

CONSERVATION BIOLOGY OF THE SMALLTOOTH SAWFISH: SCIENCE TO HELP SAVE THE USA'S FIRST ENDANGERED ELASMOBRANCH

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What Are Sawfish?

Sawfish are an elasmobranch and members of the Family Pristidae. Sawfish are a type of ray and all possess a distinctive toothed rostrum or “saw”. There are currently seven recognized species of sawfish throughout the world, found in tropical and sub-tropical coastal, estuarine and freshwaters.

The Decline of *Pristis pectinata* in US water.

Pristis pectinata, the smalltooth sawfish, was historically common in the US from the Mexican border to the Carolinas. Summer migrations took animals as far north as New York. However, from 1900 to 2000 the population is estimated to have declined in excess of 95%. Smalltooth sawfish were extirpated from most of its historic range, and now only occur regularly in southwest Florida and the Florida Keys.

The causes of decline of the US smalltooth sawfish population include:

1. Mortality in commercial and recreational fisheries (especially due to net fisheries). Although there was not a directed fishery for harvest of sawfish, they were often caught as by-catch. Often the sawfish would be killed to aid in removing it from the gear.
2. Loss of important near shore habitat due to coastal development. Newborns and juveniles use shallow bays and estuaries as nursery habitats. Juveniles are often closely associated with mangroves and their intricate prop root system, possibly to avoid predation.
3. Sawfish have a low reproductive potential. They are late maturing, and produce few young. Male sawfish reach sexual maturity at approximately 11 feet in length. It is likely that females produce liters of less than a dozen pups every other year.

The USA's First Endangered Elasmobranch.

In November 1999, National Marine Fisheries Service (NMFS) received a petition from the Ocean Conservancy (formerly the Center for Marine Conservation) requesting that smalltooth sawfish be listed as endangered under the Endangered Species Act. NMFS completed a status review in December 2000, researching what is known about the species to determine if endangered listing was warranted. On April 1, 2003, NMFS announced its final determination to list smalltooth sawfish as an endangered species under the Endangered Species Act. Listing documents are available at <http://www.nmfs.noaa.gov/pr/species/fish/smalltoothsawfish.htm>

After the listing, NMFS convened the Smalltooth Sawfish Recovery Team, comprising sawfish scientists, managers, and environmental managers, to develop a plan to recover the U.S. smalltooth sawfish. The plan recommends specific steps to recover the population, focusing on reducing fishing impacts, protecting important habitats, and educating the public.

Mote Marine Laboratory Research on *Pristis pectinata*.

Responding to the alarming decline in sawfish numbers and the lack of scientific data on the species, Mote Marine Laboratory's Center for Shark Research started the Sawfish Research Project in 1999 to provide the scientific basis for proper and effective conservation measures. The project is investigating the current distribution and abundance, critical habitats of all life stages, conservation genetics, on-going threats and methods to reduce them, and impact of human development on habitat use.

Outreach

When it comes to endangered species, educating the public about the status of the species is vital to protecting and recovering the population. The smalltooth sawfish population was severely depleted in the US and Florida waters decades ago. As a result many people have never heard of a sawfish or know they exist in our waters and few have ever seen one. Therefore, educating the public about sawfish is the first step to helping save the species from extinction. Also, few people are aware that National Marine Fisheries Service added the US population of smalltooth sawfish to the Endangered Species List in April 2003, protecting it in all State and Federal waters. This knowledge is important for fishermen because possessing or harming a sawfish is a federal offense and can carry stiff penalties.

One important aspect of the Sawfish Research Project is our on-going education and outreach project, the "Release It-Report It" campaign, which increases public awareness about the endangered status of and continuing threats to the population, promotes safe handling and release of sawfish, and encourages reporting of encounters with sawfish by the public. Mote Marine Laboratory's National Sawfish Encounter Database of public reports provides data to target field research surveys, identify critical habitats, focus

recovery efforts and monitor the species as the population recovers. Increased public understanding of the endangered status of sawfish, the need for conservation of sawfish, and how they can contribute to recovery efforts, are key requirements to successfully save this species from extinction. We use many methods to reach the public and provide educational opportunities including presentations at dive club, charter fishing guide and environmental group meetings; displaying “Report Sawfish Encounters” flyers from Texas to North Carolina at bait shops, tackle stores, dive shops, boat ramps and park visitor centers; an informative display at our Mote Marine Laboratory mobile and aquarium exhibit; personal appearances on television and radio fishing shows; sending letters and educational materials to research organizations and fisheries monitoring programs; and manning a sawfish research and conservation booth at scientific conferences, and diving and fishing shows and events. We contribute a monthly “Sawfish News” article which appears in three major Florida fishing magazines (The Nautical Mile, The Weekly Fisherman, and Coastal Angler Magazine), regularly reaching thousands of boaters, fishers and coastal residents.

Another valuable tool is our Captain’s Sawfish Reporting Logbook Program. Charter fishing guides are on the water more often and know the areas they fish better than almost anyone. Therefore we asked many fishing guides to participate in our Logbook Program to enhance the public sightings database. Charter captains multiply the observational effort substantially over that which we could achieve alone. Participating captains are given a logbook of pre-printed postcards to be filled in with details of the sawfish, habitat and catch details for each sawfish encountered. The cards can then be ripped out of the book, and mailed back to us. We currently have 24 fishing guides from Tampa Bay to the Florida Keys participating in the program.

Data collected from public sightings is used to provide information on the current distribution, providing base-line data for determining changes in the population. Such data is critical to continued recovery efforts for this species. In addition data is used to assess habitat use and population distribution. Currently, the full size range of animals is being reported by the public with the majority of reported animals being juveniles. This indicates the population is still reproducing. Juvenile sawfish are most often encountered in waters less than 5 meters in depth.

The goals of our education initiatives are 1)To raise awareness and public understanding of the endangered status and needs of the smalltooth sawfish population in US and adjacent waters by targeting other researchers, resource managers, policy makers, fish and wildlife agency staff, and recreational fishermen, boaters and divers 2)To increase the number of public sawfish encounters reported to the Mote Marine Laboratory National Sawfish Encounter Database and 3)To utilize data from public reports to monitor habitat use, distribution, movements and continuing threats of the smalltooth sawfish population.

Field Work

Intensive field sampling is conducted year-round utilizing longlines, gill nets, seine nets, and rod and reel in a variety of habitats throughout south Florida. Since 2000, nearly 1700 sampling events from Tampa Bay to the outer Florida Keys have resulted in the capture of over 100 smalltooth sawfish, with a size range of 62-496 cm total length. All sawfish captured are sexed, measured (saw, pre-caudal, fork, total, and stretch total lengths), tagged (external unique serial number fin tags, internal Passive Integrated Transponder (PIT) tags, transmitters and satellite tags), photographed, and safely released. External tags allow for identification by individuals encountering the sawfish after release. PIT tags allow researchers to identify individuals long-term, if recaptured. Transmitters allow researchers to track animals short-term from a vessel and record movements and habitat use or monitor them long-term using moored acoustic receiving stations to record residency time, influence of water quality on movements, home range, and habitat use. Satellite tags provide long-term movement, migrations and habitat use data, and can provide information on release mortality and aggregation locations. Water quality parameters (temperature, salinity, dissolved oxygen), habitat characteristics (water depth, bottom type, distance from shore, shoreline features) and environmental conditions (latitude/longitude, wind strength, wave height, cloud cover) are recorded at each sampling location and sawfish capture site to allow for determining habitat use. A small portion (about 1 gram) of the dorsal fin is removed from each captured sawfish for genetic analysis through collaborating institutions.

The completion of the Smalltooth Sawfish Recovery Plan has heralded a new phase of management for the US population of this species. Research and monitoring priorities identified in the Recovery Plan now need to be implemented. One of the high priority tasks identified in the plan is the monitoring of the number of sawfish in nursery regions throughout Florida. The most important nursery region for smalltooth sawfish is the section of coast from Marco Island (Naples) to Florida Bay. This region encompasses the coast of the Everglades National Park and Ten Thousand Islands. In 2007, Mote Marine Laboratory developed protocols to monitor the relative abundance of juvenile smalltooth sawfish in Florida nursery areas. This project completes surveys in previously identified nursery areas in this region from February to May (when sawfish are pupped in this region) to monitor the number of juvenile sawfish present in the areas, as well as continue to perform surveys in additional areas to identify further appropriate sampling locations, techniques and timing. These surveys will result in baseline relative abundance data as well as protocols for any additional recommended sampling sites for future ongoing surveys to document juvenile sawfish numbers in this region.

The movements of juvenile smalltooth sawfish in southwest Florida were studied using a combination of active acoustic tracking and automated acoustic monitoring. From 2002-2006 thirteen individuals were actively tracked for periods of up to 24 hours to provide detailed habitat use and movement data. Recently born individuals had very small home ranges, low linearity of movement and demonstrated a preference for very shallow mud banks. Larger juveniles demonstrated larger home ranges, high level of linearity of

movement and no preference for shallow mud banks. From 2003-2007 twenty-four individuals were fitted with acoustic tags for long-term monitoring of residency. Monitoring results indicated that juveniles have high levels of site fidelity for specific nursery areas for periods up to almost three months, but over the longer term had low levels of fidelity. Analysis of tracking data indicated that tides were the main factor influencing movement on short term scales. Habitat use patterns by recently born juveniles may have been a predator avoidance strategy. The combination of tracking and monitoring techniques used expanded the range of information gathered by generating both short and long term data.

To monitor the movements, residency time, possible aggregations, habitat use and post-release mortality of adult sawfish we are using satellite tags and baited remote underwater video stations. We deploy Wildlife Computers MK-10 satellite tags on three sawfish at least 2 meters in length (preferably at least 4 meters in length) which will record the sawfish location and depth, and temperature of the water. After a period of three-six months, the tags will pop-off the sawfish, float to the surface and transmit the stored data to us via the ARGOS satellite system. The data from these tags will be analyzed to determine post-release mortality in the recreational and commercial hook and line fisheries, habitat use, migration patterns and corridors, and aggregation areas. We deploy Baited Remote Underwater Video Stations at fishing and sawfish capture locations to record any activity, behavior, habitat use and possible aggregations. Each camera is deployed for 80 minutes (the recording time of the video cassettes). The data collected from this project will be used to identify future research directions and proper protocols.

Collaborations

A genetics study has been developed through collaboration with Demian Chapman of Pew Institute for Ocean Science and Kevin Feldheim of The Field Museum. This research has two objectives 1: to determine whether multiple discrete breeding populations of sawfish remain in the U.S. that should each be managed independently and locally or whether there is only one breeding population that should be managed as a unit, co-operatively by federal and state agencies; and 2: to assess the population history of smalltooth sawfish in their SW Florida “stronghold” and determine whether they have suffered a loss of genetic diversity that may compromise their ability to survive and reproduce in the future.

Another collaboration with Mahmood Shivji of Nova Southeastern University is analyzing sawfish tissue samples to create a DNA test to identify sawfish parts confiscated in trade. As international trade bans are now in place, the ability to identify the species of fins or rostra in trade is crucial to law enforcement.

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