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

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| **Title:** | Biological Opinion on the Smalltooth Sawfish (*Pristis pectinata*) Research Permit Program |
| **Consultation Conducted By:** | Endangered Species Act Interagency Cooperation Division, Office of Protected Resources, National Marine Fisheries Service |
| **Action Agency:** | Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service |
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| **Approved:** | Donna S. Wieting<br>Director, Office of Protected Resources |
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# 1 INTRODUCTION

The Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.) establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat they depend on. Section 7(a)(2) of the ESA requires Federal agencies to insure that any actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Federal agencies must do so in consultation with National Marine Fisheries Service (NMFS) for threatened or endangered species (ESA-listed), or designated critical habitat that may be affected by the action that are under NMFS jurisdiction (50 C.F.R. §402.14(a)). If a Federal action agency determines that an action "may affect, but is not likely to adversely affect" endangered species, threatened species, or designated critical habitat and NMFS concur with that determination for species under NMFS jurisdiction, consultation concludes informally (50 C.F.R. §402.14(b)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS provide a biological opinion (opinion) stating whether the Federal agency's action is likely to jeopardize ESA-listed species or destroy or adversely modifytheir designated critical habitat. If NMFS determines that the action is likely to jeopardize listed species or destroy or adversely modify designated critical habitat, we provide a reasonable and prudent alternative that allows the action to proceed in compliance with section 7(a)(2) of the ESA. If an incidental take is expected, section 7(b)(4) requires the us to provide an incidental take statement that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts and terms and conditions to implement the Reasonable and Prudent Measures.

The action agency for this consultation is NMFS, Office of Protected Resources (OPR), Permits and Conservation Division (Permits Division). The Permits Division proposes to issue smalltooth sawfish research permits authorized under section 10(a)(1)(A) of the ESA. The purpose of the Sawfish Research Permit Program (hereafter refered to as "the Sawfish Program") is the scientific research and collection of the United States (U.S.) Distinct Population Segment (DPS) of smalltooth sawfish, *Pristis pectinata* for the purposes of conservation and recovery. Included in this consultation are analysis of effects to Johnsons sea grass (*Halophila johnsonii*); north Atlantic right (*Eubalaena glacialis*), fin (*Balaenoptera physalus*), sei (*B. borealis*), blue (*B. musculus*), and sperm (Physeter macrophalus) whales; Atlantic (*Acipenser oxyrinchus oxyrinchus*), shortnose (*A. brevirostrum*), and Gulf (*A. oxyrinchus desotoi*) sturgeon; North Atlantic DPS green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), Kemp's ridley (*Lepidochelys kempii*), olive ridley (*L. olivacea*), hawksbill (*Eretmochelys imbicata*), and Northwest Atlantic DPS loggerhead (*Caretta caretta*) sea turtles; and elkhorn (*Acropora palmata*), staghorn (*A. cervicornis*), and reef building (*Dendrogyra cylindrus*, *Orbicella annualris*, *O. faveolata*, *O. franksi*, and *Mycetophyllia ferox*) corals. This consultation also considers north Atlantic right whale, Gulf sturgeon, Atlantic sturgeon, elkhorn and staghorn coral, Johnsons sea grass, and Northwest Atlantic DPS loggerhead sea turtle designated critical habitat.

Consultation in accordance with section 7(a)(2) of the statute (16 U.S.C 1536 (a)(2)), associated implementing regulations (50 C.F.R. §402), and agency policy and guidance was conducted by NMFS Office of Protected Resources's ESA Interagency Cooperation Division (hereafter referred to as "we"). This opinion and incidental take statement was prepared by the ESA Interagency Cooperation Division in accordance with section 7(b) of the ESA and implementing regulations at 50 CFR §402.

This document represents NMFS' opinion on the effects of these actions on endangered and threatened species and designated critical habitat for those species.

## 1.1 Background

The Permits Division issues ESA section 10(a)(1)(A) permits authorizing activities that result in either directed take or incidental take of other ESA-listed species (i.e. not the targeted research species). At present there are three issued ESA section 10(a)(1)(A) scientific research permits for smalltooth sawfish. Each permit authorizes sampling of adult and juvenile life stages. Since being listed under the ESA in 2003, NMFS has issued Permit Numbers 1352, 1475, 1538, 13330, 15802, 17316, 17787, and 21043 for similar research in the southern tip of Florida. Considering the large workload that individual research permits, including the ESA Section 7(a)(2) consultations, require, and the redundancy in terms of the types of research activities and their effects on ESA-listed species, the Permits Division has decided to evaluate and issue all sawfish permits at the same time each year. Like the Permits Division's program for issuing scientific research permits for sturgeon (NMFS 2017; FPR-2016-9176), the Sawfish Program within the Permits Division will establish a mortality limit within the smalltooth sawfish population.

When implemented, this programmatic opinion of the Sawfish Program will reduce the time required to issue permits in the future while; 1) enhancing species conservation and management by conducting more holistic assessments of impacts and minimizing impacts to species from duplication of research effort, 2) reducing Permits Division processing time for scientific research and enhancement permit applications to ensure uninterrupted research, and 3) establishing a transparent methodology for directed take authorization. The research proposed under this Sawfish Program has been evaluated in all of the previous permits and is not new or being conducted in ways that differ from previous assessments. Past analyses have found that these research techniques are likely to adversely affect ESA-listed species, but are not likely to jeopardize their continued existence and are not likely to adversely affect their designated critical habitat.

## 1.2 Consultation History

This opinion is based on information provided in the biological assessment and the initiation memo provided by the Permits Division, the previous opinions on smalltooth sawfish research, annual and final reports of those permits, and smalltooth sawfish publications arising from previously permitted research. The full consultation history is maintained in our administrative record for this consultation, however several of the key decision points and communications with us are summarized as follows:

- September 25, 2017: Permits Division proposed division by size of young juveniles and offshore juveniles and adults for the purposes of programmatic permitting and take allocation. On October 31, 2017, smalltooth sawfish researchers, the Permits Division, biologists from the Southeast Regional Office, and our division agreed with the size classifications.
- October 23, 2017: Permits Division provided a draft of the smalltooth sawfish biological assessment.
- December 15, 2017: The Permits Division sent an email with a number of smalltooth sawfish publications to initiate a discussion on abundance estimates.
- August 3, 2018: We held a call, along with the Permits Division, Southeast Regional Office, and smalltooth sawfish researchers to discuss delayed mortality and the idea of limiting take based on mortality.
- August 10, 2018: The Permits Division supplied a number of considerations for smalltooth sawfish mortality to ensure that the level of delayed mortality from tagging would not pose a significant risk to the species. This was used to establish mortality limits for the purposes of protecting smalltooth sawfish while still gathering data to help recover the species.
- September 25, 2018: Permits Division requested initiation of formal ESA consultation on the Sawfish Program.
- November 23, 2018: Permits Division provided a final version of the *Smalltooth Sawfish Programmatic Biological Assessment* (NMFS 2018).

# 2 Description of the Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies. The Permits Division has requested consultation on a program for the issuance of research and enhancement permits for smalltooth sawfish. There is no sunset date on the proposed Sawfish Program. The proposed Sawfish Program combines elements from the existing approach for issuing sawfish permits with elements that are completely new. Both the existing and the new features of the Program are identified and discussed in this section of the opinion, which is organized as follows: 1) permitting process overview, 2) legal authorities, policies, and requirements for permitting, and 3) conservation and recovery benefits.

The ESA mandates the protection and conservation of threatened and endangered species, and prohibits the taking, import, and export of these species, with limited exceptions. Exceptions for take[1], import, and export for scientific research and enhancement purposes are allowed provided special exception permits are applied for and received in accordance with ESA section 10(a)(1)(A) and its implementing regulations (50 CFR 222). Section 2.2 below provides a summary of these and other applicable statutes and regulations pertaining to issuance of ESA Section 10(a)(1)(A) permits.

The Permits Division processes permits and authorizations under section 10(a)(1)(A) of the ESA for actions that intentionally take (generally capture and harass) protected species under NMFS' jurisdiction. In addition to the type of activity performed and the protected species involved, whether a permit may be issued also depends upon the species' ESA-listing status and the regulations in place. This complies with ESA section 17 and ESA regulations (50 CFR 222.101(b) and 222.308(b)), simplifies permitting for applicants and NMFS, and maintains consistency in the management of permits across species/taxa.

The NMFS' Office of Protected Resources Director may issue permits for activities directed to the following species under NMFS jurisdiction:

- Cetaceans
- Pinnipeds (except walrus)
- Sawfish
- Sea Turtles (in water)
- Sturgeon
- Parts of foreign species listed under the ESA.

[1] Take under the ESA means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct (§4(19)).

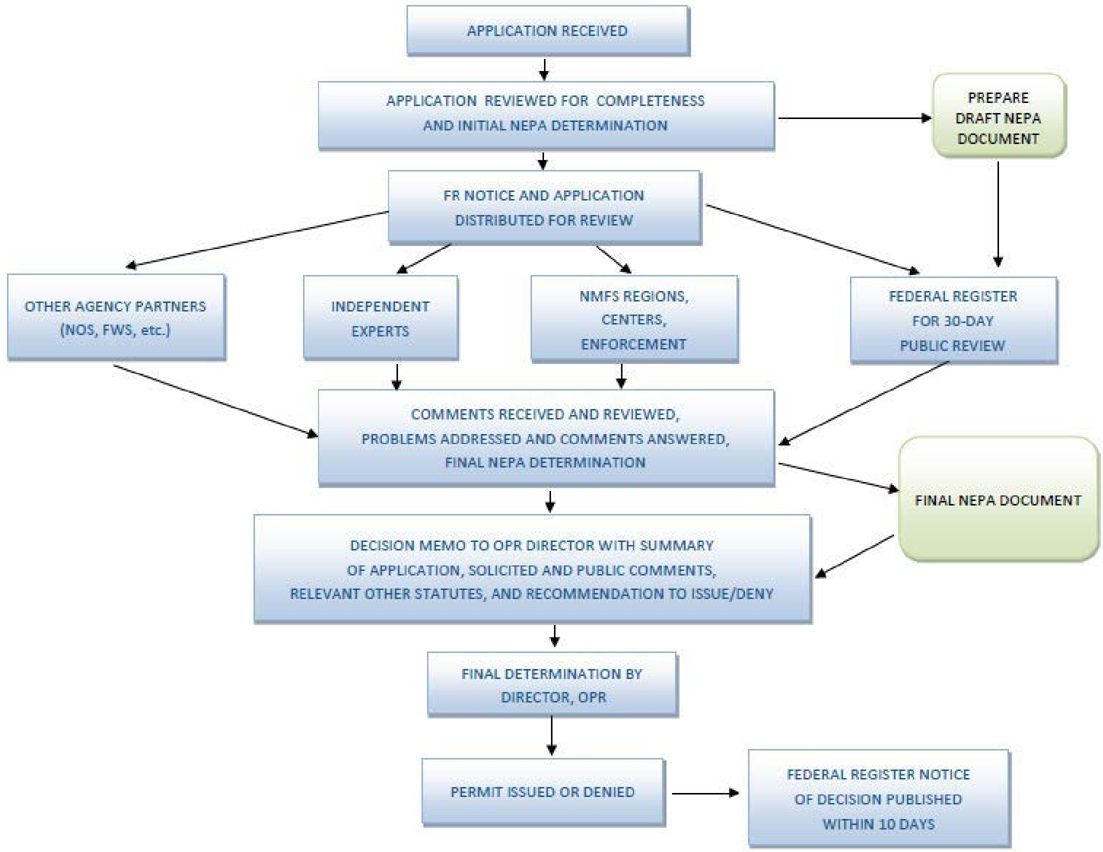


**Figure 1. Flow chart of the overall process for issuing directed take permits under section 10(a)(1)(A) of the Endangered Species Act.**

The ESA and NMFS implementing regulations establish information requirements for permit applicants. Detailed information regarding what types of activities require permits and who may apply for permits, as well as instructions specific to the different types of protected species permits and authorizations are available from the Permits Division website. Applicants seeking a special exception Permit for scientific research or enhancement under Section 10(a)(1)(A) of the ESA must submit a properly formatted and signed application to NMFS Office of Protected Resources Director. Below is a summary of the application process, the Permits Divisions analysis and decision making process.

## 2.1 Application Submission and Review

An applicant must describe the species, age or life stage, and sex to be taken; the manner, frequency, and duration of the takes; the qualifications of the personnel to conduct the proposed activities; the justification for such taking as it relates to conservation and recovery; information on the effects of the take; and appropriate monitoring and mitigation to minimize adverse impacts. These requirements are discussed in greater detail below.

The applicant must provide sufficient information about the activity to allow NMFS to determine whether permit issuance would comply with all applicable statutory and regulatory issuance criteria and to assess the potential environmental impacts of permit issuance. When applicable, an applicant may include documentation from an Institutional Animal Care and Use Committee that has reviewed and approved the proposed research under the Animal Welfare Act (AWA) to assist with NMFS' determination of whether the action would operate to the disadvantage of listed species under the ESA. An application that satisfies some but not all of the applicable criteria for permit issuance will be returned without prejudice to the applicant with an explanation of the deficiencies. The Permits Division provides an opportunity for the applicant to supply the deficient information within a 60-day timeframe. The permit process cannot proceed further until the Permits Division has a complete application.

## 2.2 Analysis and Decision Making

The Permits Division solicits comments from expert reviewers as well as the general public on all permit applications. After considering the comments and recommendations of all reviewers, the Permits Division then re-evaluates the issuance criteria for each permit in consideration of comments received and responses from the applicant, and makes a final recommendation to the Office Director on whether to issue or deny the permit. The Permits Division evaluates the application to ensure an application meets all ESA issuance criteria to inform this decision. The decision to issue or deny a permit or permit modification is based upon the following criteria:

- All relevant ESA issuance criteria (see below for details),
- All comments received or views solicited on the permit application,
- Conclusion of the Section 7 consultation resulting in a biological opinion that the proposed activity will not jeopardize the continued existence of the species or adversely modify or destroy critical habitat,
- Whether or not the activity will result in significant environmental effects, and
- Any other information or data that the Office Director deems relevant.

If the permit is issued, a *Federal Register* Notice of Issuance is published within 10 days, and the holder must date and sign the permit and return a copy of the signature page to the Permits Division as proof of their acceptance of the permit terms and conditions. The permit is not effective until the Permit Holder's signing of the permit. In signing the permit, the holder agrees to abide by all terms and conditions set forth in the permit and acknowledges that the authority to conduct certain activities specified in the permit is conditional and subject to authorization by the Office Director or Division Chief. If the permit is denied, the Office Director must provide the applicant with an explanation for the denial. The applicant or any party opposed to a permit may seek judicial review of the terms and conditions of such permit or of a decision to deny such permit. Review may be obtained by filing a petition for review with the appropriate U.S. District Court as provided for by law.

## 2.3 Legal Authorities, Policies, and Requirements for Permitting

This section summarizes how the ESA and its implementing regulations governing smalltooth sawfish research and enhancement activities along with permit requirements, duration, mitigation, and monitoring.

### 2.3.1 Endangered Species Act (ESA)

The ESA (16 U.S.C. l53l et seq.) was established to conserve and protect threatened and endangered species. It is the policy of the ESA that all federal agencies must seek to conserve threatened and endangered species and use their authorities to further the purposes of the ESA.

Under section 7(a)(2) of the ESA, federal agencies, such as NMFS are required to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any threatened or endangered species or result in destruction or adverse modification of critical habitat for such species.

Section 9 of the ESA prohibits the take of endangered and threatened species by “any person subject to the jurisdiction of the United States” unless a lawful exception is made by the issuance of a permit. Because researchers of smalltooth sawfish in waters of the United States are restricted by section 9 of the ESA, they must request a permit to conduct their research.

Under Section 10(a)(1)(A) of the ESA, NMFS may grant permits to take ESA-listed species for scientific purposes or for the purpose of enhancing the survival of the species. In consideration of the ESA’s definition of conserve, which indicates an ultimate goal of bringing a species to the point where listing under the ESA is no longer necessary, permits issued pursuant to Section 10(a)(1)(A) of the ESA must be for activities that are likely to further the conservation of the affected species.

Therefore, there are a series of requirements under the ESA that result in this consultation. The researchers are unable to ‘take’ endangered smalltooth sawfish under section 9 of the ESA. To be able to directly take smalltooth sawfish, researchers must request an ESA section 10(a)(1)(A) permit from the Permits Division. The Permits Division, by issuing permits, undertakes a federal action by authorizing research. That federal action requires a review by the Secretary under section 7(a)(2) of the ESA.

NMFS’ regulations implementing the permit provisions of the ESA can be found at 50 CFR Part 222. Regulations specifying requirements for issuance of ESA scientific research and enhancement permits are found at 50 CFR 222.308.

Section 10(d) of the ESA requires that, for NMFS to issue permits under section 10(a)(1)(A) of the ESA, the agency must find that the permit:

- Was applied for in good faith,
- If exercised will not operate to the disadvantage of the species, and
- Will be consistent with the purposes and policy in section 2 of the ESA.

### 2.3.2 Regulatory Requirements for ESA Permits

In addition to the requirements of section 10(d), the ESA states that the Secretary may revoke a permit if the Permit Holder does not comply with the terms and conditions of the permit. ESA implementing regulations establish the following requirements common to all permits issued pursuant to section 10:

- Requirements for issuing and modifying permits,
- Extending the duration of permits,
- General permit terms and conditions,
- Timeliness of required annual reports, and
- Requirements for timely dissemination of research results and notification of publications.

In addition to the above requirements for all section 10 permits, ESA regulatory requirements are identified specifically for research and enhancement permits. The below discussion illustrates how each requirement is incorporated into the permit process, decision-making, and management of permits. Where ESA regulations are silent on general permit requirements, the Permits Division has adopted Marine Mammal Protection Act regulatory requirements for consistency across species groups. Each section cites the applicable regulations from which each requirement originates.

#### 2.3.2.1 ESA permits for scientific purposes or for the enhancement of propagation or survival of the species: Issuance criteria (50 CFR 222.308(c))

ESA regulations identify issuance criteria specific to research and enhancement permits. In determining whether to issue a permit, the Assistant Administrator shall specifically consider, among other application criteria:

- Whether the permit was applied for in good faith;
- Whether the permit, if granted and exercised, will not operate to the disadvantage of such endangered species;
- Whether the permit would be consistent with the purposes and policy set forth in section 2 of the ESA.
- Whether the permit would further a bona fide and necessary or desirable scientific purpose or enhance the propagation or survival of the endangered species, taking into account the benefits anticipated to be derived on behalf of the endangered species;
- The status of the population of the requested species and the effects of the proposed action on the population, both direct and indirect;
- If a live animal is to be taken, transported, or held in captivity, the applicant's qualifications for the proper care and maintenance of the species and the adequacy of the applicant's facilities;
- Whether alternative non-endangered species or population stocks can and should be used;
- Whether the animal was born in captivity or was (or will be) taken from the wild;
- Provision for disposition of the species if and when the applicant's project or program terminates;

- How the applicant's needs, program, and facilities compare and relate to proposed and ongoing projects and programs;
- Whether the expertise, facilities, or other resources available to the applicant appear adequate to successfully accomplish the objectives stated in the application; and
- Opinions or views of scientists or other persons or organizations knowledgeable about the species, which is the subject of the application or of other matters germane to the application.

#### 2.3.2.2 Mitigation and General Conditions of ESA Permits

Scientific research and enhancement permits issued under the ESA require researchers to abide by general terms and conditions. Activities authorized in a permit must occur by the means, in the areas, and for the purposes set forth in the permit application, and are limited by the terms and conditions in a permit. Permit noncompliance constitutes a violation and is grounds for permit modification, suspension, or revocation, and for enforcement action.

All research and enhancement permits contain the following types of terms and conditions:

- Duration of permit
- Number and kinds of protected species, locations and manner of taking
- Qualifications, responsibilities, and designation of personnel
- Possession of permit
- Reports
- Notification and coordination
- Observers and inspections
- Permit modification, suspension, and revocation
- Penalties and permit sanctions
- Acceptance of permit

While the permit requires that the activities be performed as described in the application, including mitigation and monitoring measures identified by the applicant, to further mitigate possible adverse impacts to species and habitat from the permitted activities, each permit contains taxa- or species-specific conditions based on the nature of the proposed activities.

#### 2.3.2.3 Duration of Permits and the Permit Cycle (50 CFR 222.304)

Each permit specifies an expiration date. Historically the Permits Division has issued ESA permits for up to five years. However, the ESA does not limit the duration of a permit. The majority of Permit Holders are career scientists or institutions conducting research or enhancement activities on protected species for decades. Therefore, the Permits Division is opting to issue ESA permits for up to 10 years to increase efficiencies, reduce burdens on repeating applicants, and streamline paperwork.

In addition, under the ESA, a permit may be extended if the applicant has submitted a new application for work of a continuing nature (50 CFR 222.304). Under ESA extensions, the researcher may continue such activities as were authorized by the permit until a decision has been made on the renewal application. In addition, it is the Permits Division’s practice to only consider extension requests for ESA permits for work of a continuing nature if the Permit Holder has submitted a new application to continue the research. To ensure that environmental analyses prepared for issuance of the permit under the ESA and NEPA remain valid in extending the permit, the Permits Division conditions the extension such that no additional take numbers are authorized over the life of the extension. Rather, the extension allows the Permit Holder to use any takes remaining from the last year of the permit over an additional 12 months or until the take authorized for the final year of the permit has been exhausted, whichever occurs first.

The permit also clarifies that the Permit Holder may continue to possess biological samples of the target species acquired under the permit after permit expiration without additional written authorization.

To date, the Permits Division has processed individual smalltooth sawfish research permit requests as they are received, batching the processing of requests that have a similar nature and scope where possible. However, issuing permits on a case-by-case basis provides less opportunity for authorizing and monitoring annual take of ESA-listed species than does a holistic approach. To address this, the Permits Division is proposing an annual permit cycle for the Sawfish Program. The Permits Division will establish an annual permit cycle for processing new permit applications and major modifications. All of the permit issuance requirements identified above will still apply. Minor permit modifications and authorizations, often administrative in nature, that do not increase the risk of adverse impacts to the species and can often be processed within a few weeks, will continue to be processed throughout the year as they are received.

The Permits Division will set an application deadline for all smalltooth sawfish researchers each year. The Permits Division will have six months to (1) review and process all research permit requests for the upcoming year, (2) conduct an evaluation of the level of requested take for all permits requested for each life stage, and (3) issue permits authorizing research activities and take, as appropriate, following the detailed procedures described herein as part of the proposed action. If a permit request is received after the submission deadline, at the Permits Division Deputy Division Chief’s discretion, the request may either be merged into the batch or the applicant will have to wait until the next permit cycle for the request to be processed. This decision will largely be based on the completeness and complexity of the request. Under the proposed Sawfish Program, the Permits Division will be responsible for ensuring that submitted permit applications that fall within the scope of this consultation are processed in accordance with the requirements of the opinion.

#### 2.3.2.4 Number and Kinds of Protected Species, Locations and Manner of Taking (50 CFR 216.36, 222.301(e), and 222.308(d))

Each permit contains a table outlining the number of animals authorized to be taken (by species and listing unit), and the locations, manner, and time period in which they may be taken. In addition, authorized personnel working under a permit may take photographs and video incidental to research or enhancement provided it does not result in take not authorized by the permit. The Chief, Permits Division also may authorize non-essential activities (e.g., a documentary film crew). Non-essential activities must not influence the research or enhancement or result in taking a protected species.

#### 2.3.2.5 Qualifications, Responsibilities, and Designation of Personnel (50 CFR 216.3, 216.35(f-i), 216.36, and 216.41(c)(iii) and (iv))

All research and enhancement permits identify by name the researchers (Principal Investigator [PI] and Co-investigators [CIs]) authorized to direct and supervise the permitted activities. Individuals conducting permitted activities must possess qualifications commensurate with their roles and responsibilities. The roles and responsibilities of personnel operating under a permit are as follows:

- The Permit Holder is ultimately responsible for activities of individuals operating under the permit. Where the Permit Holder is an institution, the Responsible Party is the person at the institution who is responsible for the supervision of the PI.
- The PI is the individual primarily responsible for the taking, import, export, and related activities conducted under the permit. The PI must be on site during activities conducted under this permit unless a CI is present to act in place of the PI.
- CIs are individuals who are qualified to conduct activities authorized by the permit without the on-site supervision of the PI. CIs assume the role and responsibility of the PI in the PI's absence.
- Research Assistants (RA) work under the direct and on-site supervision of the PI or a CI. RAs cannot conduct permitted activities in the absence of the PI or a CI and are not named in the permit.

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

- Individuals who perform a function directly supportive of and necessary to the permitted activity (including operation of vessels or aircraft);
- Individuals included as backup for essential personnel; and
- Individuals included for training purposes.

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

Permitted activities may be conducted on vessels or aircraft or in cooperation with individuals engaged in commercial activities, provided the commercial activities are not conducted simultaneously with the permitted activities, except with written approval of the Chief, Permits Division, such as for a news article or documentary film.

The Permit Holder cannot require direct or indirect compensation from persons requesting to conduct activities under the permit. For permits held by NMFS offices, the Permits Division may allow the Responsible Party or PI may designate additional CIs and must provide a copy of the letter designating the individual to the Permits Division on the day of designation.

#### 2.3.2.6 Possession of Permit (50 CFR 216.35(i) and (j), 222.301(d)(1) and (2), 222.305), and 222.308(d))

Permits cannot be transferred or assigned to any other person. The Permit Holder and persons operating under the authority of a permit must possess a copy of the permit when engaged in a permitted activity. A copy of the permit must be attached to any means of containment in which a protected species or protected species part is placed for purposes of storage, transit, supervision or care.

#### 2.3.2.7 Reports (50 CFR 216.38, 216.41(c)(ii), 222.301(h) and (i), and 222.308(d))

Permit Holders must submit annual and incident reports, and papers or publications resulting from the activities authorized by a permit. Research results must be published or otherwise made available to the scientific community in a reasonable period of time.

Annual reports must be submitted at the conclusion of each year for which a permit is valid, due 30 days after the end of each reporting period (either a calendar year or a 12-month period). As required by conditions of the permit, each annual report must include the following:

- A table reporting the number of animals taken, by activity and location;
- Observed effects and frequency of effects to permitted activities for target and non-target animals;
- Problems or unforeseen effects encountered and steps to resolve such problems;
- Discussion of any serious injuries, mortalities, or unauthorized species taken;
- Efforts to conduct post-research monitoring;
- Efforts to coordinate and collaborate with other Permit Holders and NMFS Regional Offices;
- Progress to meeting the objectives, including citations of reports, publications resulting from the reporting period; and
- Additional information as required by the permit on a case-by-case basis to monitor impacts of specific activities to animal health, effectiveness of protocols, etc.

The Permits Division may determine that a permit requires additional reporting to closely monitor and evaluate the impacts of specific research procedures; this is referred to as annual reauthorization. This may occur when more information is needed on the potential for harm or injury of a research procedure or when new scientific information (reports, publications, presentations, etc.) indicates that an activity may warrant closer monitoring for impacts to the target species or other portions of the environment. When such a report is required, the permit also will contain a requirement for annual reauthorization. In this scenario, the permit is temporarily suspended at the end of each permit year (12-month period) and the Permit Holder must report on the work that occurred during the year as noted above and any additional monitoring requirements, such as re-sighting data, photographs or tag transmissions of target animals, for the Permits Division's review. Based on review of the report, veterinarian and expert opinions as warranted, and relevant information from the literature, the Permits Division may modify, discontinue or reauthorize the activities under the permit for the next permit year.

Incident reports are required for any events of serious injury, mortality or exceeding take authorized by the permit. Incident reports must be submitted within two weeks of the incident and describe the events and steps that will be taken to reduce the potential for additional incidents. If the activity is not authorized or the Permit Holder reaches their mortality take limit, as required by the permit, researchers must cease permitted activities until the Permits Division allows the work to resume. The Permits Division reviews the report and facts relevant to the incident, such as a necropsy report for mortality, and determines whether the methods and protocols and/or permit requirements, such as mitigation measures or take numbers, need to be modified before work can resume.

After the conclusion of research or permit expiration, the last annual report due for the permit must include the above details for annual reports in addition to

- Whether the objectives were met and what was learned;
- An explanation of why objectives were not accomplished, if applicable;
- A description of how the activities benefited the species, promoted recovery, or conserved the target species and fulfilled objectives listed in the recovery or conservation plan; and
- Identification of any additional or improved mitigation measures.

This information is merged into the annual report form for the last year that a report is due to streamline reporting, resulting in a combined annual/final report.

#### 2.3.2.8 Notification and Coordination (50 CFR 216.36)

Permit Holders must provide written notification of planned fieldwork to the applicable Assistant Regional Administrator for Protected Resources at least two weeks prior to initiation of a field trip/season and must include the locations of the intended field study and/or survey routes, estimated dates of research, and number and roles of participants.

Permit Holders must coordinate activities with other Permit Holders conducting the same or similar activities on the same species, in the same locations, or at the same times of year to avoid unnecessary, repeated disturbance of animals.

#### 2.3.2.9 Observers and Inspections (50 CFR 216.36, 222.301(g), (i) and (j), and 222.308(d))

At the request of NMFS, the Permit Holder must allow an employee of NOAA or another designated person to observe permitted activities. The Permit Holder must provide documents or other information relating to the permitted activities upon request.

#### 2.3.2.10 Modification, Suspension, and Revocation (50 CFR 216.36, 216.39, 216.40, and 222.306)

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

The OPR Office Director may modify, suspend, or revoke a permit in whole or in part:

- To make the permit consistent with a change in the regulations prescribed under Section 103 of the MMPA and Section 4 of the ESA;
- In a case in which a violation of the terms and conditions of the permit is found;
- In response to a written request from the Permit Holder;
- If NMFS determines that the application or other information pertaining to the permitted activities includes false information; and
- If NMFS determines that the authorized activities will operate to the disadvantage of threatened or endangered species or are otherwise no longer consistent with the purposes and policy in Section 2 of the ESA.

Because ESA regulations do not distinguish between types of modifications, the Permits Division adopts MMPA regulations defining major and minor amendments (50 CFR 216.39) for issuance of ESA and joint ESA/MMPA permits. As such, a "major" modification to an ESA permit is a request to change:

- The number or type of species to be taken/imported/exported,
- The location where animals are taken/imported/exported,
- The manner in which animals are taken/imported/exported such that it would result in an increased level of take or risk of adverse impact, or
- Increase the duration for more than 12 months.

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

#### 2.3.2.11 Penalties and Permit Sanctions (50 CFR 216.36, 216.40(a), 222.301(f), and 222.306(e)

A person who violates a provision of a permit, the ESA, or the regulations at 50 CFR 216 and 50 CFR 222-226 is subject to civil and criminal penalties, permit sanctions, and forfeiture as authorized under the MMPA, ESA, and 15 CFR Part 904. In addition, per ESA regulation, permits shall not be altered, erased, or mutilated, and any permit which has been altered, erased, or mutilated shall immediately become invalid.

The Office of Protected Resources is the sole arbiter of whether a given activity is within the scope and bounds of the authorization granted in a permit. The Permit Holder must contact the Permits Division for verification before conducting an activity if they are unsure whether an activity is within the scope of the permit. Failure to verify, where NMFS Office of Protected

Resources subsequently determines that an activity was outside the scope of the permit, may be used as evidence of a violation of the permit, the MMPA, the ESA, and applicable regulations in any enforcement actions.

#### 2.3.2.12 Acceptance of Permit (50 CFR 216.33(e)(3)(i) and (ii))

When a permit is issued by signature of the Office of Protected Resources Director, the Permit Holder must date and sign the permit, and return a copy of the original signature to the Permits Division. The permit is effective upon the Permit Holder's signing of the permit. In signing an ESA permit, the Permit Holder

- Agrees to abide by all terms and conditions set forth in the permit, all restrictions and relevant regulations under 50 CFR Parts 222-226, and all restrictions and requirements under the MMPA and ESA;
- Acknowledges that the authority to conduct certain activities specified in the permit is conditional and subject to authorization by the Office Director; and
- Acknowledges that the permit does not relieve the Permit Holder of the responsibility to obtain any other permits, or comply with other Federal, State, local, or international laws or regulations.

## 2.4 Conservation and Recovery Benefits

As a program, scientific research and enhancement permits promote the conservation and recovery of listed species. The Permits Division's mission is to protect and conserve marine mammals and threatened and endangered species by providing special exceptions for take, import, and export that maximize recovery value and minimize individual and cumulative impacts as directed under ESA Section 10(a)(1)(A) and its regulations. As such, conservation and recovery are the foundation upon which the Permits Division processes ESA permit applications and manages issued research and enhancement permits. From the initial step of application submission, an applicant is required to demonstrate how the proposed activities meet ESA issuance criteria. More specifically, the applicant is required to discuss the following:

- How the action will enhance or benefit the wild population/species
- Whether the project has broader significance beyond the applicant's goals
- Why the work must take an endangered species
- How research is bona fide and likely to be published in a refereed scientific journal
- How the work will contribute to understanding the species' biology or ecology contribute to identified objectives of a species' recovery plan or otherwise respond to recommendations of a scientific body charged with management of the species, and contribute significantly to identifying, evaluating, or resolving conservation problems
- For enhancement, how the work will enhancing the health the survival, conservation, and recovery of the species in the wild, or will enhance the propagation of the species for conservation and recovery purposes
- How the research is not unnecessarily duplicative of other work

- The anticipated effects of the activities to protected species
- How the applicant will minimize impacts of the activities, in particular mortality
- How the applicant will coordinate activities with other Permit Holders

A recovery plan for smalltooth sawfish exists (NMFS 2009a). The following are examples of objectives in past research permits that are tied to recovery plan priorities for smalltooth sawfish:

- Minimize incidental interactions through outreach;
- Reduce threats from research;
- Ensure nursery habitat size and quality;
- Determine numbers of adults to ensure recovery; and
- Determine numbers of juveniles to ensure recovery.

Applicants are encouraged to link research objectives to priorities identified in NMFS ESA-listed species recovery plans.

## 2.5 Research Activities and Mitigation Measures

The following is a description of the general activities that may be authorized by the Permits Division as part of the proposed Sawfish Program. The Permits Division will require mitigation measures to minimize impacts to protected species when authorizing smalltooth sawfish research activities. Permit Holders will be required as a condition of their permits to adhere to all mitigation measures discussed below.

### 2.5.1 Capture Methods

Smalltooth sawfish researchers use a variety of sampling methods and techniques for capturing smalltooth sawfish, depending upon the targeted life stage and mitigations prescribed to avoid capturing non-target species. Not all capture methods discussed here will be authorized in each individual permit. Permit holders will need to specify their proposed capture method(s) and demonstrate their understanding of the required mitigation measures associated with each method proposed.

#### 2.5.1.1 Gill Nets

Gill nets (i.e., typically monofilament; Figure 2) will be used primarily to sample smalltooth sawfish under 2200 mm (7.2 ft). The nets would typically be deployed by boat in shallow waters, perpendicular to mangrove thickets and shoreline with an anchor at each end and a float line containing a foam core and a lead line core. Brightly reflective surface buoys would vary depending on the research objectives and the habitat and type of sampling performed. During sampling, gill nets typically vary between 30.5 m (100 ft), 45 m (150 ft), 61 m (200 ft) and 183 m (600 ft) with 102 mm to 152.4 mm (4 to 6 in) stretch monofilament mesh. All gill nets are routinely fished up to 10 ft deep (i.e., deployed at depths of 0-10 ft). In most cases, two smaller nets may be used in non-open-water areas (i.e., canals or creeks) if enough manpower is available to constantly monitor all nets every half-hour. However, when longer nets (183-m) are used, only one gillnet may be deployed at a time. Gillnets may be fished near-shore shallow waters over sand and mud bottoms for one hour; they must be constantly monitored at half-hour intervals, when the float line is down, or when an animal has hit the net (e.g., splash observed), whichever comes first. Sampling would occur primarily between March and December, but at any period when surface water temperatures are between 14.5 and 34 degrees Celsius and when surface dissolved oxygen concentrations are adequate to minimize stress on individual sawfish.

**Figure 2. Photograph showing a typical gill net set (with a captured sawfish). Photo: NMFS SEFSC (Permit No. 1538).**

### 2.5.1.2 Beach Seines

Beach seines (Figure 3) are seldom used capture gear in sawfish research; however, they are particularly useful on occasion to encircle sawfish observed swimming along a sand bar or shallow flat. The seine length used in studies have been up to a 183 x 3 m (600 ft) center-bag haul seine (38 mm [1.5 inch] to 51 mm [2 inch] stretched nylon mesh), which are deployed from the bank having relatively firm substrates, or otherwise deployed from a boat in a rectangular motion along shorelines and then retrieved by hand. When first setting the seine from a central location (i.e., either from the shoreline or boat), one end is lengthened by long ropes while the lead wing is set out in the shallow water in a wide arc. The fish are encircled and the seine is then drawn back to the beach on a firm substrate. The head rope of the seine (~30 meters or 100 feet long) is fitted with floats on the surface, while the footrope remains in permanent contact with the bottom and weighted with a leaded line. Both lines act as natural barriers, preventing sawfish from escaping from the area enclosed by the net. The catch is gathered in a central bag as both ends of the seine is drawn underneath the fish in a pooled area where the sawfish and other non-target fish can be dealt with with minimized stress. Seines are monitored constantly from the beginning of the set until the sampling is completed, releasing any non-target species as soon as possible.

**Figure 3. Photograph of a sample beach seine net haul in an estuarine river at low tide. The seine was pulled over the edge of the mud flat to capture a small sawfish which was seen swimming at the waters edge. (Photo: NMFS SEFSC; Permit No. 1538).**

#### 2.5.1.3 Longlines

Longlines (Figure 4) would generally be set in open water coastal areas, passes, Florida Bay and the Florida Keys and can be extended to longer distances to cover more area. Longlines would typically target smalltooth sawfish over 2200 mm (7.2 ft). Routine sawfish sampling longlines would consist of a 1300-2600 ft bottom set mainline of 8 mm (1/3 inch) braided nylon rope anchored at both ends. Ganglions are typically constructed of 3 feet of 5 mm (0.2 inch) braided nylon cord and 1 m of stainless steel wire leader. Mustad tuna circle hooks ranging in size from 10/0 to 16/0 are used to sample the various size range of sawfish. Small hooks (10/0 and 12/0) are required to fish for juvenile sawfish, given the small size of their mouth. Larger hooks (14/0 and 16/0) are required to collect adult sawfish to prevent breaking or straightening of the hook given the large size of adult sawfish. Hooks will be single-hooked (i.e., not threaded) and baited with fishes such as striped mullet (*Mugil cephalus*), ladyfish (*Elops saurus*), bonita (*Euthynnus allettaratus*), or northern mackerel (*Scomber scombrus*). Size 10/0 hooks are also baited with frozen shrimp when available. Squid would not be used for bait. Longlines are anchored and marked with a buoy at each end of a segment. Ganglions are spaced approximately 10 m (33 ft) apart along the mainline. To protect air breathing animals, the gangions would be positioned 1.5 times the water depth from the anchors. In other words, in 10 feet of water, there would be 15 feet from the anchor to the baited line and in 50 feet of water, there would be a 75 foot area without bait. The longline would be deployed for 3-4 hours and then retrieved, but would also be checked hourly or when the surface bouys react to a captured sawfish or non-target animal.

**Figure 4. Photograph of a typical longline set in an estuarine river. (Photo: NMFS SEFSC; Permit No. 1538).**

### 2.5.1.4 Drumlines

Drumlines are very similar to longlines but shorter in length, consisting of a cement block anchor with a monofilament leader (or bait line), a 14/0-18/0 circle hook and a single surface float. Drum lines are typically shorter than longlines and are generally set in bays, estuaries, rivers and backwater areas. Sampling typically occurs primarily between March and November. The bait line is set at least 1 ½ times the water depth in length to allow for any captured air-breathing animals to surface and allow for removal of these animals from the gear soon after capture. The gear is fished for up to two hours but is monitored continuously and checked hourly or in response to captures as soon as they are evident from the float line reaction.

### 2.5.1.5 Rod and Reel

Young of year, juvenile, and adult sawfish can each be targeted using rod and reel. Adults are often targeted using 8/0 to 10/0 circular hooks baited with oily fish and having a 40-60-lb monofilament line and 0.5-m (20 inch) plastic coated wire leader. Researchers would be directed to follow handling guidelines established by the Smalltooth Sawfish Recovery Team (NMFS 2009a), minimizing the potential for injury, including keeping sawfish in the water as much as possible (especially the gills) and untangling lines wrapped around the saw or any part of the body (Figure 5). If the hook cannot be readily removed, researchers would cut lines at the shank or as close to the hook as possible. Any hooks remaining in captured sawfish will corrode and dissolve approximately two to three weeks after release. To prevent the side-to-side slashing of the rostrum when retrieving a hooked sawfish, researchers would hold the tip of the rostra (for small specimens) or loop a rope around the tip of the rostra (for larger specimens) soon after capture, securing the animal before measuring, tagging and sampling activities are conducted.

**Figure 5. Smalltooth sawfish captured with fishing line (Pristis pectinata) (Photo: Florida Museum of Natural History; Permit No. 17316).**

### 2.5.2 Recaptures

Depending on specific research objectives, a recapture event would provide an opportunity to validate growth rates, assess the health of the animal, monitor tag wound healing rate and tag retention, as well as other responses from other research activities. The methods of recapturing an animal would not differ from the capture techniques described above. The primary difference is the stress associated with research techniques would be applied to an animal that has already been stressed at some time in the past. Recaptured animals would be subjected to additional capture, measuring, weighing (if appropriate), photographing, scanning for an internal passive integrated transponder (PIT) tag, assessing tagging wounds, and if the external acoustic tag, data logging tag, PIT tag, dart tag, or roto-tag are no longer attached, apply a new external tag, when appropriate. Moreover, recaptured animals may also have potential to be used for estimating relative abundance over time and location of young-of-the-year and juvenile life stages of sawfish (i.e., obtained through scientific surveys). This information taken from recaptures must be reported to NMFS in annual reports.

### 2.5.3 Research Techniques

As discussed for capture methods above, the research procedures commonly authorized for sawfish research are capture, handling and restraining, tagging, tissue sampling, blood collection, and ultrasounding. However, the Permits Division recognizes procedures other than those described in the following sections may also become available as methods evolve with technological advances and as accepted by the research community. The Permits Division would not authorize additional methods, or variations of the following methods, unless those new methods have been shown to have similar effects or minimize the effects of procedures below. If new techniques would cause more harm or have a greater impact on survival and recovery than what was considered in this consultation, then the Permits Division would need to request further analysis of the Sawfish Program. The proposed methodologies in this section are divided into two categories:

(1) Procedures that may affect sawfish, but are not expected to result in mortality; and

(2) Highly invasive procedures potentially posing a risk for delayed mortality after release.

#### 2.5.3.1 Procedures that are Not Expected to Result in Mortality

This section discusses procedures that are not expected to result in mortality to smalltooth sawfish.

##### 2.5.3.1.1 Handling and Restraining Sawfish

Once sawfish are captured they must be handled according to the *NMFS Sawfish Handling and Release Guidelines* (NMFS 2014a) and removed from capture gear by immediately untangling (if necessary, cutting the line from the rostrum) and processing and sampling as quickly as possible. To protect researchers and avoid chipping a sawfish's rostral teeth, designated crewmembers must immobilize the rostrum of larger captured sawfish by grasping the rostrum, usually while wearing padded welding gloves. The tail of such animals should be restrained in the water alongside of the boat using a soft tethering rope tied to the tail (Figure 6). To maintain smaller juvenile sawfish prior to sampling, some sawfish researchers have built water-filled net wells in the stern of the boat. This is a recommended practice because it is less stressful to sawfish and particularly less stressful when multiple animals are in line to be processed.

**Figure 6. Photographs of larger smalltooth sawfish teathered beside the boat for processing via ropes around the rostrum and tail.**

Sawfish should be measured, photographed, sexed, externally tagged, tissue sampled, and life stage noted as quickly as possible. Smaller individuals may be measured aboard the vessel for short periods of time for measuring, or preferably, in the water using a measuring board or while tethered boat side (Figures 6, 7, and 8). Measurements taken would include precaudal length (PCL), fork length (FL), stretch total length (STL), disc width (DW) and rostrum length (RL). Rostral teeth counts are also to be taken and any parasites removed before releasing animals. In shallower water, sawfish may be released by gently placing them in the water and leading them away from the boat, or releasing them in deeper water and allowing them to descend.

**Figure 7. Photographs of young-of-year sawfish being measured in the boat (left) and in the water (right).**

**Figure 8. Photograph showing an example of measuring a sawfish boat side with a fiberglass measuring tape.**

#### 2.5.3.1.2 External and/or Minimally Invasive Implanted Tags

Several different tags types are used on sawfish; and depending on the size of the animals and the information objective of the tag, up to five of the following tag types may be externally attached on the same animals. However, as noted, as technology advances, researchers would be allowed to utilize variants of these tags or other types to meet research objectives, as long as the resulting impacts are equal to or less than the impact analyzed for this programmatic. Through adaptive management, the Permits Division would be responsible for evaluating the likely effects of new tagging methods and providing an assessment of the probable effects to us and making their determination part of the administrative record for the research program.

Passive Integrated Transponder tags are small implantable electronic tags containing a unique identification code (Figure 9), and is transmittable to a reader to identify the animal throughout its life when it is recaptured. These tags, measuring approximately 12.0 mm (0.5 inch) in length by 1.5 mm (0.06 inch) in diameter, are implanted into the surface musculature of sawfish at the base of the first or second dorsal fin using a 12 gauge hypodermic needle (Figure 9). The PIT tags remain dormant until activated by an electromagnetic field generated by a tag reader when it is passed over the implant site (Smyth and Nebel 2013). As a permit requirement, all captured sawfish would be scanned with a PIT tag reader, and all untagged animals would then have a unique PIT tag injected. The most commonly used brands of PIT tags transmit 134.2 kHz, and thus would be typical of researchers conducting studies on sawfish.

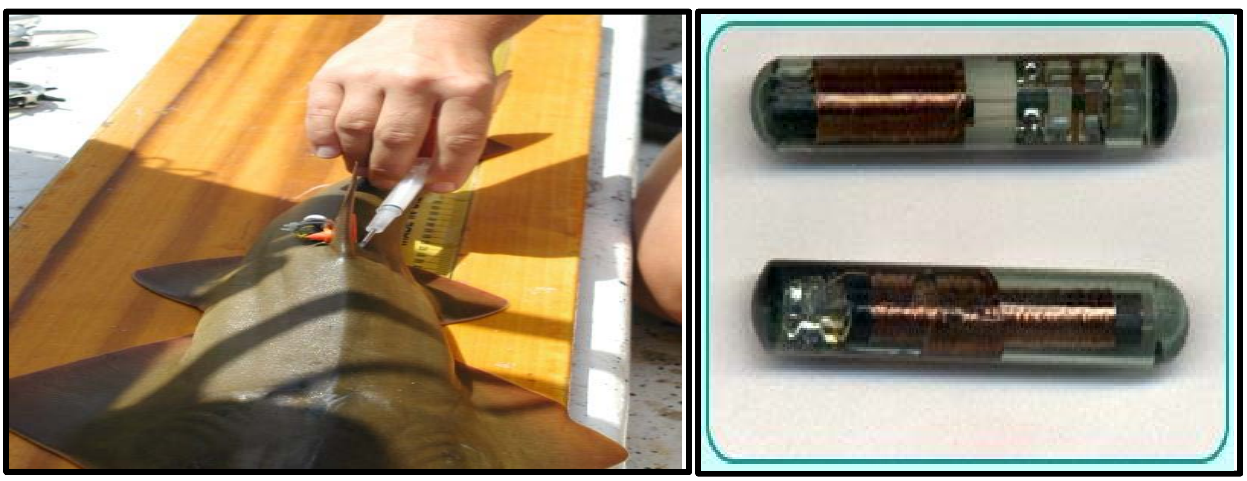

**Figure 9. 12-gauge syringe applicator (left) inserting a PIT tag (right).**

Streamer tags are numbered anchor tags made from polyvinyl chloride (PVC) plastic material used for externally identifying previously captured sawfish. These tags are applied to sawfish at the base of the first dorsal fin using an applicator needle to position the barbed head behind the cartilaginous rays supporting the fin. The tags are approximately 7 to 10 cm (2.8 to 4 inches) long (Figures 10 and 11) and are twisted once in position to secure the tag at the base of the first or second dorsal fin within the cartilaginous rays supporting the fin. Not all current researchers utilize plastic-tipped stream tags, but would be authorized to use them if requested.

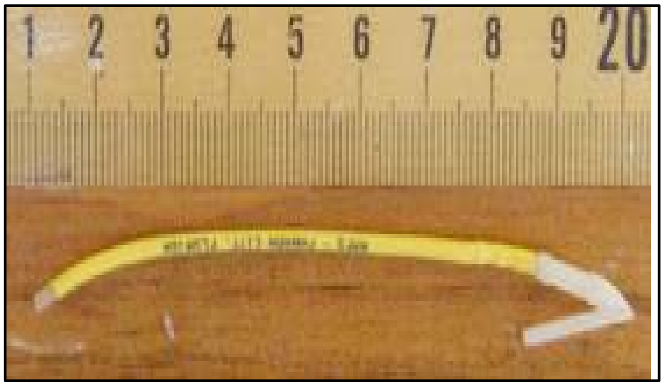


**Figure 10. Examples of dart tag with barbed plastic anchor to externally tag smalltooth sawfish.**

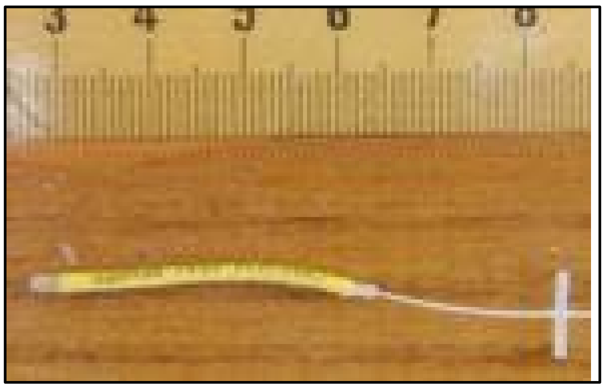

**Figure 11. Image of a spaghetti tag with plastic anchor for externally marking sawfish.**

Rototags are brightly colored plastic tags having a unique identification and used for externally identifying and reporting recaptured sawfish. A hole is first punched through the first dorsal fin with a leather hole-punch, and subsequently the two halves of the tag are clipped together through the fin to make a firm connection. Rototags are used in two sizes, depending on objectives. Smaller rototags are persistent tags used for routine external identification, while larger rototags are used as external attachment platforms for other acoustic and data logger tags (Figure 12). The latter tags are not long-term but can last up to three months to a year, depending on the corrosivity of the ocean environment.

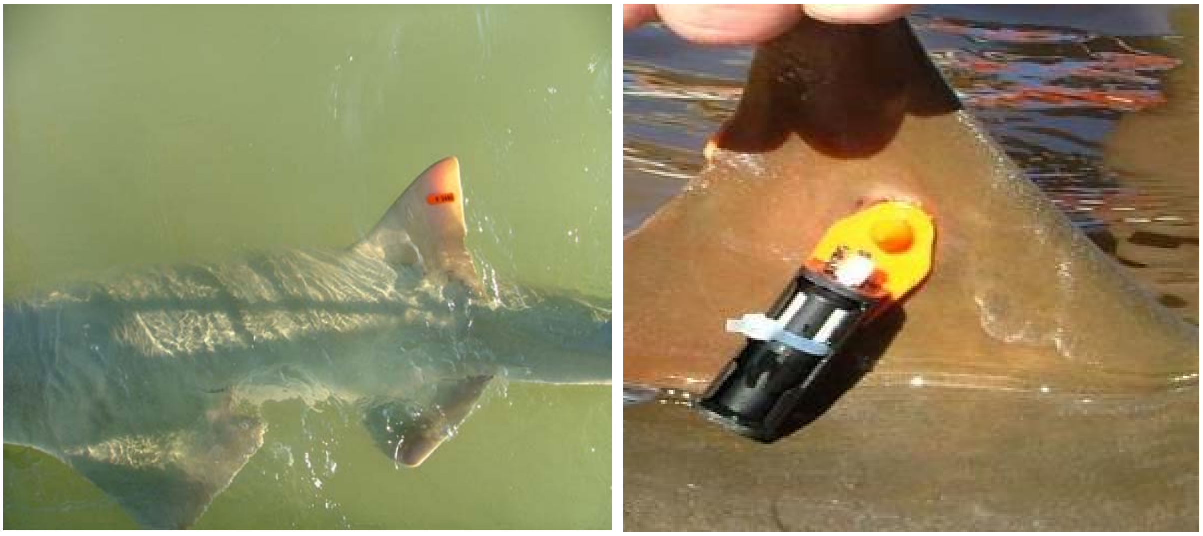

**Figure 12. Photograph of a juvenile sawfish with a small roto tag (left) and a larger “jumbo” roto tag (right) attaching an 8 mm acoustic tag to its dorsal fin.**

Acoustic tags transmit a coded pulse stream at 50 - 69 kHz. For example, the tags manufactured by VEMCO© Ltd. have varying dimensions in diameter. The V-9 acoustic tag is approximately 9 mm diameter (Figure 13), while the V-16 tag is the largest at 16 mm diameter. Two styles of tag are used: (1) active tracking tags where the pulse stream is repeated every three seconds, allowing the animal to be closely followed using a small boat (e.g., kayak), and (2) monitoring tags, producing a pulse stream every 45 to 75 seconds. The monitoring tags are used in conjunction with moored acoustic monitors recording the tag position passively when the tag is within its range. Currently, acoustic tags (transmitters) are applied externally to the first dorsal fin via roto tags (i.e., attached to the “jumbo” rototags (Figure 14) with a cable tie and covered in marine epoxy) or by using the “loop method (Figure 14).”

The loop method of attachment includes punching two small 1-2 mm holes in the anterior base of the first dorsal fin using a 20-gauge, 4 cm (1.5 inch) long needle. The holes are made through the thick portion of connective tissue of the dorsal fin, which has little vascularization, allowing for better tag retention and minimal discomfort or bleeding. A second attachment point is created further posterior from the first attachment point (between 30 mm and 36 mm or 1 to 1.5 inches) on the dorsal fin. A small piece of anti-chaffing tubing is then inserted through the anterior hole, through which an 80 lb test monofilament is threaded. Next, two equally sized neoprene strips are positioned on either side of the fin, which serve to cushion the site. Two equally sized plastic plates are then used to secure the site by providing leverage when the monofilament is snugged. After the tag is fixed by epoxy to the plastic backings, the monofilament line is then threaded through the holes in the backings through the tubing passed through the dorsal fin. It is secured by pulling the lines taut and then crimping them using corrodible metal (nickel-plated brass) crimps. Once the crimps corrode over a few months time, the tag is released leaving two small holes in the dorsal fin.

**Figure 13. VEMCO© Ltd. V9 acoustic tag.**

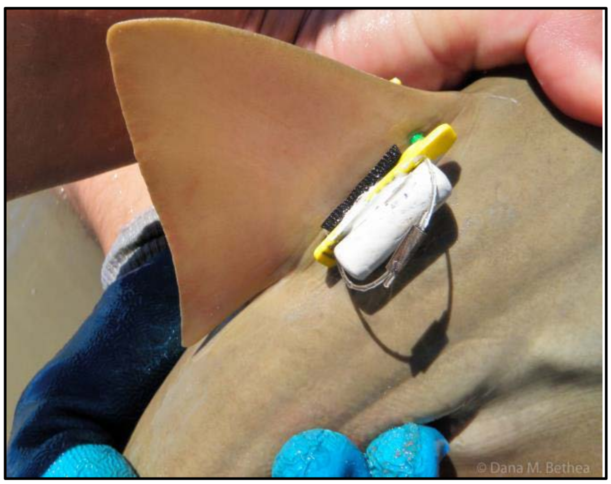


**Figure 14. An acoustic tag applied to the dorsal fin of a juvenile sawfish via the "Loop Method"**

Pop-up Satellite Archival Tags (PSAT) are used by permit holders to track movements and habitat use of adult and large juvenile sawfish (Figure 15). PSATs are both data archival and global positioning system (GPS) tracking tags. Tags are programmed to archive data at set intervals, recording (1) pressure (depth), (2) ambient temperature and (3) light. Next it transmits the data to the Advanced Research and Global Observation Satellite (ARGOS satellite) when the tag detaches from the host animal at a pre-assigned date (e.g., 3-6 months after release), floating to the surface. However, the GPS location is also transmitted to the ARGOS whenever the tag breaks the surface. PSAT tags are attached externally without surgery by fastening the tag to the dorsal fin via harness and are designed to be neutrally buoyant in marine environments (Figure 16).


**Figure 15. Photograph of a smalltooth sawfish swimming with a deployed PSAT tag.**

**Figure 16. Photo of a Mk10 PSAT tag being attached to a sawfish.**

There are two types of PSAT tags often used by sawfish researchers in permits (tag names, Mk10 and PTT-100, manufactured by Wildlife Wildlife Computers and Microwave Telemetry, Inc.). The larger of the two tags is about 18 cm (7 inches) long (without antenna), 4 cm (1.5 inches) in diameter, and weigh 65-79 g. A smaller version of the above PSAT tag is also available which is about 12 cm (5 inches) long (without antenna), 3 cm (1.1 inches) maximum diameter and weighs 40 g. PSAT-F tags are 5.1 cm (2 inches) long, 5.2 cm in diameter and weigh 150 g. All tag models used are highly streamlined and easily towed by a smalltooth sawfish.

The PSAT Tag is attached to the smalltooth sawfish by a 75 cm (30 inch) section of 1.8 mm (0.07 inch), stainless steel, 7x7 (49 strand) cable or 1.8 mm monofilament forms the structural base of the Mk10 PSAT tag attachment (Figure 17). One end of this cable is attached to the satellite tag using two 1.8 mm double copperlock crimps. The following are threaded onto the free end of the steel cable in order: two 1.8 mm double copperlock crimps, a 5.0 cm (2 inch) section of 3.2 mm (0.13 inch) polyolefin heat-shrinkable tubing, a 30-50 cm (12 to 20 inches; depending on sawfish size) section of 2.0 mm (0.07 inches) nylon chafe tubing, then a second 5.0 cm (2 inches) section of 3.2 mm polyolefin heat-shrinkable tubing. The lead piece of heat-shrinkable tubing is pushed to within 1.0 cm (2.5 inches) of the second crimp and the chafe tubing is pushed 2.5 cm (10 inches) inside of the heat-shrinkable tubing and the tubing is heated with a flame to shrink this section in place. The final section of heat-shrinkable tubing pushed 2.5 cm over the trailing end of the chafe tubing and heated with a flame to secure. Finally, the free end of the harness is threaded through and centered within a section of Tygon® tubing (3.2 mm or 0.13 inches) 5.0 cm (2 inches) shorter than the length of chafe tubing.

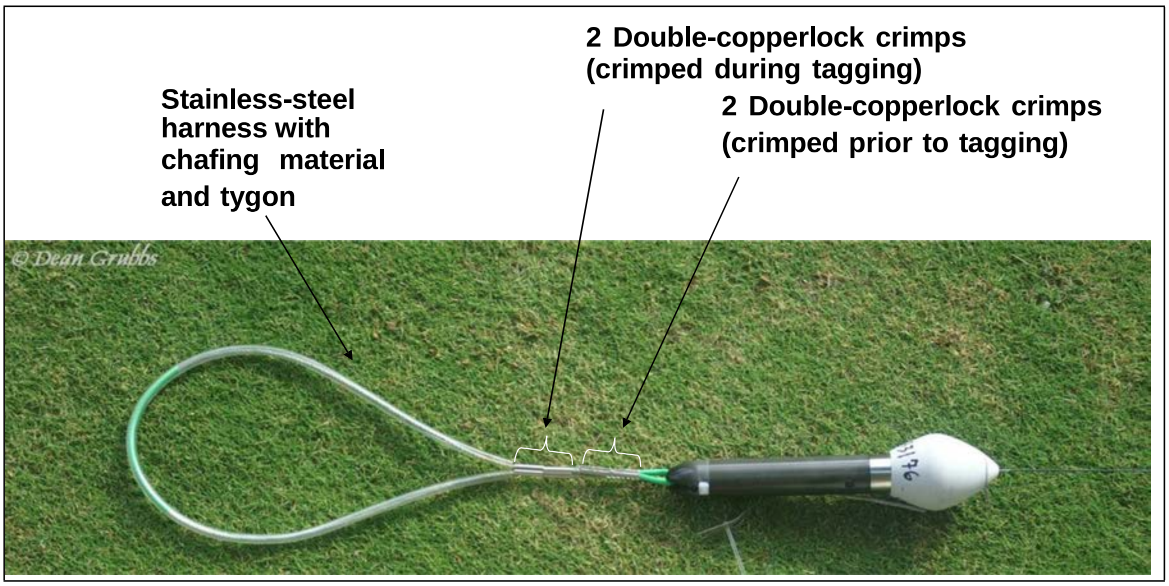


**Figure 17. Configuration of an Mk10 PSAT tag with the harness attachment.**

Smart Position only Transmitting Tags (SPOT) are similar to PSAT tags in function (i.e., archival and GPS), but transmits a signal to the ARGOS satellite system whenever the dorsal fin (and thereby the tag) comes out of the water. Thus the signal is undetected by potential predators. These tags are also smaller than PSAT tags, weighing only 28 g (including antenna), and measuring 7 cm x 4 cm x 1.5 cm or 2.8 inch x 1.5 incb x 0.6 inch (excluding antenna). These tags will be attached to the dorsal fin of sawfish using nylon bolts or cable ties as illustrated in Figure 18 below. They are typically short-term tags, released from the animal within six months.

**Figure 18. Photograph of a juvenile sawfish being released (left) after a SPOT tag is attached to the first dorsal fin (right).**

### 2.5.3.1.3 Genetic Tissue Sampling

In order to characterize the genetic make-up and level of diversity within the species, a small sample (1 $cm^2$) of sawfish fin tissue would be collected from the first dorsal fin using surgical scissors. Genetic tissue samples would be preserved in individually labeled vials containing ethanol or other preservative and processed by collaborators appropriate to the applicant's permit. Proper certification, identity, and chain of custody for the tissue samples would be maintained as samples are transferred.

### 2.5.3.1.4 Biopsy Tissue Sampling

A hand-held biopsy punch (6 mm [0.25 inch] diameter; 8 mm [0.3 inch] deep; with safety flange to prevent insertion beyond 8 mm) would be used to biopsy muscle samples collected from the dorsal flank of each sawfish. Objectives of the biopsy would be to measure baseline levels of skin and muscle histology, including environmental toxins such as mercury (total mercury) and organochlorines, as well as validate stable isotope results derived from genetic tissue fin clips. Additional biopsies would be taken on fish having gross external lesions for histopathological evaluation to characterize pathogens (e.g., fungi, bacteria, viruses) or tumors. A new sterile punch would be used for each sample. This standard biopsy methodology is described for other large fishes (e.g., sharks, billfish), smaller endangered freshwater fishes, and endangered mammals such as right whales and manatees (Peterson et al. 2005).

#### 2.5.3.1.5 Blood Collection

Blood samples would be collected from sawfish to provide a baseline of hormone levels, comparing between life stages and for reproductive determination and other objectives such as radioimmunoassay. Blood volume, needle, and syringe size would be dependent on fish weight, as presented below in Table 1. Each blood sample would be transferred directly or by common carrier to the CI or laboratory identified in the respective permit for diagnostic work. Unused blood samples could be archived for further future research.

**Table 1. Sawfish body weight determinant of the amount of blood draw.**

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

Blood would be drawn (Figure 19) using sterile, disposable 2.5 cm to 3.8 cm (1–1.5 inch) 20–24 gauge needle and syringe. All sawfish would be restrained with the ventral side up, securing the saw and caudal tail. Larger sawfish (>2 m or 6 ft) would be secured boat side with tether ropes wrapped around the rostrum, mid-section and caudal tail. During the venipuncture procedure the needle would enter the tail at the ventral midline and remain as close to the midline position as possible until the vertebral column is reached. Slight penetration of the caudal vertebrae allows access to the caudal vein. Further details and photographs of caudal venipuncture are included in Walsh and Luer (2004) of the *Elasmobranch Husbandry Manual: Captive Care of Sharks, Rays and their Relatives* (Chapter 23 pp 216-317).

**Figure 19. Photograph showing drawing blood via caudal venipuncture from a captive bonnethead shark species.**

#### 2.5.3.1.6 Ultrasound Procedures

The ultrasound examination will occur when a sawfish is captured as part of the normal health assessment workup procedure. Its use is associated with the results from other collected data (i.e., diet, stable isotope analysis, reproductive capacity, necropsy, fin clips, observations), learning about the feeding ecology and reproductive capacity of the species. For juveniles, researchers may be able to determine stomach contents and gonad size. For adults, the stomach contents, gonad size, and brood size (females) may be determined. The time required for the ultrasound examination would be shorter for juveniles (~5 min) than for adults (~5–10 min) mainly because of quantity differences (adults will probably have more in their stomachs). When conducting ultrasound analyses, the spiracles and gills of all sawfish will be kept in the water during the exam. The procedures described by Madigan et al. (2015), and Sulikowski et al. (2016), or slightly different variations, will be used when examining sawfish using ultrasonography. The ultrasound transducer is coated with ultrasound gel. During scanning, output power, focus depth, and frame rates are kept constant. The transducer is maneuvered along the abdomen between the gills and the anus.

#### 2.5.3.1.7 Photograph/Videography

Researchers having photography and videography takes described in the research objectives of permits would have authorized personnel able to film sawfish to document recovery efforts. These activities, for example, could include photography and videography activities by individuals essential to the permit's objectives, documenting the health of the fish, research methods, and any identifying marks on individual sawfish useful for future identification. These efforts could also include filmography performed by individuals with film companies associated achieving the objectives of a permit. However, the Chief, Permits Division may also grant written approval for photography, filming, or audio recording activities by individuals present during authorized research, but who are not essential to achieving the objectives of the permitted activities. This is provided if the activities of these individual do not interfere with other research activities and do not result in takes of the animals.

#### 2.5.3.1.8 Underwater Remotely Operated Vehicles

Remotely operated vehicles (ROVs), including autonomous underwater vehicles (AUVs), can be used to closely track acoustically tagged smalltooth sawfish in offshore environments, recording location, movement, and foraging activities. Units in current use are approximately 2 m (6 ft) in length. The ROV may be tethered to the research vessel. For example, the base ROV tethers (with a Kevlar braid strength member and high visibility polyurethane flotation jacket) have one coax conductor and one Twisted Shielded Pair. The tether may be several hundred meters long and have neutral buoyancy in seawater.

Tracking of animals may occur upon sighting a target animal during a vessel survey or upon release of a captured animal outfitted with an acoustic transmitter. The ROV is deployed from the side of the vessel and maneuvered towards the animals, maintaining a pre-programmed distance. Two AUVs may also be deployed concurrently when tracking an acoustically tagged animal to increase positional resolution of its location. The AUVs are outfitted with sensors to detect acoustic tag transmissions and are able to then alter their path in order to follow a moving transmitter. The AUVs process these detections to position the acoustic tag in 3D space with a resolution of < 10 m (33 ft) over 30 times a minute. The distance maintained between the units and the tagged animals may vary depending on the study objectives and capabilities (e.g., sensors) of the unit. The AUVs may be operated underwater or at the surface, allowing for visual monitoring of their positions from the research vessel. Tracking may occur for 10 hours or more depending on ROV battery life or acoustic tag attachment duration.

#### 2.5.3.2 Highly Invasive Procedures with Risk of Delayed Mortality

The following section discusses procedures that are invasive or stressful to such an extent that there is a risk of mortality.

##### 2.5.3.2.1 Surgical Telemetry Tagging (Internal)

Researchers will internally implant acoustic tags via surgical procedures after capture. No anesthetic would be used for immobilizing the animals undergoing surgery to implant tags. Selected sawfish adults and some large juveniles would first be inverted with the ventral side up to initiate tonic immobility (also known as animal hypnosis, death feigning, or catalepsy) (Figure 20). Versions of the same acoustic transmitter used for external attachment (e.g., VEMCO© Ltd. V9, V13, or V16 transmitter) would be used for internally implanting the acoustic tags in sawfish. Researchers may also use other brands and styles of internal acoustic tags as long as the combined weights of all tags are limited in size to less than 2 percent of the fish’s total weight (in air), and/or adverse impact would not be greater than the VEMCO tags identified.

**Figure 20. Photograph showing closure of surgical incision after implanting an acoustic tag into a smalltooth sawfish.**

To surgically implant acoustic tags, a 2 to 4 cm (0.75 to 1.5 inch) incision would be made on the animal's ventral surface just anterior to the pelvic fins using sterile, disposable scalpels. The transmitter would be inserted and pushed cranially until it is completely within the peritoneal cavity, and if necessary, transmitters would be coated with a combination of paraffin and beeswax to eliminate any potentially sharp edges on the transmitter and alleviate internal damage. This technique has been shown to be effective in decreasing transmitter rejection in several species (Holland 1999, Bridger and Booth 2003, Meyer et al. 2010). To help ensure the body cavity is completely closed, the incision would be sutured with two layers of silk surgical sutures, one in the muscle layer and the secondary one in the skin layer. Sutures fitted with cutting needles would be used with new, sterile suture material for each surgical procedure. After surgery, animals would be recovered in the water and observed for any abnormal behavior prior to release. The entire surgical procedure would take less than 5 minutes, and animals would be released as soon as possible after surgery to reduce handling time and stress. Each animal's movement would be tracked both manually and passively to monitor the reaction to the procedure, as well as to document long-term survival and health of the internally tagged animal.

## 2.6 Authorizing Capture, Handling, and Mortality

Scientific research permits authorized under the Permits Division's proposed Program will promote smalltooth sawfish conservation and recovery, and result in a net benefit to ESA-listed species and DPSs. As discussed above, as a condition of their permit, researchers will be required to follow specific protocols to avoid, minimize, and mitigate the unintended detrimental effects that may result from research activities such as capture, handling, or performing various invasive procedures. In addition to these standard protocols, as a condition of their permit researchers are required to consider additional precautionary measures to further minimize potential impacts on smalltooth sawfish. While these precautionary measures have proven highly effective at reducing detrimental impacts of research, and continue to improve over time, there remains some risk of mortality, either (1) “observed” mortality as a direct result of capture, restraint during capture (predation), handling, or performing a procedure, or (2) “delayed” mortality due to invasive procedures (e.g., surgery, gastric lavage) performed on captured fish but that do not heal properly. As such, some small amount of lethal take (i.e., mortality) will be authorized for research permitted under the Permits Division’s proposed Program.

Beyond ensuring the action is not likely to jeopardize ESA-listed species or destroy or adversely modify designated critical habitat, the Permits Division will attempt to reduce the level of authorized smalltooth sawfish take to the maximum extent possible while also ensuring researchers can collect valuable information necessary for species conservation and recovery. The Permits Division’s proposed approach for authorizing, monitoring, and managing lethal and sub-lethal take is described in this section.

### 2.6.1 Assessing and Updating Abundance Estimates

The current assessment of smalltooth sawfish abundance relies on the best available scientific information at the time of this programmatic. Information was available in the form of density estimates, effective population size estimates, and relative abundance trends from nursery areas (Simpfendorfer 2000, Wiley and Simpfendorfer 2010, Chapman et al. 2011, Norton et al. 2012, Carlson and Simpfendorfer 2015). No true abundance estimates have been published and little information is available on adult smalltooth sawfish. Using this information and understanding the different habitat utilizations of sawfish depending on life stage, managmenet of the species was divided into two groups of juveniles and sub-adults/adults (Figure 21).

Simpfendorfer (2000) provides a general abundance model based on four years of encounter data of juvenile life stages in the inshore core habitats of southwest Florida. The model suggests an estimate of 2,000 individual sawfish but with wide confidence intervals of approximately 1,000 individuals more or less. However, the data contained in Figure 21 shows the estimated abundance is primarily of smaller individuals residing in shallow water. Calson and Simpfendorfer (2014) extrapolated abundance numbers from effective population size (Chapman et al. 2011) and extrapolations of density assuming normal distributions (Wiley and Simpfendorfer 2010). Because all of these methods have unequal probabilities of encountering all animals, the abundance estimates produced are likely under-estimates of the true abundance.

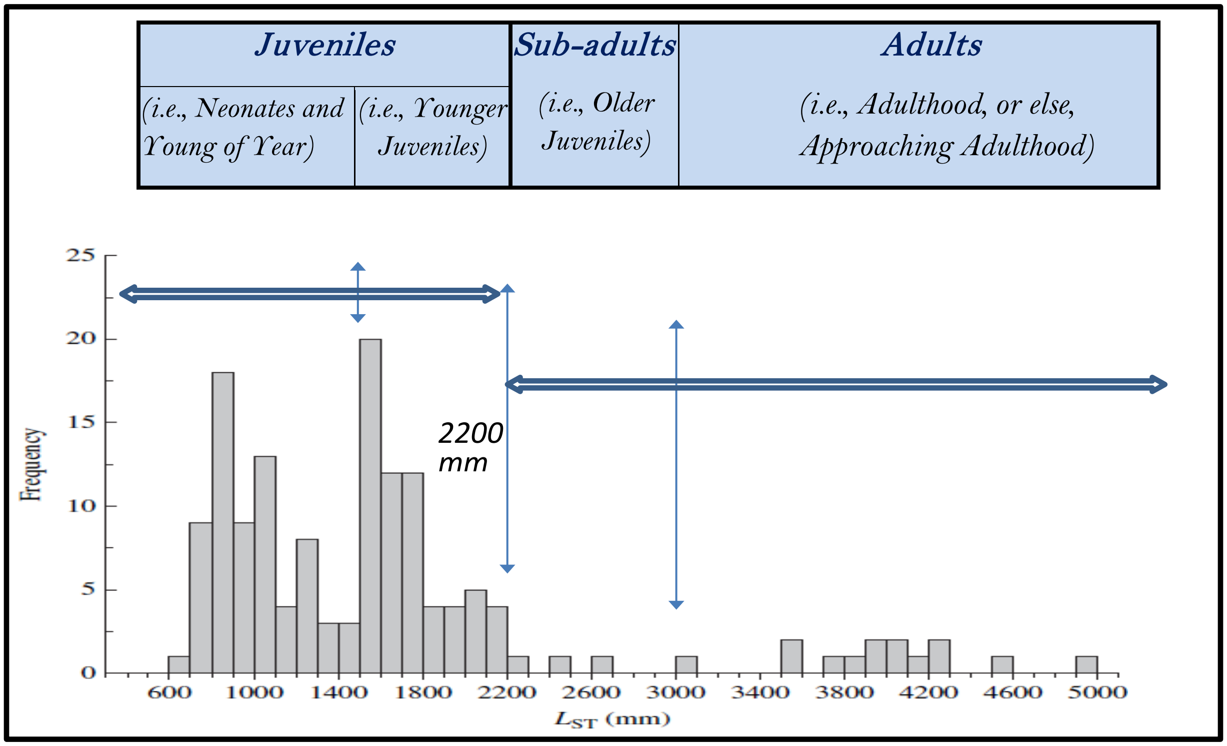


**Figure 21. Capture frequency of past smalltooth sawfish research (Simpfendorfer et al. 2008) where individuals under 2200 mm (7.2 ft) were captured in inshore environments and larger individuals moved offshore and were more dispersed.**

Encounter databases of juvenile smalltooth sawfish in Everglades National Park show annual reproductive success (Carlson et al. 2007, Carlson and Osborne 2012). Furthermore, the encounter database reports suggest the population is increasing at a rate of four to six percent per year. However, because the database is dependent on recreational anglers reporting their catch, there is no way to determine whether the rate of reporting has increased as more anglers learn about the database.

The Permits Division used all of this data, relying more heavily on the most recent publication (Carlson and Simpfendorfer 2015) to establish a total population estimate of 2,250 females in the population, distributed through all age classes. With an equal ratio of males and females, this would be approximately 4500 individuals in the populations. The Permits Division, using published survival rates (Carlson and Simpfendorfer 2015), estimated juvenile abundance of approximately 2,500 individuals and sub-adult and adult abundance of approximately 2,000 individuals.

As new information becomes available, the Permits Division will update the status of both portions of the population. These updates will be made as new information is published or as unpublished information is synthesized in five year status reviews.

### 2.6.2 Authorizing Lethal Take of Smalltooth Sawfish

Scientific research permits authorized under the Sawfish Program will provide data to support conservation and recovery. However, some adverse effects on individual smalltooth sawfish fitness as a species are anticipated as a result of research activities. As a condition of a permit, researchers will be required to follow specific protocols to avoid, minimize, and mitigate the unintended adverse effects that may result from research activities (e.g., capture, handling, performing various invasive procedures). In addition to these standard protocols, researchers are required to consider and describe additional precautionary measures they can take to further minimize potential impacts of their research on individual smalltooth sawfish.

While these precautionary measures have proven highly effective at reducing adverse impacts of research, some risk of smalltooth sawfish mortality remains either from 1) observed mortality that occurs during research, or 2) delayed mortality due to invasive procedures, particularly internal tagging. As such, a small amount of lethal take (i.e., mortality) will be authorized for research permitted under the Permits Division's proposed program.

The Permits Division is responsible for ensuring that the cumulative impact of lethal and sub-lethal takes authorized will not approach a level that jeopardizes the continued existence of listed smalltooth sawfish. In order to ensure the action is not likely to jeopardize listed smalltooth sawfish or destroy or adversely modify smalltooth sawfish designated critical habitat, the approach used to establish authorized levels of smalltooth sawfish take must be adaptive to incorporate new information regarding changes in the status of listed smalltooth sawfish over time. Beyond ensuring the action is not likely to jeopardize listed smalltooth sawfish or destroy or adversely modify designated critical habitat, the Permits Division will attempt to reduce the level of authorized smalltooth sawfish take to the maximum extent possible while also ensuring researchers can collect information necessary for species conservation and recovery.

### 2.6.3. Smalltooth Sawfish Mortality Limits

The Permits Division proposes to establish mortality limits for authorizing and managing the level of lethal take of smalltooth sawfish life stages resulting from research activities. The level of lethal take by smalltooth sawfish researchers in the last 17 years is based on empirical data of observable mortality, or amounting to 0.11 percent of sawfish taken (i.e., captured). However, the mortality limits will establish an annual lethal take limit for separate life stages comprised of both observable and delayed mortality, plus and a reserve of lethal takes, (i.e., not authorized up front in research permits) (Table 2).

As suggested, the Mortality Limits are designed to provide limits to the impacts of the program resulting from research activities. That is, the level of authorized mortality, calculated as a percentage of the estimated population, serves as a proxy for the fitness of the species. Approximating population abundances of smalltooth sawfish life stages is difficult given the paucity of information available. Supporting our conservative approach and using the best available information for estimating the population sizes of smalltooth sawfish (including encounter data, effective population estimates, and general growth index trends), the Permits Division adopted a survivorship model to approximate population numbers of both juvenile and older life stages.

The initial model estimates juvenile abundance as approximately 2,500 individuals. Using the same approach, the Permits Division estimated the base population for all sub-adult and adult life stages at approximately 2,000 individuals. Although the Permits Division cautions that the actual current juvenile population level may vary over time, these estimates will be updated periodically to reflect the best available science at any given time as described above.

Respective mortality limits for both adult/sub-adult and juvenile life stages will be calculated at 0.3 percent of their estimated populations, accounting for the accumulated observable and delayed mortality of the total population. This level of mortality is considered far enough below the estimated current intrinsic rate of increase of four to six percent per year to ensure growth of the smalltooth sawfish population while still authorizing sufficient research to help us understand the species and obtain important information for managers to protect them further.

All animals undergoing invasive surgical procedures, including humans, have a probabilitiy of mortality following the procedure (Knights and Lasee 1996, Ward et al. 1998, Walsh et al. 2000, Brattey and Cardigan 2004, Berger et al. 2014, Curtis et al. 2018). Delayed mortality is rarely measured by researchers and has not been measured for smalltooth sawfish. Consequently, the Permits Division is conservatively estimating a delayed mortality rate of 2.5 percent for all smalltooth sawfish receiving internal tags during permitted research. At that rate, the Permits Division anticipates one delayed mortality for every 40 smalltooth sawfish implanted with a telemetry tag. The number of internal tags implanted each year will be restricted by annual motality limits as well as the Permits Division discretion over the reserve buffer. These estimates will be updated periodically to incorporate new data as it becomes available.

**Table 2. Proposed annual limits for observed and unobserved (delayed) mortalities during permitted smalltooth sawfish research.**

| Life Stage | Column A (Population Estimate) | Column B ( percent of total population to be lethally taken) | Column C (Total allowed annual mortality) | Column D (Reserve Buffer over 5 years ) |
|---|---|---|---|---|
| Adult & Sub-adult (≥2200 mm STL) | 2000 | 0.30 percent | 6 | 3 |
| Juvenile (< 2200 mm STL) | 2500 | 0.30 percent | 7.5 | 3 |

### 2.6.4. Mortality Limit Management

The mortality limits represents the maximum number of smalltooth sawfish mortalities allowable annually resulting from scientific research under the scope of the programmatic consultation. This section describes the Permits Division's proposed approach for: 1) allocating authorized mortalities among research permits at levels below the Mortality Limits; 2) tracking and monitoring mortalities based on information obtained from researchers; 3) implementing measures to minimize mortalities; and 4) addressing scenarios if mortality limits are exceeded.

As part of the proposed program the Permits Division will establish an annual permit cycle for processing new smalltooth sawfish permit applications and major modifications. The annual cycle will allow the Permits Division staff to review and evaluate all requests for directed take of smalltooth sawfish for the upcoming year at one time. Permit applicants are required to specify the listed entity (i.e., species), number, life stage (e.g., neonate, juvenile, adult), research activity (e.g., capture, tagging, tissue biopsy), and research location. Once the annual window for submitting new research permit applications is closed, the Permits Division can evaluate the number of lethal takes that are anticipated in the upcoming year for purposes of comparison with the mortality limits established for smalltooth sawfish life stages.

A single mortality has been observed in the previous 15 years of research. Most permitees were not authorized mortality resulting from research activities. While smalltooth sawfish research mortality resulting from capture, handling, or procedures is extremely rare, the Permits Division will authorize it on a case-by-case basis to researchers within the Program because it cannot be ruled out. Such mortality will be analyzed in terms of mortality limits. If the lethal take numbers requested by all applicants for the year's permit cycle are within the annual mortality limits for any smalltooth sawfish life stage, these takes would be authorized as requested. This assumes that all applications and proposed mortality numbers have been deemed bona fide and are recommended for issuance. If an applicant's requested number of observed mortalities is greater than numbers historically reported by the applicant and the applicant has not fully justified the need for the lethal take numbers, the Permits Division will work with the researcher to determine why he/she is requesting lethal takes. For example, if a researcher has never experienced direct mortality from research, but still anticipates some mortality based on an increased level of research, the Permits Division could authorize a level of mortality averaged over a three-, five-, or ten-year term. If an applicant's request for an observed mortality is not warranted (i.e., based on past reports or riskier methods employed), the request may also be denied by the Permits Division. Any requests for mortality not meeting ESA issuance criteria or based on a legitimate conservation value, could be returned, withdrawn or denied. Authorized mortalities would then necessarily be removed from the pool in the lethal take analysis.

In addition to observed mortality, unobserved (or delayed) mortality rates will be applied and assumed to occur for authorized invasive surgery/internal tagging. The unobserved level of mortality will begin as an estimate of 2.5 percent. For example, if the Permits Division authorizes 100 internal tags for adult smalltooth sawfish, 2.5 "mortalities" would be considered authorized, leaving no more than 3.5 mortalities available for other permits. Within an application cycle, the Permits Division will ensure all authorized in hand and delayed mortality will be less than the maximum allowed annually.

Because not all active research permits are on the same issuance cycle, only a few of the permits will fall under the programmatic consultation at the beginning of the program in 2019. In general, in any given year, the pool of active permits will include both newly issued permits, and permits issued in previous permit application cycles once the programmatic consultation is in effect. Going forward, authorized smalltooth sawfish mortality from all permits issued under the programmatic consultation in prior years must be considered managed to stay below the Mortality Limits in each subsequent year when considering the year's new requests for lethal take. The Permits Division will use the same approach, tallying all authorized mortalities from existing active permits issued under the programmatic combined with requested mortalities for new applications for the upcoming year.

Though not anticipated, if the level of requests in a given year's cycle exceeds the mortality limits for the species, the Permits Division will contact affected researchers to discuss options for reducing the anticipated mortality. Options may include reducing the number of lethal takes, or changing the protocols or procedures requested. The Permits Division will initially contact new applicants in a given permit cycle to reduce the anticipated mortalities for the species and life stage to be below the mortality limits. Researchers with permits issued in previous years may also be contacted to assess their flexibility in reducing their authorized take or altering their research approach for the upcoming years.

### 2.6.5. Monitoring Actual Mortality

The Permits Division will monitor and track observed smalltooth sawfish mortalities from capture, handling, and both non-invasive and invasive procedures, as information from researchers is reported throughout the year. As a condition of each permit, the Permits Division must be notified of each observed mortality within two business days followed by submission of a written incident report detailing the observed mortality within two weeks. If a Permit Holder reaches or exceeds their limit of observed (authorized) mortalities specified in their permit, they also must stop their research activities until they receive approval to resume work. Upon review of the incident, the permit could be modified in a number of ways to ensure that best practices are used to minimize further mortality. These include options such as: 1) improving protocols and methods that likely resulted in or contributed to the mortality; 2) limiting authorized capture numbers or specific procedures; and 3) requiring additional coordination among researchers or monitoring of the species. Before issuing a modification to a permit that has exceeded its mortality limit, the Permits Division must determine that the change will not likely result in a mortality level that exceeds the limits of mortality for the species.

### 2.6.6. Exceeding Mortality Limits

The Permits Division will closely monitor smalltooth sawfish mortality occurring under research permits throughout the year. Every effort will be made to avoid exceeding the mortality limits established for the species. Mortality limits may be exceeded if a researcher fails to follow (either intentionally or unintentionally) the research techniques, procedures, and conditions as specified in the permit.

Considering the inherent, though low, amount of uncertainty involved with managing smalltooth sawfish mortality limits, and the possibility of random or unforeseen events potentially exceeding the annual limit (Table 2, Column C) the Permits Division anticipates a level of mortality that will not be authorized, but used as a buffer within the program to address unanticipated mortalities (Table 2, Column D). The reserve buffer would be established for a 5-year moving average. That is, mortalities recorded in a research year would be counted against this reserve each year for a five year period, at which, they will not longer be considered for permitting purposes. If the reserve buffer is used in year one, no additional mortalities will be available to the program over what is allotted annually in the program until the five years has passed. At the end of the 5-year period, the reserve buffer would reset. Moreover, the reserve buffer takes would also be used if a death occurs under a permit that does not authorize an incidental lethal take based on the nature of the activities or if researchers exceed the authorized numbers for the duration of their permit (e.g., 2 deaths when only 1 is authorized). If upon review of the incident, the Permits Division determines that additional mortalities need to be authorized for the permit, these would be drawn from the reserve buffer if takes are all allocated. This assumes the Permits Division has made all other efforts to reduce the likelihood of another mortality occurring under the permit. The reserve buffer will allow the Permits Division to exceed the permitted annual limit at any time. However, the Permits Division will only use the reserve buffer as an exceptional measure in cases where the mortality limit was unexpectedly exceeded due to circumstances beyond its control. Because reported mortality in general is extremely low, the Permits Division does not expect to need to use this buffer, but believes it is appropriate to have protocols in place in the unlikely event reported mortalities increase rapidly.

### 2.6.7 Expected Responses to Unintentional Mortality

As described above in this section, unintentional (observed) mortality of smalltooth sawfish would be authorized in individual permits as needed based on risk of mortality from research activities. Unobserved (delayed) mortality would also be applied to the mortality limits for take authorizing invasive surgery or internal tagging. For this consultation, we are proposing limits by life stage of unintentional and unobserved mortality from field research of wild smalltooth sawfish based on empirical data from the Permits Division’s program and the best available information on the risk of mortality from each method.

Because we have limited information about the population estimates of each life stage of smalltooth sawfish, our proposed mortality numbers are designed to be conservative limits for each life stage. If we authorize takes for mortality conservatively as described above for the species, the relatively small number of unintentional mortalities that would be authorized for the Permits Division’s program is not expected to have a significant effect to the species.

As evidenced by past reported smalltooth sawfish mortalities in the permitting program from 2003 to present, unintentional mortality amounted to 0.1 percent of takes during research permitting the capture or handling of smalltooth sawfish. The Permits Division expects the unintentional mortality rate to remain at comparable or decreased levels in the foreseeable future due to permit protocols/conditions and mitigation measures.

## 2.7 Adaptive Management Mechanisms

Adaptive management is an integral component of how the smalltooth sawfish research permit functions. Any aspect (species, take numbers, methods, mitigation measures, etc.) of a permit can be modified at any time as a result of new information that informs the Permits Division's assessment of potential impacts to species or habitat and our knowledge of the species (e.g., status, threats, habitat range, etc.). New information comes not only from submitted permit reports but also by the Permits Division remaining apprised of new publications, presentations, and monitoring common listserves used by the research community. This allows the Permits Division to ensure the program satisfies our statutory mandates and regulatory requirements, while also minimizing impacts and promoting conservation and recovery of the species.

Adaptive management is built into the Permits Division's reporting requirements. The Permits Division has also incorporated adaptive management into the mortality bank for smalltooth sawfish to continually monitor impacts to the species. In addition to establishing a Mortality Limit for lethal takes, the Permits Division will monitor available information regarding the status of each species to ensure that the basis for concluding low/negligible risk to the species remains valid.

For example, as part of the proposed adaptive management approach of the permitting program, the estimated "delayed" mortality rate (initially set at 2.5 percent of tagging takes) would be evaluated and adjusted, as necessary, as more data are collected. Similarly, if supported by additional available data, the Permits Division would apply different estimated population levels of smalltooth sawfish life stages.

Moreover, if new information indicates that other authorized procedures (i.e., besides internal tagging) result in an added risk of delayed mortality, the Permits Division will apply a delayed mortality rate to those procedures for purposes of managing long-term mortality risk. The Permits Division will also evaluate all new procedures for their risk to cause mortality (or a reduction of fitness) and if necessary assign mortality rates, as needed, to new procedures based on the best available data. Each of these changes would affect the limits of research allowable under the program.

Nevertheless, the Permits Division also recognizes that additional methods may become available as sawfish research evolves with technological advances in other species that have lesser or equal impacts as those already considered. This could include improvements in protocols or capture methods, such as new material or completely new net/trap designs, allowing for capture or collection in areas or at times that currently are not logistically feasible. This could also include minor modifications in tag designs that result in equivalent or lesser impacts. Consequently, the Permits

Division anticipates authorizing additional methods or variations of the above-described gear as they become available. As applicable, the Permits Division's standard mitigation measures for each method would be applied to any the new methods so that the impacts of using new methods do not result in a level of impact (serious injury or mortality) not evaluated as part of this programmatic consultation. As such, the level of mortality authorized by the Permits Division would not change because of any new methods authorized.

The adaptive management process for assessing impacts of new permitted research activity requested under the Program could include a determined "no effect" memo from the Permits Division, advising us of a newly intended method or action to the Program. However, it could also include the Permits Division initiating informal discussions with us, asking us if the new action would fall within the scope of effects already considered in this mixed programmatic biological opinion for the smalltooth sawfish research. Because additional risks may be associated with new or experimental procedures, the Permits Division will only authorize the a new procedure (i.e., one that is not discussed in our original consultation), if, after reviewing the best available scientific information, they determine: 1) the procedure is effective at achieving the research objectives, and 2) any adverse effects on smalltooth sawfish resulting from the procedure are less than or equal to the adverse effects of any of the procedures previously authorized or described for the same research objective. If after concluding and presenting evidence why the Permits Division believes the new action will not violate the above criteria, the new procedure would be acceptable for authorization. If the effects of the new procedure would be greater than any effects analyzed in the programmatic opinion, then the new effects would need to be analyzed under the programmatic opinion before they could be authorized.

## 2.8 Monitoring the Species Status of Smalltooth Sawfish

NMFS recognizes that a species' abundance, population trend, habitat use, or range could change in the future for a host of reasons (climate change, fishery changes, prey availability, habitat degradation, water quality, other human impacts, etc.). Therefore, the Permits Division will monitor any new information about the target species on an annual basis to ensure that they do not authorize take to a degree that would result in greater impacts than discussed herein, particularly the annual lethal take limits for reported deaths, which would trigger re-initiation. The Permits Division also will consider whether new information indicates that they should request re-initiation of the programmatic consultation. This could be information such as a new or revised ESA listing, evidence that the population has grown and the amount of lethal and non-lethal take should be adjusted accordingly, evidence that a higher amount of incidental take of non-target species is needed, or an expansion or shift in species range beyond the action area.

## 2.9 Internal Program Review

The Permits Division will complete an internal review of how the program is working upon completion of one permit cycle and submission of annual reports once the programmatic consultation is in place. This review will look at how the Permits Division is operating as a program to evaluate whether resources (time, staff, etc.) need adjustment, identify challenges or problems that arose and lessons learned, and identify ways to improve how the program functions. More specifically, the Permits Division will assess such aspects as:

- Permit cycle - Are the majority of applicants submitting requests on time? Is the volume of requests in a cycle manageable in addition to other workload? Is the 6-month processing window adequate?
- Take allocation – Are the levels of mortality requested and authorized in line with what was expected based on past data? Are the mortality and incidental take bank estimates sufficient or over-estimated?
- Reporting schedule– Are Permit Holders submitting annual and incident reports on time? Are we getting the details we need?
- What other challenges or problems arose and how were they resolved? Does the process need revision?
- Do we foresee issues on the horizon based on funding announcements, trending research interests, species status, new information/papers, etc., that would require re-initiation?

The Permits Division will continue this internal review on a regular basis (~ every 12-16 months) as other taxa/species programmatic consultations are completed or more frequently as necessitated by other drivers (e.g., staffing, other Permits Division tasks and projects, changes in ESA listings, etc.) that may affect how the Permits Division processes and manages permits.

### 2.10 Annual Reporting

The last component of implementation is the reporting of the work done within the Permits Division's program each year. The Permits Division will review and compile the information from the annual reports submitted by Permit Holders for the prior permit year. The report will synthesize data such as the percentage of takes used for lethal vs non-lethal activities, the frequency of observed effects of activities, and the number and kinds of non-target species incidentally taken. These data also will be used internally by the Permits Division as part of its internal program review to improve the implementation of the program over time; one way this may occur is by evaluating the percentage of takes used annually on average by Permit Holders and determining whether future requested take numbers for a given activity or objective need reconsideration or closer review in the next permit cycle. In other words, are the take levels reasonable for the work that can be accomplished based on the survey effort, species abundance, and resources needed to accomplish the work?

The Permits Division will provide annual reports to us each year, notifying us if new information becomes available indicating that the estimated delayed mortality rate has changed, this information will be conveyed and discussed in the report, including references to literature and other reports that were the basis for this determination. If new information indicates a procedure has greater impacts than those analyzed in the biological opinion, the Permits Division will informally consult with us and use the additional documentation to modify individual permits as needed; permits may be modified to authorize or remove procedures or add or revise mitigation measures to limit the potential impacts of authorized activities. The timing of the annual reporting will allow the two divisions to consult on such matters before the next year's permit cycle begins. The Permits Division will also continue to work closely with us during the life of the programmatic to routinely check-in (e.g., every five years or more frequently as needed) on how the programmatic is functioning, and to determine whether new information indicates that the Permits Division should proactively re-initiate the consultation. The Permits Division foresees regular reporting and periodic check-ins as an ongoing dialogue as part of their adaptive management of the program using the best available information.

## 2.11 Action Area

"Action area" means all areas affected directly, or indirectly, by the Federal action, and not just the immediate area involved in the action (50 CFR 402.02). This programmatic addresses research activities to wild smalltooth sawfish as well as smalltooth sawfish held in captivity. The action area of the Sawfish Program is discussed in terms of wild smalltooth sawfish research and captive smalltooth sawfish research in the sections below.

### 2.11.1 Wild Smalltooth Sawfish

The listing range of smalltooth sawfish within its U.S. DPS (68 FR 15674) encompasses the U.S. Atlantic coast and the Gulf of Mexico to the international border with Mexico. Although historically smalltooth sawfish interactions in the U.S. were commonly recorded from Texas to the Carolinas, ranging rarely as far north as New York, the species' current range has contracted ≥ 95 percent over a period of three generations (i.e., 1962) (Carlson et al. 2013). It is now effectively restricted to peninsular Florida, where all of its life stages are found with regularity in extreme southwestern Florida. (Figure 22).

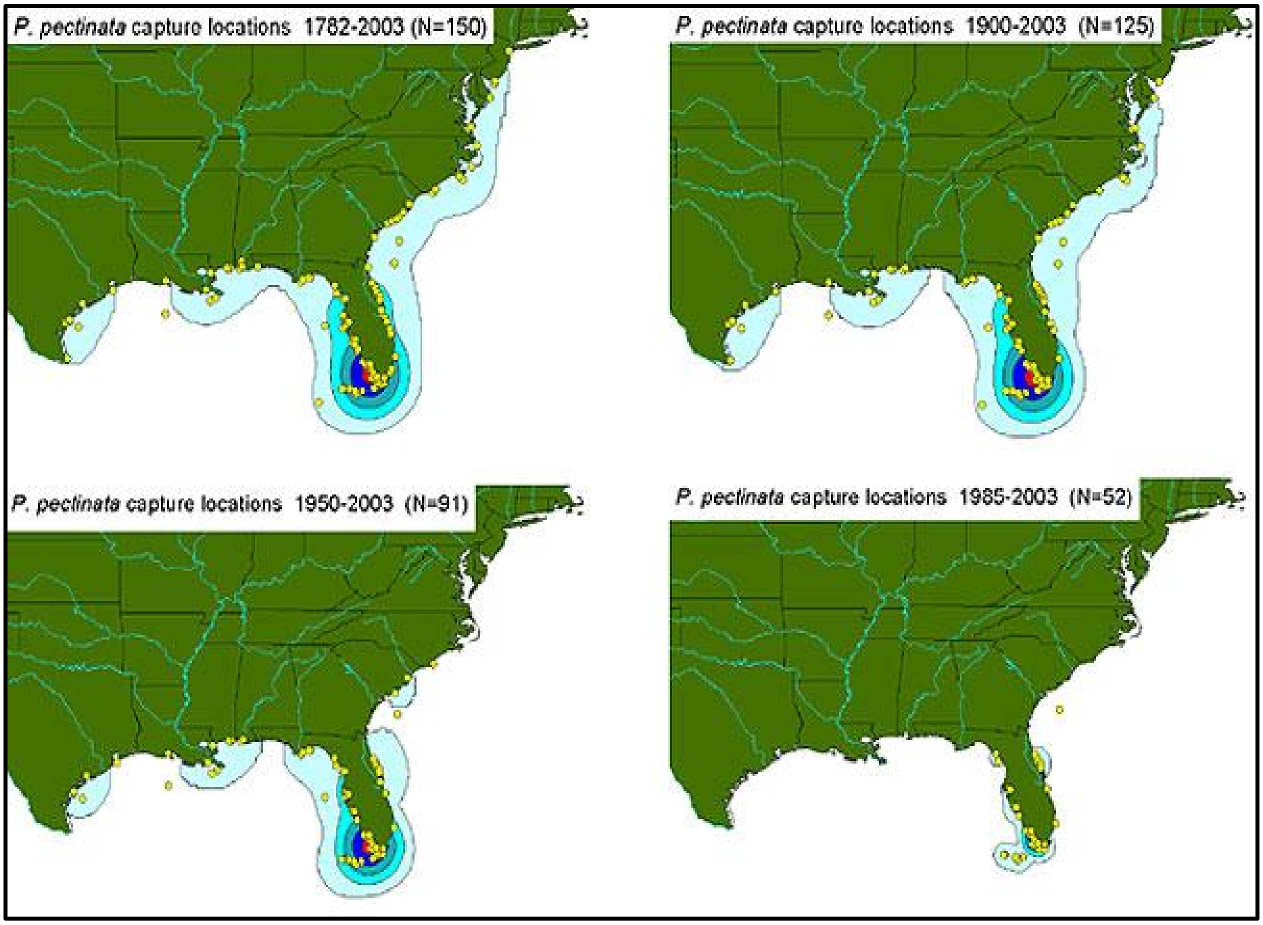


**Figure 22. Historic interaction with smalltooth sawfish in the U.S. Darker areas indicate greater concentration of records (From Burgess and Curtis 2003).**

The action area for the smalltooth sawfish permitting program is divided into three sampling zones to reflect the location of smalltooth sawfish research given the current contraction of their range and expected expansion of research efforts as the species recovers (Figure 23), which is adopted from the Smalltooth Sawfish Recovery Plan (NMFS 2009a). The complete sampling region for smalltooth sawfish begins at the North Carolina-Virginia border in the Mid-Atlantic and extends to the Texas-Mexico international border in the Gulf of Mexico, including coastal rivers, estuaries and marine waters in state waters, and federal waters to the U.S. Exclusive Economic Zone. For the foreseeable future, most activities will occur in the primary sampling region (Figure 22). Although the program will remain flexible to authorize directed research takes wherever bona fide research activity is proposed, it is anticipated that much of the action area will remain relatively undisturbed due to the sparse distribution of smalltooth sawfish outside of its core area of distribution. As the species recovers, sampling areas are likely to become more common outside of Florida.

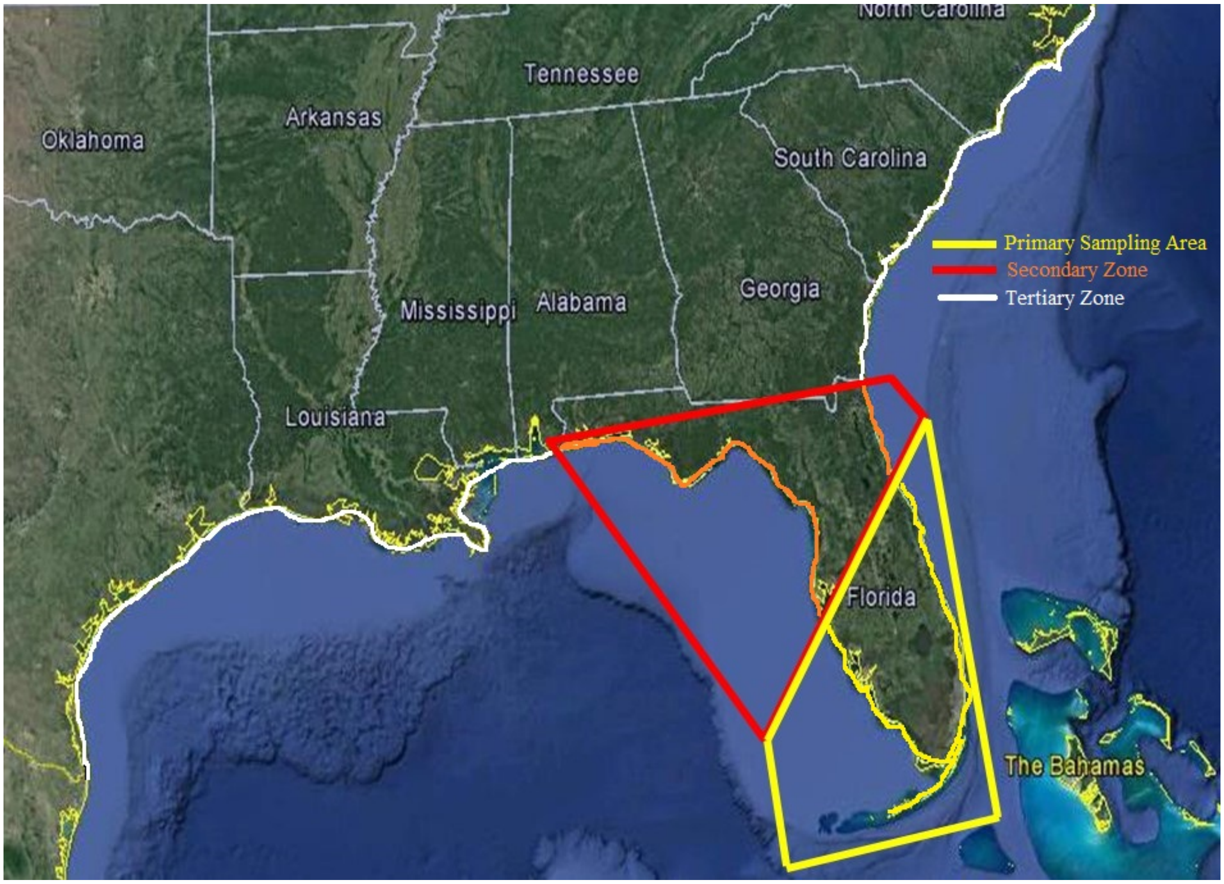


**Figure 23. The primary, secondary, and tertiary sampling areas ranging from Texas to North Carolina. At present, almost all smalltooth sawfish research occurs in the primary sampling area, with some research occurring in the secondary area. There are currently no research projects in the tertiary sampling area though there have been recent, though rare, encounters with smalltooth sawfish reported in those locations.**

The Primary Zone of research covers Sarasota County to Monroe County on the Gulf of Mexico coast of Florida, and Volusia County to Monroe County on the Atlantic east coast of Florida (Figure 24). Highlighted are the key areas, including Charlotte Harbor, Ten Thousand Islands NWR, Everglades National Park, Florida Keys and Florida Bay in southwest Florida; and St. Lucie and Indian Rivers in east Florida. This core distribution for the species is concentrated within critical habitat zones designated for juvenile life stages in 2009, where historically the majority of the directed research to be conducted within the Program.

The Primary Zone would likely target juvenile life stages because of their higher concentrations in critical habitat. Mangrove habitats, sand bottoms, oyster bars along shorelines, docks, seawall-lined canals and piers would present likely sampling locations for juvenile sawfish. Larger juveniles, referred to as sub-adults (> 2,200 mm STL), are also sometimes found in the same habitat. However, as sub-adults mature, they tend to migrate to near offshore areas better suited for their foraging (NMFS 2009a). Based on prior research and reported commercial and recreational fishery interactions, as smalltooth sawfish approach adulthood (> 3 meters), they commonly frequent deeper off-shore shelf edges (at water depths of 40-55-m) in locations of Florida Bay and the Florida Keys. Researchers would typically target these larger life stages in more open waters using longline and angling gear. Nevertheless, adult and sub-adult sawfish could also be targeted opportunistically anywhere within the Primary Zone by using active acoustics to locate animals (i.e., if previously tagged), or else, targeting individual animals located through reports of their extended presence in shallower waters. For example, public sightings of adult sawfish within the main stem of the St. Lucie River (mid-southeast coast of Florida) were used to opportunistically take two adults in 2016 using longline gear (Permits Division annual reports). Other research activities in the Primary Zone would be authorized from collections of incidentally bycaught sawfish taken in otherwise legal activities (e.g., Section 7 incidental take statements, Section 10(a)(1)(B) permits, acquired through enforcement actions, or stranding).

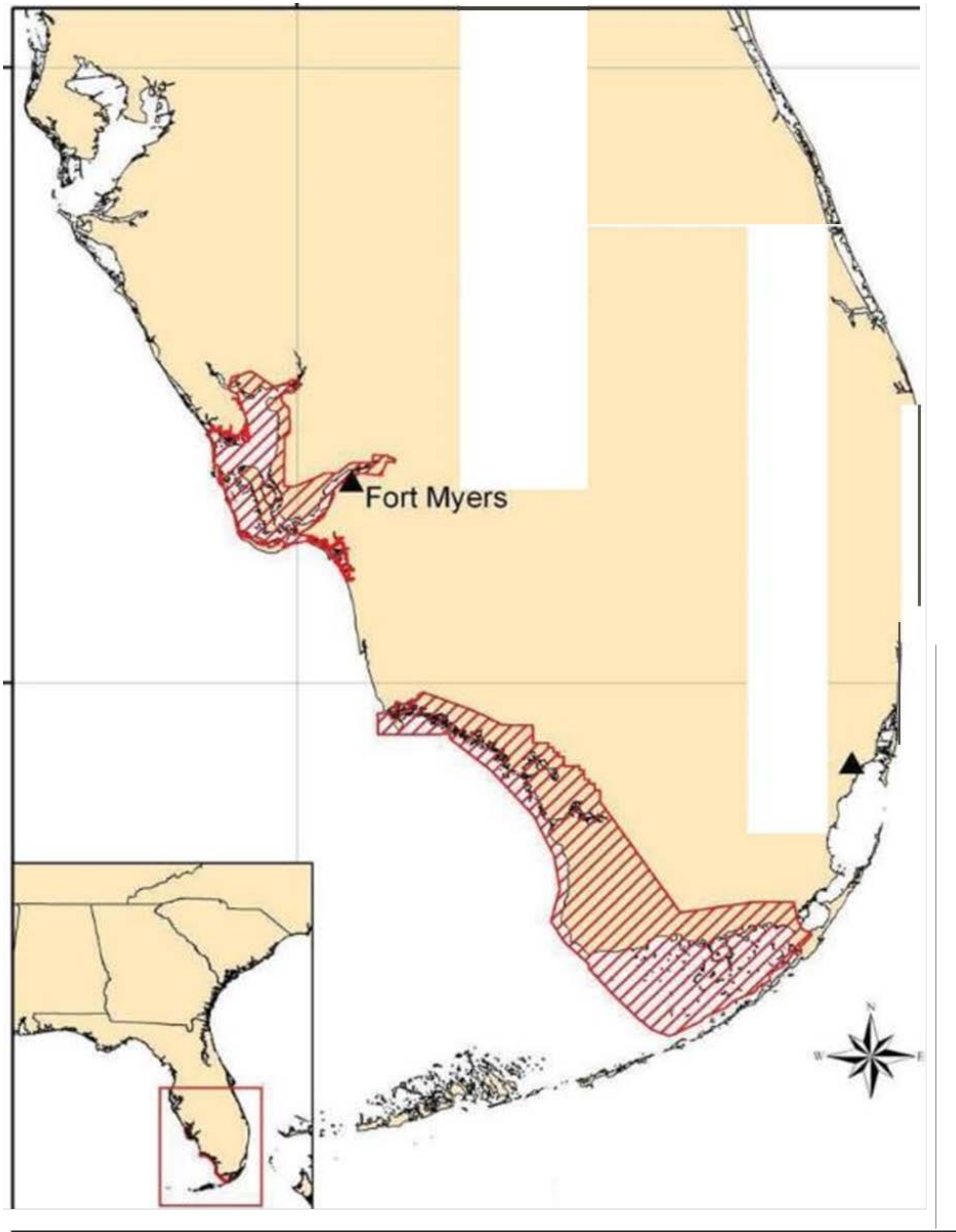


**Figure 24. Map of core areas of smalltooth sawfish habitat within the Primary Zone of research, highlighting critical habitat units designated in southwest Florida (Adapted from Norton et. al. 2012).**

The Secondary Zone of research includes northern Florida latitudes, extending to the Georgia-Florida border on the Atlantic coast and to the Alabama-Florida border in the Gulf of Mexico. However, the lack of desirable sawfish habitat in northern Florida and the species' cold-intolerance (i.e., temperatures approaching 16-18ºC) have been cited as limits to its northerly movements outside of its normal range (NMFS 2009a). The periodic sawfish encounters in the Secondary Zone would therefore limit the amount of directed research activities conducted by researchers. However, it is anticipated that sampling in the Secondary Zone could include opportunistic targeting of individual sawfish reported (or tracked) in an area and further directed sampling of incidentally taken sawfish (or parts).

The Tertiary Zone of research includes the Atlantic coast between the Florida and Virginia borders and the coastal range of the Gulf of Mexico between Florida and the international border with Mexico. Interactions with sawfish in the Gulf of Mexico and Atlantic coastal areas from scientific research, commercial or recreational fisheries are extremely rare in the Tertiary Zone. Historical interactions recorded in Louisiana's shrimp trawl dropped continuously from 1950 to 1978, from around five metric tons to less than 0.2 metric tons during this period (NMFS 2009a). Further, there have not been any records of landings in this area of the Gulf since 1978. Likewise, there have been only four documented encounters in the Atlantic Ocean with sawfish north of Jacksonville, Florida, in the last 17 years and only one of those during research activities. Consequently, the Permits Division anticipates that most directed research within the Tertiary Zone of research will occur years down the road or be associated with opportunistic sampling.

### 2.11.2 Captive Smalltooth Sawfish

There are 12 smalltooth sawfish (5 males and 7 females) maintained in three Association of Zoos and Aquariums accredited institutions. The action, however, is limited to the two facilities in the United States (Sea World of Orlando and Ripley's Aquarium of Myrtle Beach), currently possessing a single pair (male/female), held in captivity prior to the effective date (May 1, 2003) of the smalltooth sawfish listing. Because these sawfish were collected prior to the ESA listing, they may continue to be held in captivity, provided the provisions under Section 9(a)(1) are not violated (i.e., animals are not taken or harassed, are not killed or harmed, are provided adequate care and normal routine husbandry practices, including veterinary care, and are not sold). Moreover, experimental or potentially injurious veterinary procedures, scientific research, or breeding activities would not be covered by the standards of normal animal husbandry practices, and thus, may violate the ESA Section 9 prohibitions.

A captive facility in Nassau, Bahamas (Atlantis-Paradise Island) is reported to have successfully bred smalltooth sawfish in 2012, resulting in four surviving pups. However, multiple subsequent breeding attempts by the facility did not produce viable offspring. Because NMFS has not found any other records of successful captive breeding of smalltooth sawfish, we believe captive breeding is inherently experimental and potentially injurious. Therefore, attempting to breed smalltooth sawfish, beyond having a male and female in a tank for natural breeding, would be considered outside the scope of normal husbandry. This would include retrieval of eggs/sperm, attempting to artificially inseminate animals, introducing chemicals/stimulants, or to facilitating or inducing breeding by changing the environment (e.g., temperature, lightning). Consequently, such activities beyond natural breeding would require a scientific research permit. Furthermore, any sawfish progeny produced through either natural or artificial breeding would be afforded all of the protections under ESA section 9, and may not be "taken" or used for commerce.

Although currently there are no ESA section 10(a)(1)(A) permits authorizing maintenance of captive listed sawfish for scientific research purposes, applicants proposing bona fide research activities on captive sawfish could be issued a scientific research permit under ESA section 10(a)(1)(A). However, because husbandry techniques for research and breeding are not well documented or standardized, and the effects of captive research and breeding activities have not been previously analyzed or are not well understood, captive research on smalltooth sawfish is excluded from the current Program. Thus, any future permit applications proposing research activities on captive smalltooth sawfish would be considered independently of the programmatic biological opinion informing this action.

### 2.12 Interrelated and Interdependent Actions

Interrelated actions are those that are part of a larger action and depend on that action for their justification. Interdependent actions are those that do not have independent use, apart from the action under consideration. We have determined that there are no interrelated or interdependent actions resulting from the proposed smalltooth sawfish research program.

## 3. THE ASSESSMENT FRAMEWORK

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

"To jeopardize the continued existence of an ESA-listed species" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of an ESA-listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02).

This particular consultation and section 7 analysis assesses a mixed programmatic action (50 CFR 402.02). This is "a Federal action that approves action(s) that will not be subject to further section 7 consultation, and also approves a framework for the development of future action(s) that are authorized, funded, or carried out at a later time and any take of an ESA- listed species would not occur unless and until those future action(s) are authorized, funded, or carried out and subject to further section 7 consultation." The jeopardy analysis considers both survival and recovery of the species through the following steps:

1) We identify the program, its authoritites, where the action agency has discretion and how decisions are made, and how new information is updated and integrated into the program through time.
2) We identify the extent of the area that may be exposed, directly or indirectly, to stressors resulting from actions authorized, funded, or carried out by the program.
3) We identify the ESA-listed species and designated critical habitat that are likely to co-occur with those stressors in space and time.
4) We describe the environmental baseline in the action area including: past and present impacts of Federal, state, or private actions and other human activities in the action area; anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation; and impacts of state or private actions that are contemporaneous with the consultation in process.
5) We then identify those aspects (or stressors) of the program that are likely to have direct or indirect effects on the listed species or physical, chemical, and biotic environment within the action area, including the spatial and temporal extent of those stressors. We identify the number, age (or life stage), and gender of ESA-listed individuals that are likely to be exposed to the stressors and the populations or subpopulations to which those individuals belong. We also consider whether the action "may affect" designated critical habitat. This is our exposure analysis. The likelihood of exposure will rely on the program, its authorities, and the action agency's discretion as well as any uncertainties identified during informal consultation (50 CFR 402.13).
6) We evaluate the available evidence to determine how individuals of those ESA-listed species are likely to respond given their probable exposure. We also consider how the action may affect designated critical habitat. This is our response analyses.
7) We assess the consequences of these responses of individuals that are likely to be exposed to the populations those individuals represent, and the species those populations comprise. This is our risk analysis.
8) The adverse modification analysis considers the impacts of the proposed action on the essential physical and biological habitat features and conservation value of designated critical habitat.
9) We describe any cumulative effects, as defined in our implementing regulations (50 CFR §402.02) of the proposed action in the action area.
10) We then summarize the above factors by considering the effects (exposure, response, and risk) of the action given the status of the species, the environmental baseline, and the cumulative effects to determine whether the action could reasonably be expected to:
    - Reduce appreciably the likelihood of both survival and recovery of the ESA-listed species in the wild by reducing its numbers, reproduction, or distribution; or

- Reduce the conservation value of designated or proposed critical habitat.

These assessments are made in full consideration of the status of the species and designated critical habitat. We then state our conclusions regarding jeopardy and the destruction or adverse modification of designated critical habitat.

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

To comply with our obligation to use the best scientific and commercial data available, we conducted electronic searches for information relevant to smalltooth sawfish status, factors affecting smalltooth sawfish within the action area, and for information about how elasmobranchs respond to the stressors that are likely to result from the issuance of this permit. We also searched for research relevant to incidental capture and its effects to sea turtles. We used those studies to determine how target and non-target species may be affected by the proposed action to draw conclusions about the likely risks to the continued existence of these species and the conservation value of their critical habitat.

# 4. Status of Endangered Species Act Protected Resources

This section identifies the ESA-listed species that potentially occur within the action area and that may be affected by the smalltooth sawfish program (Table 3). It then summarizes the biology and ecology of those species and what is known about their life histories in the action area. While the Permits Division determined largetooth sawfish and humpback whales may be affected by this action, these ESA-listed entities do not occur in the action area and therefore will not be affected by this action.

**Table 3. Threatened and endangered species that may be affected by this proposed smalltooth sawfish research permit.**

| Species | ESA Status | Critical Habitat | Recovery Plan |
|---|---|---|---|
| **Marine Mammals – Cetaceans** | | | |
| North Atlantic Right Whale (Eubalaena glacialis) | E – 73 FR 12024 | 59 FR 28805 | 70 FR 32293 |
| Blue whale (*Balaenoptera musculus*) | E – 35 FR 18319 | | Draft: 83 FR 51665 |
| Fin whale (*B. physalus*) | E – 35 FR 18319 | | 75 FR 47538 |
| Sei whale (*B. borealis*) | E – 35 FR 18319 | | 12/2011 |
| Sperm whale (*Physeter macrophalus*) | E – 35 FR 18309 | | 12/2010 |

| Species | ESA Status | Critical Habitat | Recovery Plan |
|---|---|---|---|
| **Sea Turtles** | | | |
| Green Turtle (*Chelonia mydas*) | E – 43 FR 32800 | 63 FR 46693 | 63 FR 28359 |
| Hawksbill Turtle (*Eretmochelys imbricata)* | E – 35 FR 8491 | 63 FR 46693 | NMFS and USFWS 1993 |
| Kemp's Ridley Turtle (*Lepidochelys kempii*) | E – 35 FR 18319 | -- -- | 75 FR 12496 |
| Leatherback Turtle (*Dermochelys coriacea*) | E – 35 FR 8491 | 44 FR 17710 | 63 FR 28359 |
| Loggerhead Turtle (*Caretta caretta*) – Northwest Atlantic DPS | E – 76 FR 58868 | 79 FR 39856 | 63 FR 28359 |
| Olive Ridley Turtle (*Lepidochelys olivacea*) | E – 43 FR 32800 | | |
| **Fishes** | | | |
| Smalltooth sawfish (*Pristis pectinate*) | E – 68 FR 15674 | 74 FR 45353 | 74 FR 3566 |
| Shortnose sturgeon (*Acipenser brevirostrum*) | E – 32 FR4001 | -- -- | 63 FR 69613 |
| Gulf sturgeon (*Acipenser oxyrinchus desotoi*) | T – 56 FR 49653 | 68 FR 13370 | USFWS and GSMFC 1995 |
| Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) | | | |
| Atlantic Sturgeon, South Atlantic and Carolina DPSs | E – 77 FR 5914 | 82 FR 39160 | -- -- |
| Atlantic Sturgeon, Chesapeake Bay, New York Bight, and Gulf of Maine DPSs | E – 77 FR 5880 | 82 FR 39160 | -- -- |
| Nassau grouper (*Epinephelus striatus*) | T – 81 FR42268 | | |
| Scalloped hammerhead shark, Central and Southwest Atlantic DPS (*Sphyrna lewini*) | T – 79 FR 38213 | | |
| Giant manta ray (*Manta birostris*) | T – FR 2916 | | |
| **Corals** | | | |
| Elkhorn Coral (*Acropora palmata*) | T – 71 FR 26852 | 73 FR 72210 | 80 FR 12146 |
| Staghorn Coral (*Acropora cervicornis*) | T – 71 FR 26852 | 73 FR 72210 | 80 FR 12146 |
| Reef building coral (*Dendrogyra cylindrus*, *Orbicella annularis*, *Orbicella faveolata*, *Orbicella franksi*, *Mycetophyllia ferox*) | T – 79 FR 53851 | | |

| Species | ESA Status | Critical Habitat | Recovery Plan |
|---|---|---|---|
| **Plants** | | | |
| Johnsons sea grass *(Halophila johnsonii)* | T – 63 FR 49035 | 65 FR 17786 | 67 FR 62230 |

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

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

The second criterion is the probability of a response given exposure. ESA-listed species or designated critical habitat that is exposed to a potential stressor but is likely to be unaffected by the exposure is also not likely to be adversely affected by the proposed action. We applied these criteria to the United States DPS of smalltooth sawfish, North Atlantic right, blue, fin, sei, and sperm whales, shortnose sturgeon, Gulf sturgeon, South Atlantic and Carolina DPSs of Atlantic sturgeon, Nassau grouper, scalloped hammerhead sharks, giant manta rays, elkhorn coral, staghorn coral, reef building coral, and Johnson's sea grass and we summarize our results below.

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

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

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

For designated critical habitat, we first assess the potential effects to each of the essential features and determine whether the effects are "beneficial," "discountable," or "insignificant." In the context of designated critical habitat, "take" is not an issue so we define insignificant effects slightly differently. Insignificant effects are when there is an actual possibility of an effect to the essential feature and the effect is temporary, minor, or both, so that there is no discernible impact on the conservation function of that essential feature in that designated critical habitat unit. We assessed the impacts to designated and proposed critical habitat of North Atlantic right whales, Gulf sturgeon, Atlantic sturgeon, smalltooth sawfish, and loggerhead sea turtles. Critical habitat for leatherback, green, and hawksbill sea turtles are not within the action area and are not considered below.

### 4.1.1 North Atlantic Right Whales and Their Designated Critical Habitat

North Atlantic right whales occur in Florida coastal waters, overlapping with smalltooth sawfish research activities. Gill netting for smalltooth sawfish could occur in locations that overlap in time and space with North Atlantic right whale calving. Entanglement could occur for both mothers and offspring. In the event entanglement occurred, the worst case scenario could be delayed mortality. However, the probability of overlap is seasonal, number of North Atlantic right whales are minimal, the area affected by netting is very small and in inshore areas and embayments, and therefore the chance of entanglement is extremely unlikely and therefore, discountable. Sawfish research in offshore locations will use longlines. Both research gears will be monitored at all times. Mitigation contained in the proposed permit further reduces any risks this activity may pose to right whales. Therefore, we find the Sawfish Program is not likely to adversely affect North Atlantic right whale. This species will not be discussed further in this opinion.

North Atlantic right whale designated critical habitat exists in Florida state waters and is solely identified to protect calving. The requirements for calving are related to wind, temperature, and depth. No activities proposed during this research would affect these components of designated critical habitat. Therefore, smalltooth sawfish research will have no effect to north Atlantic right whale designated critical habitat.

### 4.1.2 Other Large Whales

Blue, fin, sei, and sperm whales can occur in Florida coastal waters. These species tend to stay offshore and would be a rare and unexpected species in any of the sampling areas for smalltooth sawfish. However, if they were to venture into a sampling location, there is the potential for overlap with sampling gear. Large whales have been documented being entangled in gill nets and other lines for fishing gear. Smalltooth sawfish researchers will be required to tend their gill nets at all time. The possibility of one of these species interacting with smalltooth sawfish research nets is extremely unlikely and therefore discountable. Therefore, we find the Sawfish Program is not likely to adversely affect blue, fin, sei, or sperm whales. These species will not be discussed further in this opinion.

### 4.1.3 Smalltooth Sawfish Designated Critical Habitat

Smalltooth sawfish designated critical habitat is present within the action area. Critical habitat was designated to protect red mangroves and shallow euryhaline habitats. Sampling for smalltooth sawfish will overlap in time and space with these habitats, but the act of deploying research gear, capturing, handling, and studying smalltooth sawfish will not reduce the number of red mangroves or alter the salinity or depth of bays. Because the activities covered by the Sawfish Program will not effect smalltooth sawfish critical habitat, NMFS concludes this research will have no effect to smalltooth sawfish designated critical habitat and it will not be considered further in this opinion.

### 4.1.4 Shortnose Sturgeon

Shortnose sturgeon occasionally range south along the East Coast from North Carolina to Florida in coastal waters, potentially overlapping with smalltooth sawfish research activities. Gill netting for smalltooth sawfish could occur in locations that overlap in time and space with shortnose sturgeon coastal migrations. Entanglement could occur, resulting in capture of shortnose sturgeon. However, the probability of overlap is extremely unlikely as shortnose sturgeon are rare visitors to the state of Florida, sampling for smalltooth sawfish in Georgia and locations north is currently non-existent and not expected to become common, shortnose sturgeon rarely participate in coastal migrations, and mitigation contained in the proposed permit further reduces any risks this activity may pose to shortnose sturgeon. Because the probability of exposure is discountable, NMFS concludes this research is not likely to adversely affect shortnose sturgeon and this species will not be considered further in this opinion.

### 4.1.5 Gulf Sturgeon and Their Designated Critical Habitat

Gulf sturgeon occur regularly in the northern Gulf Coast waters of Florida west to Louisiana, overlapping with smalltooth sawfish research activities. Gill netting for smalltooth sawfish could occur in locations that overlap in time and space with Gulf sturgeon coastal migrations. Entanglement could occur, resulting in capture of Gulf sturgeon. However, the probability of overlap is extremely unlikely as Gulf sturgeon rarely overlap with the primary sampling region, sawfish sampling in secondary and tertiary regions is expected to be rare, and mitigation contained in the proposed permit further reduces any risks smalltooth sawfish research may pose to Gulf sturgeon by limiting the response Gulf sturgeon would experience if captured. Therefore the effects of this action on Gulf sturgeon are both discountable and negligible. This research is not likely to adversely affect Gulf sturgeon and this species will not be considered further in this opinion.

Critical habitat is designated along the Gulf Coast for Gulf sturgeon. The primary constituent elements for Gulf sturgeon critical habitat are related to food, spawning locations, aggregating locations, water quantity, water quality, sediment quality, and migratory pathways. The only habitat element that could be affected by smalltooth sawfish research would be the disruption of migratory pathways, however, the researchers will not set gill nets for more than one hour at a time and no gear will be left behind. This momentary disruption of migratory pathways would have a negligible impact on migratory behavior. Because the probability of exposure is discountable and the impacts to designated critical habitat is insignificant, NMFS concludes this research is not likely to adversely affect Gulf sturgeon designated critical habitat. Therefore Gulf sturgeon designated critical habitat will not be considered further in this opinion.

### 4.1.6 Atlantic Sturgeon and Their Designated Critical Habitat

Atlantic sturgeon occasionally range south along the East Coast of Florida in coastal waters and are more abundant from North Carolina south to the Florida border. Therefore, the probability of smalltooth sawfish research occurring in locations with Atlantic sturgeon is low, the probability of sawfish research occurring in secondary locations is small as is the probability of Atlantic sturgeon presence, and finally the probability of sawfish research in tertiary areas will be rare while Atlantic sturgeon overlap may be common. While five DPSs of Atlantic sturgeon are listed, it is believed that only the Carolina and South Atlantic DPSs of Atlantic sturgeon may overlap with smalltooth sawfish research activities. In the event the Carolina or South Atlantic DPS of Atlantic sturgeon overlaps with research activities, it would be during Atlantic sturgeon coastal migrations. Entanglement could occur, resulting in capture of Atlantic sturgeon. No Atlantic sturgeon has ever been captured during smalltooth sawfish research activities since 2004. Additionally, mitigation contained in the proposed permit further reduces any risks this activity may pose to Atlantic sturgeon. Because the threat of smalltooth sawfish research activities affecting Atlantic sturgeon is negligible, the Sawfish Program is not likely to adversely affect Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, or South Atlantic Atlantic sturgeon DPSs and therefore this species will not be considered further in this opinion.

Atlantic sturgeon critical habitat features protected are salinity with appropriate gradients for all life stages, hard bottom, water quality, and water generally that supports staging and movement of adults, sub-adults, and juveniles. The only feature of proposed Atlantic sturgeon critical habitat that could be affected by smalltooth sawfish research could be a temporary disruption of migratory pathways due to nets. Conditions of each permit will limit each net deployment to not exceed one hour at a time and no gear will be left unattended. It is highly unlikely that nets set for that short of time, would disrupt the migratory pathways or have an impact on migratory behavior. Because the probability of exposure and response are discountable and the impacts to proposed critical habitat are insignificant, NMFS concludes this research is not likely to adversely affect Atlantic sturgeon designated critical habitat, and therefore this critical habitat will not be considered further in this opinion.

### 4.1.7 Nassau Grouper

The Nassau grouper is a large, long-lived, slow growing fish species primarily occupying nearshore waters. Current spawning locations are found in Mexico, Bahamas, Belize, Cayman Islands, the Dominican Republic, Cuba, Puerto Rico and the U.S. Virgin Islands. As illustrated, the Nassau grouper is distributed throughout the Caribbean, south to the northern coast of South America. Current Nassau grouper distribution is considered equivalent to its historical range, although abundance has been severely depleted. However, the probability of overlap is extremely unlikely because Nassau grouper rarely overlap with the sampling region for sawfish research. Critical habitat has not been designated for the Nassau grouper. Because the probability of exposure is discountable and there is no designated critical habitat, NMFS concludes the Sawfish Program is not likely to adversely affect Nassau grouper.

#### 4.1.8 Scalloped Hammerhead Shark

Scalloped hammerheads are found over continental shelves and the shelves surrounding islands, as well as adjacent deep waters, but is seldom found in waters cooler than 22°C (Compagno 1984; Schulze-Haugen and Kohler 2003). They range from the intertidal and surface to depths of up to 450-512 m (Klimley 1993), with occasional dives to even deeper waters (Jorgensen et al. 2009). Scalloped hammerheads have also been documented entering enclosed bays and estuaries (Compagno 1984). Although abundance estimates and quality catch data are unavailable for this DPS, the evidence of heavy fishing pressure on this species off the coast of Brazil, Central America, and the Caribbean, with documented large numbers of juvenile and neonate landings, suggests this DPS is likely approaching a level of abundance and productivity that places its current and future persistence in question (Miller et al. 2014). Critical habitat has not been designated for the scalloped hammerhead shark. As mentioned, in the Caribbean the DPS is listed as threatened under the ESA. However, there is very little probability for interaction with smalltooth sawfish research activity as there is very little overlap between the two species in the action area. Because the probability of exposure is discountable, NMFS concludes smalltooth sawfish research under this program is not likely to adversely affect scalloped hammerhead sharks.

#### 4.1.9 Giant Manta Ray

Giant manta ray is found worldwide in tropical, subtropical, and temperate bodies of water. It is commonly found offshore, in oceanic waters, and near productive coastlines. There are no current or historical estimates but populations potentially range from around 100-1,500 individuals. Giant manta rays have been documented to grow as large as 6.8 meters disc width. In the Northern hemisphere, the species has been documented as far north as southern California and New Jersey (Gudger 1922). Giant manta rays can be found in water as cool as 19°C; off the east coast of the U.S. they are commonly found in waters between 19-22°C (Freedman and Roy 2012). Giant manta rays and smalltooth sawfish target different food sources and, although may congregate in shallow waters, there is no reason to expect these two species would be found together. Because the probability of exposure is discountable, NMFS concludes this research may affect but is not likely to adversely affect giant manta rays.

#### 4.1.10 Northwest Atlantic DPS Loggerhead Sea Turtle Critical Habitat

Northwest Atlantic DPS of loggerhead sea turtles have designated critical habitat in the action area. Critical habitat was designated to protect reproductive, foraging, wintering, breeding, and migratory habitat. Sampling for smalltooth sawfish has the potential to interfere with migratory habitat. Because researchers will not set gill nets for more than one hour and no gear will be left behind, disruption of migratory pathways would be spatially miniscule and temporary such that they would be extremely unlikely to occur. Therefore, NMFS concludes this research is not likely to adversely affect Northwest Atlantic DPS loggerhead sea turtle designated critical habitat. Critical habitat for this species will not be considered further in this opinion.

#### 4.1.11 Elkhorn, Staghorn, and Reef Building Corals and Their Critical Habitat

Elkhorn, staghorn, and reef building corals occur in Florida coastal waters, overlapping with smalltooth sawfish research activities. These species occur in Florida coastal waters and the Caribbean Sea and are located in the Primary and Secondary Zones of sawfish research. Gill netting and other smalltooth sawfish research activities could occur in locations where these corals exist. It is possible anchored gill nets could hit and damage corals. However, the probability of an anchor impacting a coral is discountable due to the rarity of these corals, the locations of sampling, and mitigation contained in the proposed permit further reduces any risks this activity may pose to corals extremely unlikely. Elkhorn and staghorn coral critical habitat exists in Florida state waters. The only aspect of designated critical habitat for these species is substrate of suitable quality and availability necessary for recruitment. Gill nets and anchors should not alter the substrate quality or availability in any way and therefore any potential threats to designated critical habitat are extremely unlikely. Because the probability of exposure is discountable, NMFS concludes this research is not likely to adversely affect elkhorn, staghorn or reef building corals. Additionally, exposure of elkhorn and staghorn coral designated critical habitat is discountable and therefore this action is not likely to adversely affect designated critical habitats of elkhorn and staghorn coral. Therefore these species and their designated critical habitats will not be considered further in this opinion.

#### 4.1.12 Johnsons Sea Grass and Its Designated Critical Habitat

Johnsons sea grass occurs in Florida coastal waters, overlapping with smalltooth sawfish research activities. Gill netting for smalltooth sawfish could occur in locations with Johnson's sea grass. The only means of adverse effects of gill nets on Johnson's sea grass is anchor drag, but in areas where Johnson's sea grass is found, the researcher would be fishing for juvenile smalltooth sawfish using drift gill nets or baited lines. Because of this, the chance of the lead line dragging on the bottom is the only threat and the potential of exposure and response rising to an adverse effect is extremely unlikely. Johnson's sea grass critical habitat exists in Florida state waters, requiring protection of substrate and water where Johnson's sea grass is growing. Smalltooth sawfish research could only affect substrates and as discussed, would cause a discountable disturbance in the event the lead line of a gill net dragged across the substrate. Because the probability of exposure is discountable, NMFS concludes this research is not likely to adversely affect Johnsons sea grass and this species will not be considered further in this opinion. Likewise, any risks to Johnsons sea grass designated critical habitat are negligible and therefore this action is not likely to adversely affect its designated critical habitat. Johnsons sea grass critical habitat will not be considered further in this opinion.

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

This section examined the status of each species that would be affected by the proposed action. The status is determined by the level of risk that the ESA-listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. More detailed information on the status and trends of these ESA-listed species, and their biology and ecology can be found in the listing regulations and critical habitat designations published in the Federal Register, status reviews, recovery plans, and on NMFS' Web site: http://www.nmfs.noaa.gov/pr/species/index.htm.

The species and designated critical habitat that is likely to be adversely affected by the Sawfish Program are: Smalltooth sawfish, loggerhead sea turtles, leatherback sea turtles, hawksbill sea turtles, Kemp's ridley sea turtles, green sea turtles, and olive ridley sea turtles.

### 4.2.1 Smalltooth Sawfish

**Species Description**

Although this species is reported to have a circumtropical distribution, NMFS identified smalltooth sawfish from the Southeast United States as a DPS. Within the United States, smalltooth sawfish have been captured in estuarine and coastal waters from New York southward through Texas, although peninsular Florida has historically been the region of the United States with the largest number of recorded captures (NMFS 2010) (Figures 22-25).

The smalltooth sawfish is a tropical marine and estuarine elasmobranch. Although they are rays, sawfish physically 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 (NMFS 2009a). The United States DPS of smalltooth sawfish was listed as endangered under the ESA effective May 1, 2003.

**Reference Table: Smalltooth Sawfish Portion of Table 3.**

| Species | Common Name | Distinct Population Segments (DPS) | ESA Status | Recent Review Year | Listing | Recovery Plan | Critical Habitat |
|---|---|---|---|---|---|---|---|
| *Pristis pectinata* | Sawfish, smalltooth | US portion of range | Endangered | 2010 | 2003<br>68 FR 15674 | 2009 | 2009<br>74 FR 45 353 |

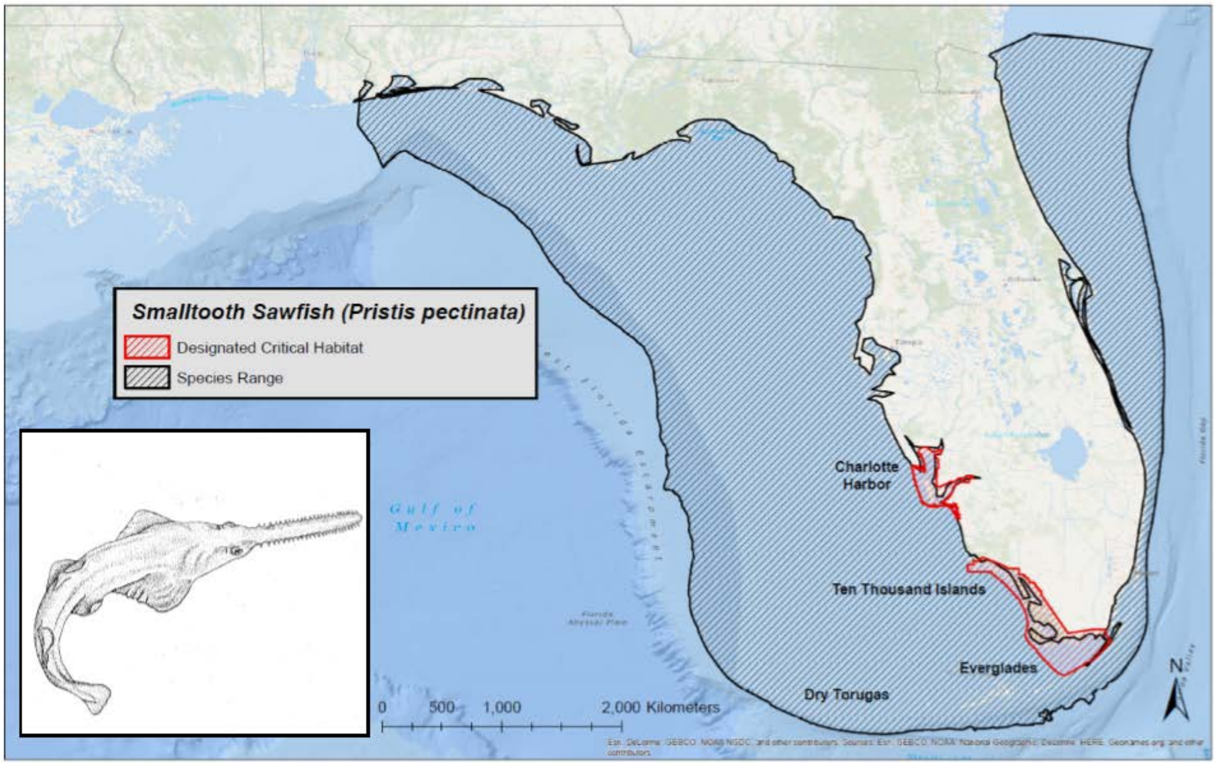


**Figure 25. Smalltooth sawfish range and designated critical habitat.**

## Life History

Smalltooth sawfish size at sexual maturity has been reported as 360 cm total length by Simpfendorfer (2005). Carlson and Simpfendorfer (2015) estimated that sexual maturity for females occurs between 7 and 11 years of age. As in all elasmobranchs, smalltooth sawfish are viviparous; fertilization is internal. The gestation period for smalltooth sawfish is estimated at 5 months based on data from the largetooth sawfish (Thorson 1976). Females move into shallow estuarine and nearshore nursery areas to give birth to live young between November and July, with peak parturition occurring between April and May (Poulakis et al. 2011). Litter sizes range between 10 and 20 individuals (Bigalow and Schroeder 1953, Simpfendorfer 2005, Carlson and Simpfendorfer 2015).

Neonate smalltooth sawfish are born measuring 67 – 81 cm total length and spend the majority of their time in the shallow nearshore edges of sand and mud banks (Poulakis et al. 2011; Simpfendorfer et al. 2010). Once individuals reach 100 – 140 cm total length they begin to expand their foraging range. Capture data suggests smalltooth sawfish in this size class may move throughout rivers and estuaries within a salinity range of 18 and 30 (practical salinity units). Individuals in this size class also appear to have the highest affinity to mangrove habitat (Simpfendorfer et al. 2011). Juvenile sawfish spend the first 2-3 years of their lives in the shallow waters provided in the lower reaches of rivers, estuaries, and coastal bays (Simpfendorfer et al. 2008; Simpfendorfer et al. 2011). As smalltooth sawfish approach 250 cm total length they become less sensitive to salinity changes and begin to move out of the protected shallow-water embayments and into the shorelines of barrier islands (Poulakis et al. 2011). Adult sawfish typically occur in more open-water, marine habitats (Poulakis and Seitz 2004).

**Population Dynamics**

The abundance of smalltooth sawfish in U.S. waters has decreased dramatically over the past century. Efforts are currently underway to provide better estimates of smalltooth sawfish abundance (NMFS 2014a). Current abundance estimates are based on encounter data, genetic sampling, and geographic extent. Carlson and Simpfendorfer (2015) used encounter densities to estimate the adult female population size to be 600. Chapman et al. (2011) analyzed genetic data from tissue samples (fin clips) to estimate the effective population size as 250-350 adults (95 percent confidence interval from 142 to 955). Simpfendorfer (2002) estimated that the U.S. population may number less than five percent of historic levels based on the contraction of the species' range.

The abundance of juveniles encountered in recent studies (Poulakis et al. 2014; Seitz and Poulakis 2002; Simpfendorfer and Wiley 2004) suggests that the smalltooth sawfish population remains reproductively viable. The overall abundance appears to be stable (Wiley and Simpfendorfer 2010). Data analyzed from the Everglades portion of the smalltooth sawfish range suggests that the population growth rate for that region may range from one to five percent per year (Carlson and Osborne 2012; Carlson et al. 2007). Intrinsic rates of growth (λ) for smalltooth sawfish have been estimated at 1.08-1.14 per year and 1.037-1.150 per year by Simpfendorfer (2000) and Carlson and Simpfendorfer (2015), respectively. However, these intrinsic rates are uncertain due to the lack of long-term abundance data.

Chapman et al. (2011) investigated the genetic diversity within the smalltooth sawfish population. The study reported that the remnant population exhibits high genetic diversity (allelic richness, alleles per locus, heterozygosity) and that inbreeding is rare. The study also suggested that the protected population will likely retain > 90 percent of its current genetic diversity over the next century.

Recent capture and encounter data suggests that the current distribution is focused primarily to south and southwest Florida fromCharlotte Harbor through the Dry Tortugas (Poulakis and Seitz 2004; Seitz and Poulakis 2002) (Figure 23). Water temperatures (no lower than 16-18°C) and the availability of appropriate coastal habitat (shallow, euryhaline waters and red mangroves) are the major environmental constraints limiting the distribution of smalltooth sawfish (Bigalow and Schroeder 1953).

**Status**

The decline in the abundance of smalltooth sawfish has been attributed to fishing (primarily commercial and recreational bycatch), habitat modification (including changes to freshwater flow regimes as a result of climate change), and life history characteristics (i.e. slow-growing, relatively late-maturing, and long-lived species) (NMFS 2009a; Simpfendorfer et al. 2011). These factors continue to threaten the smalltooth sawfish population. Recent records indicate there is a resident reproducing population of smalltooth sawfish in south and southwest Florida from Charlotte Harbor through the Dry Tortugas, which is also the last U.S. stronghold for the species (Poulakis and Seitz 2004; Seitz and Poulakis 2002; Simpfendorfer and Wiley 2004). Recent information indicates the smalltooth sawfish population is likely stable or increasing (Carlson and Osborne 2012; Carlson and Simpfendorfer 2015). While the overall abundance appears to be stable, low intrinsic rates of population increase suggest that the species is particularly vulnerable to rapid population declines (NMFS 2010).

Carlson and Simpfendorfer (2015) estimate there are 2,250 females in the population, distributed through all age classes. With an equal ratio of males and females, this would be approximately 4500 individuals in the population. Using published survival rates (Carlson and Simpfendorfer 2015), juvenile abundance may be approximately 2,500 individuals and sub-adult and adult abundance may be approximately 2,000 individuals.

**Designated Critical Habitat**

Critical habitat for smalltooth sawfish was designated in 2009 and includes two major units: Charlotte Harbor (221,459 acres) and Ten Thousand Islands/Everglades (619,013 acres) (Figure 25). These two units include essential sawfish nursery areas. Within the nursery areas, two features were identified as essential to the conservation of the species: red mangroves (*Rhizophora mangle*), and euryhaline habitats with water depths ≤0.9 m.

### 4.2.2 Loggerhead Sea Turtles – Northwest Atlantic DPS

**Species Description**

Loggerhead sea turtles are circumglobal, and are found in the temperate and tropical regions of the Indian, Pacific and Atlantic Oceans (Figure 26).

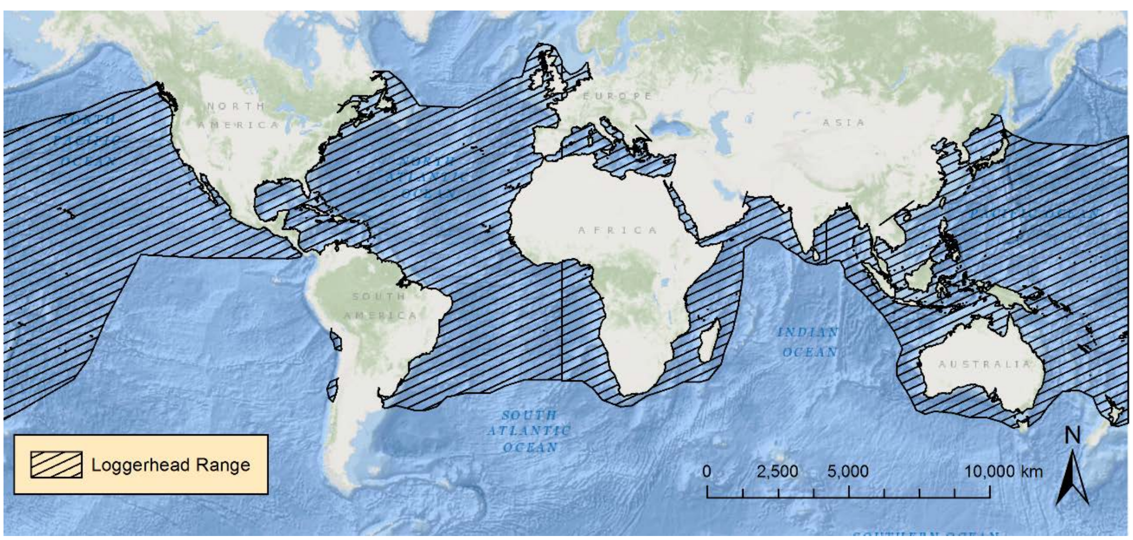


**Figure 26. Map identifying the range of the loggerhead sea turtle.**

The loggerhead sea turtle is distinguished from other turtles by its reddish-brown carapace, large head and powerful jaws. The species was first listed as threatened under the ESA in 1978. On

September 22, 2011, the NMFS designated nine DPSs of loggerhead sea turtles, with the Northwest Atlantic Ocean DPS being found in the action area and listed as threatened.

We used information available in the 2009 Status Review (Conant et al. 2009) and the final listing rule to summarize the life history, population dynamics and status of the species, as follows.

### Life History

Mean age at first reproduction for female loggerhead sea turtles is 30 years. Females lay an average of three clutches per season. The annual average clutch size is 112 eggs per nest. The average remigration interval is 2.7 years. Nesting occurs on beaches, where warm, humid sand temperatures incubate the eggs. Temperature determines the sex of the turtle during the middle of the incubation period. Turtles spend the post-hatchling stage in pelagic waters. The juvenile stage is spent first in the oceanic zone and later in the neritic zone (i.e., coastal waters). Coastal waters provide important foraging habitat, inter-nesting habitat, and migratory habitat for adult loggerheads.

**Reference Table: Loggerhead Sea Turtle Northwest Atlantic Ocean DPS Portion of Table 3.**

| Species | Common Name | Distinct Population Segments (DPS) | ESA Status | Recent Review Year | Listing | Recovery Plan | Critical Habitat |
|---|---|---|---|---|---|---|---|
| *Caretta caretta* | Loggerhead sea turtle | Northwest Atlantic Ocean | Threatened | 2009 | 2011<br>76 FR 58868 | 2009<br>74 FR 2995 | 2014<br>79 FR 39855 |

### Population Dynamics

Using a stage/age demographic model, the adult female population size of the DPS is estimated at 20,000 to 40,000 females, and 53,000 to 92,000 nests annually (NMFS-SEFSC 2009). Based on genetic information, the Northwest Atlantic Ocean DPS is further categorized into five recovery units corresponding to nesting beaches: Northern Recovery Unit; Peninsular Florida Recovery Unit; Dry Tortugas Recovery Unit; Northern Gulf of Mexico Recovery Unit; and the Greater Caribbean Recovery Unit. The Northern Recovery Unit, from North Carolina to northeastern Florida, and is the second largest nesting aggregation in the DPS, with an average of 5,215 nests from 1989 to 2008, and approximately 1,272 nesting females (NMFS and USFWS 2008). The Peninsular Florida Recovery Unit hosts more than 10,000 females nesting annually, which constitutes eighty-seven percent of all nesting effort in the DPS (Ehrhart et al. 2003). The Greater Caribbean Recovery Unit encompasses nesting subpopulations in Mexico to French Guiana, the Bahamas, and the Lesser and Greater Antilles. The majority of nesting for this recovery unit occurs on the Yucatán peninsula, in Quintana Roo, Mexico, with 903 to 2,331 nests annually (Zurita et al. 2003). Other significant nesting sites are found throughout the Caribbean, and including Cuba, with approximately 250 to 300 nests annually (Ehrhart et al. 2003), and over one hundred nests annually in Cay Sal in the Bahamas (NMFS and USFWS 2008). The Dry Tortugas Recovery Unit includes all islands west of Key West, Florida. The only available data for the nesting subpopulation on Key West comes from a census conducted from 1995 to 2004 (excluding 2002), which provided a mean of 246 nests per year, or about sixty nesting females (NMFS and USFWS 2007a). The Gulf of Mexico Recovery Unit has between one hundred to 999 nesting females annually, and a mean of 910 nests per year.

The population growth rate for each of the four of the recovery units for the Northwest Atlantic DPS (Peninsular Florida, Northern, Northern Gulf of Mexico, and Greater Caribbean) all exhibit negative growth rates (Conant et al. 2009). Nest counts taken at index beaches in Peninsular Florida show a significant decline in loggerhead nesting from 1989 to 2006, most likely attributed to mortality of oceanic-stage loggerheads caused by fisheries bycatch (Witherington et al. 2009). Loggerhead nesting on the Archie Carr National Wildlife Refuge (representing individuals of the Peninsular Florida subpopulation) has fluctuated over the past few decades. There was an average of 9,300 nests throughout the 1980s, with the number of nests increasing into the 1990s until it reached an all-time high in 1998, with 17,629 nests. From that point, the number of loggerhead nests at the Refuge have declined steeply to a low of 6,405 in 2007, increasing again to 15,539, still a lower number of nests than in 1998 (Bagley et al. 2013). For the Northern recovery unit, nest counts at loggerhead nesting beaches in North Carolina, South Carolina and Georgia declined at 1.9 percent annually from 1983 to 2005 (NMFS and USFWS 2007a). The nesting subpopulation in the Florida panhandle has exhibited a significant declining trend from 1995 to 2005 (Conant et al. 2009; NMFS and USFWS 2007a). Recent model estimates predict an overall population decline of seventeen percent for the St. Joseph Peninsula, Florida subpopulation of the Northern Gulf of Mexico recovery unit (Lamont et al. 2014).

Based on genetic analysis of nesting subpopulations, the Northwest Atlantic Ocean DPS is further divided into five recovery units: Northern, Peninsular Florida, Dry Tortugas, Northern Gulf of Mexico, and Greater Caribbean (Conant et al. 2009). A more recent analysis using expanded mitochondrial DNA sequences revealed that rookeries from the Gulf and Atlantic coasts of Florida are genetically distinct, and that rookeries from Mexico’s Caribbean coast express high haplotype diversity (Shamblin et al. 2014). Furthermore, the results suggest that the Northwest Atlantic Ocean DPS should be considered as ten management units: (1) South Carolina and Georgia; (2) central eastern Florida; (3) southeastern Florida; (4) Cay Sal, Bahamas; (5) Dry Tortugas, Florida; (6) southwestern Cuba; (7) Quintana Roo, Mexico; (8) southwestern Florida; (9) central western Florida; and (10) northwestern Florida (Shamblin et al. 2012).

Loggerhead hatchlings from the western Atlantic disperse widely, most likely using the Gulf Stream to drift throughout the Atlantic Ocean. Mitochondrial DNA evidence demonstrates that juvenile loggerheads from southern Florida nesting beaches comprise the vast majority (71-88 percent) of individuals found in foraging grounds throughout the western and eastern Atlantic: Nicaragua, Panama, Azores and Madiera, Canary Islands and Adalusia, Gulf of Mexico and Brazil (Masuda 2010).

**Status**

Due to declines in nest counts at index beaches in the United States and Mexico, and continued mortality of juveniles and adults from fishery bycatch, the Northwest Atlantic Ocean DPS is at risk and likely to decline in the foreseeable future (Conant et al. 2009). Bycatch data from the southeastern United States (central North Carolina through central Florida) indicate a possible increase in the abundance of neritic loggerheads in this region over the past one to two decades. However, this increase in catch rates for the southeastern United States was not consistent with the declining trend in nesting seen over the same period. Aerial surveys and one in-water study conducted in the northeastern United States (north of Cape Hatteras, North Carolina) also indicate a decrease in abundance in recent years (TEWG 2009).

**Critical Habitat**

On July 10, 2014, NMFS and U.S. Fish and Wildlife Service designated critical habitat for the Northwest Atlantic Ocean DPS loggerhead sea turtles along the U.S. Atlantic and Gulf of Mexico coasts from North Carolina to Mississippi. These areas contain one or a combination of nearshore reproductive habitat, winter area, breeding areas, and migratory corridors. See Section 4.1 for a more detailed discussion of loggerhead critical habitat within the action area.

### 4.2.3 Leatherback Sea Turtles

**Species Description**

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 (Figure 27). Leatherbacks are the largest living turtle, reaching lengths of six feet long, and weighing up to one ton. Leatherback sea turtles have a distinct black leathery skin covering their carapace with pinkish white skin on their belly. The species was first listed under the Endangered Species Conservation Act and listed as endangered under the ESA since 1973.

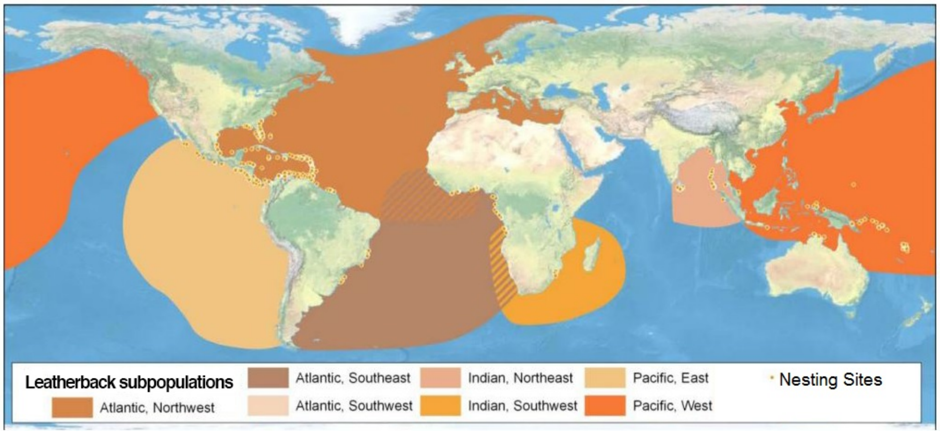


**Figure 27. Map identifying the range of the endangered leatherback sea turtle. Adapted from (Wallace et al. 2013).**

We used information available in the five-year review (NMFS 2013a) and the critical habitat designation to summarize the life history, population dynamics and status of the species, as follows.

**Reference Table: Leatherback Sea Turtle Portion of Table 3.**

| Species | Common Name | Distinct Population Segments (DPS) | ESA Status | Recent Review Year | Listing | Recovery Plan | Critical Habitat |
|---|---|---|---|---|---|---|---|
| *Dermochelys coriacea* | Leatherback sea turtle | None Designated | Endan-gered range wide | 2013 | 1970<br>35 FR 8491 | 1992<br>63 FR 28359 | 1979 and 2012<br>44 FR 17710 and 77 FR 4170 |

## Life History

Age at maturity has been difficult to ascertain, with estimates ranging from 5 to 29 years (Avens et al. 2009; Spotila et al. 1996). Females lay up to seven clutches per season, with more than 65 eggs per clutch and eggs weighing greater than 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) is approximately fifty percent worldwide (Eckert et al. 2012). Females nest every one to seven 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 about 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. Therefore, their remigration intervals (the time between nesting) are dependent upon foraging success and duration (Hays 2000; Price et al. 2004).

**Population Dynamics**

Leatherbacks are globally distributed, with nesting beaches in the Pacific, Atlantic, and Indian oceans. Detailed population structure is unknown, but is likely dependent upon nesting beach location. Based on estimates calculated from nest count data, there are between 34,000 and 94,000 adult leatherbacks in the North Atlantic (TEWG 2007). In contrast, leatherback populations in the Pacific are much lower. Overall, Pacific populations have declined from an estimated 81,000 individuals to less than 3,000 total adults and subadults (Spotila et al. 2000). Population abundance in the Indian Ocean is difficult to assess due to lack of data and inconsistent reporting. Available data from southern Mozambique show that approximately ten females nest per year from 1994 to 2004, and about 296 nests per year counted in South Africa (NMFS 2013a).

Population growth rates for leatherback sea turtles vary by ocean basin. Counts of leatherbacks at nesting beaches in the western Pacific indicate that the subpopulation has been declining at a rate of almost six percent per year since 1984 (Tapilatu et al. 2013). Leatherback subpopulations in the Atlantic Ocean, however, are showing signs of improvement. Nesting females in South Africa are increasing at an annual rate of four to 5.6 percent, and from nine to thirteen percent in Florida and the U.S. Virgin Islands (TEWG 2007), believed to be a result of conservation efforts.

Analyses of mitochondrial DNA from leatherback sea turtles indicates a low level of genetic diversity, pointing to possible difficulties in the future if current population declines continue (Dutton et al. 1999). Further analysis of samples taken from individuals from rookeries in the Atlantic and Indian oceans suggest that each of the rookeries represent demographically independent populations (NMFS 2013a).

Leatherback sea turtles are distributed in oceans throughout the world (Figure 27). Leatherbacks occur throughout marine waters, from nearshore habitats to oceanic environments (Shoop and Kenney 1992). Movements are largely dependent upon reproductive and feeding cycles and the oceanographic features that concentrate prey, such as frontal systems, eddy features, current boundaries, and coastal retention areas (Benson et al. 2011).

**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. Because 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, due to sea-level rise. The species' resilience to additional perturbation is low.

The population in the Caribbean appears to be stable; however, information regarding the status of the entire leatherback population in the Atlantic is lacking and it is certain that some nesting populations (e.g., St. John and St. Thomas, U.S. Virgin Islands) have been extirpated (NMFS and USFWS 2007b).

**Critical Habitat**

On March 23, 1979, leatherback critical habitat was identified adjacent to Sandy Point, St. Croix, Virgin Islands from the 183 meter isobath to mean high tide level between 17° 42'12" N and 65°50'00" W. 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.

On January 20, 2012, NMFS issued a final rule to designate additional critical habitat for the leatherback sea turtle. 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 meter depth contour.

There is no overlap between the action area for this biological opinion and leatherback sea turtle designated critical habitat.

### 4.2.4 Hawksbill Sea Turtles

**Species Description**

The hawksbill turtle has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical oceans (Figure 28). The hawksbill sea turtle has a sharp, curved, beak-like mouth and a "tortoiseshell" pattern on its carapace, with radiating streaks of brown, black, and amber. The species was first listed under the Endangered Species Conservation Act and listed as endangered under the ESA since 1973.

We used information available in the five year reviews (NMFS 2013b; NMFS and USFWS 2007c) to summarize the life history, population dynamics and status of the species, as follows.

**Life History**

Hawksbill sea turtles reach sexual maturity at 20 to 40 years of age. Females return to their natal beaches every two to five years to nest and nest an average of three to five 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 20 two to 25 centimeters in straight carapace length.

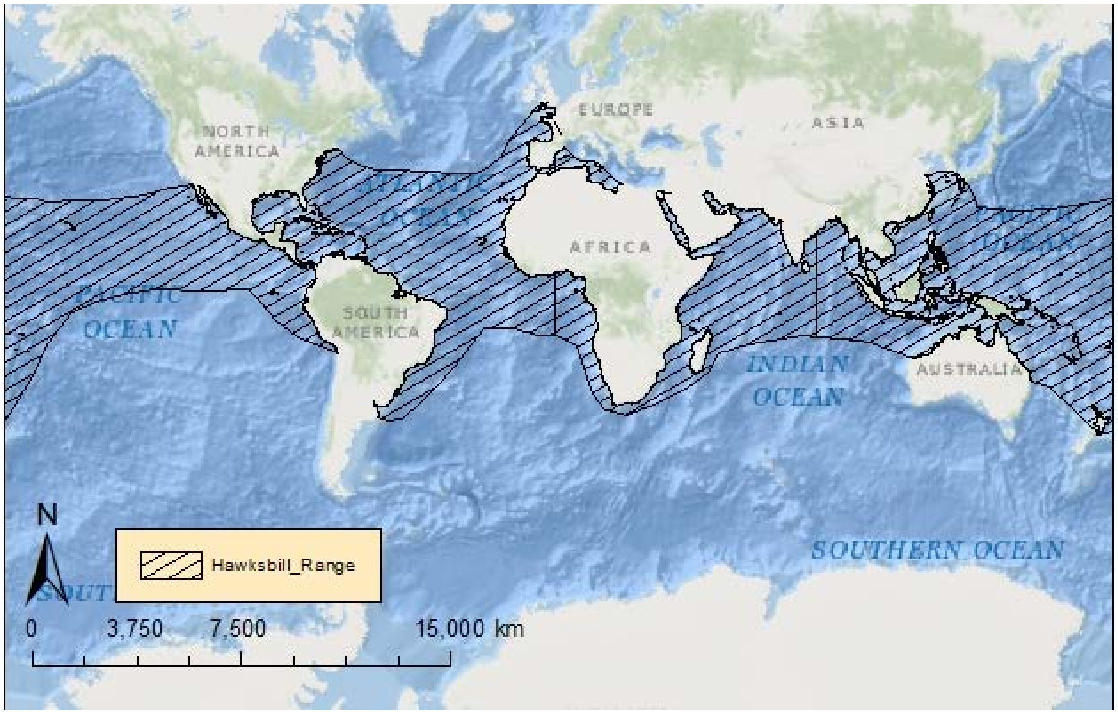


**Figure 28. Map identifying the range of the endangered hawksbill turtle.**

Juvenile hawksbills take up residency in coastal waters to forage and grow. Adults use their sharp, beak-like mouths to feed on sponges and corals. Hawksbill sea turtles are highly migratory and use a wide range of habitats during their lifetimes (Musick and Limpus 1997; Plotkin 2003). Satellite tagged turtles have shown significant variation in movement and migration patterns. Distance traveled between nesting and foraging locations ranges from a few hundred to a few thousand kilometers (Horrocks et al. 2001; Miller et al. 1998).

**Reference Table: Hawksbill Sea Turtle Portion of Table 3.**

| Species | Common Name | Distinct Population Segments (DPS) | ESA Status | Recent Review Year | Listing | Recovery Plan | Critical Habitat |
|---|---|---|---|---|---|---|---|
| *Eretmochelys imbricata* | Hawksbill turtle | None designated | Endangered range wide | 2013 | 1970<br>35 FR 8491 | 1992<br>57 FR 38818 | 1998<br>63 FR 46693 |

### Population Dynamics

Surveys at 88 nesting sites worldwide indicate that 22,004 to 29,035 females nest annually (NMFS 2013b). 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. From 1980 to 2003, the number of nests at three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased 15 percent annually (Heppell et al. 2005); however, due to recent declines in nest counts, decreased survival at other life stages, and updated population modeling, this rate is not expected to continue (NMFS 2013b).

Populations are distinguished generally by ocean basin and more specifically by nesting location. Our understanding of population structure is relatively poor. Genetic analysis of hawksbill sea turtles foraging off the Cape Verde Islands identified three closely-related haplotypes in a large majority of individuals sampled that did not match those of any known nesting population in the western Atlantic, where the vast majority of nesting has been documented (McClellan et al. 2010; Monzon-Arguello et al. 2010). Hawksbills in the Caribbean seem to have dispersed into separate populations (rookeries) after a bottleneck roughly 100,000 to 300,000 years ago (Leroux et al. 2012).

The hawksbill has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical waters of the Atlantic, Indian, and Pacific Oceans. In their oceanic phase, juvenile hawksbills can be found in *Sargassum* mats; post-oceanic hawksbills may occupy a range of habitats that include coral reefs or other hard-bottom habitats, seagrass, algal beds, mangrove bays and creeks (Bjorndal and Bolten 2010; Musick and Limpus 1997).

### 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. Regarding regional trends, nesting populations in the Atlantic (especially in the Insular Caribbean and Western Caribbean Mainland) are generally doing better than those in the Indo-Pacific regions (e.g., 9 of the 10 sites showing recent increases were all located in the Caribbean). Surveys of Mona Island, Puerto Rico, nesting beaches indicate an increasing population trend spanning the past three decades. 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 one hundred 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. 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.

There is no overlap between the action area for this biological opinion and hawksbill turtle designated critical habitat.

### 4.2.5 Kemp's Ridley Sea Turtles

## Species Description

The Kemp's ridley turtle is considered the most endangered sea turtle, internationally (Groombridge 1982; Zwinenberg 1977). Its range extends from the Gulf of Mexico to the Atlantic coast, with nesting beaches limited to a few sites in Mexico and Texas (Figure 29).

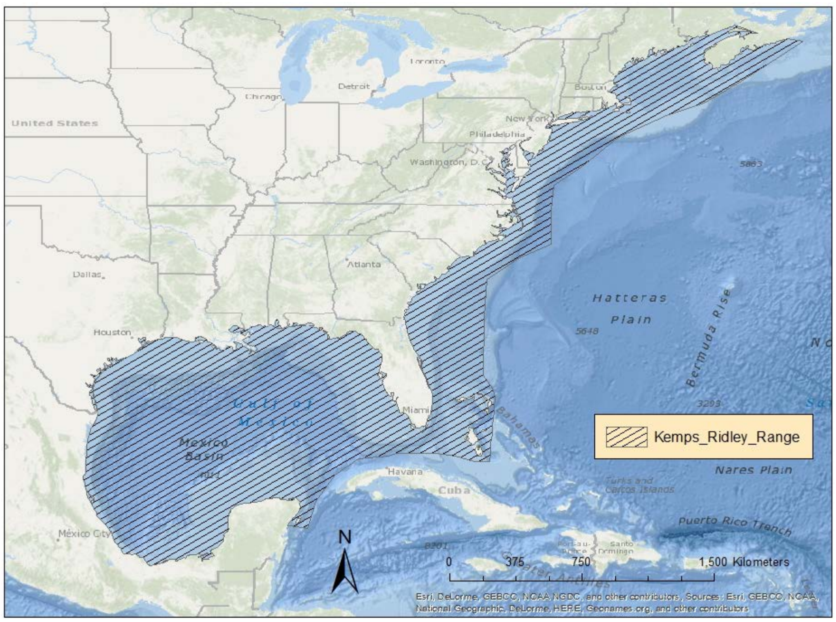


**Figure 29. Map identifying the range of the endangered Kemp's ridley sea turtle.**

Kemp's ridley sea turtles the smallest of all sea turtle species, with a nearly circular top shell and a pale yellowish bottom shell. The species was first listed under the Endangered Species Conservation Act and listed as endangered under the ESA since 1973.

**Reference Table: Kemp's Ridley Sea Turtle Portion of Table 3.**

| Species | Common Name | Distinct Population Segments (DPS) | ESA Status | Recent Review Year | Listing | Recovery Plan | Critical Habitat |
|---|---|---|---|---|---|---|---|
| *Lepidochelys kempii* | Kemp's ridley turtle | None Designated | Endangered range wide | 2015 | 1970<br>35 FR 18319 | 2010<br>75 FR 12496 | None Designated |

We used information available in the revised recovery plan (NMFS and USFWS 2011) and the Five-Year Review (NMFS and USWFS 2015) to summarize the life history, population dynamics and status of the species, as follows.

### Life History

Females mature at 12 years of age. The average remigration is two 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 to 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 two 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 temperatures drop. Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 feet (37 m) deep, although they can also be found in deeper offshore waters. Adult Kemp's ridleys forage on swimming crabs, fish, jellyfish, mollusks, and tunicates (NMFS and USFWS 2011).

### Population Dynamics

Of the sea turtles species 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. In 2014, there were an estimated 10,987 nests and 519,000 hatchlings released from three primary nesting beaches in Mexico (NMFS and USWFS 2015). The number of nests in Padre Island, Texas has increased over the past two decades, with one nest observed in 1985, four in 1995, 50 in 2005, 197 in 2009, and 119 in 2014 (NMFS and USWFS 2015).

From 1980 to 2003, the number of nests at three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased 15 percent annually (Heppell et al. 2005); however, due to recent declines in nest counts, decreased survival at other life stages, and updated population modeling, this rate is not expected to continue (NMFS and USWFS 2015).

Genetic variability in Kemp's ridley turtles is considered to be high, as measured by heterozygosis at microsatellite loci (NMFS and USFWS 2011). Additional analysis of the mitochondrial DNA taken from samples of Kemp's ridley turtles at Padre Island, Texas, showed six distinct haplotypes, with one found at both Padre Island and Rancho Nuevo (Dutton et al. 2006).

The Kemp's ridley occurs from the Gulf of Mexico and along the Atlantic coast of the U.S. (TEWG 2000). The vast majority of individuals stem from breeding beaches at Rancho Nuevo on the Gulf of Mexico coast of Mexico. During spring and summer, juvenile Kemp's ridleys occur in the shallow coastal waters of the northern Gulf of Mexico from south Texas to north Florida. In the fall, most Kemp's ridleys migrate to deeper or more southern, warmer waters and remain there through the winter (Schmid 1998). As adults, many turtles remain in the Gulf of Mexico, with only occasional occurrence in the Atlantic Ocean (NMFS et al. 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.

### 4.2.6 Green Sea Turtles – North Atlantic DPS

**Species description**

The green sea turtle is globally distributed and commonly inhabits nearshore and inshore waters. Green turtles from the North Atlantic DPS range from the boundary of South and Central America (7.5°N, 77°W) in the south, throughout the Caribbean, the Gulf of Mexico, and the U.S. Atlantic coast to New Brunswick, Canada (48°N, 77°W) in the north (Figure 30). The range of the DPS then extends due east along latitudes 48°N and 19°N to the western coasts of Europe and Africa. The green sea turtle is the largest of the hardshell marine turtles, growing to a weight of 350 lbs. (159 kgs) and a straight carapace length of greater than 3.3 feet (1 meter).

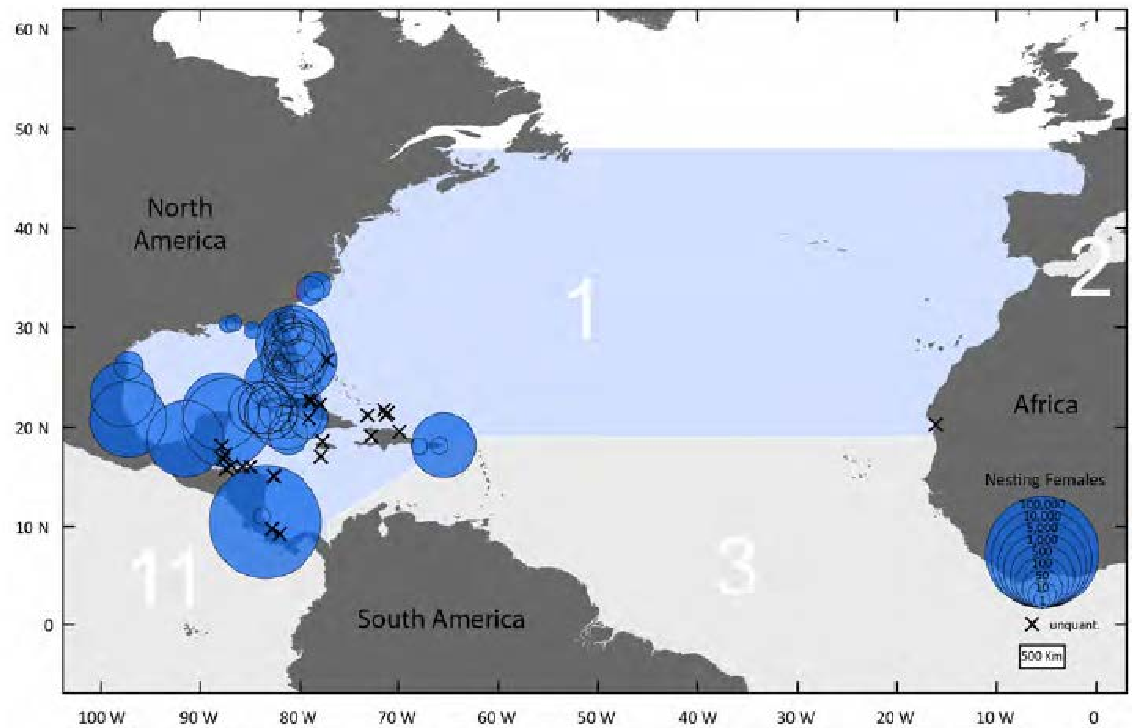


**Figure 30. Geographic range of the green sea turtle North Atlantic DPS, with location and abundance of nesting females. From (Seminoff et al. 2015).**

The species was listed under the ESA on July 28, 1978. 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 April 6, 2016, NMFS listed 11 DPSs of green sea turtles as threatened or endangered under the ESA. The North Atlantic DPS is listed as threatened. We used information available in the 2007 Five-Year Review (USFWS 2007) and 2015 Status Review (Seminoff et al. 2015) to summarize the life history, population dynamics and status of the species, as follows.

**Reference Table: Green Sea Turtle Portion of Table 3.**

| Species | Common Name | Distinct Population Segment | ESA Status | Recent Review Year | Listing | Recovery Plan | Critical Habitat |
|---|---|---|---|---|---|---|---|
| *Chelonia mydas* | Green Turtle | North Atlantic (4 sub-populations) | Threatened | 2015 | 81 FR 20057 | 62 FR 28359 | 63 FR 46693 |

**Life history**

Age at first reproduction for females is twenty to forty years. Green sea turtles 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 two to five 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.

**Population dynamics**

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

Worldwide, nesting data at 464 sites indicate that 563,826 to 564,464 females nest each year (Seminoff et al. 2015). Compared to other DPSs, the North Atlantic DPS exhibits the highest nester abundance, with approximately 167,424 females at seventy-three nesting sites, and available data indicate an increasing trend in nesting. The largest nesting site in the North Atlantic DPS is in Tortuguero, Costa Rica, which hosts seventy-nine percent of nesting females for the DPS (Seminoff et al. 2015).

For the North Atlantic DPS, the available data indicate an increasing trend in nesting. There are no reliable estimates of population growth rate for the DPS as a whole, but estimates have been developed at a localized level. Modeling by Chaloupka et al. (2008) using data sets of twenty-five years or more show the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9 percent, and the Tortuguero, Costa Rica, population growing at 4.9 percent.

The North Atlantic DPS has a globally unique haplotype, which was a factor in defining the discreteness of the population for the DPS. Evidence from mitochondrial DNA studies indicates that there are at least four independent nesting subpopulations in Florida, Cuba, Mexico and Costa Rica (Seminoff et al. 2015). More recent genetic analysis indicates that designating a new western Gulf of Mexico management unit might be appropriate (Shamblin et al. 2016).

**Status**

Historically, green turtles in the North Atlantic DPS were hunted for food, which was the principle cause of the population's decline. Apparent increases in nester abundance for the North

Atlantic DPS in recent years are encouraging but must be viewed cautiously, as the datasets represent a fraction of a green sea turtle generation, up to fifty years. While the threats of pollution, habitat loss through coastal development, beachfront lighting, and fisheries bycatch continue, the North Atlantic DPS appears to be somewhat resilient to future perturbations.

The estimated total green turtle nesting female abundance for Florida is 8,426 turtles (Seminoff et al. 2015). A Population Viability Analysis was conducted for the Florida population based on an index of adult female nesters from 1989 to 2012. Nesting beach monitoring data and the Population Viability Analysis indicate that there is a 0.3 percent probability that this population will fall below the trend reference point (50 percent decline) at the end of 100 years, and a 0 percent probability that this population will fall below the absolute abundance reference (100 females per year) at the end of 100 years (Seminoff et al. 2015).

**Critical Habitat**

On September 2, 1998, NMFS designated critical habitat for green sea turtles, 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.

There is no overlap between the action area for this biological opinion and green turtle designated critical habitat.

### 4.2.7 Olive Ridley Sea Turtles

**Species Description**

The olive ridley sea turtle is a small, mainly pelagic, sea turtle with a circumtropical distribution (Figure 31). It is found in tropical and subtropical waters of the Atlantic, Pacific and Indian Oceans. The range of the endangered Pacific coast breeding population extends as far south as Peru and up to California.

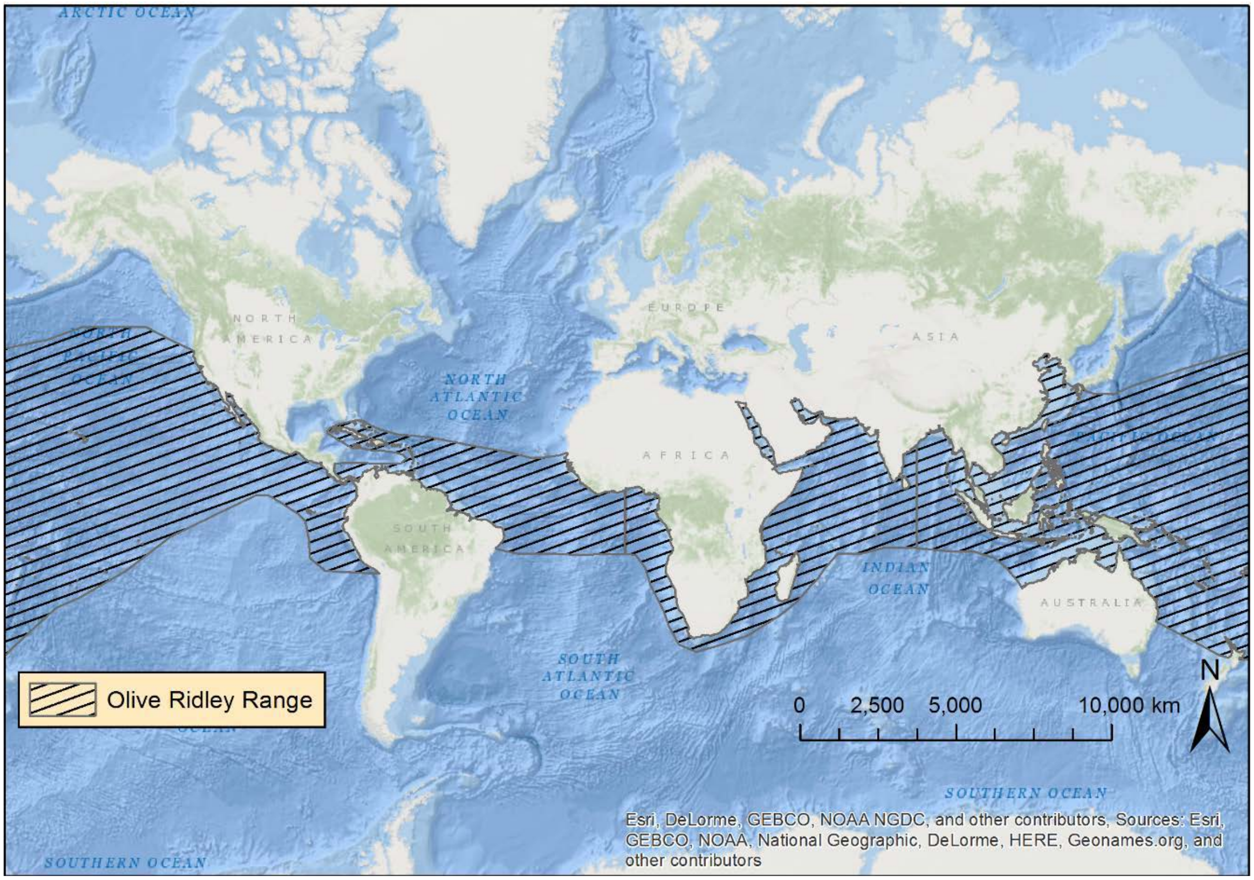

Figure 31. Map identifying the range of the olive ridley sea turtle.

Olive ridley sea turtles are olive or grayish-green in color, with a heart-shaped carapace (Figure 32).

Figure 32. Olive ridley sea turtle. Photo: Reuven Walder.

The species was listed under the ESA on July 28, 1978. The species was separated into two listing designations: endangered for breeding populations on the Pacific coast of Mexico, and threatened wherever found except where listed as endangered (i.e., in all other areas throughout its range).

**Reference Table: Olive ridley sea turtle portion of Table 3**

| Species | Common Name | Distinct Population Segments (DPS) | ESA Status | Recent Review Year | Listing | Recovery Plan | Critical Habitat |
|---|---|---|---|---|---|---|---|
| *Lepidochelys olivacea* | Olive ridley sea turtle | None designated | Threatened outside of Mexico | 2014 | 1978<br>43 FR 32800 | None | None designated |

## Life History

Olive ridley females mature at ten to eighteen years of age. They lay an average of two clutches per season (three to six months in duration). The annual average clutch size is 100 to 110 eggs per nest. Olive ridleys commonly nest in successive years. Females nest solitarily or in arribadas, large aggregations coming ashore at the same time and location. As adults, olive ridleys forage on crustaceans, fish, mollusks, and tunicates, primarily in pelagic habitats.

## Population Dynamics

Olive ridley sea turtles are thought to be the most abundant species of sea turtle, and can be found in the Atlantic, Indian and Pacific Oceans. There is no global estimate of olive ridley abundance, and we rely on nest counts and nesting females to estimate abundance in each of the ocean basins, described below. However, Eguchi et al. (2007) estimated a weighted average of the yearly abundance estimates as 1.39 million (confidence interval: 1.15 to 1.62 million).

In the Western Atlantic, a small portion of the threatened population, two arribada nesting beaches occur in Suriname and French Guiana. The Cayenne Peninsula in French Guiana hosts about 2,000 nests annually, while the Galibi Nature Reserve in Suriname had 335 nests in 1995. Solitary nesting also occurs elsewhere in Suriname, Guyana and French Guiana, although no abundance estimates are available. In Sergipe, Brazil, solitary nesting amounted to about 2,600 nests in 2002 and 2003.

Nesting at arribada beaches in French Guiana appears to be increasing, while in Suriname, nesting has declined by more than ninety percent since 1968. Solitary nesting also occurs elsewhere in Suriname, Guyana and French Guiana; no trend data are available. Solitary nesting in Brazil appears to be increasing, with one hundred nests recorded in 1989 to 1990, to 2,606 in 2002 to 2003. Low levels of genetic diversity among Atlantic French New Guinea nesting sites are attributed to a population collapse caused by past overharvest (NMFS and USFWS 2014).

## Status

It is likely that solitary nesting locations once hosted large arribadas; since the 1960s, populations have experienced declines in abundance of fifty to eighty percent. Many populations continue to decline. Olive ridley sea turtles continue to be harvested as eggs and adults, legally in some areas, and illegally in others. Incidental capture in fisheries is also a major threat. The olive ridley sea turtle is the most abundant sea turtle in the world; however, several populations are declining as a result of continued harvest and fisheries bycatch. The large population size of the range-wide population, however, allows some resilience to future perturbation.

**Designated Critical Habitat**

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

# 5. ENVIRONMENTAL BASELINE

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

## 5.1 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). Mangrove and reef habitat is present along the Gulf Coast and the Florida Atlantic Coast. Wetlands and estuaries are critical for sawfish in the entire action area and are affected by agriculture, coastal and urban development, dredging, fisheries, and scientific research.

### 5.1.1 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).

In recent years, large red tides in the spring and summer associated with water releases from sugar production have caused large fish kills along the Atlantic Coast. These red tides are responsible for massive fish, sea turtle, invertebrate, and marine mammal death (Gilbert 2007, Martin et al. 2017, Lapointe et al. 2018). While red tides have historically affected Florida beaches (Slobodkin 1952), the predictable nature of the red tides affecting eastern Florida suggest these may be annual events now responsible for large mortality events of listed and non-listed species.

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, remove nearshore habitat structure, and lead to beach erosion which reduces nesting, rearing, and feeding habitat for smalltooth sawfish and sea turtles.

### 5.1.2 Coastal and Urban Development

The population in the Southeast increased at approximately 25.7 percent between 1980 and 1990, primarily along the coast (Chambers 1992, Cordell and Macie 2002). Threats from development include loss of wetlands, loss of beaches, increased night lighting, 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 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 hectares 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 percent 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. This can kill sea turtle eggs and destroy nesting habitat. 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).

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. Mangrove habitats are essential for neonate and juvenile smalltooth sawfish.

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. For sea turtles, nest failures and loss of nesting sites may be one of the primary risks impeding recovery. Juvenile sawfish and sea turtles are particularly likely to be affected by nearshore habitat losses or alternations, due to their reliance on these locations. 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.

## 5.2 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). Dredging poses direct and indirect risks to smalltooth sawfish and sea turtles.

Both species may be killed or injured during dredge operations. While sea turtles are more abundant and therefore more likely to be killed during dredge activity, neonate and juvenile smalltooth sawfish often rely on off-channel habitats adjacent to locations of dredging and are therefore at risk of being crushed during dredge operations in the future.

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).

## 5.3 Fisheries Bycatch

Bycatch occurs when fisheries interact with living marine resources (e.g., marine mammals, sea turtles, non-market fish species, corals, or seabirds) that are not the target species for commercial sale. Bycatch represents a global threat to many ESA-listed species. Populations of marine megafauna (e.g., turtles, dolphins, sharks) can be particularly sensitive to the detrimental effects of bycatch due to life history parameters such as slow growth, late age at maturity, and low reproductive rates (Hall et al. 2017). Highly migratory, transboundary species that spend large amounts of time in ocean jurisdictions lacking adequate bycatch mitigation measures, monitoring or enforcement are often most vulnerable to this threat. Therefore, smalltooth sawfish and sea turtles are vulnerable to bycatch.

### 5.3.1 Smalltooth Sawfish Bycatch

Bycatch mortality is cited as the primary cause for the decline in smalltooth sawfish in the United States (NMFS 2010). While some have targeted sawfish for their saws, 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 one 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[2]."

Smalltooth sawfish are still occasionally documented in shrimp trawls in Florida. Smalltooth sawfish are also occasionally captured in various Federal shark fisheries using drift gillnet and bottom longline. Based on mandatory observers placed on two percent 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 2012, NMFS relied on studies from Seitz and Poulakis (2002), Poulakis and Seitz (2004), Simpfendorfer and Wiley (2004) to anticipate 32 smalltooth sawfish to be captured in the shark fishery over the next three years with 7 mortalities during that time. NMFS anticipates a total of 288 smalltooth sawfish (over three-year aggregates) to be captured by the southeastern shrimp fishery, with no more than 105 lethal takes approved. In total, NMFS anticipates 340 captured sawfish and 112 mortalities every three years as a result of bycatch (Table 4).

**Table 4. Anticipated take in federal fisheries of smalltooth sawfish.**

| Federal Fishery | 3-Year Intervals of Incidental Take of Smalltooth Sawfish | |
|---|---|---|
| | Lethal | Non-Lethal |
| Atlantic HMS-Shark Fishery | 7 | 25 |
| Coastal Migratory Pelagics | 0 | 2 |
| Gulf of Mexico/South Atlantic Spiny Lobster Fishery | 0 | 2 |
| Gulf of Mexico Reef Fish | 0 | 8 |
| South Atlantic Snapper-Grouper | 0 | 8 |
| Southeastern U.S. Shrimp Fishery | 105 | 183 |

### 5.3.2 Sea Turtle Bycatch

Bycatch of ESA-listed sea turtles occurs in a diversity of fisheries throughout the broad geographic oceanic ranges of these species. Sea turtle bycatch occurs in both large-scale

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

commercial fishing operations as well as small-scale, artisanal fisheries throughout the world. The southeastern U.S. comprises one of the largest aggregate nesting rookeries for loggerhead sea turtles in the world, and the continental shelf provides critical ontogenetic habitats for this population. Thus, because a large number of individuals are present throughout areas of high fishing activity, loggerheads interact with a greater number of fishing fleets and gear types in the Atlantic than other sea turtle species (Moore et al. 2009).

Fishing gears that are known to interact with sea turtles include trawls, longlines, purse seines, gillnets, pound nets, dredges and to a lesser extent, pots and traps (Finkbeiner et al. 2011, Lewison et al. 2013). Sea turtle bycatch rates (i.e., individuals captured per unit of fishing effort) and mortality rates (i.e., individuals killed per number captured) can vary widely both within and across particular fisheries due to a combination of factors. These include gear types and gear configurations, fishing methods (e.g., depth fished, soak times), fishing locations, fishing seasons, time fished (i.e., day versus night), and turtle handling and release techniques used (Lewison et al. 2013, Wallace et al. 2010).

In 2010, the Gulf of Mexico shrimp trawl fishery had an estimated bycatch mortality of 5,166 turtles (18 leatherback, 778 loggerhead, 486 green and 3,884 Kemp's ridley). By comparison, the southeast Atlantic fishery had an estimated bycatch mortality of 1,033 turtles (eight leatherback, 673 loggerhead, 28 green and 324 Kemp's ridley) in 2010 (NMFS 2014b). The federal shark fishery likely captures 19 green, six hawksbill, 12 Kemp's ridley, six leatherback, and 42 loggerhead sea turtles annually on average (NMFS 2012a). The scallop dredges likely kill up to two green, three Kemp's ridley, two leatherback, and no more than 101 loggerhead sea turtles each year on average (NMFS 2012b). Coastal migratory fisheries capture 31 green, one hawksbill, eight Kemp's ridley, one leatherback, and 27 loggerhead sea turtles (NMFS 2015). The grouper fishery captures 39 green, four hawksbill, 19 Kemp's ridley, 25 leatherback, and 202 loggerhead sea turtles each year (NMFS 2006). The reef fisheries capture 116 green, nine hawksbill, 108 Kemp's ridley, 11 leatherback, and 1,044 loggerhead sea turtles each year (NMFS 2011). The spiny lobster fishery may catch a single sea turtle of any species (NMFS 2009b). The stone crab fishery captures four green, one hawksbill, three Kemp's ridley, one leatherback, and 16 loggerhead sea turtles each year (NMFS 2009b). State fisheries in Virginia and North Carolina capture 168 green, 152 Kemp's ridley, two leatherback, and 507 loggerhead sea turtles each year. Gillnet and trawl fisheries that don't target shrimp capture up to 2,365 loggerhead sea turtles. These same fisheries authorize observed takes of seven green, seven Kemp's ridley, and 12 leatherback sea turtles, of which, actual numbers captured may be much higher (NMFS 2013c). Total anticipated bycatch from all combined fisheries affecting sea turtle species that nest or aggregate around Florida, the Gulf Coast, or southeastern Atlantic Coast are 910 green, 21 hawksbill, 4,368 Kemp's ridley, 86 leatherback, and 5,755 loggerhead sea turtles each year (Table 5).

**Table 5. Sea Turtle captures anticipated through ESA section 7 consultation.**

| Fishery | Green Sea Turtle | Hawksbill Sea Turtle | Kemp's Ridley Sea Turtle | Leatherback Sea Turtle | Loggerhead Sea Turtle |
|---|---|---|---|---|---|
| GOM shrimp trawl | 486 | 0 | 3,884 | 18 | 778 |
| Atlantic shrimp trawl | 38 | 0 | 324 | 8 | 673 |
| Shark | 19 | 6 | 12 | 6 | 42 |
| Scallop | 2 | 0 | 3 | 2 | 101 |
| Coastal Migratory | 31 | 1 | 8 | 1 | 27 |
| Grouper | 39 | 4 | 19 | 25 | 202 |
| Reef fish | 116 | 9 | 108 | 11 | 1,044 |
| Stone Crab | 4 | 1 | 3 | 1 | 16 |
| Federal gillnet and trawl | 7 | 0 | 7 | 12 | 2,365 |
| State | 168 | 0 | 152 | 2 | 507 |

## 5.4 Research

NMFS authorizes research for sea turtles and smalltooth sawfish. There are currently three smalltooth sawfish research permits. Based on applications received and permit deadlines, two smalltooth sawfish permits will expire and three have been requested, so there will likely be four smalltooth sawfish research permits in use in 2019. Captures of smalltooth sawfish are predominantly of juveniles in estuarine areas. In the past five years, approximately 100 smalltooth sawfish juveniles and neonates have been captured each year and fewer than 25 adults are captured in any given year. Only one smalltooth sawfish has been killed during capture or research since the species was listed and that was the result of a shark attack while entangled in a gill net.

There are currently 41 sea turtle research permits issued. On average, 988 sea turtles are captured for research each year. Table 6 shows authorized and reported sea turtle mortalities associated with currently active research permits.

**Table 6. Authorized and reported mortality under currently issued sea turtle research permits.**

| Species | Authorized mortality | Reported Mortality |
|---|---|---|
| Green | 6 | 2 |
| Hawksbill | 3 | 0 |
| Kemp's ridley | 6 | 2 |
| Leatherback | 4 | 0 |
| Loggerhead | 13 | 1 |
| Olive ridley | 2 | 0 |
| Unidentified/Any species | 9 | 0 |
| Total | 43 | 5 |

## 5.5 Climate Change

There is a large and growing body of literature on past, present, and future impacts of global climate change, exacerbated and accelerated by human activities. Effects of climate change include sea level rise, increased frequency and magnitude of severe weather events, changes in air and water temperatures, and changes in precipitation patterns, all of which are likely to impact ESA resources. NOAA's climate information portal provides basic background information on these and other measured or anticipated climate change effects (see https://www.climate.gov).

In order to evaluate the implications of different climate outcomes and associated impacts throughout the 21st century, many factors have to be considered. The amount of future greenhouse gas emissions is a key variable. Developments in technology, changes in energy generation and land use, global and regional economic circumstances, and population growth must also be considered.

A set of four scenarios was developed by the Intergovernmental Panel on Climate Change (IPCC) to ensure that starting conditions, historical data, and projections are employed consistently across the various branches of climate science. The scenarios are referred to as representative concentration pathways (RCPs), which capture a range of potential greenhouse gas emissions pathways and associated atmospheric concentration levels through 2100 (IPCC 2014). The RCP scenarios drive climate model projections for temperature, precipitation, sea level, and other variables: RCP 2.6 is a stringent mitigation scenario; RCP 2.5 and RCP 6.0 are intermediate scenarios; and RCP 8.5 is a scenario with no mitigation or reduction in the use of fossil fuels. The IPCC future global climate predictions (2014) and national and regional climate predictions included in the Fourth National Climate Assessment for U.S. states and territories

(2018) use the RCP scenarios.

The increase of global mean surface temperature change by 2100 is projected to be 0.3 to 1.7°C under RCP 2.6, 1.1 to 2.6°C under RCP 4.5, 1.4 to 3.1°C under RCP 6.0, and 2.6 to 4.8°C under RCP 8.5 with the Arctic region warming more rapidly than the global mean under all scenarios (IPCC 2014). The Paris Agreement aims to limit the future rise in global average temperature to 2°C, but the observed acceleration in carbon emissions over the last 15 to 20 years, even with a lower trend in 2016, has been consistent with higher future scenarios such as RCP 8.5 (Hayhoe et al. 2018).

The globally-averaged combined land and ocean surface temperature data, as calculated by a linear trend, show a warming of approximately 1.0°C from 1901 through 2016 (Hayhoe et al. 2018). The IPCC Special Report on the Impacts of Global Warming (Allen et al. 2018) noted that human-induced warming reached temperatures between 0.8 and 1.2°C above pre-industrial levels in 2017, likely increasing between 0.1 and 0.3°C per decade. Warming greater than the global average has already been experienced in many regions and seasons, with most land regions experiencing greater warming than over the ocean (Allen et al. 2018). Annual average temperatures have increased by 1.8°C across the contiguous U.S. since the beginning of the 20th century with Alaska warming faster than any other state and twice as fast as the global average since the mid-20th century (Jay et al. 2018). Global warming has led to more frequent heatwaves in most land regions and an increase in the frequency and duration of marine heatwaves (Hoegh-Guldberg et al. in press). Average global warming up to 1.5°C as compared to pre-industrial levels is expected to lead to regional changes in extreme temperatures, and increases in the frequency and intensity of precipitation and drought (Hoegh-Guldberg et al. 2018).

Several of the most important threats contributing to the extinction risk of ESA-listed species, particularly those with a calcium carbonate skeleton such as corals and mollusks as well as species for which these animals serve as prey or habitat, are related to global climate change. The main concerns regarding impacts of global climate change on coral reefs and other calcium carbonate habitats generally, and on ESA-listed corals and mollusks in particular, are the magnitude and the rapid pace of change in greenhouse gas concentrations (e.g., carbon dioxide and methane) and atmospheric warming since the Industrial Revolution in the mid-19th century. These changes are increasing the warming of the global climate system and altering the carbonate chemistry of the ocean (ocean acidification; IPCC 2014). As carbon dioxide concentrations increase in the atmosphere, more carbon dioxide is absorbed by the oceans, causing lower pH and reduced availability of calcium carbonate. Because of the increase in carbon dioxide and other greenhouse gases in the atmosphere since the Industrial Revolution, ocean acidification has already occurred throughout the world's oceans, including in the Caribbean, and is predicted to increase considerably between now and 2100 (IPCC 2014).

The Atlantic Ocean appears to be warming faster than all other ocean basins except perhaps the southern oceans (Cheng et al. 2017). In the western North Atlantic Ocean surface temperatures have been unusually warm in recent years (Blunden and Arndt 2016). A study by Polyakov et al. (2009) suggests that the North Atlantic Ocean overall has been experiencing a general warming trend over the last 80 years of 0.031±0.0006 degrees Celsius per decade in the upper 2,000 meters (6,561.7 feet) of the ocean. Additional consequences of climate change include increased ocean stratification, decreased sea-ice extent, altered patterns of ocean circulation, and decreased ocean oxygen levels (Doney et al. 2012). Since the early 1980s, the annual minimum sea ice extent (observed in September each year) in the Arctic Ocean has decreased at a rate of 11 to 16 percent per decade (Jay et al. 2018). Further, ocean acidity has increased by 26 percent since the beginning of the industrial era (IPCC 2014) and this rise has been linked to climate change. Climate change is also expected to increase the frequency of extreme weather and climate events including, but not limited to, cyclones, tropical storms, heat waves, and droughts (IPCC 2014).

Climate change has the potential to impact species abundance, geographic distribution, migration patterns, and susceptibility to disease and contaminants, as well as the timing of seasonal activities and community composition and structure (MacLeod et al. 2005; Robinson et al. 2005; Kintisch 2006; Learmonth et al. 2006; McMahon and Hays 2006; Evans and Bjørge 2013; IPCC 2014). Though predicting the precise consequences of climate change on highly mobile marine species is difficult (Simmonds and Isaac 2007), recent research has indicated a range of consequences already occurring. For example, in sea turtles, sex is determined by the ambient sand temperature (during the middle third of incubation) with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25 to 35°C (Ackerman 1997). Increases in global temperature could skew future sex ratios toward higher numbers of females (NMFS and USFWS 2007d). These impacts will be exacerbated by sea level rise. The loss of habitat because 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).

Changes in the marine ecosystem caused by global climate change (e.g., ocean acidification, salinity, oceanic currents, dissolved oxygen levels, nutrient distribution) could influence the distribution and abundance of lower trophic levels (e.g., phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish), ultimately affecting primary foraging areas of ESA-listed species including marine mammals, sea turtles, and fish. Marine species ranges are expected to shift as they align their distributions to match their physiological tolerances under changing environmental conditions (Doney et al. 2012).

It is difficult to accurately predict the consequences of climate change to a particular species or habitat. It is likely that many of the species occupying warm water areas around the Florida peninsula will experience a possible range expansion along the Atlantic Coast on the condition that their prey base is able to colonize those locations as they become available. Generalist predators are more likely to be able to adapt to a rapidly changing environment. While smalltooth sawfish and sea turtles may be adaptable and able to forage in any hospitable environment, they have specific needs for reproduction that are likely to be lost with climate change. A range of consequences are expected that are likely to change the status of the species and the condition of their habitats.

# 6 Effects of the Action

Section 7 regulations define "effects of the action" as the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but are reasonably certain to occur. This effects analyses section is organized following the stressor, exposure, response, risk assessment framework.

The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of a listed species," which is "to engage in an action that would be expected, directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50

C.F.R. §402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

The destruction and adverse modification analysis considers whether the action produces "a direct or indirect alteration that appreciably diminished the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (50 C.F.R. 402.02).

Below we summarize our analysis of the effects of the action on smalltooth sawfish, Northwest Atlantic DPS loggerhead turtles, leatherback sea turtles, hawksbill sea turtles, Kemp's ridley, North Atlantic green sea turtles, and olive ridley sea turtles.

## 6.1 Stressors Associated with the Proposed Action

The Sawfish Program will create stressors that may affect the target species of smalltooth sawfish and stressors that may incidentally affect several species of sea turtles. Stressors that would affect sawfish are broken into two categories based on the probability of delayed mortality. The first category is low impact procedures that will be stressful but are not anticipated to cause delayed mortality. The second category are procedures that carry a minimal risk of delayed mortality and as such, we assume some mortality occurs when those procedures are authorized. Within this second category, we also consider capture and handling of smalltooth sawfish, which during rare situations can be so stressful as to cause "in-hand" mortality. This case of "in-hand" mortality can be assessed and authorized by the smalltooth sawfish research program and included in the permit issuance. When the research program considers an action to have a probability of delayed mortality, those mortalities will be monitored and limited across permits, but not authorized within permits.

The stressors with no anticipated risk of delayed mortality of smalltooth sawfish are capture, handling and restraint during examinations, minimally invasive tagging, tissue sampling, muscle biopsy, blood sampling, underwater ROV operation or tracking, and ultrasound. Activities like ultrasound, measuring, weighing, and photographing will not have an impact beyond the stress of handling the sawfish. The only procedure thought to carry a risk of delayed mortality is invasive surgical procedures to implant telemetry tags. The stressor of capturing smalltooth sawfish may carry the risk of direct mortality. The stressor of bycatch, including capture, handling, and release, may pose a threat to leatherback, loggerhead, hawksbill, Kemp’s ridley, green, and olive ridley sea turtles.

The following sections provide specific details of the stressors associated with each procedure that will affect smalltooth sawfish and summarize the available data on the responses of individuals that have been exposed to the procedures. We also discuss the anticipated effects to sea turtles where appropriate. The proposed mitigation measures included in the proposed action are discussed again in this section to explain how their inclusion in the project is likely to minimize anticipated reponses of the different procedures.

## 6.2 Mitigation to Minimize Response

There are a number of standard mitigation measures meant to make capturing smalltooth sawfish safer that will be implemented for all permits issued under this program. Specific permit conditions to mitigate adverse effects on both target and non-target ESA-listed species are described for each research activity discussed in Section 2.4 above.

To minimize the effects of research, the program applies a broad analysis to requested research applications. Initially, the Permits Division considers (1) whether alternative non-endangered species or population stocks can and should be used, (2) how the research is not unnecessarily duplicative of other work, (3) how the applicant will coordinate activities with other Permit Holders; and (4) how the applicant will minimize impacts of the activities, in particular to avoid or minimize mortality. Once a decision is made to authorize particular activities, Appendix 3 to the Biological Assessment contains detailed information about the minimization and mitigation measures for each activity covered by the program. Minimization for capture activities are detailed in section III(B)(5)(a), holding and handling conditions are in section III(B)(5)(b), non-invasive tagging conditions are in section III(B)(5)(c), surgical tagging conditions are in section III(B)(5)(d), tissue sampling conditions are in section III(B)(5)(e), and conditions for interactions with non-target species are in section III(B)(5)(h).

Capture mitigations require researchers to make changes to protect both smalltooth sawfish and sea turtles. When sampling, researchers must always tend their gear, use nets sized to minimize bycatch, only allowing fishing during daylight, removing nets if non-target ESA-listed species are detected in the area, be prepared for unlikely circumstances, ensure no entangled gear is left behind, and minimize handling times. When using longlines, they must check them within an hour of when the last hook was deployed, use corrodible hooks, have lines long enough to allow any captured animal to surface (1.5 times the depth being fished), and use single hooks.

Handling and holding mitigations require researchers to follow the handling and release guidelines for smalltooth sawfish, wear gloves, keep animals in the water as much as possible, not keep fish out of water for more than one minute without having seawater run over its gills, have additional holding pens to accommodate more than one sawfish being captured at a time, and released as quickly as possible.

Tagging mitigations require researchers to report the type of tags attached to the fish, clean and sterilize all instruments before tagging, not exceed 2 percent of the fish's weight with tags, avoid double tagging fish, and must assess the growth between capture and recapture events of tagged fish. In addition, surgical tag implantation has additional mitigation measures requiring researchers to be well-trained and experienced before attempting to tag a fish, ensure all fish are healthy before tagging, use approved suture material, use redundant knots to prevent failure from breakage, and monitor recaptured fish to identify possible problems.

Tissue sampling mitigations require researchers to be experienced or well-trained, use clean and sterile instruments, change gloves between specimens, collect tissue samples from all captured smalltooth sawfish, and to take no more than two muscle biopsies from each smalltooth sawfish.

For sea turtles, mitigation measures require researchers to closely watch for turtles in the sampling area, to delay gear deployment for 30 minutes if a sea turtle is seen in the area, use gear that will allow sea turtles to reach the surfaces, and to tend all gear while fishing to allow for the quick release of captured turtles.

Following these initial mitigation measures identified by the Permits Division, there is also a monitoring, reporting, and adaptive management component to the program. As a result of these processes, any time an additional mitigation measure is identified in the field, either as the result of injury or mortality or observation of authorized activities, the Permits Division will consider whether it is appropriate to include additional mitigation in future permits.

## 6.3 Exposure Analysis

The following section identifies the expected amount of exposure to each stressor and the response to that exposure that would be expected. As identified in section 6.1, the stressors resulting from these research procedures will be capture, handling and restraint during examinations, tagging, tissue sampling, muscle biopsy, and blood sampling. For sea turtles, the risks are simply being captured.

### 6.3.1 Smalltoot Sawfish

The smalltooth sawfish research program intends to consider the research requests in terms of individual objectives of the research to ensure there is no overlap between permit objectives or duplication of work and also ensure the cumulative risk of issued permits will not work to the detriment of the species. The stressors that will affect smalltooth sawfish are divided into two different types: those that may result in delayed mortality and those that not expected to result in delayed mortality.

For permits that propose activities that are not anticipated to carry a risk of delayed mortality, the Permits Division is not proposing any limitations on the amount of research authorized. That is not to say that individual permits will have unlimited captures or non-invasive activities. Each permit will be limited to the number of stressful activities necessary to accomplish the goals of those particular research objectives. However, in the event there is a considerable influx of permit requests, it will be possible for the Permits Division to assess those objectives and if appropriate, authorize sufficient captures and other procedures to accommodate all reasonable requests.

The Permits Division is proposing limitations on the number of “in-hand” mortalities and “delayed” mortalities, which could limit the number of permits issued or number of invasive procedures authorized. Another obvious and significant limitation on research is the expense of conducting that research. Tags, vessel time, technicians, etc. create natural limits to the amount of research that can be conducted under any permit. Section 2.5 describes the facets of authorizing mortalities, changing the acceptable numbers through time, and monitoring actions to more accurately understand the expected responses of invasive procedures. The number of mortalities authorized are linked to the best scientific information available on the abundance of the two size classes of smalltooth sawfish considered for permitting purposes. In the event smalltooth sawfish become more abundant in the future, the numbers of “in-hand” and “delayed” mortalities can increase and if the estimated abundance was to decline in the future, the number of permissible mortalities would decrease.

Limitations put in place on “in-hand” and “delayed” mortalities could indirectly limit the number of non-invasive procedures authorized on smalltooth sawfish. In the event the Permits Division authorizes as many mortalities as the known abundance of smalltooth sawfish can safely accommodate while still allowing for recovery, research would be halted to eliminate the risk of “in-hand” mortalities resulting from capture. The Permits Division is proposing to issue a fraction of the calculated mortalities to ensure all research is not stopped at any point. This strategy also ensures that the level of mortality anticipated in this opinion is not actually ever reached.

### 6.3.2 Sea Turtles

Sea turtles are vulnerable to capture in gear used to capture smalltooth sawfish. Furthermore, sea turtles occur frequently in habitats overlapping smalltooth sawfish research. In the past 14 years, seven sea turtles have been captured by smalltooth sawfish researchers using longlines and gill nets. However, the number of requested smalltooth sawfish research permits is increasing, as is the research effort under each permit. Additionally, many sea turtle populations in the primary and secondary smalltooth sawfish sampling locations have been increasing. Therefore, we anticipate capture and release of up to 12 green, 12 hawksbill, 12 Kemp’s ridley, 12 loggerhead, 4 olive ridley, and 4 leatherback sea turtles over any given 10-year period. Over any 10-year permit period, no more than 3 sea turtles are anticipated to be killed by research activities and no more than two of any species.

## 6.4 Response Analysis

This section analyzes the anticipated response to each stressor identified in Section 6.1. These analyses in some cases may acknowledge a wide range of possible responses, afterwhich the response that is most likely to occur will be identified.

### 6.4.1 Capture

Capturing sawfish has the potential for killing or harming them. Sawfish sampling is conducted with seines, hook and line, longlines, drum lines, cast nets and gill nets. While each gear type is often authorized in permits for all life stages, gillnets are the primary gear used for taking neonates, young of year, and smaller juveniles, typically in inshore environments. In offshore environments, longlines, drumlines, and angling gear are the primary gears used for capturing adults and older juveniles.

Prohaska et al. (2018) found smalltooth sawfish have a similar or less pronounced stress response than other previously examined elasmobranchs, suggesting physiological resiliency in the species. In particular, elevations in glucose and lactate levels were relatively low when compared to other elasmobranchs. Mortality of elasmobranchs during scientific sampling usually occurs because of asphyxiation associated with impaired ability to move water across their gills while hooked or in a net. However, as noted in Prohaska et al. (2018), elasmobranchs such as rays and sawfishes have the ability to self-ventilate by actively moving waters over their gills, and, thus, do not suffer this fate.

Bottom longline and drum line captures affect smalltooth sawfish by hooking and entanglement. Stress to the sawfish would be likely during capture and handling. Based on data from hooking events in other fisheries and research surveys, the vast majority of smalltooth sawfish are hooked in the mouth (NMFS 2003). Foul hooking (i.e., hooking in fin, near eye, etc.) reports are not nearly as frequent, but do occur occasionally. Previous research captures reported to the Permits Division has not identified incidents of foul hooking. Of 20 longline captures reported, animals all were hooked in corner of mouth or wrapped in the line. Once hooked, the gangion frequently becomes wrapped around the animals’ saw (NMFS 2003). This is likely the result of struggling to get free.

All individual sawfish observed in the bottom longline fishery have been very active when brought to the water’s surface, and were released in good health, without any noticeable damage to their rostrums. In the studies conducted by Mote Marine Laboratory between 2000 and 2008 using bottom longlines, soak times did not appear to be a factor affecting smalltooth sawfish because they are naturally benthic and when captured, can remain motionless on the ocean floor. Thorson (1982) reports that when the similar species, largetooth sawfish, were caught by fishermen at night, or when no one was present to tag them, they were left tethered in the water with a line tied around the rostrum for several hours with no apparent harmful effects.

Effects to sawfish from rod and reel hook and line capture would be similar to that for longline capture. Animals would be hooked and could become entangled in the line. However, since researchers would immediately tend to animals at the moment of capture (i.e., they would not be on the lines for hours and subject to longer period of stress, entanglement in gear, etc.), the effects from this type of gear is expected to be less severe than the effects from capture on longline.

Animals captured in gill nets would be removed from nets immediately, researched, and released immediately. While animals would experience stress during capture and disentanglement, the fact that researcher's would minimize time in the net, work to remove the animals as fast as possible, and cut the net if required to minimize effects to the animals, no serious injury or mortality would be expected from this capture technique.

There are no studies on the post-release mortality of smalltooth sawfish related to handling stress. However, based on the handling methods and lively conditions of sawfish released after research procedures, it is likely that post-release mortality due to handling is very low. Furthermore, because almost every smalltooth sawfish that is captured will also be tagged, it would be impossible to discern whether a post-release mortality was due to the capture, handling, or tagging stress. However, the threat of that post-release mortality is covered by the conservative estimates for tagging stress below.

Mote Laboratory's capture of 100 smalltooth sawfish, ranging from 68 cm to 496 cm during previous research (58 by gill net, 20 by longline, 15 by rod and reel, 7 by seine), resulted in all animals released in good condition. Individuals fitted with external acoustic tags were tracked and relocated several months after capture, suggesting long-term survival after capture and handling. It is important to note that not all individuals were tracked and recaptured and therefore it is not possible to estimate the survival rate associated with tagging procedures, only to state that some did in fact survive.

In addition to effects to animals from the capture gear, injury to animals could potentially occur by the loss of individual rostral teeth through slashing, coming into contact with the research boat during handling and release. Loss of rostral teeth could affect the feeding success of the sawfish or its ability to defend itself. However the loss or chipping of teeth is a natural occurrence in the wild and as long as the base of a damaged tooth is not harmed, it will eventually regrow (Clippinger 1993). To minimize the potential for damage, researchers would hold the base of rostra (for small specimens) or loop a rope around the tip of the rostra (for larger specimens) of captured sawfish as soon as possible after capture to prevent the natural side-to-side slashing of the rostrum. A member of the NMFS sawfish recovery team would train all researchers in handling procedures. Animals (especially their gills) would be kept in the water to the greatest extent practicable.

To date, the Permits Division has received only one report of a smalltooth sawfish killed during capture. In that incident, the animal was captured in a gill net and as researchers were retrieving the net, it was attacked and killed by a shark. While the shark killed the sawfish, it was a result of the capture and restraint during research. Predation events on captured smalltooth sawfish are expected to remain rare, but possible. Additionally, while large numbers of smalltooth sawfish have been captured in gill nets and longlines primarily, there are no reported incidents of mortality associated with capture. It is also possible this changes, though the rate of "in-hand" mortality associated with capture events is currently so low as to be incalculable.

Sea turtles could be captured as bycatch during research activities. Gill nets would trap sea turtles underwater. Mitigation identified in the previous section should prevent the death of captured sea turtles, particularly given that capture has been historically rare. However, because the number of permits and the research effort as a result of each permit are increasing, bycatch of sea turtles is also expected to increase. As discussed in the exposure section, sea turtles will be captured as bycatch during smalltooth sawfish research, but the mortality rates associated with this bycatch will be minimized by these measures. Most sea turtles will be released as healthy individuals. Mortalities could affect as many as three captured sea turtles over a 10-year period. Because of the number of different species of sea turtles in the area and limitations in the issued permits, no more than two of those mortalities will affect the same species.

### 6.4.2 Effects of External and/or Minimally Invasive Implanted Tags

Rototags, PIT tags, dart tags, and other external or non-invasive tags have been used in previous smalltooth sawfish permits. In many cases, multiple tags would be applied to the same smalltooth sawfish. All of the above mentioned tags are small (Section 2.4.3.1.2) compared with the size of a sawfish and involve making small holes (e.g., with a leather punch) in or below dorsal fins to affix rototags and external acoustic or satellite tags or small holes (i.e., with a syringe needle) at the left side base of the first dorsal fin to inject internal PIT tags. Creating a small hole in a sawfish for the insertion of a tag would be expected to cause a response. Importantly, Snow et al. (1993) concluded, "sharks and rays lack the neural apparatus essential for the sensation of pain." 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.

Rototags and satellite tags would be attached through the dorsal fin. Since 2004, 497 rototags and 46 satellite tags have been applied to smalltooth sawfish. Manire and Gruber (1991) documented the effects of punching holes in the dorsal fins of elasmobranchs by taking 5 mm 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. They summarized that the use of rototags and Jumbo rototags appears to be an efficient way of marking elasmobranchs with minimal damage to the shark. They added that the mucous layer on the skin may be a primary response to injury that helps reduce ionic exchange and prevent infection of wounds. Therefore no swabbing of the area would be used to prevent any disruption to this natural mucous layer.

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). Empirical studies have generally demonstrated that when PIT tags are inserted into animals having large body sizes relative to the size of the tag, there are no resulting adverse effects 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). Since 2004, 914 PIT tags have been put in smalltooth sawfish with no indication of adverse effects.

Heupel and Bennett (1997) sampled dermal and epidermal tissues of sharks and examined them histologically to assess damage caused by tagging with standard single-barb dart (or streamer) tags. 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. Further hemorrhaging and red and white blood cell movement into the wound area characterized this phase. 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 tag and provides a continuous barrier between the muscle and tag. Tissue repair appeared to progress consistently in all specimens and no secondary infections at the tag site were seen. Once the tag head is encapsulated within connective tissue (after about 10 days) the tag does not appear to migrate and is therefore unlikely to cause further trauma to the muscle. Tagging produced only localized tissue disruption and did not appear to be detrimental to the long term health of individual sharks. Although the gross (raised) appearance of the tag site suggests inflammation or infection, no evidence of infection was found with the raised area due to formation of scar tissue. Their findings suggest that dart tagging is an acceptable method for marking individuals. Histological examination showed that all sharks sampled were free of obvious infection at and around the tag site. No signs of infection were seen in gross external examinations of tag sites (Heupel and Bennett 1997). All sharks appeared in good health and showed no long-term detrimental effects from the tagging procedure. Even sharks found with clumps of filamentous algae fouling the tags (this has been observed in sawfish recaptures) were free of infection, supporting the assertion that tagging does not appear to predispose sharks to infection. In previous tagging of sawfish with dart tags by other researchers, some minimal localized bleeding has occurred upon tag insertion. The amount of drag caused by the protruding tag is unknown.

However, smalltooth sawfish are a benthic species that do not constantly swim so any hydrodynamic drag from the tag would be expected to represent an extremely small increase, if any, in the work required for locomotion. No long-term adverse effects are anticipated from these tag types.

### 6.4.3 Effects of Genetic Clips and Muscle Biopsies

Smalltooth sawfish researchers have taken 754 tissue samples from smalltooth sawfish since 2004. There is no indication of adverse effects associated with tissue samples, but no direct studies have been undertaken. There are no adverse effects anticipated as a result of fin clips. 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. NMFS would expect that the collection of a tissue sample would not cause any significant additional stress or discomfort to the animal beyond what was experienced during the other research activities. Biopsy sites (with diameters up to 5 cm) are known to heal quickly and completely when used on a variety of vertebrates such as sharks, teleosts, and marine mammals (Weller et al. 1997, Krutzen et al. 2002). While muscle biopsies have not been collected from smalltooth sawfish historically, they are not expected to result in any long-term effects, such as reduced growth or swimming ability.

### 6.4.4 Effects of Blood Sampling

Caudal venipuncture has been performed for years on sharks, skates, and rays and the researchers are experienced in the process. There are no reports of problems from the procedure or any post handling observations of stress (Manire et al. 2001). Since 2004, 79 blood samples have been collected from smalltooth sawfish. 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 (NMFS 2014c). 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 et al. 2009). In order to ensure the samples are taken with minimal impact to the smalltooth sawfish, all staff listed on the permit to sample blood would be trained on blood draw procedures from experienced scientists and/or veterinarians. Given the success of blood draws on many other elasmobranch species NMFS does not foresee any side effects from this process.

#### 6.4.5 Effects of Ultrasound

Ultrasound is a non-invasive procedure that would involve handling and restraint. Any stresses associated with this activity are expected to be minimal, short-term, and associated with the stress of being handled. There are no effects, beneficial or adverse, from the use of ultrasound. Therefore the only stressor actually associated with this research method is prolonged hanlding stress, beyond what would occur if ultrasound was not conducted.

#### 6.4.6 Effects of Photograph/Videography

Researchers may photograph/video smalltooth sawfish during research efforts by essential personnel to document recovery efforts or impacts of research. Additionally, non-essential personnel may be authorized by the Permits Division to photograph, film, or audio record activities during authorized research. However, these activities would occur simultaneously with other research activities and should not significantly prolong the handling and restraint of individuals.

#### 6.4.7 Effects of Underwater Remotely Operated Vehicles

The Permits Division expects this type of technology to grow in the research community because it allows researchers to collect short-term behavioral and biological data, and in some cases, avoids the need to directly attach instruments to target animals. There is little published information available about reactions of sawfish to ROV or AUV units in the wild; however, Baronio (2012) documented the use of micro remotely operated vehicles as a tools for studies of shark behavior in captivity, finding a lack of behavioral response of sharks to the presence of ROVs, even at very close proximity. The Permits Division therefore expects no more than minimal effects to targeted smalltooth sawfish from underwater tracking by ROV and AUV units. The target animals may not even be aware of the unit's presence unless a close approach is made. Animals that are made aware of its presence could have varied expected behavioral responses including avoidance behavior to moving away from the unit. However, animals would be expected to resume their prior behaviors and recover from any incurred stress as soon as the encounter ends. Because the ROV's tether is thick and somewhat rigid, it does not pose a significant risk of entanglement to the target animals or other marine life, such as sea turtles. Smolowitz et al. (2015) reported no entanglements in encounters with 70 loggerhead sea turtles using a 250 m tether. Patel et al. (2016) noted observations of the tether briefly wrapping around a flipper from which the animal quickly escaped.

#### 6.4.8 Effects of Invasive Surgical Procedures

As indicated in Chapter 2.4.3.2, invasive surgery involving internal tagging procedures on sawfish is associated with a risk of delayed mortality in a certain percentage of individual animals. In addition to the potential for reduced survival, sawfish could also be expected to experience handling stress, discomfort, hemorrhage at the site of incision, risk of infection from surgery, affected swimming ability, and reduced growth rates. Choice of surgical procedures, fish size, morphology, behavior, environmental conditions, and qualifications of researchers could each affect the success of telemetry implantation in fish (Jepsen et al. 2002, Kyne and Pillans 2014).

Smalltoot sawfish were first given internal tags in 2016. Since then, only 32 have been tagged. Smalltooth sawfish selected for internal tagging would be positioned alongside a research vessel and then inverted with its ventral side up to initiate a physiological response referred to as "tonic immobility." Henningsen (1994), mentioning tonic immobility in elasmobranchs as "animal hypnosis," "death feigning," or "catalepsy," described it as an unlearned response of immobility and torpor, lasting from under a minute to several hours. Kessel and Hussey (2015) recognized the reduced potential for negative sub-lethal effects as a result of using tonic immobility over a chemical anesthetic during surgical implantation procedures, including: no risk of overdose, no uptake of chemicals to body tissues, minimal disruption to respiration, and immediate and full recovery. Heupel and Simpfendorfer (2002) found that invasive tagging surgeries on blacktip sharks could be completed 10 minutes sooner than when otherwise using chemical anesthesia. Carlson and Parsons (2003) found that bonnethead sharks exposed to anesthetic were often in a "groggy" condition, requiring significantly more recovery time and effort prior to release than those not exposed to anesthetic. Related to this, Heupel and Simpfendorfer (2002) documented two incidences of predation on blacktip sharks, occurring less than an hour after release, as the animals were apparently not fully recovered from the effects of anesthetization. Consequently, using the tonic immobility response as a form of physical anesthesia would reduce potential effects in sawfish undergoing tagging surgeries and for speeding recovery.

Heupel and Simfendorfer (2002) reported, individual animals had no responses to incision, tag insertion or suturing and were found in good condition at release. Other research by Snow et al. (1993) concluded that since elasmobranch fishes lack complete myelination of neural tissues, "sharks and rays lack the neural apparatus essential for the sensation of pain." Rose (2002, 2007) and the American Fisheries Society has also supported this finding. Therefore there will be no pain response from sawfish when the incision is made for tag implantation.

Internal tagging involving invasive surgery could also result in improper healing of wounds. Two factors affecting the healing rate of wounds in fish after invasive surgery would include secondary infection and inflammation. Because fish epidermal cells at all levels are capable of mitotic division, during wound healing there is a loss of the intracellular attachments, causing cells to migrate rapidly to the injury to cover the defect and provide some waterproof integrity (Wildgoose 2000). This response leads to a reduction in the thickness of the surrounding epidermis, producing a thin layer of epidermis at least one cell thick over the wound. However, the process can also sometimes be inhibited by secondary infection and inflammation (Wildgoose 2000). Thorstad et al. (2000) found that surgical incisions were not fully healed in 13 farmed-raised Atlantic salmon surgically implanted with transmitter devices. Two of these animals had signs of inflammation and necrotic tissue developing from a resulting infection. The selection of suture material may affect healing rate. Juvenile largemouth bass implanted with micro- radio transmitters exhibited short-term (five days) inflammation around incisions and suture insertion points for both non-absorbable braided silk and non-absorbable polypropylene monofilament (Cooke et al. 2003). However, longer-term healing was found complete at 20 days post-surgery in these same animals; almost all sutures were shed and the incisions had healed (Cooke et al. 2003). Similarly, Chapman and Park (2005) examined the healing rate of Gulf of Mexico sturgeon following surgical gonad biopsy, finding both absorbable and non-absorbable suture material used to close incisions gave good results. All sturgeon survived the procedure and wounds had healed at 30 days post-surgery. However, Wagner et al. (2000) found that the use of dummy radio transmitters in test animals compounded the inflammatory effect that silk sutures had on the healing rate of incisions compared to surgeries without implanted transmitters.

There is no published information documenting the long-term survival rate of smalltooth sawfish after invasive surgeries to implant transmitters. However, researchers have evaluated post-surgery conditions of several elasmobranchs species after similar surgeries. Little harm was attributed to individual recaptured animals surgically implanted with transmitters (e.g., for bat ray – Matern et al. 2000; blacktip shark – Heupel et al. 2004; blacktip reef shark – Meyer et al. 2007; bonnethead shark – Heupel et al. 2006; Galapagos shark – Meyer et al. 2010; lemon shark – Morrissey and Gruber 1993; Wetherbee et al. 2007; school shark – West and Stevens 2001; and tiger shark – Holland et al. 1999, Meyer et al. 2010). In the case of 38 juvenile lemon sharks (47-100 cm PCL) tagged internally with acoustic tags, all had normal color and muscle tone and appeared healthy when recaptured 20 days post-surgery; only thin black lines at the incision site were evident (Morrissey and Gruber 1993). In another lemon shark study, Wetherbee et. al. (2007) similarly found that sutures were absent three weeks post-surgery, with only faint scars remaining where incisions had been made. Holland et al. (1999) observed that the healing of incisions in tiger sharks implanted with acoustic transmitters were not as qualitatively severe in comparison to naturally occurring wounds on such animals.

Researchers using inadequate materials or methods have been documented to contribute to the potential for delayed mortality or harm of elasmobranchs after invasive surgery. Incorrect suturing material, prematurely absorbed, or prematurely shed due to overtightened knots (Caputo et al. 2009), have been cited as causes of improper healing of surgical incisions. In contrast, sutures remaining in the body too long can also hinder the healing process, acting as an attachment point for bacteria, and ultimately causing inflammation, infection, necrosis, and various other side effects, including death (Schoonyan et al. 2017).

In the absence of post-tagging survival studies of elasmobranchs, large, primative marine fishes such as sturgeon are reliable surrogates. Devries (2006) reported on the movements of eight male and four female (≥ 768 mm TL) internally tagged shortnose sturgeon between 14 November 2004 and 14 January 2005. Nine of these fish were tracked until the end of 2005; however, the movements of the remaining individuals were censored after no movement from them was detected, or they were not relocated after a 4-month period (Devries 2006). Recent three-month post-release detection data of internally tagged sturgeon has also been reported to the Permits Division by sturgeon researchers (Permit Numbers 17861, 19255, 19642, and 20548; 2015 annual reports), indicating that between 2 and 5 percent of the internally tagged sturgeon went undetected before the end of the three-month period. Although there was no direct evidence of delayed mortality attributable in these data to the surgical procedure, the unknown status of the un-relocated individuals implies existing potential for delayed mortality. Other possibilities, though, could include tag-malfunction (3 of 21 recaptured sturgeon had failed tags, but were still alive), tag rejection/expulsion, undetection of the tagged animals through the passive receiver arrays, or natural or unnatural (i.e., poaching) mortality.

The tag weight relative to a fish body weight has also received attention in studying the effects of an internal tagging procedure (Jepsen et al. 2002). Two factors directly affecting a tagged fish have been reported, including tag weight in water (excess mass) and tag volume. Winter (1996) recommends that the tag/body weight ratio in air should not exceed 2 percent. Although some studies cite higher ratios as non-detrimental to tagged fishes (Brown et al. 1999, Childs et al. 2011), Researchers of sharks and sawfish have generally followed protocols published by Kyne and Pillans (2014), adhering to the accepted 2 percent maximum tag to body mass ratio for tagging animals.

Incidences of tag expulsion or rejection of surgically implanted transmitters have been reported from a number of studies, and have been mentioned as cause for using externally attached transmitters (Chisholm and Hubert 1985, Lacroix et al. 2004, Moser and Ross 1995, and Kieffer and Kynard 1993). However, it is not clear if transmitter expulsion causes further complications or death in fish. Rates of tag shedding and tag implants exiting the body cavities of fishes depends on the species, fish condition, tag weight and environmental conditions (Jepsen et al. 2002). Although, such expulsions often occur shortly after tagging and can lead to a premature end of study results, there are basically three ways of implant exit: through the incision, through an intact part of the body wall, and through the intestine. Trans-intestinal expulsion is rare but has been occasionally reported in rainbow trout (Chisholm and Hubert 1985). Five months after tagging, Moore et al. (1990) reported that 20 percent of juvenile Atlantic salmon had expelled their tags through the body wall, adjacent to the healed incision. Moser and Ross (1995) reported two Atlantic sturgeon had also apparently expelled transmitters. Similarly, Kieffer and Kynard (1993) had one shortnose sturgeon reject an implanted sonic tag in a study.

Further anecdotal information has been gained on the long-term health and survival rates of recaptured elasmobranches after surgical implanting of internal tags. For example, Morrissey and Gruber (1993) recaptured 17 internally tagged juvenile lemon sharks after 1055 days post-surgery. These animals exhibited growth ranging from 0.3 to 28.2 cm PCL (6.4–9.9 cm/year). Holland et al. (1999) recaptured tiger sharks 377 days after 12 month internal tags had terminated. Meyer et al. (2010) found that some internally tagged tiger sharks at French Frigate Shoals, Hawaii, were detected year-round by acoustic receiver stations. Others were recorded visiting the atoll periodically during the summer to forage on fledging albatross, and then swimming thousands of kilometers along the Hawaiian chain, or out into the open ocean before returning in subsequent years (518–980 days post-surgery).

Since researchers have been authorized by NMFS in permits to begin internally tagging smalltooth sawfish with acoustic transmitters, 32 animals have been tagged through 2017 using the previously outlined surgical technique. However, only 26 tagged have thus far been detected by associated listening stations, with some detections occurring 12 months post-surgery (smalltooth sawfish annual report for Permit Number 17787). Although none of the six remaining, undetected animals have been recorded at sparse recording stations to date, researchers are required to continually monitor and report newly detected animals to NMFS as soon as possible to confirm the long-term survival of tagged animals.

## 6.5 Risk Analysis

This section assesses the likely risk of procedures authorized within this programmatic action. Furthermore, we address any limitations of particular research techniques and which techniques can occur without limit. Risk is assessed as a combination of the probability of exposure and the range of response that are reasonably likely to occur. This risk is assessed to the individual smalltooth sawfish or sea turtle, then to the population of those individuals, and finally to the species.

### 6.5.1 Non-Lethal Procedures

Based on our response analysis above, we determine that many of the stressors created by the research activities would result in minor behavioral responses by individuals. In response to capture, non-invasive tagging, genetic clips, muscle biopsies, blood samples, ultrasound, photo/video, and remote vehicles, the responses are anticipated to be stressful, but no harm, injury, or mortality is expected apart from "in-hand" mortality during the capture process. Any mortalities associated with capture activities will be addressed in the next section. Because the effects of these procedures will be minimal, short-term, and have no cumulative effects due to repeated sampling, there are no limits to the number of exposures for each individual smalltooth sawfish. The activities covered in this section are not expected to reduce fitness or result in any loss of fecundity to individual smalltooth sawfish. Mitigation measures contained in the permits further reduce the risk of any of these procedures.

Since non-lethal effects are not likely to result in reduced fitness or fecundity of individuals, it follows that non-lethal effects from research activities are not likely to negatively impact smalltooth sawfish populations. Therefore, we determine that the authorized non-lethal take of smalltooth sawfish as part of the proposed action is not likely to affect their survival or recovery. In addition, as part of the adaptive management approach that is an integral part of the smalltooth sawfish research program, the Permits Division will continuously monitor and evaluate the non-lethal effects of authorized activities. If the non-lethal effects associated with a particular activity are greater than anticipated, the Permits Division will reevaluate the authorization of the activity in permits and consider additional mitigation measures as necessary.

### 6.5.2 Procedures with the Risk of "In-Hand" or "Delayed" Mortality

As identified above, the activities of capture and surgical tag implantation carry a risk of both "in-hand" and "delayed" mortality. Generally speaking, the effects of capture are limited to mortality during the capture process, where smalltooth sawfish or sea turtles would be brought to the research vessel as "in-hand" mortalities. On the other hand, because of the tagging location, the act of surgically implanting a tag in a smalltooth sawfish has almost no chance of causing an "in-hand" mortality, but there is the chance that due to infection or suture failure, the incision can lead to "delayed" mortality.

There are a number of different methods used for capturing sawfish and each carries a slightly different risk as well as mitigation measures intended to minimize those risks. The primary research methods used for capture are gill nets, longlines, and hook and line. As noted above, despite the extensive list of mitigations in place for each type of research gear, there has been a single "in-hand" mortality reported since smalltooth sawfish were listed in 2004. While the probability of a single capture event being lethal is extremely small, all capture attempts in a year or over a 10 year permit increase the probability of mortality. The probability of mortality is unrelated to whether an individual is captured multiple times or every capture is of a unique individual.

In similar fashion, proper training, quick recovery time, and proper suture material and techniques can minimize the risks of smalltooth sawfish death as a result of the surgical implantation of a tag. However, even the best mitigation may not be enough to completely remove the risk associated with surgery on wild animals released back into the wild. And, as above, the probability of a single surgery resulting in mortality is likely quite low, but the risk of "delayed" mortality increases as the frequency of surgery increases. While there have been no studies on post-release mortality of smalltooth sawfish following surgical tagging, similar studies have been conducted on sturgeon as discussed above. The "delayed" mortality rates for sturgeon are established at 2.5 percent, but that is with the understanding that this mortality rate is an over-estimate because the study measured tags that failed to be detected within 90 days, which could be mortality or tag failure, tag loss, or limited acoustic arrays. To be conservative, and until we are able to obtain information on smalltooth sawfish post-release survival, we are assuming no more than 2.5 percent of surgically tagged smalltooth sawfish will be killed.

The permits division plans to manage the mortalities of smalltooth sawfish in terms of both "in-hand" and "delayed" mortality as they affect two geographically different life stages: adults (primarily offshore) and juveniles (primarily inshore). By conservatively accounting for projected authorized mortality issued in permits, the Permits Division's approach ensures the fitness of the species is protected. The risk of "in-hand" mortality is authorized as an extent of mortality that could occur during sampling while the risk of "delayed" mortality is authorized as a probability of mortality from individual surgeries, which can be monitored as fractions of a whole mortality across research permits. The Permits Division would also maintain a safety net of anticipated smalltooth sawfish mortality that is not issued through permits, but rather used for rare cases of unforeseen mortality in the Program (see Table 6).

The mortality limits of smalltooth sawfish would be calculated as a percentage of the estimated modeled abundance for each sawfish life stage group, identified in Section 4.2.1 and proposed to be updated as better information becomes available. As discussed above, approximating these population abundancies of the separate life stage groups is difficult given the paucity of information available. However, supporting our conservative approach and using the best available information for estimating the population sizes of smalltooth sawfish (including encounter data, effective population estimates, and general growth index trends), we adopted a survivorship model to approximate population numbers of life stages above and below 2200 mm.

The model approximates the base abundance for all cohorts of juvenile sawfish less than 2,200 mm in length (i.e., 0-4 years; or neonates, young-of-year, and smaller juveniles) at approximately 2,500 individuals. Using the same approach, we estimated the base population for all cohorts of sub-adult and adult life stages greater than or equal to 2,200 mm in length (ages 5-30) at approximately 2,000 individuals. These abundances were derived from information in Carlson and Simpfendorfer (2015). The true juvenile abundance will vary through time with successes and failures depending on biotic and abiotic factors in the environment. However, as discussed in section 4.2.1, juvenile abundance appears to be increasing annually in the range of five to six percent. These estimates will be updated periodically as possible, reflecting the best available science at any given time.

The mortality limit for each life stage group would be calculated at a rate of 0.3 percent of their estimated abundance (Table 7). Abundance estimtes will be updated as new information is available, reflecting changes in the current intrinsic rate of growth of juvenile sawfish life stages of 5-6 percent per year (Carlson and Osborne 2012). Thus, this adaptive approach would ensure the impacts of research would have minimal effects on adult and juvenile smalltooth sawfish abundances while still authorizing sufficient research effort to understand the species and obtain important information for managers to protect them further.

**Table 7. Proposed annual mortality limits for "in-hand" and "delayed" mortalities during all permitted smalltooth sawfish research activities.**

| Life Stage | Population Estimate | Percent of Population Killed | Total Allowed Mortality Annually | Reserve Buffer (5yr average) |
|---|---|---|---|---|
| Adult and sub-adult (>2200 mm TL) | 2000 | 0.3 percent | 6 | 3 |
| Juveniles (<2200 mm TL) | 2500 | 0.3 percent | 7.5 | 3 |

Sea turtles could be killed if captured as bycatch in smalltooth sawfish research gear. No "delayed" mortality of sea turtles is expected as any mortality that may occur would be "in-hand." Since research has been authorized by the Permits Division, no sea turtles have been killed during smalltooth sawfish research activities. However, because capture gear is selective for both smalltooth sawfish and sea turtles in areas where known ranges of turtles and smalltooth sawfish overlap, we cannot rule out the possibility that a minimal number of turtles are bycaught in any year. In addition, because this programmatic has no proposed end date, we must also consider the potential for these sea turtle populations to increase over time, increasing the likelihood of capture. In the past 14 years, seven sea turtles have been captured by smalltooth sawfish researchers. However, the number of requested smalltooth sawfish research permits is increasing, as is the research effort under each permit. Additionally, many sea turtle populations in the primary and secondary smalltooth sawfish sampling locations have been increasing. Therefore, we anticipate incidental non-lethal capture and release of up to 12 green, 12 hawksbill, 12 Kemp's ridley, 12 loggerhead, 4 olive ridley, and 4 leatherback sea turtles over any given 10-year period. While no sea turtle mortalities have been caused by smalltooth sawfish research in the past, there is a risk that these capture methods could be lethal to sea turtles in the future. As such, we anticipate incidental lethal take of up to 3 sea turtles (any species) but no more than 2 of any one species over any given 10-year period.

Trends of sea turtles appear to be stable or increasing in the primary sampling area for smalltooth sawfish. The Northwest Atlantic DPS of loggerhead sea turtles have been expanding their nesting range, however the number of nests has fluctuated since the 1980s, with a recent increase since 2007. Leatherback sea turtles in the Atlantic Ocean are increasing at 9 to 14 percent per year in Florida. Hawksbill sea turtles in the Caribbean Ocean are increasing in 9 of 10 sites studied, with increases over the past 30 years. Kemp's ridley sea turtles were increasing at 15 percent per year through 2003, though that rate of increase was not expected to continue. The North Atlantic DPS of green sea turtles also show an increasing trend in nesting and nesting sites with local increases of between 5 and 14 percent. The olive ridley sea turtle is the most abundant sea turtle in the world but most nesting takes place outside of the U.S. with some western

Atlantic populations increasing and some decreasing. All of these sea turtles species trends in recent past include the environmental baseline stressors discussed in this opinion.

## 6.6 Programmatic Effects

The effects to individuals, populations, and species are considered previously, but in an programmatic opinion, there are administrative measures in place to ensure the amount of take considered is not likely to be exceeded. These limitations are described in the Proposed Action section and establish lethal and non-lethal limits for individual permits as well as the adaptive management process that will ensure those limits are not exceeded at any point in the future.

To facilitate a wholistic approach, new permits and changes to anticipated take within existing permits are handled during a single annual cycle. The risk of "in-hand" and "delayed" mortality will be assessed and modifications to requested research will be made as needed to ensure the mortality limits established here are not exceeded cumulatively in all permits. Furthermore, additional mortalities that are assessed herein are retained for emergency situations, but not authorized in permits. In other words, the Permits Division is proposing to withhold a portion of the anticipated mortalities to ensure there will not be a situation in the future when the mortality limits proposed are later exceeded.

No more than 0.3 percent of the smalltooth sawfish population could be killed by research activities in any given year. Additionally, this rate of mortality is very conservative given the current increasing trend in abundance discussed in section 4.2.1 and threats discussed in section 5. We assume mortality for all surgically implanted tags no longer detected, however the causes of no detection could be mortality, tag failure, tag loss, or too few receivers to detect a tag over its life. Given the rate of population growth (Carlson and Osborne 2012) observed for juvenile smalltooth sawfish, the baseline stressors impacting the species, and the level of mortality anticipated to be caused by research, we would expect the smalltooth sawfish abundance will continue to increase and expand their range towards their historic occupation. There is no indication that the anticpated amount of lethal take caused by capture and tagging would pose a threat to the recovery of the U.S. DPS of smalltooth sawfish.

The Permits Division would not explicitly authorize sea turtle bycatch for any smalltooth sawfish research permit, but instead monitor the number of incidental takes of sea turtles during 10 year periods to ensure these estimates are not exceeded. The numbers were developed by taking into consideration the incidental take authorized in past permits, the low level of historical incidental take that has occurred using similar fishing gears, population trends of each species, and forecasting future smalltooth sawfish survey effort. Researchers are instructed to report incidental take of sea turtle to the Permits Division, at which time they should be allowed to continue their research.

The anticipated levels of sea turtle bycatch in smalltooth sawfish research would have both lethal and non-lethal effects on a minimal number of sea turtles. The sea turtles that are captured and released are expected to have no long-term impacts as a result of the capture stress. There would be no loss of fitness or reduced fecundity for those individuals. The three individuals over any 10 year period that are anticipated to be "in-hand" mortalities as a result of smalltooth sawfish research are too few to have population level effects for North Atlantic green, hawksbill, Kemp's ridley, Northwest Atlantic loggerhead, olive ridley, or leatherback sea turtle populations in the area. Under the worst case scenario of the smallest population (Kemp's ridley), the anticipated mortalities would be fewer than 0.05 percent of the adult female portion of the population. As such, the level of mortality to any of those species would also not cause a declining trend in abundance.

# 7 CUMULATIVE EFFECTS

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

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.

An emerging threat along the East Coast of Florida during the 2017 and 2018 summer periods has been the occurrence of a large, coastally isolated red tide. The red tide has caused mass fish and sea turtle mortalities, but at this time there is no indication that smalltooth sawfish have been killed by these events. It is also unclear whether the state of Florida intends to address the runoff issues driving these conditions and therefore whether or not the red tides can be expected to occur in the future.

No future actions with effects beyond those already described are reasonably certain to occur in the action area.

# 8 INTEGRATION AND SYNTHESIS

The Integration and Synthesis section is the final step in our assessment of the risk posed to species due to implementation of the proposed action. In this section, we add the effects of the action (Section 6) to the environmental baseline (Section 5) and the cumulative effects (Section 7) to formulate the agency's biological opinion as to whether the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of ESA-listed species in the wild by reducing their numbers, reproduction, or distribution. These assessments are made in full consideration of the status of the species (Section 4).

## 8.1 Smalltooth Sawfish

The smalltooth sawfish research program considers both procedures with no risk of mortality and procedures with the risk of either “in hand” or “delayed” mortality. The only source of “in hand” mortality is from the capture process. Capture is authorized by gill net, beach seines, long-lines, drum-lines, and rod and reel. Invasive surgical procedures to implant a telemetry tag could result in “delayed” mortality. Handling, restraining, external tagging, minimally invasive tagging, genetic tissue sampling, biopy tissue sampling, blood collection, ultrasound, photography, and operation of ROVs are not expected to pose any threat of mortality to smalltooth sawfish.

Smalltooth sawfish are currently confined to waters around Florida with very few encounters in the rest of their historic range. As reported above, there may be as many as 2,000 adult smalltooth sawfish and 2,500 juveniles. Intrinsic rates of growth (λ) for smalltooth sawfish have been estimated at 1.08-1.14 per year and 1.037-1.150 per year by Simpfendorfer (2000) and Carlson and Simpfendorfer (2015), respectively. However, these intrinsic rates are uncertain due to the lack of long-term abundance data. Smalltooth sawfish abundance is limited by habitat alterations from agriculture as well as coastal and urban development, dredging, bycatch and recreational fisheries, research, and climate change. Despite these sources of mortality or lost fecundity, smalltooth sawfish are apparently increasing in abundance.

The research program limits the amount of mortality to both juveniles and adults to 0.3% of the population annually. While this amounts to approximately 33 adult and 40 juvenile smalltooth sawfish every five years, this rate when coupled from estimated mortality from other authorized sources would still allow the intrinsic rate of growth to be positive. We therefore determine the proposed action will not reduce appreciably the likelihood of both the survival and recovery of the US DPS of smalltooth sawfish.

## 8.2 Sea Turtles

The smalltooth sawfish research program considers the risk of unintended capture of loggerhead, leatherback, hawksbill, Kemp’s ridley, green, and olive ridley sea turtles. Capture of smalltooth sawfish is authorized by gill net, beach seines, long-lines, drum-lines, and rod and reel. Any of these methods of capture could inadvertently capture sea turtles resulting in the possibility of mortality.  There are mitigation measures included in the smalltooth sawfish research program specifically to minimize the effects of accidentally capturing smalltooth sawfish.

Sea turtles have been closely monitored and protected under the Endangered Species Act. Loggerhead sea turtles in the area have large populations and appear to be expanding nexting sites, despite a general decreasing trend in abundance. Leatherback sea turtles in the Caribbean appear generally stable. Hawksbill sea turtles have experienced increases and decreases on different nesting beaches, with an overall greater number of declining nest counts. Kemp’s ridley sea turtles suffered a great decline in the 1970s from overharvest of their eggs, but have been generally increasing with the help of head start programs to protect nests and get juveniles to the sea. Green sea turtles have been relatively stable in abundance around Florida with a recent population viability analysis suggesting it is very unlikely the go extinct in the next 100 years. Olive ridley sea turtles are very abundant worldwide but nesting success remains a concern as a result of poaching.

Sea turtles are still subject to poaching, primarily of eggs. Sea turtles can also be captured as bycatch, but less now with turtle excluder devices. They also face threats from disease, oil spills, vessel strikes, sound, marine debris, habitat degradation, climate change, power plants, and hydromodification. Despite these threats, many populations remain stable. Where populations are decreasing, it is thought that mitigation of the main threats will improve nesting success over time.

Accidental capture associated with the smalltooth sawfish research program could result in the capture of 12, 12, 12, 12, 4, and 4 individual Northwest DPS loggerhead, North Atlantic green, hawksbill, Kemp’s ridley, leatherback, and olive ridley sea turtles, respectively. Of those, up to three sea turtles may be killed every 10 years but no more than 2 of any species in that time. The three individuals over any 10 year period that are anticipated to be “in-hand” mortalities as a result of smalltooth sawfish research are too few to have population level effects for North Atlantic green, hawksbill, Kemp’s ridley, Northwest Atlantic loggerhead, olive ridley, or leatherback sea turtle populations in the area. Under the worst case scenario of the smallest population (Kemp’s ridley), the anticipated mortalities would be fewer than 0.05 percent of the adult female portion of the population. As such, the level of mortality to any of those species would also not cause a declining trend in abundance.

We therefore determine: 1) the proposed action will not reduce appreciably the likelihood of both the survival and recovery of the Northwest Atlantic DPS of loggerhead sea turtles, 2) the proposed action will not reduce appreciably the likelihood of both the survival and recovery of the leatherback sea turtles, 3) the proposed action will not reduce appreciably the likelihood of both the survival and recovery of the hawksbill sea turtles, 4) the proposed action will not reduce appreciably the likelihood of both the survival and recovery of the Kemp’s ridley sea turtles, 5) the proposed action will not reduce appreciably the likelihood of both the survival and recovery of the North Atlantic DPS of green sea turtles, and 6) the proposed action will not reduce appreciably the likelihood of both the survival and recovery of the olive ridley sea turtles.

# 9 CONCLUSION

After reviewing the current status of the ESA-listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS’ opinion that the proposed action is not likely to jeopardize the continued existence of the U.S. DPS of smalltooth sawfish, northwest Atlantic DPS loggerhead sea turtles, leatherback sea turtles, north Atlantic DPS green sea turtles, hawksbill sea turtles, olive ridley, or Kemp’s ridley sea turtles. As was identified in Section 4 of this opinion, all critical habitat that is designated or proposed will either be outside of the action area or is not likely to be adversely affected by this action.

# 10 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to ESA-listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is further defined as an act which “create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering” (NMFS 2016). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement. This being a mixed programmatic action, any proposed research that is expected to exceed the amount or extent of anticipated take considered in this opinion, a separate opinion can be tiered to this action without the need to completely reinitiate consultation as explained in section 11 below.

## 10.1 Amount or Extent of Take

Section 7 regulations require NMFS to specify the impact of any incidental take of endangered or threatened species; that is, the amount or extent, of such incidental taking on the species (50 CFR § 402.14(i)(1)(i)). The amount of take represents the number of individuals that are expected to be taken by the proposed action. The extent of take represents the “extent of land or marine area that may be affected by an action” and may be used if we cannot assign numerical limits for animals that could be incidentally taken during the course of an action.

Section 6.5 assesses the risks of the program to smalltooth sawfish and sea turtles. While the action proposes to capture smalltooth sawfish, there is a chance of sea turtle bycatch associated with those efforts. This project anticipates the capture of loggerhead, leatherback, hawksbill, Kemp’s ridley, and green sea turtles (Table 8), and anticipates up to three mortalities over any given 10 year period affecting no more than two sea turtles of the same species. Because the bycatch of sea turtles is unintentional and the researchers cannot anticipate which species may be captured, these estimates are based on observations from previous research permits, anticipation of more smalltooth sawfish research in the future, and increasing populations of many sea turtle species in Florida waters and throughout parts of the tertiary sampling locations. There is mitigation in place to minimize the likelihood of mortality, though it cannot be completely prevented.

**Table 8. Proposed incidental take non-target sea turtles during the proposed action over any given ten-year period.**

| Species | Non-Lethal Captures (10 year maximum) |
|---|---|
| Northwest DPS loggerhead sea turtle | 12 |
| North Atlantic DPS green sea turtle | 12 |
| Hawksbill sea turtle | 12 |
| Kemp's ridley sea turtle | 12 |
| Leatherback sea turtle | 4 |
| Olive ridley sea turtle | 4 |
| **Species** | **Lethal Captures** |
| All sea turtle species combined | 3, but no more than 2 of any species |

### 10.2 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). Section 7(b)(4) of the ESA requires that when a proposed agency action is found to be consistent with section 7(a)(2) of the ESA and the proposed action may incidentally take individuals of ESA-listed species, NMFS will issue a statement that specifies the impact of any incidental taking of endangered or threatened species. To minimize such impacts, reasonable and prudent measures, and terms and conditions to implement the measures, must be provided. Only incidental take resulting from the agency actions and any specified reasonable and prudent measures and terms and conditions identified in the ITS are exempt from the taking prohibition of section 9(a), pursuant to section 7(o) of the ESA.

Reasonable and prudent measures are nondiscretionary, and must be undertaken by the Permits Division so that they become binding conditions for the exemption in section 7(o)(2) to apply. The reasonable and prudent measures are co-extensive with the appropriate mitigation, monitoring, reporting, and adaptive management activities within the Sawfish Program.

## 11 Conservation Recommendations

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

We recommend the Permits Division:

1. Prioritize research focused on understanding post-release mortality rates of smalltooth sawfish receiving surgery. These studies should be more rigorous than reporting recapture events or long-term detection data. The studies should rely on smalltooth sawfish tagged with multiple tags that track movement to address the issue of tag shedding or tag failure.
2. Work with researchers to establish databases for the purpose of sharing genetic clips or recreational hook and line captures of smalltooth sawfish.
3. Work with researchers to coordinate telemetry receiver placement to optimize data collection for a number of different research projects, maximizing the utility of a limited number of receivers.

# 12 Reinitiation of Consultation

This concludes formal consultation on the Permits Division's Smalltooth Sawfish Research Program. As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect ESA-listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the ESA-listed species or critical habitat that was not considered in this opinion, or (4) a new species is ESA-listed or critical habitat designated that may be affected by the action.

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