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ON THE COVER

Sleek, fast-moving blacktip reef sharks moved into their new home at the *Blacktip Reef* exhibit in Baltimore's Inner Harbor. Twenty sharks have taken up permanent residence in the National Aquarium's new centerpiece attraction. The \$12.5 million coral reef exhibit is the first stage of a project to renew and refresh the National Aquarium, which draws more than 1.4 million visitors each year. Several upgrades have been made to the aquarium to improve visitors' ability to get close to the animals of the *Blacktip Reef* exhibit, including a 27-foot viewing window that curves four feet into the underwater reef itself, and daily diver presentations and feedings.

BLACKTIP REEF SHARK © NATIONAL AQUARIUM





SAND TIGER SHARK TAGGING IN THE WESTERN ATLANTIC

Shark tagging is certainly not what it used to be. Thanks to high tech devices, several geostationary satellites high above the planet, and biologists here on earth who can comprehend all the data collected, this very important aspect of shark conservation is more precise than ever.



Tagging has become one of the greatest ways for an aquarium staff to help in the conservation of the species it most often features in the largest habitat in their facility.

Every year since 1999, marine biologists on staff at the two Ripley's Aquariums, joined by other staff from the Audubon Aquarium of the Americas in New Orleans, La., and the New York Aquarium on Coney Island, N.Y., have ventured out onto the western Atlantic Ocean to catch, tag and release sand tiger sharks (*Carcharias taurus*) as a part of a long-term study on the migration pattern of this species.

For several weeks during April, May and June, when these highly migratory species are traveling by, biologists climb on board Ripley's boat, the *Believe It or Knot!* and set off for the coastal Carolina waters. Sand tigers were chosen because they are also a popular aquarium shark species on display at many aquariums around the world, including Ripley's Aquarium in Myrtle Beach, S.C., and Ripley's Aquarium of the Smokies in Gatlinburg, Tenn.

While the sand tiger shark is not listed on the U.S. Endangered Species List, it is listed as "vulnerable" on the IUCN Red List, and wild populations are threatened by poaching for fins and overfishing. By tagging sand tiger sharks, marine biologists can study their migratory patterns and learn important facts about their lives and potentially about how to protect them better in the future.

Sand tiger sharks are found in temperate and subtropical waters in many parts of the world, including the western Atlantic Ocean. In this region, sand tiger sharks occur from the Gulf of Maine to Argentina. They are highly migratory, especially in the northern and southern extremes of their range. In U.S. waters, they are found in shallow coastal waters in the summer months, but may move south or into offshore waters as winter approaches. They occur most commonly at depths of between 15 and 25 meters, but may swim in depths from less than one meter to as much as 191 meters. Likely factors influencing seasonal movements include water temperature, food availability, predatory pressures, and the reproductive cycle.

Tagging is an important way to increase our biological understanding of sharks and to obtain information for rational resource management. The tagging of sharks provides information on stock identity, movements and migration, abundance, age and growth, mortality, and behavior. Information obtained through the tagging process is being used to assist federal and state agencies in their efforts to develop better and more consistent conservation strategies for sand tigers and other large coastal sharks in the western Atlantic Ocean.

The easiest, most common and least expensive way to study the migration and movement of sharks is by tagging them with a uniquely numbered tag with reporting instructions for the next person who catches the tagged shark. In this way, scientists can get a glimpse of how far a shark can travel over a period of time.

Ripley's has been participating in the Cooperative Shark Tagging Program (CSTP) operated by the National Marine Fisheries Service (NMFS) since 1999. The tagging program is a collaborative effort between recreational anglers, the commercial fishing industry, and NMFS to study the life history of Atlantic sharks.

The CSTP was initiated in 1962 and the tagging methods used have been essentially unchanged during the past 50 years and as a result, the information gleaned from the tags is quite limiting.

The tag that has been used for all these years is composed of a stainless steel dart head, monofilament line, and a Plexiglas

capsule containing a vinyl plastic legend with return instructions printed in English, Spanish, French, Japanese and Norwegian. These dart tags, in use since 1965, are implanted in the back muscle area near the base of the first dorsal fin.

Anglers using rod and reel accomplish the majority of the tagging for all species combined. Biologists and commercial fishermen using primarily long lines, hand lines, and nets (gill, trawl) account for the remainder. Conversely, commercial fishermen using long lines and net gear, and rod and reel anglers are responsible for the majority of the recaptures.

For the 48 year period ending in 2010, more than 221,000 sharks of 52 species were tagged and more than 13,000 and 33 species have been recaptured, a rate of recapture between 1 percent and 13 percent, depending on species. Amazing information on migration can be found from these catches. Distances travelled for the 33 species ranged from no movement at all to 3,997 nautical miles.

Although valuable and inexpensive to accomplish, the one flaw with these simple tags is that they only provide a few pieces of information; the date and location first caught and released and the date and location of recapture. We need to know more.

The High-Tech Better Way

The tagging system that provides much additional information is the battery powered Pop-up Archival Satellite Transmitting Tag (PAT). It records and archives depth, ambient temperature, and ambient light levels at periodic intervals before being jettisoned from the animal at user-specified dates and times.

After jettison, PAT tags float to the surface and broadcast their locations and stored sensor data to orbiting satellites. The locations of jettisoned transmitters, along with deployment locations, provide point-to-point tracks of movements of tagged sharks. The user may estimate smaller-scale movements between tag deployment and release using the stored sensor data. Temperature and depth data provide insight into vertical movements. Ambient light data provide estimates of latitude and longitude for points between tag deployment and tag jettison.

Ripley's Aquariums first assisted with and provided material support in 2001 for the comprehensive tagging project which utilized these more technology-advanced tags. Led by Hans Walters of the New York Aquarium and Wildlife Conservation Society (WCS), initially as his graduate school thesis project for Hofstra University, the project continues to this day as a joint research venture between Ripley's Aquariums and the New York Aquarium, with assistance from the Audubon Aquarium of the Americas.

Ripley's Aquariums have proudly assisted with this project and will continue to collaborate by providing technical support and assistance with the proper collection, handling, tagging and release of these animals of South Carolina.

Since Ripley's started collecting sand tiger sharks in 1999, its marine biologists have tagged and released more than 100 specimens of sand tiger sharks in Delaware Bay and the coastal waters of South Carolina.

About Ripley's Aquariums:

Ripley's Aquarium in Myrtle Beach opened in 1997 and Ripley's Aquarium of the Smokies opened in 2000. Ripley's is building its third aquarium, Ripley's Aquarium of Canada, in Toronto, Ontario, Canada, and is scheduled to open later this year.

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