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
Activities Considered:	ESA section 7 consultation for permit number 17787 (the Southeast Fisheries Science Center) to authorize research on smalltooth sawfish along the coast of Florida
Consultation Conducted by:	Endangered Species Act Interagency Cooperation Division of the Office of Protected Resources, National Marine Fisheries Service
Approved by:	Donna S Wieting
Date:	FEB 12 2014

Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. 1531 *et seq.*) 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 protected species, that agency is required to consult with either the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the protected species that may be affected. For the actions described in this document, the action agency is NMFS' Office of Protected Resources – Permits and Conservation Division (PR1). The consulting agency is NFMS' Office of Protected Resources - Endangered Species Act Interagency Cooperation Division (PR5).

This document represents NMFS's biological opinion (Opinion) based on our review of PR1's proposed permit 17787. Permit 17787 is a renewal of the smalltooth sawfish research permit 13330, held by the Southeast Fisheries Science Center between 2008 and 2013. The documents used for this consultation were the draft environmental assessment, the 5 year review of the smalltooth sawfish (*Pristis pectinata*), the recovery plan for smalltooth sawfish, past and current research, including annual reports from permit number 13330, and population dynamics modeling efforts, published literature and reports, and Opinions on similar research.

Consultation History

On March 19, 2013, PR1 requested pre-consultation on this project.

On June 24, 2013, PR1 provided consultation documents to PR5 and requested to initiate consultation. PR5 initiated consultation at that time.

On September 24, 2013, PR1 contacted the applicant to renegotiate the number of adult and juvenile captures.

On October 1, 2013, the federal government was closed and this analysis was placed on hold.

On October 16, 2013, the federal government was reopened and consultation resumed at that time.

BIOLOGICAL OPINION

Description of the Proposed Action

The Southeast Fisheries Science Center proposes to capture and study adult, juvenile, and neonate smalltooth sawfish using longline, rod and reel, set lines (drum lines), gill nets, and beach seines each year (Table 1). All sawfish captured during field surveys will be handled, measured, tagged, sampled, and released alive. The proposed permit requests to conduct this research between January 1, 2013 and December 31, 2018. Specific permit terms and conditions are identified in the draft permit and will be included in the final permit. They are intended to minimize the potential adverse affects resulting from capturing, handling, sampling, and transmitter attachment to smalltooth sawfish as well as minimizing or eliminating the potential for adverse affects to other listed species, such as sea turtles or manatees, or marine mammals, such as bottlenose dolphins and beaked whales that could result from efforts to capture smalltooth sawfish.

Table 1: Annually requested smalltooth sawfish captures with corresponding sampling gear.

SPECIES	LIFESTAGE	EXPECTED TAKE	OBSERVE / COLLECT METHOD	PROCEDURES	DETAILS
Sawfish, smalltooth	Adult / Juvenile	20	Longline	Instrument, external (e.g., VHF, satellite); Instrument, internal (e.g., VHF, sonic); Mark, Floy T-bar; Mark, M-tag; Mark, PIT tag; Measure; Sample, blood ;	Other capture methods include: Gillnet, rod and reel, and seine. 50 blood samples would be taken over the life of the permit. Juvenile/Adult sawfish would receive one internal tag and one external SPOT or PAT tag.

				Sample, fin clip	
Sawfish, smalltoot h	Neonate	50	Net, Gill	Instrument, internal (e.g., VHF, sonic); Mark, dart; Mark, PIT tag; Measure; Photograph/Video ; Sample, fin clip	Other capture methods include: rod and reel and seine. Minimum size for fish receiving internal tags would be 65cm STL.
Sawfish, smalltoot h	Neonate	50	Net, Gill	Mark, dart; Mark, PIT tag; Measure; Photograph/Video ; Sample, blood ; Sample, fin clip	Other capture methods include: rod and reel and seine. 20 blood samples would be taken over the life of the permit.
Sawfish, smalltoot h	Unknown	20	Other	Salvage (carcass, tissue, parts)	

Capture

Permit number 17787 proposes the capture of 20 adult or juvenile smalltooth sawfish each year along with 100 neonate smalltooth sawfish. Adults and juveniles will be captured primarily using longline, but also could be captured using rod and reel or seine nets. Neonates will be primarily captured with gillnets but may also be captured by rod and reel or seine nets. These sampling techniques are the same as were used for the capture of smalltooth sawfish between 2008 and 2013, which will allow for an accurate assessment of their risks to individual smalltooth sawfish as well as the smalltooth sawfish species.

Handling

This proposed research project will not change handling techniques from the previous permit (Number 13330). Four measurements of straight line length would be taken when possible: precaudal length, fork length, total length and stretched total length. Rostral tooth counts (left, right and total) and rostral length would be taken on all sawfish. Small individuals (under 150 cm) would be measured aboard the vessel or in the water using a measuring board; larger individuals would be left in the water and measured using a fiberglass measuring tape. Small individuals would be weighed using a mesh bag suspended from a spring scale. All smalltooth sawfish would be tagged and released. Occasional recaptures would be measured, weighed, re-tagged if necessary, re-sampled, and released.

Tagging

All 20 adult or juvenile smalltooth sawfish will receive both an internal acoustic tag as well as an external tag (either a Pop-Up Archival Transmitting (PAT) tag (Figure 1) or a Smart Position Only Transmitting (SPOT) tag (Figure 2)). Fifty neonates will receive external dart tags for identification purposes but no other tags. The other fifty neonates will receive internal acoustic tags but no external tags. The smallest fish to receive an internal tag will be 65cm. The combined weight of all tags applied to each smalltooth sawfish will not exceed 2% of the body weight of the fish. The tagging procedures remain unchanged from the previous research approved under Permit Number 13330.

Figure 1: Pop-up archival tag as proposed for use in permit number 17787.

Figure 2: SPOT tag attached to a smalltooth sawfish as authorized under permit number 13330 and proposed under permit number 17787.

Genetic sampling
The researchers would take a small tissue sample clipped with disinfected scissors from the dorsal fin of all smalltooth sawfish for genetic analysis. The genetic samples are approximately 1 cm^2.

Blood sampling
A total of 50 adults or juveniles and 20 neonates will have blood samples taken over the five years of the permit. The methods will be identical to the methods described for Permit Number 13330. Up to 10% of circulating blood volume can be collected from an animal in a single sampling without significant disturbance to the individual's normal physiology (Diehl *et al.* 2001). Given this, the following conservative protocols (Table 2) would be used to collect blood from smalltooth sawfish collected during this study:

Table 2: Protocol for determining the appropriate amount of blood collection.

Sawfish body weight	Amount of blood draw
<1 kg	1 ml
1-2 kg	3 ml
>2 kg	5 ml

Approach to the Assessment

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

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

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

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

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

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

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

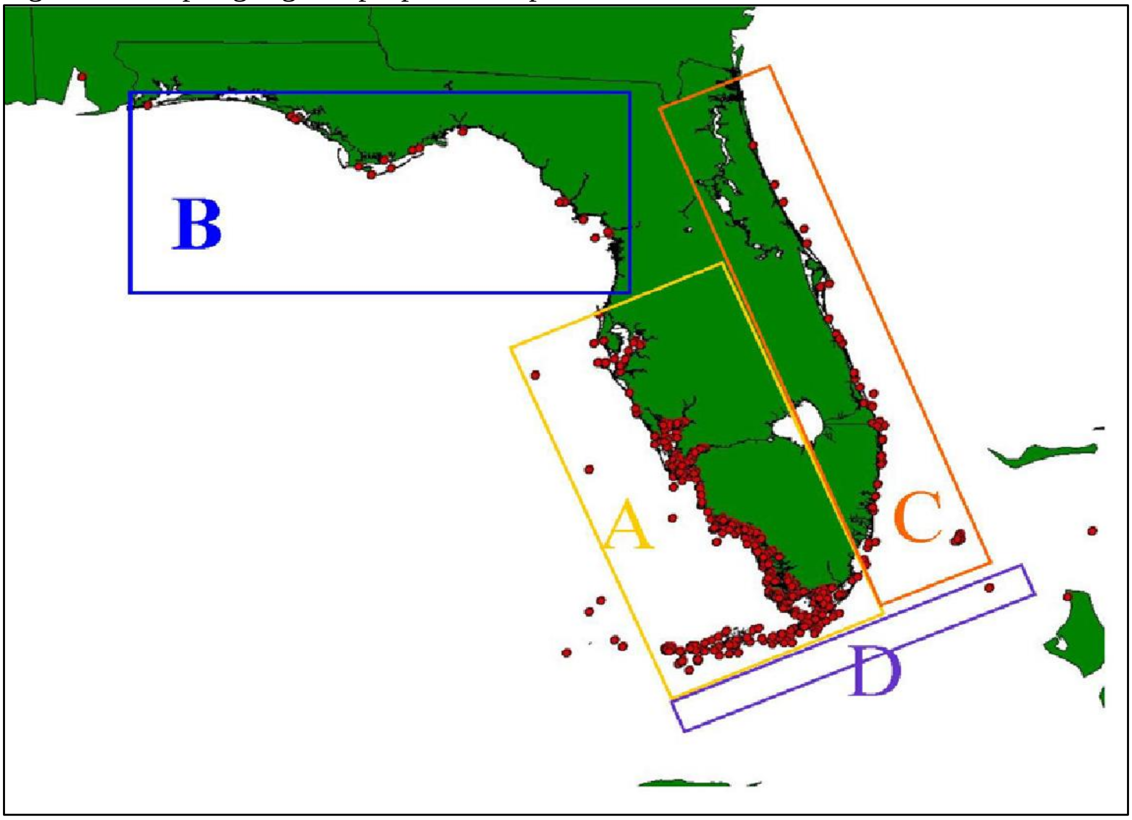
To conduct these analyses, we rely on all of the evidence available to us. This evidence can consist of monitoring reports submitted by past and present permit holders; reports from NMFS Science Centers; reports prepared by natural resource agencies in States, and other countries; reports from foreign and domestic nongovernmental organizations involved in marine conservation issues; the information provided by PR1 when it initiates formal consultation; information from commercial interests; and the general scientific literature.

During each consultation, we conduct electronic searches of the general scientific literature using *SCOPUS*, *American Fisheries Society*, *Google Scholar*, *JSTOR*, and/or *Aquatic Sciences and Fisheries Abstracts* search engines. We supplement these searches with electronic searches of doctoral dissertations and master's theses. These searches specifically try to identify data or other information that supports a particular conclusion (for example, a study that suggests smalltooth sawfish will exhibit a particular response to dissolved oxygen concentrations) as well as data that does not support that conclusion. When data are equivocal, or in the face of 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.

Action Area

Sampling would occur throughout the coastal waters of Florida (Figure 3). Research efforts are primarily focused in the region of the Florida coast from Naples to Key West, encompassing the Ten Thousand Islands and Everglades National Park. Sampling may occur in waters throughout Florida if reliable and sufficient reports of smalltooth sawfish encounters are received to warrant sampling in those areas.

Figure 3: Sampling regions proposed for permit number 17787.



Status of the Species

NMFS has determined that the following species (Table 3) will be present in the action area of permit number 17787.

Table 3: Species present in the action area during the five year duration of permit number 17787.

Species	Scientific name	Listing status
Shortnose sturgeon	*Acipenser brevirostrum*	Endangered
Atlantic sturgeon (any DPS)	*Acipenser oxyrinchus*	Endangered
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Threatened
Smalltooth sawfish	*Pristis pectinata*	Endangered
Western Atlantic DPS Loggerhead sea turtle	*Caretta caretta*	Threatened
Green sea turtle (Florida)	*Chelonia mydas*	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered

Hawksbill sea turtle	*Eretmochelys imbricate*	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered

Listed Species and Critical Habitat No Longer Considered in this Opinion

Permit number 17787 will authorize research in areas with loggerhead, green, leatherback, hawksbill, and Kemp's ridley sea turtles. Under permit 13330, no sea turtles were adversely affected and because permit 17787 will not change the amount of effort being put into capturing sub-adult and adult smalltooth sawfish, the risk to sea turtles by authorizing an additional five years of smalltooth sawfish research under permit number 17787 presents a negligible risk to these individual sea turtles and their populations. Sampling for neonates is done by sight and would not affect sea turtles. For this reason, NMFS will not consider sea turtle species further in this Opinion.

Elkhorn and staghorn coral and Johnson's sea grass can be found off the coast of Florida, but this action will have no effect on them because the researchers have identified where these species live and have agreed to not sample in those locations. For this reason, NMFS will not consider coral species further in this Opinion.

Shortnose sturgeon historically occupied the Saint Johns and Saint Mary's river in Florida, but Kahnle *et al.* (1998) and Rogers and Weber (1994) determined that shortnose sturgeon had been extirpated from those systems. Likewise, the southern extent of Atlantic sturgeon's historical range was somewhere in the vicinity of these rivers. Altantic sturgeon may still congregate along the Georgia/Florida border in small numbers. Transient shortnose and Atlantic sturgeon may enter Florida's waters, but due to the sampling methods for this project, the risks to these species are negligible. Because this action may effect, but is not likely to adversely affect shortnose or Atlantic sturgeon, NMFS will not consider sturgeon species further in this Opinion.

Gulf sturgeon currently inhabit the west coast of Florida. While there is a good chance that gulf sturgeon will be in the same vicinity as the research being conducted, the only sampling gear that would impact them would be gillnets. The gillnets proposed for use in this project are to be used in water less than 40 inches deep after visually identifying and targeting a smalltooth sawfish. If a gulf sturgeon or another listed animal is seen in the vicinity, gill nets will not be deployed and therefore the chances of bycatch are negligible. The three to four inch mesh size used when targeting sawfish is significantly smaller than what would be used to capture gulf sturgeon (6 to 12 inch mesh). Because the researchers will be targeting smalltooth sawfish and will be able to see and avoid gulf sturgeon during gillnet sets and will bait longlines with food not consumed by gulf sturgeon, gulf sturgeon will not be present or affected by the temporary activities in their critical habitat. For these reasons, NMFS believes this project poses a discountable risk to gulf sturgeon and is not likely to adversely affect individual Gulf sturgeon or the species. Gulf sturgeon will not be considered further in this Opinion.

Critical habitat has been designated for smalltooth sawfish, gulf sturgeon, green sea turtles, hawksbill sea turtles, and leatherback sea turtles in the action area. The critical habitat for hawksbill and leatherback sea turtles is outside of the action area and will therefore not be affected.

Critical habitat for gulf sturgeon does occur within the action area of this project. That critical habitat occurs in Pensacola Bay, Santa Rosa Sound, Florida nearshore Gulf of Mexico, Choctawhatchee Bay, Apalachicola Bay, and Suwannee Sound (units 9 to 14). The primary constituent elements of Gulf sturgeon are riverine habitat, migratory pathways, food resources, and sediment and water quality. Permit number 17787 will authorize the use of long line, gillnet, hook and line, and seine net sampling for smalltooth sawfish. The use of this gear as well as the vessels to deploy that gear will be temporarily present in riverine and nearshore habitat. Gillnets will be deployed when smalltooth sawfish are observed in shallow, nearshore habitats. They will have no effect on riverine habitat, migratory corridors, or Gulf sturgeon food resources. Additionally, none of the gear or vessels will have an effect on sediment or water quality. NMFS therefore concludes there will be no effect to gulf sturgeon critical habitat and it will not be considered further in this Opinion.

Smalltooth sawfish critical habitat is designated in the action area. No specific physical or biological features were identified for adult smalltooth sawfish. Two physical and biological features were identified for juvenile sawfish nursery habitat. These features were red mangrove habitat and shallow euryhaline habitat. Because of the sampling methods employed by this research project, no modification of either of these features will take place. Therefore, NMFS concludes there will be no effect to smalltooth sawfish critical habitat and it will not be considered further in this Opinion.

Listed Species and Critical Habitat that are Likely to be Adversely Affected

Smalltooth Sawfish

Description of the Species

The smalltooth sawfish is a tropical marine and estuarine elasmobranch fish (sharks and rays) that has been reported to have a circumtropical distribution. All extant sawfish belong to the Suborder *Pristoidea*, Family *Pristidae,* and Genus *Pristis*. Although they are rays, sawfish physically more resemble sharks, with only the trunk and especially the head ventrally flattened. Smalltooth sawfish are characterized by their "saw," a long, narrow, flattened rostral blade with a series of transverse teeth along either edge.

In the western Atlantic, the smalltooth sawfish has been reported from Brazil through the Caribbean and Central America, the Gulf of Mexico, and the Atlantic coast of the United States. The smalltooth sawfish has also been recorded from Bermuda (Bigelow and Schroeder 1953). Forms of smalltooth sawfish have been reported from the eastern Atlantic in Europe and West Africa; the Mediterranean; South Africa; and the Indo-West Pacific, including the Red Sea, India, Burma, and the Philippines (Bigelow and Schroeder 1953, Van der Elst 1981, Compagno and Cook 1995). Whether populations outside of the Atlantic are truly smalltooth sawfish or closely related species is unknown (Adams and Wilson 1995). Pacific coast records of smalltooth sawfish off Central America need confirmation (Bigelow and Schroeder 1953, Compagno and Cook 1995).

The range of the smalltooth sawfish in the Atlantic has contracted markedly over the past century. The northwestern terminus of their Atlantic range is located in the waters of the eastern United States. Historic capture records within the U.S. range from Texas to New York. Water temperatures no lower than 16° to 18°C and the availability of appropriate coastal habitat serve as the major environmental constraints limiting the northern movements of smalltooth sawfish in the western North Atlantic. As a result, most records of this species from areas north of Florida occur during spring and summer periods (May to August) when inshore waters reach appropriately high temperatures. Most specimens captured along the Atlantic coast north of Florida have also been large (over nine feet) adults and likely represent seasonal migrators, wanderers, or colonizers from a core population(s) to the south rather than being members of a continuous, even-density population (Bigelow and Schroeder 1953). It is likely that these individuals migrated southward toward Florida as water temperatures declined in the fall, as there is only one winter record from the Atlantic coast north of Florida. The Status Review Team (NMFS 2000) collected and compiled literature accounts, museum collection specimens, and other records of the species to document the changes in distribution and abundance. At about the same time, two groups of researchers began collecting reports of sawfish encounters and captures in Florida to assess the current distribution of this species. Based on smalltooth sawfish encounter data, the current core range for the smalltooth sawfish is from the Caloosahatchee River, Florida, to Florida Bay (Seitz and Poulakis 2002, Poulakis and Seitz 2004, Simpfendorfer and Wiley 2004, NMFS 2006).

Life history information on smalltooth sawfish is limited. Small amounts of data exist in old taxonomic works and occurrence notes (e.g., Breder 1952, Bigelow and Schroeder 1953, Thorson *et al.* 1966, Wallace 1967). However, as Simpfendorfer and Wiley (2004) note, these relate primarily to occurrence and size. Recent research and sawfish public encounter information is now providing new data and hypotheses about smalltooth sawfish life history (e.g., Simpfendorfer 2001, Seitz and Poulakis 2002, Simpfendorfer 2003, Poulakis and Seitz 2004, Simpfendorfer and Wiley 2004), but more data are needed to confirm many of these new hypotheses.

As in all elasmobranchs, fertilization is internal. Bigelow and Schroeder report the litter size as 15 to 20. Simpfendorfer and Wiley (2004), however, caution this may be an overestimate, with recent anecdotal information suggesting smaller litter sizes (~10). Smalltooth sawfish mating and pupping seasons, gestation, and reproductive periodicity are all unknown. Gestation and reproductive periodicity, however, may be inferred based on that of the largetooth sawfish, sharing the same genus and having similarities in size and habitat. Thorson (1976) reported the gestation period for largetooth sawfish was approximately five months and concluded that females probably produce litters every two years.

Bigelow and Schroeder (1953) describe smalltooth sawfish as generally about two feet long (61 cm) at birth and growing to a length of 18 feet (549 cm) or greater. Recent data from smalltooth sawfish caught off Florida, however, demonstrate young are born at 75-85 cm (Simpfendorfer and Wiley 2004), with males reaching maturity at approximately 270 cm and females at approximately 360 cm. The maximum reported size of a smalltooth sawfish is 760 cm (Last and Stevens 1994), but the maximum size normally observed is 600 cm (Adams and Wilson 1995). No formal studies on the age and growth of the smalltooth sawfish have been conducted to date, but growth studies of largetooth sawfish suggest slow growth, late maturity (10 years) and long lifespan (25-30 years) (Thorson 1982, Simpfendorfer 2000). These characteristics suggest a very low intrinsic rate of increase (Simpfendorfer 2000).

Smalltooth sawfish feed primarily on fish, with mullet, jacks, and ladyfish believed to be their primary food resources (Simpfendorfer 2001). By moving its saw rapidly from side to side through the water, the relatively slow-moving sawfish is able to strike at individual fish (Breder 1952). The teeth on the saw stun, impale, injure, or kill the fish. Smalltooth sawfish then rub their saw against bottom substrate to remove the fish, which are then eaten. In addition to fish, smalltooth sawfish also prey on crustaceans (mostly shrimp and crabs), which are located by disturbing bottom sediment with their saw (Norman and Fraser 1937, Bigelow and Schroeder 1953).

Smalltooth sawfish are euryhaline, occurring in waters with a broad range of salinities from freshwater to full seawater (Simpfendorfer 2001). Tracking data from the Caloosahatchee River in Florida indicate very shallow depths and salinity are important abiotic factors influencing juvenile smalltooth sawfish movement patterns, habitat use, and distribution (Simpfendorfer 2011). Another recent acoustic tagging study in a developed region of Charlotte Harbor, Florida identified the importance of mangroves in close proximity to shallow water habitat for juvenile smalltooth sawfish, stating that juveniles generally occur in shallow water within 328 ft (100 m) of mangrove shorelines [generally red mangroves (Simpfendorfer *et al.* 2010)]. Their occurrence in freshwater is suspected to be only in estuarine areas temporarily freshwater from receiving high levels of freshwater input. Many encounters are reported at the mouths of rivers or other sources of freshwater inflows, suggesting estuarine areas may be an important factor in the species distribution (Simpfendorfer and Wiley 2004).

The literature indicates that smalltooth sawfish are most common in shallow coastal waters less than 82 feet (Bigelow and Schroeder 1953, Adams and Wilson 1995). Indeed, the distribution of the smallest size classes of smalltooth sawfish indicate that nursery areas occur throughout Florida in areas of shallow water, close to shore and typically associated with mangroves (Simpfendorfer and Wiley 2004). These movements often involve moving from shallow sandbars at low tide to within red mangrove prop roots at higher tides (Simpfendorfer *et al.* 2010), behavior likely to reduce the risk of predation (Simpfendorfer 2006). As juveniles increase in size, they begin to expand their home ranges (Simpfendorfer *et al.* 2010; Simpfendorfer *et al.* 2011), eventually moving to more offshore habitats where they likely feed on larger prey and eventually reach sexual maturity. An examination of the relationship between the depth at which sawfish occur and their estimated size indicates that larger animals are more likely to be found in deeper waters. Since large animals are also observed in very shallow waters, it is believed that smaller (younger) animals are restricted to shallow waters, while large animals roam over a much larger depth range (Simpfendorfer 2001). Recent data from sawfish encounter reports and from satellite tagging indicate mature animals occur regularly in waters in excess of 164 feet (Poulakis and Seitz 2004, Simpfendorfer and Wiley 2004).

Researchers have identified several areas within the Charlotte Harbor Estuary that are disproportionately more important to juvenile smalltooth sawfish, based on intra- or inter-annual (within or between year) capture rates during random sampling events within the estuary (Poulakis 2012; Poulakis et al. 2011). These areas were termed “hotspots” and also correspond with areas where public encounters are most frequently reported. Use of these “hotspots” can vary within and among years based on the amount and timing of freshwater inflow. Smalltooth sawfish use hotspots further upriver during high salinity conditions (drought) and areas closer to the mouth of the Caloosahatchee River during times of high freshwater inflow (Poulakis et al. 2011). At this time researchers are unsure what specific biotic (e.g., presence or absence of predators and prey) or abiotic factors influence this habitat use, but believe a variety of conditions in addition to salinity, such as temperature, dissolved oxygen, water depth, shoreline vegetation, and food availability, may influence habitat selection (Poulakis et al. 2011).

While adult smalltooth sawfish may also use the estuarine habitats used by juveniles, they are commonly observed in deeper waters along the coasts. Poulakis and Seitz (2004) noted that nearly half of the encounters with adult-sized smalltooth sawfish in Florida Bay and the Florida Keys occurred in depths from 200 to 400 ft (70 to 122 m) of water. Similarly, Simpfendorfer and Wiley (2005) reported encounters in deeper waters off the Florida Keys, and observations from both commercial longline fishing vessels and fishery-independent sampling in the Florida Straits report large smalltooth sawfish in depths up to 130 ft (~40 m) (NSED 2012). However, NMFS believes adult smalltooth sawfish use shallow estuarine habitats during parturition (when adult females return to shallow estuaries to pup) because very young juveniles still containing rostral sheaths are captured in these areas. Since very young juveniles have high site fidelities, we hypothesize that they are birthed nearby or in their nursery habitats.

Mote Marine Laboratory data indicate smalltooth sawfish occur over a range of temperatures but appear to prefer water temperatures greater than 64.4°F (18°C) (Simpfendorfer 2001). The data also suggest that smalltooth sawfish may utilize warmwater outflows of power stations as thermal refuges during colder months to enhance their survival or become trapped by surrounding cold water from which they would normally migrate. Almost all occurrences of smalltooth sawfish in warm-water outflows were during the coldest part of the year, when water temperatures in these outfalls are typically well above ambient temperatures. Further study of the importance of thermal refuges to smalltooth sawfish is needed. Significant use of these areas by sawfish may disrupt their normal migratory patterns (Simpfendorfer and Wiley 2004).

Historic records of smalltooth sawfish indicate that some large mature individuals migrated north along the U.S. Atlantic coast as temperatures warmed in the summer and then south as temperatures cooled (Bigelow and Schroeder 1953). Recent Florida encounter data, however, do not suggest such migration. Only two smalltooth sawfish have been recorded north of Florida since 1963 (the first was captured off of North Carolina in 1999 (Schwartz 2003) and the other off Georgia 2002 [Burgess unpublished data]) but it is unknown whether these individuals resided in Georgia and North Carolina waters annually or if they had migrated north from Florida. Given the very limited number of encounter reports from the east coast of Florida, Simpfendorfer and Wiley (2004) hypothesize the population previously undertaking the summer migration has declined to a point where the migration is undetectable or does not occur. Further research focusing on states north of Florida or using satellite telemetry is needed to test this hypothesis.

Status and Trends

Few long-term abundance data exist for the smalltooth sawfish, making it very difficult to estimate the current population size. However, Simpfendorfer (2001) estimated that the U.S. population may number less than five percent of historic levels, based on anecdotal data and the fact that the species' range has contracted by nearly 90 percent, with south and southwest Florida the only areas known to support a reproducing population. The decline in the population of smalltooth sawfish is attributed to fishing (both commercial and recreational), habitat modification, and sawfish life history. Large numbers of smalltooth sawfish were caught as bycatch in the early part of this century. Smalltooth sawfish were historically caught as bycatch in various fishing gears throughout their historic range, including gillnet, otter trawl, trammel net, seine, and to a lesser degree, handline. Frequent accounts in earlier literature document smalltooth sawfish being entangled in fishing nets from areas where smalltooth sawfish were once common but are now rare or extirpated (Everman and Bean 1898). Loss and/or degradation of habitat contributed to the decline of many marine species and continue to impact the distribution and abundance of smalltooth sawfish.

Since actual abundance data are limited, researchers have begun to compile capture and sightings data (collectively referred to as encounter data) in the National Sawfish Encounter Database (NSED) that was developed in 2000. Since the conception of the NSED, over 3,000 smalltooth sawfish encounters have been reported and compiled in the encounter database (NSED 2012). Although this data cannot be used to assess the population because of the opportunistic nature in which they are collected (i.e., encounter data are a series of random occurrences rather than an evenly distributed search over a defined period of time), researchers can use this database to assess the spatial and temporal distribution of smalltooth sawfish. We expect that as the population grows, the geographic range of encounters will also increase. Seitz and Poulakis (2002) and Poulakis and Seitz (2004) document recent (1990 to 2002) occurrences of sawfish along the southwest coast of Florida, and in Florida Bay and the Florida Keys, respectively. This information is confirmed by Wiley and Simpfendorfer (2010) who show the core range has expanded.

The majority of smalltooth sawfish encounters today are from the southwest coast of Florida between the Caloosahatchee River and Florida Bay. Outside of this core area, the smalltooth sawfish appears more common on the west coast of Florida and in the Florida Keys than on the east coast, and occurrences decrease the greater the distance from the core area (Simpfendorfer and Wiley 2004). The capture of a smalltooth sawfish off Georgia in 2002 is the first record north of Florida since 1963. New reports during 2004 extend the current range of the species to Panama City, offshore Louisiana (south of Timbalier Island in 100 ft of water), southern Texas, and the northern coast of Cuba. The Texas sighting was not confirmed to be a smalltooth sawfish and may have been a largetooth sawfish.

Despite the lack of scientific data on abundance, recent encounters with young-of-the-year, older juveniles, and sexually mature smalltooth sawfish indicate that the U.S. population is currently reproducing (Seitz and Poulakis 2002; Simpfendorfer 2003). The abundance of juveniles encountered, including very small individuals, suggests that the population remains viable (Simpfendorfer and Wiley 2004), and data analyzed from Everglades National Park as part of an established fisheries-dependent monitoring program (angler interviews) indicate an increase of between 2 and 5% per year in abundance within the park over the past decade (Carlson and Osborne 2012; Carlson *et al.* 2007). Also, the declining numbers of individuals with increasing size is consistent with the historic size composition data (Simpfendorfer and Wiley 2004).

The effective population size, the number of animals in the population that produce offspring was recently estimated to be between 250 and 350 individuals (Chapman *et al.* 2011). Given the small effective population size and the increasing number of neonates produced, inbreeding depression was suspected to be a concern for smalltooth sawfish. Given the degree of decline and range contraction that smalltooth sawfish have experienced over the last few generations, it was originally hypothesized that the remnant smalltooth sawfish population has experienced a genetic bottleneck. However, an analysis of tissue samples (fin clips) collected under the previous permit (number 13330) indicates inbreeding is rare (Chapman *et al.* 2011). Results of this study also suggest that the remnant smalltooth sawfish population will probably retain 90% of its current genetic diversity and there is no evidence of a genetic bottleneck accompanying last century's demographic bottleneck.

The status and trends and recent encounters in new areas beyond the core abundance area suggest that the population may be increasing. However, smalltooth sawfish encounters are still rare along much of their historical range and they are thought to be extirpated from areas of historical abundance such as the Indian River Lagoon and John's Pass (Snelson and Williams 1981, Simpfendorfer and Wiley 2004).

Critical Habitat

Critical habitat was established in 2009 (74 FR 45353) in the Charlotte Harbor Estuary and Ten Thousand Islands/ Everglades Estuary. The designation is meant to specifically protect red mangrove habitat and shallow euryhaline habitat that is essential to juvenile smalltooth sawfish as nursery habitat. No physical or biological features could be identified as essential to adult sawfish.

Environmental Baseline

By regulation, environmental baselines for Opinions include the past and present impacts of all state, Federal or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR §402.02). The environmental baseline for this Opinion includes the effects of several activities that affect the survival and recovery of the listed species at different locations in the action area.

The following information summarizes the primary human and natural phenomena along the entire coast of Florida, that are believed to affect the status and trend of endangered smalltooth sawfish as well as their probable responses to these phenomena.

Destruction of Mangrove and Reef Habitat

Modification and loss of smalltooth sawfish habitat, especially nursery habitat, is a contributing factor in the decline of the species. Activities such as agricultural and urban development, commercial activities, dredge-and-fill operations, boating, erosion, and diversions of freshwater runoff contribute to these losses (SAFMC 1998).

Agriculture

Agricultural activities convert wetlands and shed nutrient, pesticide, and sediment-laden runoff. These in turn lead to excessive eutrophication, hypoxia, increased sedimentation and turbidity, stimulation of hazardous algal blooms, and delivery of chemical pollutants (SAFMC 1998). Freshwater wetlands associated with southeastern rivers have been extensively converted to agriculture or degraded by flood control and diversion projects in support of agriculture. Likewise, coastal wetlands have been converted to agricultural fields and degraded by flow alterations linked to agriculture. Agriculture is the single largest contributor of nutrients in southeastern watersheds (SAFMC 1998). Animal wastes and fertilizers are the largest sources of non-point source nutrient loading (USGS 1997). Agricultural non-point discharges are responsible for the introduction of a wide range of toxic chemicals into coastal waters around Florida (Scott 1997). Even areas not immediately adjacent to agricultural areas can be affected by these activities. For example, all of Florida Bay, including shore and reef habitat, has undergone biological, chemical, and physical change due to large scale agricultural practices and hydrologic modifications in the Everglades (Fourqurean and Robblee 1999).

Introduction of point and non-point source pollution can have impacts to smalltooth sawfish as there is evidence from other elasmobranches that pollution disrupts endocrine systems and potentially leads to reproductive failure (Gelsleichter *et al.* 2006). Sedimentation and pesticides increase turbidity, blocking out light, and poison coral reef systems. Both of these stressors physically kill coral reefs, which reduces feeding habitat for smalltooth sawfish.

Coastal and Urban Development

The population in the Southeast increased at approximately 25.7% between 1980 and 1990, primarily along the coast (Chambers 1992, Cordell and Macie 2002). Threats from development include loss of wetlands, point and non-point sources of toxins, eutrophication, and hydrologic modification. Since the mid 1980s, rates of habitat loss have been decreasing, but habitat loss continues. From 1998-2004, approximately 64,560 acres of coastal wetlands were lost along the Atlantic and Gulf coasts of the United States, of which approximately 2,450 acres were intertidal wetlands consisting of mangroves or other estuarine shrubs (Stedman and Dahl 2008). Further, Orlando *et al.* (1994) analyzed 18 major southeastern estuaries and recorded over 703 miles of navigation channels and 9,844 miles of shoreline with modifications.

Sawfish may also alter seasonal migration patterns in response to warm water discharges from power stations (Simpfendorfer and Wiley 2004). A major concern is the destruction of wetlands by filling for urban and suburban development (SAFMC 1998). In Florida, between 1943 and 1970, approximately 10,000 ha of this habitat were lost due to dredge fill and other activities related to accommodating the increasing human population. In addition, seawalls and canals for waterfront homes have replaced marsh and mangrove intertidal shorelines and shallow estuarine waters. Of particular concern are sawfish habitats in places such as the Indian River Lagoon (Gilmore 1995), where the species was once abundant, but now appear to have been extirpated (Snelson and Williams 1981). Many of the wetland habitats in the Indian River Lagoon were impounded for mosquito control (Brockmeyer *et al.* 1996) and the effects of these alterations on the smalltooth sawfish populations there are unknown.

Coastal development too close to the beach has influenced natural coastal processes such as erosion rates, resulting in accelerated erosion rates and interruption of natural shoreline migration. Where beachfront development occurs, the site is often fortified to protect the property from erosion. Beach armoring is a common type of construction that includes sea walls, rock revetments, riprap, sandbag installations, groins and jetties. Approximately 20% of Florida's coast has been armored. Groins and jetties are designed to trap sand during longshore transport or to keep sand from flowing into shipping channels. These structures prevent sediment deposition and cause increased erosion on upcurrent and downcurrent beaches.

In Florida, coastal development often involves the removal of mangroves and the armoring of shorelines through seawall construction. While loss of mangrove ecosystems throughout Florida is not overwhelming, losses at specific locations have been substantial (Odum *et al.* 1982, Veliela *et al.* 2001). Direct destruction of mangrove habitat is no longer allowed without a permit, but indirect damage to mangrove habitat from increased urbanization and the resulting overall habitat degradation still occurs.

Changes to the natural freshwater flows into estuarine and marine waters through construction of canals and other water control devices have also altered the temperature, salinity, and nutrient regimes; reduced both wetlands and submerged aquatic vegetation; and degraded vast areas of coastal habitat utilized by smalltooth sawfish (Gilmore 1995; Reddering 1988; Whitfield and Bruton 1989). While these modifications of habitat are not the primary reason for the decline of smalltooth sawfish abundance, it is likely a contributing factor and almost certainly hampers the recovery of the species. Juvenile sawfish and their nursery habitats are particularly likely to be affected by these kinds of habitat losses or alternations, due to their affinity for shallow, estuarine systems. Although many forms of habitat modification are currently regulated, some permitted direct and/or indirect damage to habitat from increased urbanization still occurs and is expected to continue to threaten survival and recovery of the species in the future.

Dredging

Modifications of natural freshwater flows into estuarine and marine waters through construction of canals and other controlled devices have changed temperature, salinity, and nutrient regimes; reduced both wetlands and submerged aquatic vegetation; and degraded vast areas of coastal habitat (Gilmore 1995, Reddering 1988, Whitfield and Bruton 1989). Profound impacts to hydrological regimes have been produced in South Florida through the construction of a 1,400 mile network of canals, levees, locks, and other water control structures which modulate freshwater flow from Lake Okeechobee, the Everglades, and other coastal areas (Serafy *et al.* 1997). Dredges are used to maintain these canals and shipping channels. Of particular concerns are Biscayne Bay (Serafy *et al.* 1997), Florida Bay, the Ten Thousand Islands (Fourqurean and Robblee 1999), and Charlotte Harbor. Three of these four areas support the last remaining populations of smalltooth sawfish in U.S. waters (Seitz and Poulakis 2002, Poulakis and Seitz 2004, Simpfendorfer and Wiley 2004).

Fisheries Bycatch

Bycatch mortality is cited as the primary cause for the decline in smalltooth sawfish in the United States (NMFS 2010). Large-scale directed fisheries for smalltooth sawfish have not existed. Historically, smalltooth sawfish were often bycatch in various fishing gears, including otter trawl, trammel net, seine, and, to a lesser degree, hand line. Reports of smalltooth sawfish becoming entangled in fishing nets are common in early literature from areas where smalltooth sawfish were once common, but are now rare, if not extirpated, including Florida (Snelson and Williams 1981), Louisiana (Simpfendorfer 2002), and Texas (Baughman 1943) . Henshall (1895) noted that the smalltooth sawfish "does considerable damage to turtle nets and other set nets by becoming entangled in the meshes and is capable of inflicting severe wounds with its saw, if interfered with." Evermann and Bean (1898) noted that smalltooth sawfish could be concentrated in areas such as the Indian River Lagoon, where on fisherman reported taking an estimated 300 smalltooth sawfish in just one netting season. In another example, smalltooth sawfish landings data gathered by Louisiana shrimp trawlers from 1945-1978, which contained both landings data and crude information on effort (number of vessels, vessel tonnage, number of gear units), indicated declines in smalltooth sawfish landings from a high of 34,900 pounds in 1949 to less than 1,500 pounds in most years after 1967. The Florida net ban passed in 1995 has led to a reduction in the number of smalltooth sawfish incidentally captured, "…by prohibiting the use of gill and other entangling nets in all Florida waters, and prohibiting the use of other nets larger than 500 square feet in mesh area in nearshore and inshore Florida waters[1]" (FLA. CONST. art. X, § 16).

The majority of the documented landings of smalltooth sawfish were from otter trawl fisheries. There were also landings from trammel nets, beach haul seines, pelagic longlines, cast nets, trap float lines, and hand lines. While there are no records of smalltooth sawfish captured in Louisiana waters since 1978, anecdotal information collected by NMFS port agents indicates that smalltooth sawfish are now taken very rarely in the shrimp trawl fishery. Smalltooth sawfish are still occasionally documented in shrimp trawls in Florida, with four reports in the 1990s. Smalltooth sawfish are also occasionally captured in various Federal shark fisheries using drift gillnet and bottom longline. Based on mandatory observers placed on 2% of all shrimp trawls beginning in 2007 and 2008 for the Gulf of Mexico and South Atlantic, respectively, an increased number of smalltooth sawfish were reported, likely indicating that the previous observer coverage was missing a large number of interactions. In May of 2012, NMFS authorized 270 smalltooth sawfish to be captured by shrimp fishing boats over the next three years, with 90 mortalities approved during that time. Additionally in 2012, NMFS authorized 32 smalltooth sawfish to be captured in the shark fishery over the next three years with 7 mortalities approved during that time.

Smalltooth sawfish have historically occurred as occasional bycatch in the hook-and-line recreational fishery (Caldwell 1990). In Texas, Caldwell (1990) stated that sport fishermen in the bays and surf prior to the 1960's took many sawfish incidentally but retained and displayed as trophy fish, but most were released. Caldwell noted that the saws of smalltooth sawfish were consistently removed prior to their live releas, thereby reducing their chances for survival. Seitz and Poulakis (2002), Poulakis and Seitz (2004), and Simpfendorfer and Wiley (2004) indicate that smalltooth sawfish are still taken as bycatch, mostly by shark, red drum, snook, and tarpon fishers. Possession of smalltooth sawfish has been prohibited in Florida since April 1992. The

[1] "nearshore and inshore Florida waters" means all Florida waters inside a line three miles seaward [1]of the coastline along the Gulf of Mexico and inside a line one mile seaward of the coastline along the [1]Atlantic Ocean.

records in the angler survey database indicate that only one sawfish was kept; this record was from 1990. There were 14 smalltooth sawfish recorded as kept in the guide survey database; one in 1991, one in 1992, and twelve in 1997.

Climate Change

Changes to the global climate are likely to be a threat to smalltooth sawfish and the habitats they use. The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts to coastal resources may be significant. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, changes in the amount and timing of precipitation, and changes in air and water temperatures [e.g.,(EPA 2012; NOAA 2012). The impacts to smalltooth sawfish cannot, for the most part, currently be predicted with any degree of certainty, but we can project some effects to the coastal habitats where they reside. We know that the coastal habitats that contain red mangroves and shallow, euryhaline waters will be directly impacted by climate change through sea level rise, which is expected to exceed 1 meter globally by 2100 according to Meehl et al. (2007), Pfeffer et al. (2008), and Vermeer and Rahmstorf (2009). Sea level rise will impact mangrove resources, as sediment surface elevations for mangroves will not keep pace with conservative projected rates of elevation in sea level (Gilman et al. 2008). Sea level increases will also affect the amount of shallow water available for juvenile smalltooth sawfish nursery habitat, especially in areas where there is shoreline armoring (e.g., seawalls). Further, the changes in precipitation coupled with sea level rise may also alter salinities of coastal habitats, reducing the amount of available smalltooth sawfish nursery habitat.

Research

NMFS has authorized other research on smalltooth sawfish within the waters of the state of Florida. Much of this research already authorized will use the same methodology in the same locations as this permit. Permit Numbers 17316 and 15802 authorize the capture and study of 145 neonates and 110 adult and juvenile smalltooth sawfish per year.

Effects of the Proposed Action

In this section of the Opinion, we assess the probable direct and indirect effects of authorizing the proposed procedures on smalltooth sawfish in the action area. We also summarize the results of studies that have examined the direct and indirect effects of each sampling procedure on these fish, such as annual reports from previous research permits. We rely the scientific literature and reports to determine how individual smalltooth sawfish are likely to respond upon being exposed to a particular sampling procedure. Based on this body of information, we then assess the risks the activities contained in the proposed permit pose to the species as they are listed.

The specific stressors associated with the proposed permit are capture, handling and restraint during examinations, tagging, tissue sampling, and blood sampling. The following sections provide specific details of the stressors associated with each procedure and summarize the available data on the responses of individuals that have been exposed to the procedures.

Capture

The gillnets and longlines proposed for use in this research can result in mortality to smalltooth sawfish (Musick *et al.* 2001, Simpfendorfer 2006) as seen through years of incidental captures in commercial fisheries. Much of the smalltooth sawfish mortality was due to the difficulty of removing smalltooth sawfish from fishing gear without damaging the gear. Most of the time, this meant lethal removal of the saw before returning the fish to the water to starve to death or killing the sawfish in the net and dropping the carcass overboard.

Research on smalltooth sawfish has been conducted under four permits since 2003. Table 4 shows the number of sawfish that have been captured, the number of sawfish that have been killed, and the number of listed sea turtle species that have been incidentally captured. To date, there have been no lethal takes of sawfish or sea turtles resulting from these research practices. Based on a review of annual reports for actions that use long line and gillnets to capture listed species, NMFS has established mitigation measures such as short sets and monitoring nets and longlines at all times while they are set to reduce the chances of killing a listed species.

Table 4: number of sawfish and sea turtles captured, injured, or killed over the previous 10 years of permits.

Permit Number (years valid)	Sawfish captured	Sawfish injured or killed	Sea turtles captured (no recorded deaths)
#13330 (2008-2012)	100	0	0
#1352 (2003-2008)	112	0	0
# 1475 (2005-2008)	99	0	2
#1538 (2006-2008)	2	0	0

This project proposes to capture 20 adult and juvenile smalltooth sawfish each year until 2018 for a total of 100 adults or juveniles over the life of the project. Additionally, 100 neonates each year for a total of 500 over the life of this project will be captured. Adults and juveniles will be targeted using long lines, the same as are used in commercial fisheries. As demonstrated in the commercial fisheries portion of the environmental baseline, there is a chance that smalltooth sawfish could die during capture, but mitigation measures included in the project have been proven to prevent mortality. Neonates are targeted by sight in shallow water habitats and captured in gillnets. This method of capture is extremely safe and minimizes stress to the maximum extent possible. Adults and juveniles over 150 cm are captured using long lines and this method of capture has caused mortalities in the commercial fishery. Because of this, NMFS requires the researchers to tend the nets so they can release the smalltooth sawfish as soon as it is caught. Based on the results of smalltooth sawfish captures in the past 10 years, the previous research conducted by the applicant, and the thorough mitigation measures included with this project, NMFS does not expect any smalltooth sawfish mortalities.

Handling

Handling and restraining smalltooth sawfish may cause short term stress responses, but those responses are not likely to result in pathologies because of the short duration of the handling.

The proposed methods of handling smalltooth sawfish are the same as have been carried out in previous permits and consistent with the handling of other elasmobranchs. Mitigation measures built into the handling requirements in the permit such as fish will not be held out of water for more than a minute without having sea water run over their gills, should negate the chance of mortality during handling and restraint. NMFS expects that individual smalltooth sawfish would normally experience no more than short-term stresses as a result of these activities. No injury would be expected from these activities.

Tagging

Dart tags, PIT tags, PAT tags, SPOT tags, and acoustic tags will be attached to smalltooth sawfish during the next five years. These tags have been used in this and previous smalltooth sawfish permits.

SPOT tags will be attached with nylon bolts through the dorsal fin. Manire and Gruber (1991) documented the effects of punching holes in the dorsal fins of elasmobranchs by taking 5mm hole punches from the fin of lemon shark. They found the holes were readily apparent for two to four weeks and became scars within a year of removing the punch from the dorsal fin. Heupel *et al.* (1998) monitored the effects of attaching tags through the dorsal fins of carcharhinids. No infection was observed in tissues surrounding the wound. Disruption of the fin surface was observed due to abrasion by the tag, but did not appear to cause a severe tissue reaction. Even though the tags caused continued tissue disruption (until they fall off) no signs of infection were found in the tissue samples. SPOT tags would work their way through the fin and leave no long-term damage. The use of satellite tracking tags is recommended for elasmobranchs over 150 cm (Simpfendorfer and Heupel 2004). However, to be conservative and ensure the tag to animal weight ratio is not exceeded SPOT tags will be used only on sawfish exceeding 200 cm in length.

Acoustic transmitters will be attached to sawfish via the rototag. To ensure the tag to animal weight ratio is not exceeded small transmitters (8mm) would be used on sawfish less than 200 cm. Sawfish over 200 cm would be fitted with 8mm or the larger 16 mm transmitters. The 16 mm transmitters have more battery power and can therefore be used for longer tracking. Since the transmitters are attached to the sawfish via a dorsal fin rototag, the transmitter/tag apparatus will eventually work its way through the fin and leave no long-term damage.

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). 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 (Brännäs *et al.* 1994, Elbin and Burger 1994, Keck 1994, Jemison *et al.* 1995, Clugston 1996, Skalski *et al.* 1998, Hockersmith *et al.* 2003). The smallest smalltooth sawfish researchers expect to capture is approximately 62 cm and therefore is well within the bounds of tag to animal weight ratio.

There has not been a formal assessment of the effects of dart tags on smalltooth sawfish. These effects have been studied on other elasmobranchs and it is reasonable to assume the effects of dart tags on sharks and smalltooth sawfish would be similar because they have similar skin and muscle structure. The effects of dart tags on sharks were analyzed by Heupel and Bennett (1997), who sampled the dermal and epidermal tissues and examined them histologically. Tissues from around tag sites were removed at time intervals ranging from 100 minutes to 284 days post-tagging. These samples showed acute and chronic responses to tagging. Acute responses consisted of localized tissue breakdown and hemorrhaging and occurred within the first few hours after tag insertion. At 10 hours post-tagging an intermediate response was apparent. This phase was characterized by further hemorrhaging and red and white blood cell movement into the wound area. The chronic response observed in the 10-284 day post-tagging samples was characterized by fibrous tissue formation to sequester the tag. This tissue presumably protects the adjacent musculature from further trauma produced by movement of the. Tissue repair appeared to progress consistently in all specimens and no secondary infections at the tag site were seen. Tagging produced only localized tissue disruption and did not appear to be detrimental to the long term health of individual sharks in that study. Therefore, NMFS believes similar results should be expected when dart tagging smalltooth sawfish.

As a PAT tag would be attached using a nylon headed anchor the effects would be similar to those of the dart tags. When the PAT tag pops off the sawfish, the nylon headed anchor (and the monofilament) would remain implanted in the animal, resembling a streamer tag. The use of satellite tracking tags is recommended for elasmobranchs over 150 cm (Simpfendorfer and Heupel 2004). However, to be conservative and ensure the tag to animal weight ratio is not exceeded PAT tags would be used only on sawfish exceeding 200 cm in length.

In many cases, multiple tags will be applied to the same smalltooth sawfish. In all situations, the researchers have established length standards of the fish being tagged to ensure that the weight of the tags will not be detrimental to the fish being tagged.

Tissue Sample

The researchers will take a small tissue sample clipped with disinfected scissors from the dorsal fin for genetic analysis. The procedure is common and accepted practice in elasmobranch research. Research has shown that it does not impair the animal's ability to swim and is not thought to have any long-term adverse impact. An extensive tagging program for small sharks has been underway at Mote Marine Laboratory since the early 1990s. Based on recapture data there has been no difference in recapture rate between clipped and unclipped blacktip sharks. This suggests that the survival of these animals is the same, and that fin clips do not have a significant long-term impact on the health of elasmobranchs. This method has been used on all sawfish captured for the past 10 years. No bleeding occurred upon taking the samples and the 23 recaptured animals showed no sign of infection at the site. NMFS would expect that the collection of a tissue sample would not cause any significant additional stress or discomfort to the animal beyond what is experienced during other research activities.

Blood Sample

Caudal venipuncture has been performed for over 20 years by Mote Marine Laboratory Center for Shark Research staff on over 1,000 sharks, skates, and rays in a laboratory setting allowing for post-handling observation (Hull *et al.* 1994, Manire *et al.* 1995). No swabbing of the area prior to penetration will be used, as the effects of alcohol or betadine on the skin of sawfish is unknown. Dermatitis has been reported in some other elasmobranchs from the swabbing of the skin (Charles Manire, Mote Marine Laboratory, personal communication). Therefore, swabbing is not generally used unless the animal is going to be sampled numerous times and the effects of the agent applied to the skin can be observed in a controlled setting. No harmful side effects have been observed from the blood draws, and no known mortalities have resulted from the process. During a recent field collection of blood from over 50 bull sharks in the Caloosahatchee River all sharks were quickly sampled and successfully released (Gelsleichter 2009). In order to ensure the samples are taken with minimal impact to the smalltooth sawfish, all staff listed on the permit to blood sample would be trained on blood draw procedures from experienced scientists and/or veterinarians, and practice on elasmobranchs held in captivity at Mote Marine Laboratory. Given the success of blood draws on many other elasmobranch species NMFS does not foresee any side effects from this process.

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 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.

Direct threats to sawfish from anthropogenic activities have been identified in the baseline for the most part. However, there is also the risk that some members of the public may kill sawfish to keep the saw as a sort of curio.

Smalltooth sawfish habitat has been degraded or modified throughout the southeastern United States from activities like coastal development, channel dredging, boating activities. These threats were discussed in the baseline. While the degradation and modification of habitat is not likely the primary reason for the decline of smalltooth sawfish abundance or distribution, it has likely been a contributing factor. No future actions with effects beyond those already described are reasonably certain to occur in the action area.

Conclusion

After reviewing the current status of the smalltooth sawfish, the environmental baseline for the action area, the effects of the proposed research, and the cumulative effects, it is NMFS's biological opinion that the issuance of this permit to the Southeast Fisheries Science Center is not likely to jeopardize the continued existence of the smalltooth sawfish.

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

This project will result in the directed take of smalltooth sawfish (see ESA permit 17787, issued under section 10(a)(1)(A)) but there will be no incidental take caused by this proposed action.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act 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.

The only conservation recommendation is for PR1 to assess the impacts of smalltooth sawfish research in a programmatic way in the future because there are so few smalltooth sawfish researchers working in the same area in Florida. A programmatic assessment would allow PR1 to better understand overlaps in specific research activities and minimize the adverse affects of research on listed species while maximizing the knowledge that can be gained.

REINITIATION NOTICE

This concludes formal consultation on the proposed permit Southeast Fisheries Science Center [Permit Number 17787] pursuant to the provisions of section 10 of the Endangered Species Act. 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 allowable 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 identified 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.

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