Central and the Western Planning Areas of the Gulf of Mexico and its associated actions were not likely to jeopardize the continued existence of threatened or endangered species or destroy or adversely modify designated critical habitat. NMFS estimated the number of listed species that could potentially experience adverse effects as the result of exposure to an oil spill over the lifetime of the action. However, as discussed below, on April 20, 2010, a massive oil well explosion, and then subsequent release of oil at Deepwater Horizon (DWH) MC252 well occurred. Given the effects of the spill, on July 30, 2010, BOEM requested reinitiation of interagency consultation under Section 7 of the ESA on the June 29, 2007, opinion on the Five- Year Outer Continental Shelf Oil and Gas Leasing Program (2007-2012) in the Central and Western Planning Areas of the Gulf of Mexico.

On April 20, 2010, while working on an exploratory well approximately 50 miles offshore Louisiana, the semi-submersible drilling rig DWH experienced an explosion and fire. The rig subsequently sank and oil and natural gas began leaking into the Gulf of Mexico. Oil flowed for 86 days, until finally being capped on July 15, 2010. Millions of barrels of oil were released into the Gulf. Additionally, approximately 1.84 million gallons of chemical dispersant was applied both subsurface and on the surface to attempt to break down the oil. There is no question that the unprecedented DWH spill and associated response activities (e.g., skimming, burning, and application of dispersants) have resulted in adverse effects to listed sea turtles.

At this time, the total effects of the oil spill on species found throughout the Gulf of Mexico, including sea turtles, are not known. Potential DWH-related impacts to all sea turtle species include direct oiling or contact with dispersants from surface and subsurface oil and dispersants, inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, loss of foraging resources which could lead to compromised growth and/or reproductive potential, harm to foraging, resting and/or nesting habitats, and disruption of nesting turtles and nests. There is currently an ongoing investigation and analysis being conducted under the Oil Pollution Act (33 U.S.C. 2701 et seq.) to assess natural resource damages and to develop and implement a plan for the restoration, rehabilitation, replacement or acquisition of the equivalent of the injured natural resources. The final outcome of that investigation may not be known for many months to years from the time of this opinion. Consequently, other than some emergency restoration efforts, most restoration efforts that occur pursuant to the Oil Pollution Act have yet to be determined and implemented, and so the ultimate restoration impacts on the species are unknowable at this time.

During the response phase to the DWH oil spill (April 26 – October 20, 2010) a total of 1,146 sea turtles were recovered, either as strandings (dead or debilitated generally onshore or nearshore) or were collected offshore during sea turtle search and rescue operations. Subsequent to the response phase a few sea turtles with visible evidence of oiling have been recovered as strandings. The available data on sea turtle strandings and response collections during the time of the spill are expected to represent a fraction (currently unknown) of the actual losses to the species, as most individuals likely were not recovered. The number of strandings does not provide insights into potential sub-lethal impacts that could reduce long-term survival or fecundity of individuals affected. However, it does provide some insight into the potential relative scope of the impact among the sea turtle species in the area.

Another period of high stranding levels occurred in 2011, similar to that in 2010. Investigations, including necropsies, were undertaken by NMFS to attempt to determine the cause of those strandings. Based on the findings, the two primary considerations for the cause of death of the turtles that were necropsied are forced submergence or acute toxicosis. With regard to acute toxicosis, sea turtle tissue samples were tested for biotoxins of concern in the northern Gulf of Mexico. Environmental information did not indicate a harmful algal bloom of threat to marine animal health was present in the area. With regard to forced submergence, the only known plausible cause of forced submergence that could explain this event is incidental capture in fishing gear. NMFS has assembled information regarding fisheries operating in the area during

and just prior to these strandings. While there is some indication that lack of compliance with existing TED regulations and the operations of other trawl fisheries that do not require TEDs may have occurred in the area at the time of the strandings, direct evidence that those events caused the unusual level of strandings is not available. More information on the stranding event, including number of strandings, locations, and species affected, can be found at http://www.nmfs.noaa.gov/pr/species/turtles/gulfofmexico.htm.

In addition to effects on subadult and adult sea turtles, the 2010 May through September sea turtle nesting season in the northern Gulf may also have been adversely affected by the DWH oil spill. Setting booms to protect beaches, cleanup activities, lights, people, and equipment all may have had unintended effects, such as preventing females from reaching nesting beaches and thereby reducing nesting in the northern Gulf. The spill could have also affected the emergence success of hatchlings from nests along the Gulf coast. In an attempt to reduce the loss of the 2010 northern Gulf cohort, many of nests were relocated to the east coast of Florida to reduce the risk to hatchlings. The survivorship and future nesting success of individuals from one nesting beach being transported to and released at another nesting beach is unknown.

Navigation Channel Construction and Maintenance. Marine dredging vessels are common within U.S. coastal waters. Although the underwater noises from dredge vessels are typically continuous in duration (for periods of days or weeks at a time) and strongest at low frequencies, they are not believed to have any long-term effect on sea turtles. However, the construction and maintenance of federal navigation channels and dredging in sand mining sites ("borrow areas") have been identified as sources of sea turtle mortality. Hopper dredges in the dredging mode are capable of moving relatively quickly compared to sea turtle swimming speeds and can thus overtake, entrain, and kill sea turtles as the suction draghead(s) of the advancing dredge overtakes resting or swimming turtles. Entrained sea turtles rarely survive. NMFS completed a regional opinion on the impacts of USACE's hopper- dredging operation in 2003 for operations in the Gulf of Mexico (NMFS 2007b). In the Gulf of Mexico regional biological opinion (GRBO), NMFS determined that (1) Gulf of Mexico hopper dredging would adversely affect Gulf sturgeon and four sea turtle species (i.e., green, hawksbill, Kemp's ridley, and loggerheads) but would not jeopardize their continued existence and (2) dredging in the Gulf of Mexico would not adversely affect leatherback sea turtles, smalltooth sawfish, or listed large whales. An ITS for those species killed or otherwise harmed was issued.

The above-listed regional opinion considers maintenance dredging and sand mining operations. Numerous other "free-standing" opinions have been produced that analyzed hopper dredging projects that did not fall (partially or entirely) under the scope of actions contemplated by this regional opinion. Examples include: the dredging of Ship Shoal in the Gulf of Mexico Central Planning Area for coastal restoration projects [opinion issued to MMS, now Bureau of Ocean Energy Management (BOEM), in 2005 (NMFS 2005d)], East Pass dredging, Destin, Florida [to USACE in 2009 (NMFS 2009)], and dredging of City of Mexico beach canal inlet [to USACE in 2012 (NMFS 2012)]. Each of the above free-standing opinions had its own ITS and determined that hopper dredging during the proposed actions would not jeopardize the continued existence of any species of sea turtles or other listed species, or destroy or adversely modify critical habitat of any listed species.

Electrical Generating Plants. Another action with federal oversight (the Federal Energy Regulatory Commission and the Nuclear Regulatory Agency) impacting sea turtles is the operation of electrical generating plants. Sea turtles entering coastal or inshore areas have been affected by entrainment in the cooling-water systems of electrical generating plants. A detailed summary of the incidental capture of loggerhead sea turtles in power plant intake screens can be found in the Turtle Expert Working Group (TEWG) reports (1998, 2000). NMFS has reinitiated consultation on the *Issuance and Implementation of the Final Regulations to Establish Requirements for Cooling Water Intake Structures at Existing Facilities, Section 316(b) of the Clean Water Act,* and this consultation is currently underway, therefore, a new Opinion has not yet been finalized.

State Fisheries.

Various fishing methods used in state commercial and recreational fisheries, including gillnets, fly nets, trawling, pot fisheries, pound nets, and vertical line are all known to incidentally take sea turtles, but information on these fisheries is sparse (NMFS-SEFSC 2001). Most of the state data are based on extremely low observer coverage, or sea turtles were not part of data collection; thus, these data provide insight into gear interactions that could occur but are not indicative of the magnitude of the overall problem.

Gillnet Fisheries. A detailed summary of the gillnet fisheries currently operating along the mid- and southeast U.S. Atlantic coastline, and Gulf of Mexico, which are known to incidentally capture loggerheads, can be found in the TEWG reports (1998; 2000a). Florida has banned all but very small nets in state waters, as has Texas. Louisiana, Mississippi, and Alabama have also placed restrictions on gillnet fisheries within state waters such that very little commercial gillnetting takes place in Southeast waters. Some illegal gillnet incidental captures have been reported in Florida, Louisiana, and Texas (NMFS-SEFSC 2001).

On February 15, 2007, NMFS published an advanced notice of proposed rulemaking regarding potential amendments to the regulatory requirements for TEDs (72 FR 7382). The proposed changes include increasing the size of the TED escape opening currently required in the summer flounder fishery; requiring the use of TEDs in the flynets used in the whelk, calico scallop, and Mid-Atlantic sea scallop trawl fisheries; and moving the current northern boundary of the Summer Flounder Fishery-Sea Turtle Protection Area off Cape Charles, Virginia, to a point farther north. The objective of the proposed measures would be to effectively protect all life stages and species of sea turtle in Atlantic and Gulf of Mexico trawl fisheries where they are vulnerable to incidental capture and mortality. On June 24, 2011, NMFS published a proposed rule stating its intent to prepare an EIS and conduct public scoping meetings regarding potential amendments to the regulatory requirements for TEDs (76 FR 37050). Scoping meetings were held from July 12-18, 2011, in Louisiana, Mississippi, Alabama, and North Carolina. To date, NMFS has not released a draft Environmental Impact Statement.

The fishing activities discussed above may be correlated with regular pulses of greatly elevated sea turtle strandings coincident with their migrations. For example in North Carolina, in the last weeks of April through early May 2000, approximately 300 sea turtles, mostly loggerheads,

stranded north of Oregon Inlet, North Carolina. Gillnets were found with four of the carcasses. These strandings were likely caused by state fisheries as well as federal fisheries, although not any one fishery has been identified as the major cause. Fishing effort data indicate that fisheries targeting monkfish, dogfish, and bluefish were operating in the area of the strandings. Strandings in this area represent, at best, 7-13% of the actual nearshore mortality (Epperly et al. 1996). Studies by Bass et al. (1998), Norrgard (1995) and Rankin-Baransky (1997) indicate that the percentage of northern loggerheads in this area is highly over-represented in the strandings when compared to the estimated 9% representation from this subpopulation in the overall U.S. sea turtle nesting populations. Specifically, the genetic composition of sea turtles in this area is 25-54% from the northern subpopulation, 46-64% from the South Florida subpopulation, and 3-16% from the Yucatan subpopulation. The cumulative removal of these sea turtles on an annual basis could potentially severely impact the northern subpopulation and leave it vulnerable to extirpation. The loss of genetic diversity as a result of distinct nesting aggregations would severely impede the recovery of this species.

Beyond commercial fisheries, observations of state recreational fisheries have shown that loggerhead, leatherback, Kemp's ridley, and green sea turtles are known to bite baited hooks, and loggerheads and Kemp's ridleys frequently ingest the hooks. Data reported through the Marine Recreational Fisheries Statistical Survey (STSSN) show recreational fishers have hooked sea turtles when fishing from boats, piers, and beach, banks, and jetties. Recreational fisheries within the action area are expected to also present hooking and ingestion risks to sea turtles.

Although few of these state regulated fisheries are currently authorized to incidentally take listed species, several state agencies have approached NMFS to discuss applications for a Section 10(a)(1)(B) incidental take permit. Since NMFS' issuance of a Section 10(a)(1)(B) permit requires formal consultation under Section 7 of the ESA, any fisheries that come under a Section 10(a)(1)(B) permit in the future will likewise be subject to Section 7 consultation. Although the past and current effects of these fisheries on listed species are currently not determinable, NMFS believes that ongoing state fishing activities may be responsible for seasonally high levels of observed strandings of sea turtles on both the Atlantic and Gulf of Mexico coasts.

Natural Sources of Stress and Mortality

Disease and Red Tide. A disease known as fibropapilloma (FP) is a major threat to listed turtles in many areas of the world including the action area. The disease is characterized by tumorous growths, which can range in size from very small to extremely large, and are found both internally and externally. Large tumors can interfere with feeding and essential behaviors, and tumors on the eyes can cause permanent blindness (Foley et al., 2005). It was first described in green turtles in the Florida Keys in the 1930's. Since then it has been recorded in many green turtle populations around the world as well as other sea turtle species, most notably present in green turtles of Hawaii, Florida, and the Caribbean. In Florida, up to 50% of the immature green turtles captured in the Indian River Lagoon are infected, and there are similar reports from other sites in Florida, including Florida Bay, as well as from Puerto Rico and the U.S. Virgin Islands. In addition, scientists have documented FP in populations of loggerhead, olive ridley, and flatback turtles (Huerta et al. 2002). The effects of FP at the population level are not well

understood and could be a serious threat to their recovery. The cause of the disease remains unknown. Research to determine the cause of this disease is a high priority and is underway.

Harmful algal blooms, such as a red tide, also impact sea turtles in the action area. During four red tide events along the west coast of Florida, sea turtle stranding trends indicated that these events were acting as a mortality factor (Redlow et al., 2003).

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

An increased human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs and an increased presence of native species (e.g. raccoons, armadillos, and opossums) which raid and feed on turtle eggs. Non-native vegetation has invaded many coastal areas and often out competes native species. Non-native vegetation is usually less-stabilizing and can lead to increased erosion and degradation of suitable nesting habitat. Non-native vegetation may also form impenetrable root mats that can prevent proper nest cavity excavation, invade and desiccate eggs, or trap hatchlings. In light of these issues, conservation and long-term protection of sea turtle nesting and foraging habitats is an urgent and high priority need. The invasive Australian pine (*Casuarina equisetifolia*) is also particularly harmful to sea turtles throughout the state of Florida because they out compete native species and cause excessive shading of the beach that would not otherwise occur. Studies in Florida suggest that nests laid in shaded areas are subjected to lower incubation temperatures, which may alter the natural hatchling sex ratios (Marcus and Maley, 1987; Schmelz and Mezich, 1988; Hanson et al., 1998).

Climate Change. Human interference with the climate system is occurring, and climate change poses risks for human and natural systems (IPPC 2014). Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. NOAA's climate information portal provides basic background information on these and other measured or anticipated effects (see http://www.climate.gov).

Climate change impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty; however significant impacts to the hatchling sex ratios of turtles may result (NMFS and USFWS 2007c). All reptiles including sea turtles have a tremendous dependence on their thermal environment for regulating physiological processes and for driving behavioral adaptations (Spotila et al. 1997). In the case of sea turtles, where many other habitat modifications are documented (beach development, loss of foraging habitat, etc.), the prospects for accentuated synergistic impacts on survival of the species may be even more important in the long-term. In marine turtles, sex is determined by temperature in the middle third of the

incubation period with female offspring produced at higher temperatures (Hawkes et al. 2007; Fuentes et al. 2009; Mitchell and Janzen 2010; Val verde et al. 2010; Witt et al. 2010; Hawkes et al. 2013) and males at lower temperatures within a thermal tolerance range of 25°-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward higher numbers of females (NMFS and USFWS 2007c; Patino-Martinez et al. 2012; Fuller et al. 2013). Modeling suggests an increase of 2°C in air temperature would result in a sex ratio of over 80 percent female offspring for loggerheads nesting near Southport, North Carolina. The same increase in air temperatures at nesting beaches in Cape Canaveral, Florida, would result in close to 100 percent female offspring. More ominously, an air temperature increase of 3°C is likely to exceed the thermal threshold of most clutches, leading to death (Hawkes et al. 2007). Warmer sea surface temperatures have been correlated with an earlier onset of loggerhead nesting in the spring (Weishampel et al. 2004; Hawkes et al. 2007), as well as short inter-nesting intervals (Hays et al. 2002) and shorter nesting season (Pike et al. 2006).

The effects from increased temperatures may be exacerbated on developed nesting beaches where shoreline armoring and construction have denuded vegetation. Erosion control structures could potentially result in the permanent loss of nesting beach habitat or deter nesting females (NRC 1990). These impacts will be exacerbated by sea level rise. If females nest on the seaward side of the erosion control structures, nests may be exposed to repeated tidal overwash (NMFS and USFWS 2007c). Sea level rise from global climate change is also a potential problem for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993; Fish et al. 2005; Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006; Baker et al. 2006). It may increase hurricane activity leading to an increase in debris in nearshore and offshore waters, resulting in increase in entanglement, ingestion, or drowning, as well as increased physical destruction of sea turtle nests and further degradation of river and estuarine habitats.

Other changes in the marine ecosystem caused by global climate change (e.g., ocean acidification, salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish, etc., which could ultimately affect the primary foraging areas and other oceanographic features that are relevant to various sea turtles' life stages.

Hurricanes. Hurricanes and tropical storms are common in the Caribbean and have the potential to directly injure or kill targeted species and/or modify habitat in the action area. Sea turtle nests may also be unearthed during storm events and cause mortality of sea turtle hatchlings. Sand accretion, rainfall, and wave action that result from these storms can also reduce hatchling success. Additionally, with more intense storms expected in the coming years based on climate modeling, it is expected that sea turtle nesting habitat will be further impacted [Goldenburg et al., 2001; Webster et al., 2005; Intergovernmental Panel on Climate Change, 2007] and may result in

a decrease in hatching success and hatchling emergence in the action area (Martin, 1996; Ross, 2005; Pike and Stiner, 2007; Prusty et al., 2007; Van Houton and Bass, 2007).

Other Potential Sources of Impacts in the Baseline

Significant anthropogenic impacts threaten nesting populations of all species in areas within as well as outside of the United States. These impacts include poaching of eggs, immatures and adults as well as beach development problems. The impacts from these activities are difficult to measure.

Habitat Loss. Coastal development can degrade nesting habitats for sea turtles, deter or interfere with nesting, and affect nesting success. Structural impacts to nesting habitat include the construction of buildings and pilings, beach armoring and renourishment, and sand extraction (Lutcavage et al. 1997; Bouchard et al. 1998). These factors may directly, through loss of beach habitat, or indirectly, through changing thermal profiles and increasing erosion, serve to decrease the amount of nesting area available to females and may change the natural behaviors of both adults and hatchlings (Ackerman 1997; Witherington et al. 2003; Witherington et al. 2007). Beach armoring (e.g., bulkheads, seawalls, soil retaining walls, rock revetments, sandbags, and geotextile tubes) can impede a turtle's access to upper regions of the beach/dune system, thereby limiting the amount of available nesting habitat (Mazaris et al. 2009). Impacts also can occur if structures are installed during the nesting season. For example, unmarked nests can be crushed or uncovered by heavy equipment, nesting turtles and hatchlings can get caught in construction debris or excavations, and hatchlings can get trapped in holes or crevices of exposed riprap and geotextile tubes. In many areas of the world, sand mining (removal of beach sand for upland construction) seriously reduce or degrade/destroy sea turtle nesting habitats or interfere with hatchling movement to sea (NMFS 2003).

In addition, coastal development is usually accompanied by artificial lighting which has been known to alter the behavior of nesting adults (Witherington 1992) and is often fatal to emerging hatchlings that are drawn away from the water (Witherington and Bjorndal 1991). Specifically, artificial lighting may deter adult female turtles from emerging from the ocean to nest and can disorient or misorient emerging hatchlings away from the ocean (Ehrhart 1983; Salmon and Witherington 1995). Hatchlings have a tendency to orient toward the brightest direction, which on natural, undeveloped beaches is commonly toward the broad open horizon of the sea. However, on developed beaches, the brightest direction is often away from the ocean and toward lighted structures. Hatchlings unable to find the ocean, or delayed in reaching it, are likely to incur high mortality from dehydration, exhaustion, or predation (Peters and Verhoeven 1994; Salmon et al. 1995). Hatchlings lured into lighted parking lots or toward streetlights can get crushed by passing vehicles. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. However, more and more coastal counties are adopting stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting.

Marine Debris. Ingestion of marine debris can be a serious threat to sea turtles. Sea turtles living in the pelagic (open ocean) environment commonly ingest or become entangled in marine

debris (e.g., tar balls, plastic bags, plastic pellets, balloons, and ghost fishing gear) as they feed along oceanographic fronts, where debris and their natural food items converge (Bugoni *et al.* 2001; Pichel *et al.* 2007; Mrosovsky *et al.* 2009). This is especially problematic for turtles that spend all or significant portions of their life cycle in the pelagic environment (e.g., leatherbacks, juvenile loggerheads, and juvenile green turtles). Some types of marine debris may be directly or indirectly toxic to sea turtles on their migration to (and potentially within) the action area, such as oil. Turtles can become entangled in derelict gillnets, pound nets, and the lines associated with longline and trap/pot fishing gear (Schuyler et al. 2012; Martin 2013). Turtles entangled in these types of fishing gear may drown and often suffer serious injuries to their flippers from constriction by the lines or ropes (McElwee et al. 2012; Ulhmann and Broadhurst 2013).

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

Nutrient loading from land-based sources, such as coastal communities and agricultural operations, are known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effects on larger embayments are unknown. An example is the large area of the Louisiana continental shelf with seasonally-depleted oxygen levels (<2mg/l) is caused by eutrophication from both point and non-point sources. Most aquatic species cannot survive at such low oxygen levels and these areas are known as "dead zones." The oxygen depletion, referred to as hypoxia, begins in late spring, reaches a maximum in mid-summer, and disappears in the fall. The hypoxic zone has impacts on the animals found there, including sea turtles, and the ecosystem-level impacts continue to be investigated.

Multiple municipal, industrial, and household sources, as well as atmospheric transport, introduce various pollutants such as pesticides, hydrocarbons, organochlorides (e.g. DDT and PCBs), and others that may cause adverse health effects to sea turtles (Iwata et al. 1993; Grant and Ross 2002; Garrett 2004; Hartwell 2004). Recent efforts have led to improvements in regional water quality, although the more persistent chemicals are still detected and are expected to endure for years (Mearns 2001; Grant and Ross 2002).

Acute exposure to hydrocarbons from petroleum products released into the environment via oil spills and other discharges may directly injure individuals through three primary pathways: ingestion– when animals swallow oil particles directly or consume prey items that have been exposed to oil, absorption (Matkin and Saulitis 1997) – when animals come into direct contact with oil (Geraci 1990), and inhalation – when animals breath volatile organics released from oil or from "dispersants" applied by response teams in an effort to increase the rate of degradation of

the oil in seawater (Hoff and Shigenaka 2003). Several aspects of sea turtle biology and behavior place them at particular risk, including the lack of avoidance behavior, indiscriminate feeding in convergence zones, and large predive inhalations (Milton *et al.* 2003). When large quantities of oil enter a body of water, chronic effects such as cancer, and direct mortality of wildlife becomes more likely (Lutcavage et al. 1997). Chronic exposure to hydrocarbons in crude oil can affect turtle embryos, hatchlings, and adults. In embryos and hatchlings, hydrocarbons can cause developmental abnormalities and death. Abnormalities include a deformed tail, misshapen scutes, missing limbs, developmental asynchrony, lack of pigmentation, missing plastron or carapace, gastrotrichsis, and unfused skulls (Van Meter *et al.* 2006). The last two abnormalities can be lethal. Oil spills in the vicinity of nesting beaches just prior to or during the nesting season could place nesting females, incubating egg clutches, and hatchlings at significant risk (Fritts and McGehee 1982; Lutcavage et al. 1997; Witherington 1999) including skin irritation, altering of the immune system, reproductive or development damage, and liver disease (Keller *et al* 2004, 2006). Continuous low-level exposure to oil in the form of tarballs, slicks, or elevated background concentrations also challenge animals facing other natural and anthropogenic stress. Chronic exposure may not be lethal by itself, but it may impair a turtle's overall fitness so that it is less able to withstand other stressors (Milton *et al.* 2003).

The earlier life stages of living marine resources are usually at greater risk from an oil spill than adults, especially true for hatchlings, since they spend a greater portion of their time at the sea surface than adults, their risk of exposure to floating oil slicks is increased (Lutcavage *et al.* 1995). One of the reasons might be the simple effects of scale: for example, a given amount of oil may overwhelm a smaller immature organism relative to the larger adult. The metabolic machinery an animal uses to detoxify or cleanse itself of a contaminant may not be fully developed in younger life stages. Also, in early life stages, animals may contain proportionally higher concentrations of lipids, to which many contaminants such as petroleum hydrocarbons bind. Most reports of oiled hatchlings originate from convergence zones, ocean areas where currents meet to form collection points for material at or near the surface of the water. Sixty-five of 103 post-hatchling loggerheads in convergence zones off Florida's east coast were found with tar in the mouth, esophagus or stomach (Loehefener *et al.* 1989). Thirty-four percent of post-hatchlings captured in Sargassum off the Florida coast had tar in the mouth or esophagus and more than 50% had tar caked in their jaws (Witherington 1994). These zones aggregate oil slicks, such as a Langmuir cell, where surface currents collide before pushing down and around, and represents a virtually closed system where a smaller weaker sea turtle can easily become trapped (Witherington 2002; Carr 1987). Lutz (1989) reported that hatchlings have been found apparently starved to death, their beaks and esophagi blocked with tarballs. Hatchlings sticky with oil residue may have a more difficult time crawling and swimming, rendering them more vulnerable to predation.

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

hatchlings, juveniles, or adults, tarballs in a turtle's gut are likely to have a variety of effects – starvation from gut blockage, decreased absorption efficiency, absorption of toxins, effects of general intestinal blockage (such as local necrosis or ulceration), interference with fat metabolism, and buoyancy problems caused by the buildup of fermentation gases (floating prevents turtles from feeding and increases their vulnerability to predators and boats), among others. Also, trapped oil can kill the seagrass beds that turtles feed upon.

Unfortunately, little is known about the effects of dispersants on sea turtles, and such impacts are difficult to predict in the absence of direct testing. While inhaling petroleum vapors can irritate turtles' lungs, dispersants can interfere with lung function through their surfactant (detergent) effect. Dispersant components absorbed through the lungs or gut may affect multiple organ systems, interfering with digestion, respiration, excretion, and/or salt-gland function—similar to the empirically demonstrated effects of oil alone (Hoff and Shigenaka 2003). Oil cleanup activities can also be harmful. Earth-moving equipment can dissuade females from nesting and destroy nests, containment booms can entrap hatchlings, and lighting from nighttime activities can misdirect turtles (Witherington 1999).

There are studies on organic contaminants and trace metal accumulation in green and leatherback sea turtles (Aguirre et al. 1994; Caurant et al. 1999; Corsolini et al. 2000). Mckenzie et al. (1999) measured concentrations of chlorobiphenyls and organochlorine pesticides in sea turtles tissues collected from the Mediterranean (Cyprus, Greece) and European Atlantic waters (Scotland) between 1994 and 1996. Omnivorous loggerhead turtles had the highest organochlorine contaminant concentrations in all the tissues sampled, including those from green and leatherback turtles (Storelli et al. 2008). It is thought that dietary preferences were likely to be the main differentiating factor among species. Decreasing lipid contaminant burdens with turtle size were observed in green turtles, most likely attributable to a change in diet with age. Sakai et al (1995) found the presence of metal residues occurring in loggerhead turtle organs and eggs. Storelli et al. (1998) analyzed tissues from twelve loggerhead sea turtles stranded along the Adriatic Sea (Italy) and found that characteristically, mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals and porpoises (Law et al. 1991). No information on detrimental threshold concentrations are available, and little is known about the consequences of exposure of organochlorine compounds to sea turtles. Research is needed on the short- and long-term health and fecundity effects of chlorobiphenyl, organochlorine, and heavy metal accumulation in sea turtles.

Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability in the action area (Almeida *et al.* 2013). Additionally, the long-term impacts to sea turtles as a result of habitat impacts, prey loss, and subsurface oil particles and oil components broken down through physical, chemical, and biological processes are not known.

Acoustic impacts. NMFS and the USN have been working cooperatively to establish a policy for monitoring and managing acoustic impacts from anthropogenic sound sources in the marine environment. NMFS has submitted for review a Draft Guidance for Assessing the Effects of

Anthropogenic Sound on Marine Mammals (Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts) [78 FR 78822]. This guidance does not assess impacts to sea turtles, however it is known that impacts can include temporary or permanent injury, habitat exclusion, elevated stress levels due to tolerance of noise levels, and disruption of other normal sea turtle behavior patterns.

Other ESA Section 10 Sea Turtle Permits.

Regulations developed under the ESA allow for the issuance of permits allowing take of certain listed species for the purposes of scientific research under Section 10(a)(1)(A) of the ESA. In addition, the ESA allows for the NMFS to enter into cooperative agreements with states developed under Section 6 of the ESA, to assist in recovery actions of listed species. Prior to issuance of these authorizations, the proposal must be reviewed for compliance with Section 7 of the ESA.

Sea turtles are the focus of research activities authorized by a Section 10 permit under the ESA. As of the time of this consultation, there were 32 active scientific research permits directed toward sea turtles that are applicable to the action area of this biological opinion. Authorized activities range from photographing, weighing, and tagging sea turtles incidentally taken in fisheries, blood sampling, tissue sampling (biopsy) and performing laparoscopy on intentionally captured turtles. The number of authorized takes varies widely depending on the research and species involved but may involve the taking of hundreds of turtles annually. Most of takes authorized under these permits are expected to be non-lethal. Before any research permit is issued, the proposal must be reviewed under the permit regulations (i.e., must show a benefit to the species).

In addition, since issuance of the permit is a federal activity, issuance of the permit by the NMFS must also be reviewed for compliance with section 7(a)(2) of the ESA to ensure that issuance of the permit does not result in jeopardy to the species.

Conservation and Recovery Actions Shaping the Environmental Baseline

NMFS has implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles from commercial fisheries in the action area. These include sea turtle release gear requirements for Atlantic HMS, Gulf of Mexico reef fish, and South Atlantic snapper-grouper fishery, and TED requirements for Southeast shrimp trawl fishery. In addition to regulations, outreach programs have been established and data on sea turtle interactions with recreational fisheries has been collected through the Marine Recreational Fishing Statistical Survey. The summaries below discuss all of these measures in more detail.

Revised Use of TEDs in Trawl Fisheries

NMFS has also implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial shrimp trawl fisheries. NMFS has required the use of TEDs in southeast United States shrimp trawls since 1989. It has been estimated that TEDs exclude 97 percent of leatherback sea turtles and 94 percent of loggerhead sea turtles caught in

such trawls. These regulations have been refined over the years to ensure that TED effectiveness is maximized through more widespread use, and proper placement, installation, configuration (e.g., width of bar spacing), and floatation.

Placement of Fisheries Observers to Monitor Sea Turtle Takes
On August 3, 2007, NMFS published a final rule requiring selected fishing vessels to carry observers on board to collect data on sea turtle interactions with fishing operations, to evaluate existing measures to reduce sea turtle takes, and to determine whether additional measures to address prohibited sea turtle takes may be necessary (72 FR 43176). This rule also extended the number of days NMFS observers placed in response to a determination by the Assistant Administrator that the unauthorized take of sea turtles may be likely to jeopardize their continued existence under existing regulations, from 30 to 180 days.

Reducing Threats From Pelagic Longline and Other Hook-and-Line Fisheries
On July 6, 2004, NMFS published a final rule to implement management measures to reduce bycatch and bycatch mortality of Atlantic sea turtles in the Atlantic pelagic longline fishery (69 FR 40734). The management measures include mandatory circle hook and bait requirements, and mandatory possession and use of sea turtle release equipment to reduce bycatch mortality.

NMFS published the final rules to implement sea turtle release gear requirements and sea turtle careful release protocols in the Gulf of Mexico reef fish (August 9, 2006; 71 FR 45428) and South Atlantic snapper-grouper fisheries (November 8, 2011; 76 FR 69230). These measures require owners and operators of vessels with federal commercial or charter vessel/headboat permits for Gulf reef fish and South Atlantic snapper-grouper to comply with sea turtle (and smalltooth sawfish) release protocols and have on board specific sea turtle release gear.

Sea Turtle Handling and Resuscitation Techniques
NMFS has developed and published as a final rule in the Federal Register (66 FR 67495, December 31, 2001) sea turtle handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities. Persons participating in fishing activities or scientific research are required to handle and resuscitate (as necessary) sea turtles as prescribed in the final rule. These measures help to prevent mortality of hard-shelled turtles caught in fishing or scientific research gear.

Sea Turtle Entanglements and Rehabilitation
A final rule (70 FR 42508) published on July 25, 2005, allows any agent or employee of NMFS, the U.S. Fish and Wildlife Service, the U.S. Coast Guard, or any other federal land or water management agency, or any agent or employee of a state agency responsible for fish and wildlife, when acting in the course of his or her official duties, to take endangered sea turtles encountered in the marine environment if such taking is necessary to aid a sick, injured, or entangled endangered sea turtle, or dispose of a dead endangered sea turtle, or salvage a dead endangered sea turtle that may be useful for scientific or educational purposes. NMFS already affords the same protection to sea turtles listed as threatened under the ESA [50 CFR 223.206(b)].

Education and Outreach Activities
Education and outreach activities do not directly reduce the threats to listed sea turtles. However, education and outreach are a means of better informing the public of steps that can be taken to reduce impacts to sea turtles (i.e., reducing light pollution in the vicinity of nesting beaches) and increasing communication between affected user groups (e.g., the fishing community). For the HMS fishery, NMFS has been active in public outreach to educate fishermen regarding sea turtle handling and resuscitation techniques. For example, NMFS has conducted workshops with longline fishermen to discuss bycatch issues including protected species, and to educate them regarding handling and release guidelines. NMFS intends to continue these outreach efforts in an attempt to increase the survival of protected species through education on proper release techniques.

Sea Turtle Stranding and Salvage Network (STSSN)
As is the case with education and outreach, the STSSN does not directly reduce the threats to sea turtles. However, the extensive network of STSSN participants along the Atlantic and Gulf of Mexico coasts not only collects data on dead sea turtles, but also rescues and rehabilitates live stranded turtles, which can occur anywhere along these coastlines, including the action area. Data collected by the STSSN are used to monitor stranding levels and identify areas where unusual or elevated mortality is occurring. These data are also used to monitor incidence of disease, study toxicology and contaminants, and conduct genetic studies to determine population structure. All of the states that participate in the STSSN tag live turtles when encountered (either via the stranding network through incidental takes or in-water studies). Tagging studies help provide an understanding of sea turtle movements, longevity, and reproductive patterns, all of which contribute to our ability to reach recovery goals for the species.

Other Actions
A recovery plan for the loggerhead sea turtle was published January 2009 (second revision: 74 FR 2995). A 2011 Final Bi-National (U.S. and Mexico) Revised Recovery Plan for Kemp's ridley was published in September 2011. Recovery teams comprised of sea turtle experts have been convened and are currently working towards revising these plans based upon the latest and best available information. Five-year status reviews have been completed for green, Kemp's ridley, leatherback, and loggerhead sea turtles. These reviews were conducted to comply with the ESA mandate for periodic status evaluation of listed species to ensure that their threatened or endangered listing status remains accurate. Each review determined that no delisting or reclassification of a species status (i.e., threatened or endangered) was warranted at this time. However, further review of species data for the green, and leatherback was recommended, to evaluate whether distinct population segments (DPS) should be established for these species (NMFS and USFWS 2007a-e). The final rule to list nine distinct population segments (DPSs) of loggerhead sea turtles under the ESA was published September 2011 (76 FR 58868) and a proposed rule to designate critical habitat for the Northwest Atlantic DPS was published in June 2013 (78 FR 43005).

Effects of the Proposed Action

Pursuant to Section 7(a)(2) of the ESA, federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. Direct adverse effects caused by the proposed permitted activities on listed species could include disruption of feeding, breeding, resting and other behaviors. Some displacement may result from these activities. The duration of the behavioral disruptions and displacements are expected to vary by species and type of disturbance.

In this section, we describe the potential physical, chemical, or biotic stressors associated with the proposed action, the probability of individuals of listed species being exposed to these stressors based on the best scientific and commercial evidence available, and the probable responses of those individuals (given probable exposures) based on the available evidence. As described in the *Approach to the Assessment* section, for any responses that would be expected to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, and lifetime reproductive success), the assessment would consider the risk posed to the viability of the population(s) those individuals comprise and to the listed species those populations represent.

For this consultation, the proposed research includes trapping, capturing and sampling individual sea turtles during research procedures. We are also concerned about behavioral disruptions that may occur as a result of research procedures that may rise to the level of harassment through failure to feed or breed successfully or failure to complete their life history because these responses are likely to have population-level consequences. The ESA does not define harassment nor has NMFS defined the term pursuant to the ESA through regulation. For this Opinion, we use USFWS's definition, which is the intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns that include, but are not limited to, breeding, feeding, or sheltering that are essential to sea turtles' life history or its contribution to the population the animal represents.

The purpose of this assessment is, then, to determine if it is reasonable to expect that the research, as conducted under the permit and permit modification, can be expected to have direct or indirect effects on threatened and endangered sea turtle species that appreciably reduce their likelihood of surviving and recovering in the wild Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Jeopardy analyses compare reductions in a species' likelihood of surviving and recovering in the wild associated with a *specific* action with the species' likelihood of surviving and recovering in the wild that was established in the *Status of the Species* section of a biological opinion. Jeopardy analyses also consider the importance of the action area to a listed species and the effects of other human actions and natural phenomena (that were summarized in the *Environmental Baseline)* on a species' likelihood of surviving and recovering in the wild. As a result, jeopardy analyses in biological opinions distinguish between the effects of a specific action on a species' likelihood of surviving and recovering in the wild and a species' background likelihood of surviving and recovering given the full set of human actions and natural phenomena that threaten a species.

This section 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 sea turtle 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* 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 such species will not recover without addressing the full range of human activities and natural phenomena such as patterns of beach erosion, predation on turtle eggs, and turtle captures, injuries, and deaths in other domestic and international fisheries and other State, federal, and private activities that could cause these animals to become extinct in the foreseeable future.

This Opinion focuses on whether the direct and indirect effects of the proposed action can be expected to appreciably reduce the listed sea turtles' likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution or would result in a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of listed species. Jeopardy analyses in biological opinions distinguish between the effects of a specific action on a species' likelihood of surviving and recovering in the wild and a species' background likelihood of surviving and recovering given the full set of human actions and natural phenomena that threaten a species.

This Opinion treats sea turtle populations in the Atlantic Ocean as distinct from the Pacific Ocean populations for the purposes of this consultation. This approach is also consistent with traditional jeopardy analyses: 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. Finally, the loss of these sea turtle populations in the Atlantic basin would dramatically reduce the distribution and abundance of these species and would, by itself, appreciably reduce the entire species' likelihood of surviving and recovering in the wild. Similarly, the loss of any of the recovery units within the Northwest Atlantic DPS would reduce the entire species' likelihood of surviving and recovering in the wild.

Exposure Analyses

Exposure analyses identify the co-occurrence of listed species within the action's effects in space and time, and identify the nature of that co-occurrence. They identify as possible, the number, age or life stage of the individuals likely to be exposed to the action's effects and the population(s) or subpopulation(s) those individuals represent. Individuals exposed to the proposed research activities may be of either sex or of any age.

The proposed actions would expose listed sea turtle species to disturbance from boats, trapping and capture, sampling and collection activities. The applicant Jeffrey Schmid (permit 18069) requested authorization to annually sample 100 Kemp's ridley, 30 loggerheads, 20 green, and 20 hawksbill sea turtles in near shore Florida waters, animals will be:

- captured
- weighed/measured
- photographed/video
- tissue sampled
- blood sampled
- scute scrapped
- flipper and PIT tagged
- satellite and radio/sonic tagged (subset)
- a subset (60 Kemp's ridley annually) retained for fecal sampling
- and released.

The applicant Blair Witherington (permit modification 14726-02) requested authorization to annually sample 100 green, 50 hawksbills, 50 Kemp's ridley, 10 leatherback, and 250 loggerheads sea turtles in the Atlantic waters off Florida and the Gulf of Mexico, animals will be:

- captured
- weighed/measured
- photographed
- tissue sampled
- blood sampled
- scute sampled
- oral swab sampled
- lavaged/gastric sampled
- flipper and PIT tagged
- satellite tagged (subset)
- opportunistic fecal sampled
- and released.

Since these species are highly mobile, and because the proposed activities are to take place at multiple times of year, an individual sea turtle may suffer repeated exposures to trapping, capturing and sampling.

Response Analyses

As discussed in the *Approach to the Assessment* section of this Opinion, response analyses determine how listed resources are likely to respond after being exposed to an action's effects on the environment or directly on listed animals themselves. For the purposes of consultation, our assessments try to detect potential lethal, physiological, or behavioral responses that might reduce the fitness of individuals. Ideally, response analyses would consider and weigh evidence of adverse consequences as well as evidence suggesting the absence of such consequences. The proposed activities have the potential to produce disturbances that may affect listed sea turtles.

Boat Strikes, Noise and Disturbance

For all research activities, the presence of vessels has the potential to induce behavioral and physiological changes in individuals being targeted. There is a potential for boat strikes, noise and disturbance to sea turtles resulting from the proposed activities. The degree to which individuals are disturbed is highly variable. Turtles may or may not respond to the vessel approach (M. Lamont, USGS, personal observation). Overall, reactions range from little to no observable change in behavior to momentary changes in swimming speed, pattern, orientation; diving; time spent submerged; foraging; and respiratory patterns.

The speed of the Bessel can influence the sea turtle's response. Researchers examined the response of sea turtles to approaching vessels by observing the frequency of turtle fell responses to vessels travelling at slow (4 kt/hr; 2 kts), moderate (11 km/hr; 6 kts), and fast (19 km/h; 10 kts) speeds (Hazel et al 2007). When vessels travelling at moderate speeds encountered a turtle, turtles fled the Bessel infrequentl6y (22 % of observations), and only rarely (4%) when they encountered fast-moving vessels compared to turtles that encountered slow-moving vessels (60% of observations). Slower-moving vessels afford turtles more time to notice and flee the approaching Bessel, and thus reduce the risk of collision.

The responses by animals to human disturbance are similar to their responses to potential predators (Beale and Monaghan 2004; Frid 2003; Frid and Dill 2002; Gill and Sutherland 2001; Harrington and Veitch 1992; Lima 1998; Romero 2004). These responses include interruptions of essential behavior and physiological processes such as feeding, mating, resting, digestion etc. This can result in stress, injury and increased susceptibility to disease and predation (Frid and Dill 2002; Romero 2004; Walker *et al.* 2006).

However, because of the trained research personnel, maneuverability and slow or idle operating speeds of the research vessels, which includes disengaging the motor when near sea turtles and the clarity of the shallow coastal waters, boat strikes are extremely unlikely and discountable. Noise and visual disturbance can lead to increased swimming speeds, diving, change in direction, and submergence, however we expect that turtles would return to baseline behavior within a few minutes.

Trapping and Capture

Turtles may exhibit respiratory and metabolic stress, particularly if a turtle is chased and /or forced to remain submerged (swimming or evasive behavior to avoid capture). Metabolic

changes that can impair a sea turtle's ability to function can occur within minutes of a forced submergence. While most voluntary dives appear to be aerobic, showing little if any increases in blood lactate and only minor changes in acid-base status, the effects are quite different in forcibly submerged turtles where oxygen stores are rapidly consumed, anaerobic glycolysis is activated, and acid-base balance is disturbed, sometimes to lethal levels (Lutcavage and Lutz 1997; Harms et al. 2003). Forced submergence of Kemp's ridley sea turtles in shrimp trawls resulted in an acid-base imbalance after just a few minutes (times that were within the normal dive times for the species) (Stabenau *et al.* 1991) and recovery times for acid-base levels to return to normal may be prolonged as long as 20 hours or more (Henwood and Stuntz, 1987; Oravetz, 1999; Lezama et al., 2003; Sasso and Epperly, 2006). This effect is expected to be worse for sea turtles that are recaptured before metabolic levels have returned to normal. Respiratory and metabolic stress due to forced submergence is also correlated with additional factors such as size and activity of the turtle, water temperatures, and biological and behavioral differences between species (NRC 1990; Finkbeiner et al. 2011).

Capture by hand or scoop net can result in raised levels of stress hormones. The trapping and capture of individual turtles could disrupt their normal activities (e.g., foraging cycle). However, these capture methods are simple and not invasive. The turtles would be held in a manner to minimize the stress to them. If done correctly, with minimal pursuing of the animals in chase, the effects of hand capture and scoop netting are expected to be minimal. NMFS expects that individual turtles will experience no more than short-term stress during these types of capture activities and that stress would dissipate within a short period of time and not expected to rise to the level of harassment. NMFS expects no mortalities or serious injuries from these capture activities.

Entanglement nets are a type of passive, stationary fishing gear that incidentally capture turtles. Sea turtles readily enter the net and usually are able to come to the surface to breath, however turtles that attempt to elude capture could become entangled in the webbing of the net itself. This can result in some level of forced submergence, and stress due to interaction with the tangle net gear. Turtles can be affected by entanglement in the nets and/or drowning as a result of the forced submergence (Sasso and Epperly 2006). Sea turtles are particularly prone to entanglement as a result of their body configuration and behavior. Records of stranded or entangled sea turtles reveal that fishing debris can wrap around the neck or flipper, or body of a sea turtle and severely restrict swimming or feeding. Sea turtles may also experience constriction of appendages as a result of the entanglement. Constriction may cut off blood flow, causing deep gashes, some severe enough to remove an appendage. To minimize the potential for adverse impact on the turtles, when nets are in the water they are constantly monitored, so that any turtle caught would be quickly retrieved, to ensure that stress to the animal is minimized during capture. If a turtle is encountered in a comatose state, researchers will immediately commence resuscitation techniques. Since the nets will be manned at all times and turtles will be immediately removed, the risks to the turtles are expected to be greatly reduced and the raised levels of stress hormones due to the effects of the entanglement and forced submergence are expected to dissipate within a day (Stabenau and Vietti 2003). No mortalities or injuries are expected as a result of the capture.

Since the dip nets will be manned at all times and are very targeted towards a single/group of turtles, and these will be immediately removed, the risks to the turtles are expected to be greatly reduced and the effects of the entanglement and forced submergence if any are expected to dissipate within a day (Stabenau and Vietti 1999). No mortalities or injuries are expected as a result of this capture.

Measuring, Photographing, and Weighing
These procedures are simple and not invasive (Bolten 1999). Measuring will be done using a calipers and tape measure. Turtles will be weighed by placing them in a net and weighing them with a spring scale.

NMFS does not expect that individual turtles would experience more than short-term stresses during the measuring, weighing, or photographing process. No injury is expected from these activities. As discussed above, turtles would be worked up as quickly as possible to minimize stresses resulting from their capture.

Handling, measuring, photographing, and weighing can result in raised levels of stress hormones in sea turtles. The additional on-board holding time imposes an additional stressor on these already acidotic turtles (Hoopes *et al.* 2000). It has been suggested that the muscles used by sea turtles for swimming might also be used during lung ventilation (Butler *et al.* 1984). Thus, an increase in breathing effort in negatively buoyant animals may have heightened lactate production. However, the handling, measuring, photographing, carapace painting and weighing procedures are simple, non-invasive, with a relatively short time period and NMFS does not expect that individual turtles would normally experience more than short-term stresses as a result of these activities. No injury is expected from these activities, and turtles would be worked up as quickly as possible to minimize stresses resulting from their capture.

Flipper Tagging and Injection of PIT Tags
Tagging activities are minimally invasive and 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 that have lost external tags must be re-tagged if captured again at a later date, which subjects them to additional effects of tagging. The researcher will make certain that the locking mechanisms are correctly aligned and that the tag locks in place. However, care should be taken to ensure tags are not cinched too tight against the flipper without room to move freely, and that the tag is not applied too far into the edge of the flipper. The tag must be strategically located to accommodate future growth in young turtles. Ideally, 25-33% of the tag should extend beyond the edge of the flipper after application. Turtles tagged without this extension beyond the flipper run the risk of ingrown tags that may cause infection as well as the need for re-tagging because the tags unreadable. Tag applicators (pliers) will be cleaned and disinfected between turtles to avoid cross contamination. Tag applicators will also be routinely inspected and discarded when they cease to function properly.

Turtles can experience some discomfort during the tagging procedures and these procedures would produce some level of pain. The discomfort is usually short and highly variable between individuals (Balazs 1999). Most barely seem to notice, while a few others exhibit a marked response. However, NMFS expects that any stress associated with tagging to be minimal and short-term and that the small wound-site resulting from a tag applied to the flipper should heal completely in a short period of time. Similarly, turtles that must be re-tagged should also experience minimal short-term stress and heal completely in a short period of time. Re-tagging is not expected to appreciably affect these turtles.

PIT tags have been used with a wide variety of animal species that include fish (Clugston 1996; Skalski *et al.* 1998; Dare 2003), amphibians (Thompson 2004), reptiles (Cheatwood *et al.* 2003; Germano and Williams 2005), birds (Boisvert and Sherry 2000; Green *et al.* 2004), and mammals (Wright *et al.* 1998; Aguirre *et al.* 2002). PIT tags have the advantage of being encased in glass, which makes them inert, and are positioned inside the turtle where loss or damage due to abrasion, breakage, corrosion or age over time is virtually non-existent (Balazs 1999; Braun-McNeill *et al.* 2003). Also with PIT tagging, there is a lower rate of loss than with conventional methods, possibly leading to less retagging, and hence reduced interference as well as data of increased reliability and scientific value (Broderick and Godley 1999).

When PIT tags are inserted into animals that have large body sizes relative to the size of the tag, empirical studies have generally demonstrated that the tags have no adverse effect on the growth, survival, reproductive success, or behavior of individual animals (Skalski *et al.* 1998, Hockersmith *et al.* 2003). However, over time PIT tags can migrate within body tissue (van Dam and Diez 1999; Wyneken *et al.* 2010) making it necessary to scan the entire surface of the implantation area. Turtles can experience some discomfort during the tagging procedures and these procedures will produce some level of pain. The discomfort is usually short and highly variable between individuals (Balazs 1999). Most barely seem to notice, while a few others exhibit a marked physical response. 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 section 10(a)(1)(A) permit holders. In the many years that the NMFS SEFC has been PIT-tagging turtles, using the standards described in the proposed action, there have been no reports of decreased survival, reproduction, or prolonged health effects (Balazs 1999; Eckert and Beggs 2006).

NMFS expects the stress associated with PIT tagging to be minimal and short-term, and that the small wound resulting from the insertion of the tag would heal completely in a short period of time. NMFS does not expect individual turtles to experience more than short term stress during the application of the flipper (Inconel) or PIT tags. NMFS expects that turtle discomfort will be temporary, as the turtles exhibit normal behavior shortly after tagging, swim normally after release and are expected to return to baseline behavior within a few minutes.

Tissue and Scute Sampling
The permits contain conditions to mitigate adverse impacts to turtles. It is not expected that individual turtles would experience more than short-term stress during tissue sampling. SEFSC researchers who examined turtles caught 2 to 3 weeks after sample collection noted the sample collection site was almost completely healed (NMFS SEFSC 2008).

NMFS does not expect that individual turtles would experience more than short-term stress during tissue sampling. During the more than 5 years of tissue biopsying using sterile techniques, NMFS SEFSC researchers have encountered no infections or mortality resulting from this procedure (NMFS 2006). Bjorndal *et al.* (2010) found that turtles exhibited rapid healing at the tissue sampling site with no infection or scarring, and that the sampling did not adversely impact turtle physiology or health. Sample collection sites are always sterilized with alcohol or other antiseptic, prior to sampling and attempts would be limited. Additionally, all of the researchers responsible for obtaining these samples would have received extensive experience in the procedure.

As stated above, the tagging procedure is non-lethal and NMFS does not expect this method to have sub-lethal effects. NMFS acknowledges that pain, handling discomfort, possible hemorrhage at the site or risk of infection could occur, but standard procedures (such as pressure and disinfection) lessen those possibilities. NMFS believes that tissue biopsy in the manner described appears to have little probability of producing lasting effects as long as the procedure is conducted by an experienced researcher.

NMFS anticipates that the collection of tissue samples would cause minimal additional stress or discomfort to the turtle beyond that experienced during capture, collection of measurements, tagging, etc. NMFS expects that turtle discomfort will be temporary, with a return to baseline behavior within a few minutes.

Lavage (permit 14726-02 only)
The feeding habits of wild turtles can be determined by a variety of methods, but the preferred technique is gastric lavage or stomach flushing. This comparatively simple and reliable technique has been used to successfully sample the gut contents of various vertebrate animals groups without harm to the animal (Forbes 1999). Gastric lavage can provide information on diets and how they relate to seasonal foraging and habitat use (Witherington 2000; Mayor *et al.* 1998) and can provide useful information aiding to the designation of critical habitat. This technique has been successfully used on green, hawksbill, olive ridley and loggerhead turtles ranging in size from 15 to 115 curved carapace length (CCL). Forbes (1999) states that many individual turtles have been lavaged more than three times without any known detrimental effect. Individuals have been recaptured from the day after the procedure up to three years later and appear healthy and feeding normally. Laproscopic examination of the intestines following the procedure has not detected any swelling or damage to the intestines. While individual turtles are likely to experience discomfort during this procedure, NMFS does not expect individual turtles to experience more than short-term stress. Injuries are not anticipated. The applicant will 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, including having separate lavage equipment for the sampling of turtles with and without FP.

Transmitters and Epoxy Attachment

Electronic tags are clearly valuable tools for sea turtle ecological research, although considerations for the potential to affect the well-being and natural behaviors of the turtles must be made (Watson and Granger 1998; Wilson and McMahon 2006; Godley et al. 2008; Sherill-Mix and James 2008). The most important effect of transmitters on turtles may be the increased energy expenditure of the turtle from carrying the transmitter. This is based on the concept that the balance of energy expenditure with energy intake determines survival of the animal (Wilson and McMahon 2006; Wallace and Jones 2008). Along with survival, attached transmitters may in turn affect life-history traits, the timing of migratory events, and reproductive output of the animal.

When instrumenting turtles with biotelemetry packages, the goal should be to minimize the added drag effects (form drag and induced drag) (NMFS SWFSC 2011). Drag (i.e., fluid resistance) refers to the force that opposes the relative motion of an object through a fluid (liquid or gas). Instruments attached to the outside of turtles, and subsequent biofouling, can increase hydrodynamic drag, affect lift (the force perpendicular to drag in the vertical plane), and pitch (forces causing the tilt of the animal down or up). The frontal area of a tag increases the overall frontal area of the turtle, which directly increases the drag force of the turtle when moving through water (Jones et al. 2011). Therefore, minimizing the frontal area of tags will help to reduce the increase in drag force caused by the tags. The build-up of materials (e.g., epoxy, elastomer, and base plates) either under or over the tag causes an increase in profile and thus the frontal area (Jones et al. 2011). Therefore it is important that these materials are minimized. Maintaining a low profile for the tags will help to keep frontal area to a minimum and also prevent disruption of the boundary layer around the turtle. Along with the frontal area, the overall shape of the tag can decrease the additional drag force it will cause. Disruption of the boundary layer and increasing the sea turtle's profile increases the energetic costs to the animal from routine swimming and critical behaviors. See later in this section for further explanation.

NMFS recommends that tags placed on turtles should have a tear drop shape to minimize drag and have a low profile to minimally disrupt the boundary layer (NMFS SWFSC 2011). If researchers do not have tear drop shaped tags, the drag force can be greatly reduced by adding a nose cone and tail with epoxy or fiberglass. Placement of the tag in relation to the morphology of the turtle carapace is important. The drag force caused by a tag can be further reduced by avoiding the peak of the carapace. Placing tags at the peak of the carapace, while aiding in satellite uplinks causes the greatest increase in total frontal area, possibly exposing the tag to the greatest fluid flow rate (Jones et al. 2011). NMFS recommends that researchers avoid placing tags at the highest peak but rather place tags slightly anteriorly or posteriorly to the peak (NMFS SWFSC 2011) where uplinks will be maintained and the salt water switch will still be exposed to the air when the turtle breathes (Watson and Granger 1998), but the increase in total frontal area will be minimized as well as exposure to the oncoming fluid flow rate. This would lead to an acceptable compromise between ensuring satellite transmissions and minimizing the drag force.

In these permits the carapace-mounted transmitters will be attached to the turtles' posterior marginal scutes. Acoustic tags will be attached to one of the postcentral marginal scutes by a monofilament tether with a breakaway link looped through a drill hole in the scute. Tether length will be approximately one-half the carapace length of a turtle, so that the tether will not tangle in the fore flippers and the turtle is unable to bite the transmitter. The breakaway link consists of two lengths of monofilament line threaded through a 1-inch piece of surgical tubing with crimps on the end of the lines on opposite sides of the tubing. Furthermore, the rubber surgical tubing degrades in the marine environment, thus weakening the link over time. The wire serves as a corrosive link, as it degrades after approximately 3 years. A low-heat-producing marine epoxy will be used to attach equipment in order to prevent harm to the animal. Attachment of satellite, sonic, or radio tags with epoxy is a commonly used and permitted technique by NMFS (NMFS SEFSC 2008). The permits will also require that the researchers provide adequate ventilation around the turtle's head during the attachment of all transmitters. To prevent skin or eye injury due to the chemicals in the resin, transmitter attachment procedures will not take place in the water. Drill sites are always sterilized with alcohol or other antiseptic, prior to drilling and attempts will be limited. Additionally, all of the researchers responsible for sonic attachment will have extensive experience in the procedure.

In previous studies with these types of techniques (Eckert 1998; Schroeder and Balaz 2000; Eguchi et al. 2007; Epperly et al 2007), the actual attachment of the sonic tags has shown that that turtles will likely experience some small additional stress from attaching the transmitters, but not significant increases in stress or discomfort to the turtle beyond what was experienced during other research activities. Recaptured turtles previously tagged show very minimal to no signs of injury from the attachments (Keinath *et al.* 1989).

The energetic costs of swimming for an instrumented turtle may be increased, resulting in major effects on activity, behavior, metabolism, habitat selection, and other key aspects of the animals' life history. Transmitters, as well as biofouling of the tag, attached to the carapace of turtles increase hydrodynamic drag and affect lift and pitch. For example, Watson and Granger (1998) performed wind tunnel tests on a full-scale juvenile green turtle and found that, at small flow angles representative of straight-line swimming, a transmitter mounted on the carapace increased drag by 27 to 30 percent, reduced lift by less than 10 percent, and increased pitch moment by 11 to 42 percent. It is likely that this type of transmitter attachment negatively affects the swimming energetics of the turtle. However, based on the results of hardshell sea turtles equipped with this tag setup, NMFS is unaware of transmitters resulting in any serious injury to these species. These tags are unlikely to become entangled due to their streamlined profile and will typically be shed after about 3 years, posing no long-term risks to the turtle. The permit and permit modification, if issued, will require the researchers to streamline the attachment materials so that neither buoyancy nor drag affects the turtle's swimming ability, in addition to reducing the risk of entanglement. There will be no gap allowed between the transmitter and the turtle. All transmitters will be attached in the most hydrodynamic (least drag) manner possible, minimizing the epoxy footprint/frontal area. Removal of the transmitters at the end of the experiment is a non-invasive procedure and is not expected to result in any significant stress above that which has occurred during recapture. The transmitter attachment (ties) will break

away and release the sonic tag after its life is finished in case, for some unexpected reason, the researchers are unable to recapture an animal to remove it.

Sonic tags/transponders emit a moderate to high frequency sonic pulse detectable using an underwater directional hydrophone (Oden *et al.* 1983; Yano and Tanaka 1991). Triangulation of the acoustic signal allows researchers to determine turtle locations. The sonic transmitters have a frequency of approximately 50 to 80 kHz. Sea turtles have low-frequency hearing sensitivity and are potentially affected by sound energy in the band below 1,000 Hz (Lenhardt 2003; Piniak *et al.* 2012). Bartol *et al.* (1999) studied the auditory evoked potential of loggerhead sea turtles that had been captured in pound nets in tributaries to the Chesapeake Bay in Maryland and Virginia and concluded that loggerhead sea turtles had most sensitive hearing between 250 and 1000 Hz, with rapid decline above 1000 Hz (Lenhardt *et al.* 1983; O'Hara and Wilcox 1990; Moein Bartol *et al.* 1999; Lenhardt 1994; Moein Bartol and Ketten 2006). This is similar to the results produced by Ridgway *et al.* (1969) who studied the auditory evoked potentials of three green sea turtles (in air and through mechanical stimulation of the ear). They concluded that the maximum sensitivity of green sea turtles occurred from 300 to 400 Hz with rapid declines for tones at lower and higher frequencies. They reported an upper limit for cochlear potentials without injury of 2000 Hz and a practical upper limit of about 1600 Hz in water (Bartol *et al.* 1999; Piniak *et al.* 2012). There is some sensitivity to frequencies as low as 60 Hz, and probably as low as 30 Hz (L-DEO 2006). Since the sonic tags authorized for sea turtle tracking research will be well above this hearing threshold, these tags will not be heard by the turtles. NMFS does not expect the transmitters to interfere with turtles' normal activities after they are released.

Another important consideration is whether the sounds emitted by the sonic transmitters will attract potential predators, primarily sharks. Unfortunately, hearing data on sharks is limited. Casper and Mann (2004) examined the hearing abilities of the nurse shark (*Ginglymostoma cirratum*), and results showed that this species detects low-frequency sounds from 100 to 1,000 Hz, with best sensitivity from 100 to 400 Hz. Myrberg (2001) explained that audiograms have been published on elasmobranchs. Although we do not have hearing information for all the sharks that could potentially prey on sea turtles, estimates for hearing sensitivity in available studies provided ranges of 25 to 1,000 Hz. In general, these studies found that shark hearing is not as sensitive as in other tested fishes, and that sharks are most sensitive to low-frequency sounds (Nelson 1967; Casper *et al.* 2003). Thus, it appears that the sonic transmitters will not attract potential shark predators to the turtles, because the frequency of the sonic tags is well above the 1,000-Hz threshold.

We acknowledge that pain, handling discomfort, possible hemorrhage at the tag site or risk of infection could occur, but standard procedures (such as pressure and disinfection) lessen those possibilities. Tag placement has the potential to negatively impact the natural behaviors (Jones et al. 2011). We believe that sonic tag attachment in the manner described appears to have little probability of harming tagged turtles as long as the procedure follows NMFS protocols on tag size and placement, and is conducted by an experienced reseracher.

Transport and Holding
Given the precautions that will be taken by the researchers to ensure the safety of the turtles and the permit conditions relating to transport and holding, NMFS believes that any transport and holding of the animals, according to standard protocol methods, will have minimal and insignificant effects on the animals, and therefore are insignificant and discountable. All animals will be transported and held under climate-controlled conditions and later released into the sea according to release protocols to prevent/minimize injury (NMFS SEFSC 2008).

Summary of Effects
The short-term stress resulting from capture, handling, measuring, weighing, tissue sampling, lavage/gastric sampling, flipper and PIT tagging, transmitter attachment and release are expected to be minimal. The permit and permit modification contain conditions to mitigate adverse impacts to turtles from these activities. As discussed above, turtles will be worked up as quickly as possible to minimize stress resulting from the research techniques. Applicants will be required to exercise care when handling animals to minimize any possible injury and 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. As a precaution an experienced veterinarian or veterinarian technician will be listed in the research permits in case of emergencies. During release, turtles will be lowered as close to the water's surface as possible, to prevent potential injuries.

We expect responses of individual sea turtles to exposure to research activities to consist of brief, low-level to moderate behavioral responses. As a result, sea turtles that will be tagged may temporarily leave the area or cease feeding, breeding, or resting after the research activities. However, we expect that individuals would return to baseline behavior within a few minutes. As a result, any risk of research related harassment of sea turtles is highly unlikely and no reduction in the fitness of any individual listed sea turtle is expected.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions, including research authorized under ESA Section 10(a)(1)(A), that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. After reviewing available information, NMFS is not aware of effects from any additional future non-federal activities in the action area that would not require federal authorization or funding and are reasonably certain to occur during the foreseeable future.

NMFS expects the natural phenomena in the action area (e.g., oceanographic features, storms, and natural mortality), as well as the current anthropogenic effects as described in the *Environmental Baseline*, will continue to influence listed sea turtles. Potential future effects from climate change on sea turtles in the action area are hard to predict, however it has the potential to affect these species in the future, including indirectly by affecting sex ratios.

As the size of human communities increase, there is an accompanying increase in habitat alterations resulting from an increase in housing, roads, commercial facilities and other infrastructure. This results in increased discharge of sediments and pollution into the marine environment. These activities are expected to continue to degrade the habitat of sea turtles as well as that of the food items on which they depend. However, it is the combination and extent to which these natural and human-induced phenomena will affect sea turtles that remains unknown.

Integration and Synthesis of Effects

As explained in the *Approach to the Assessment* section, risks to listed individuals are measured using changes to an individual's "fitness", i.e., the individual's growth, survival, annual reproductive success, and lifetime reproductive success. When listed animals exposed to an action's effects are not expected to experience reductions in fitness, we do not expect the action to have adverse consequences on the viability of the population(s) those individuals represent or the species those populations comprise (Anderson, 2000; Brandon, 1978; Mills and Beatty, 1979; Stearns, 1992). As a result, if the assessment indicates that listed animals are not likely to experience reductions in their fitness, we conclude our assessment.

The narrative that follows integrates and synthesizes the information contained in the Status of the Species, the Environmental Baseline, and the Effects of the Action sections of this Opinion to assess the risk the proposed activities pose to green, hawksbill, Kemp's ridley, leatherback, and Northwest Atlantic loggerhead sea turtles. There are known cumulative effects (i.e., from future state, local, tribal, or private actions) that fold into our risk assessment for these species. NMFS expects that the current natural and anthropogenic threats described in the Environmental Baseline will continue. The intent of the following discussion is to provide a basis for determining the additive effects of the take authorized in the scientific research permit 18069 to Dr. Jeffrey Schmid authorizing research on green, hawksbill, Kemp's ridley, and loggerhead sea turtles populations in coastal Florida waters, and the permit modification 14726-02 to Dr. Blair Witherington on green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles populations in Atlantic and Gulf of Mexico waters, in light of their present and anticipated future status.

Actions that result in mortality affect listed species through the impact of the loss of individual turtles and also through the loss of the reproductive potential of each turtle 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.

While the loss of all these turtles, including eggs, has likely adversely affected the ability of all green, hawksbill, Kemp's ridley, leatherback, and Northwest Atlantic loggerhead sea turtle 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 are demographically vulnerable to increases in mortality, particularly of juveniles and subadults,

those stages with higher reproductive value. The potential for an egg to develop into a hatchling, into a juvenile, and finally into a sexually mature adult sea turtle varies among species, populations, and the degree of threats faced during each life stage. Each juvenile that does not survive to reproduce would 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 contributed something before being removed from the population, would not be allowed to realize their reproductive potential. Similarly, reproductive males prematurely removed from the population would be unable to make their reproductive contribution to the species' population.

As described in the Effects of the Action section of this Opinion, the research activities under permit 18069 and permit modification 14726-02 are not expected to result in mortality or injury to any green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles , nor will the short-term stress result in any sub-lethal effects. These non-lethal interactions would not affect the turtle's ability to reproduce and contribute to the maintenance or recovery of the species. These activities would affect the turtles by disturbing individual turtles during the research thus raising levels of stress hormones and the turtle may experience some discomfort from the described research procedures. These effects are expected to be short-term. Based on past observations of similar research (NMFS SEFSC 2008), it is reasonable to expect that effects would be minimal and that turtles would return to baseline behavior within a few minutes. Any lingering effects are expected to dissipate within approximately a day. Based on this prior information and experience, and conditions placed on the Permit Holders, NMFS does not expect the Permits Division's proposal to issue a permit and a permit modification to conduct the research as described above to result in more than short-term effects on individual green, hawksbill, Kemp's ridley, leatherback, and Northwest Atlantic loggerhead sea turtles. NMFS also does not expect any delayed mortality of any turtles following their release as a direct result of the research based on past research efforts by other researchers and adherence to certain protocols (NMFS SEFSC 2008) identified in the proposed action.

Although some degree of stress or pain is likely, these are not expected to have more than short-term, temporary effects for individual turtles. None of the research procedures are expected to result in mortality or reduced fitness of individuals. In particular, NMFS does not expect the proposed research permits to affect adult turtles in a way that appreciably reduces the number of animals born in a particular year; the reproductive success of adult turtles; the survival of young turtles; or the number of young turtles that annually recruit into the adult, breeding populations of any population of endangered green (both the Florida breeding population and range-wide listing), Kemp's ridley, hawksbill, leatherback, and threatened loggerhead sea turtles (Northwest Atlantic Ocean DPS).

Based on the above, We conclude that the proposed activities are not likely to reduce the viability of the sea turtle populations these individuals represent and, as a result we do not expect the proposed activities to appreciably reduce the likelihood of green, hawksbill, Kemp's ridley, leatherback, or Northwest Atlantic loggerhead sea turtles surviving and recovering in the wild by reductions in their reproduction, numbers or distribution.

The data generated by the applicant regarding these populations over the duration of this study would provide beneficial information that would be important to the management and recovery of threatened and endangered species. The information collected as a direct result of the issuance of these Permits would be valuable for helping implement the goals identified in the Recovery Plans for the U.S. Atlantic Ocean Populations of sea turtles.

Conclusion

After reviewing the current status of green (both the Florida breeding population and range-wide listing), Kemp's ridley, hawksbill, leatherback, and loggerhead sea turtles (Northwest Atlantic Ocean DPS) affected by the proposed action, the environmental baseline for the action area, the anticipated effects of the proposed research activities and probable cumulative effects, it is NMFS' biological opinion that issuance of permit No. 18069 to Dr. Jeffrey Schmid, and permit modification No. 14726-02 to Dr. Blair Witherington, as proposed, is not likely to jeopardize the continued existence of green, hawksbill, Kemp's ridley, leatherback, and Northwest Atlantic loggerhead sea turtles. It is also NMFS' biological opinion that the proposed action is also not likely to destroy or adversely modify any designated or proposed 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 to attempt to engage in any such conduct. Harm is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by USFWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of 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 terms and conditions of this Incidental Take Statement.

Amount or Extent of Take

The permits are for the directed take, for research purposes, of listed sea turtles; no incidental take of other listed species is anticipated or authorized.

This Opinion does not authorize any take of other listed species or immunize any actions from the prohibitions of section 9(a) of the ESA. Take is authorized by section 10(a)(1)(a) as specified in the permits.

CONSERVATION RECOMMENDATIONS

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

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

1. *Estimation of actual levels of "take."* The Permits Division should review the annual reports and final reports submitted by researchers that have conducted research on sea turtles as well as any data and results that can be obtained from the permit holders. This should be used to estimate the numbers of sea turtles killed and harassed by these investigations, and how the harassment affects the life history of individual animals. The results of the study should be provided to the ESA Interagency Cooperation Division for use in the consultations of future research activities.

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

REINITIATION NOTICE

This concludes formal consultation on the proposal to issue scientific research permit 18069 and permit modification 14726-02. 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 incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of authorized take is exceeded, the NMFS Permits Division must immediately request reinitiation of Section 7 consultation.

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