

## Marine Fisheries Tags White Sharks off Chatham

On Labor Day weekend, the presence of several white sharks (*Carcharodon carcharias*) off the coast of Cape Cod grabbed the attention of state and local officials, worldwide media, and *Marine Fisheries* biologists. While the seasonal (summer, fall) presence of white sharks off the coast of Massachusetts is well documented, this large charismatic shark is relatively rare in the Atlantic and much of what is known about its distribution and movements is based solely on historical sightings data.

The advent of new satellite-based tagging technology has allowed researchers to examine the movements, habitat use, and behavior of white sharks in the Pacific and Indian Oceans, but its elusive nature in the Atlantic has been a roadblock to such studies in this region. The nearshore appearance of at least 10 white sharks off Monomoy Island provided an ideal opportunity for *Marine Fisheries* biologists to deploy this technology for the first time in the North Atlantic.

The sharks were first spotted on Thursday, September 2<sup>nd</sup> when pilot George Breen saw two large sharks along the east coast of Monomoy Island while flying over the area. This information was immediately relayed to commercial fisherman Bill Chaprales, who contacted *Marine Fisheries*. Both Bill and George have been tagging sharks with the *Marine Fisheries* Shark Research Program for many years and, therefore, understood the significance of this sighting. Later that afternoon, senior *Marine Fisheries* biologist Greg Skomal returned to the area with the spotter pilot and confirmed the presence of five sharks off the coast of Monomoy in close proximity to grey seals.

Over the next five days, *Marine Fisheries* biologists worked with Bill and Nick Chaprales on the F/V Ezyduzit to tag the sharks. With the aerial assistance of George Breen, the harpoon vessel was directed to white sharks swimming in the area. Using a modified harpoon, Bill Chaprales was able to tag five white sharks, ranging from 8-13 feet long, from the pulpit of the boat. A commercial harpoon fisherman with decades of experience, Bill has been tagging sharks and tunas for scientists since 1994. Instead of using a standard

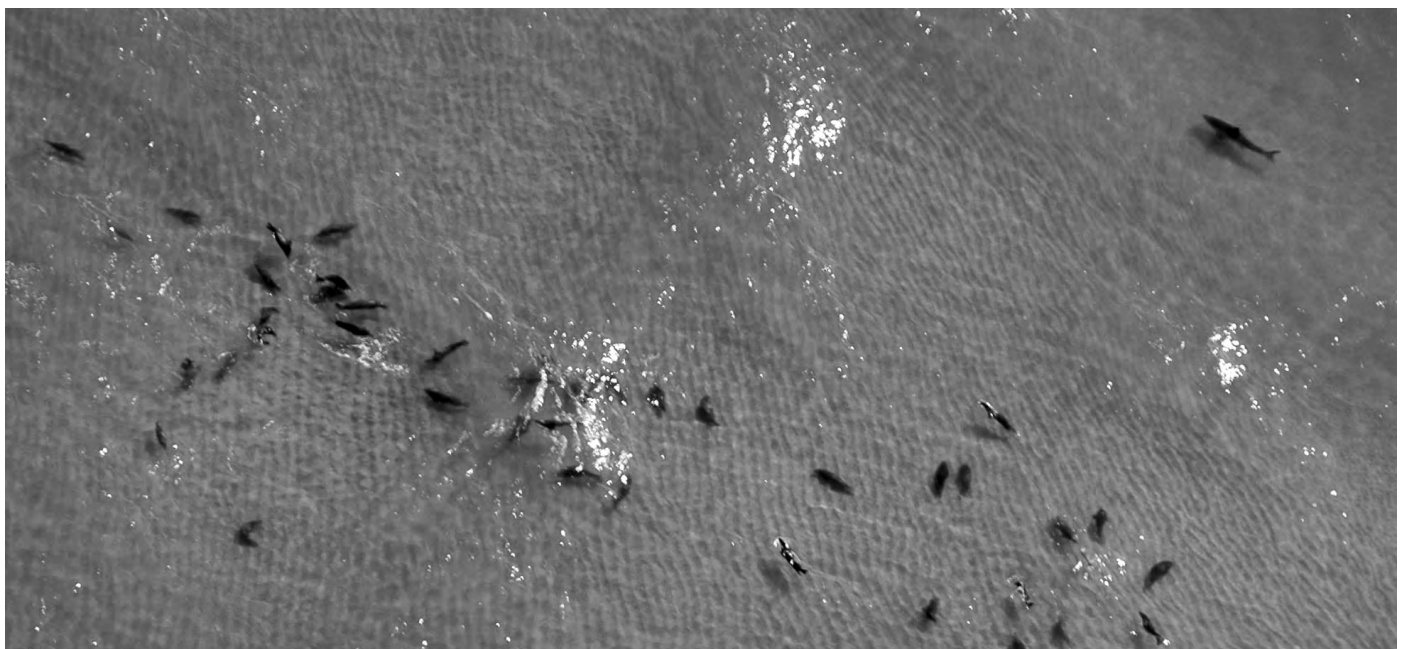
harpoon, Bill uses one that has been modified to reduce the level of skin penetration and minimize tissue damage.

All five white sharks were tagged with Pop-up Satellite Archival Transmitting (PSAT) tags. In contrast to standard satellite tags, these tags do not transmit real-time positions, but instead act as dataloggers, which collect and store temperature, depth, and light level data. At a time programmed by the researcher, the tags will pop-off the sharks, ascend to the surface, and transmit archived data to satellites, which relay them back to the researchers. At that time, the three-dimensional movements, including migration paths, depths, and temperature preferences of the shark can be re-created based on those data.

These tags are ideal for studying the ecology of highly migratory species (see: [www.mass.gov/dfwele/dmf/spotlight/basking\\_shark.htm](http://www.mass.gov/dfwele/dmf/spotlight/basking_shark.htm)). Although this tag technology has been deployed on numerous fish species including sharks, tunas, and billfish, this was the first successful effort to tag white sharks in the North Atlantic. Real time satellite tags were not used because there is no guarantee that the sharks would remain at the surface, which is required for satellite link-up. The PSAT tags do not allow for real time monitoring, but they do collect more comprehensive information on the movements of the sharks; they are programmed to release in January, March, and May, 2010.

In 2004, a large female great white shark swam into a Naushon Island estuary and remained for 13 days until it was forced to exit the area in a concerted effort by *Marine Fisheries* personnel. Although this shark was tagged with a PSAT tag, the release mechanism caused it to jettison prematurely because the shark was in shallow water for an extended period (see DMF NEWS Second Quarter - Third Quarter 2004). Since this event, the *Marine Fisheries* Shark Research Program has broadened its efforts to compile white shark sightings data.

While the occurrence of great white sharks off Massachusetts is not unusual, the unusual abundance off Monomoy over Labor Day weekend begs the question: why? The



*A white shark (upper right corner) lurks near a group of grey seals.*

Photo by Dan McKiernan, DMF



Photo by Wayne Davis, OceanAerials.com

**Captain Bill Chaprales assists Marine Fisheries biologists in harpoon tagging a 13 foot white shark from the F/V Ezyduzit.**

number of white shark sightings as well as the number of shark-bitten seals has been rising in recent years off the coast of Massachusetts. In most cases, these interactions have occurred adjacent to Monomoy Island, which hosts a sizeable growing population of grey seals.

The white shark is a documented predator and scavenger of marine mammals and has been the species most implicated in these interactions. Indeed, most white shark “hotspots” around the world are associated with large seal and sea lion colonies. While the perceived increase in shark predation on grey seals can be attributed to several factors, we speculate that white sharks, which were thought to generally feed offshore in the Atlantic, are exhibiting a dietary shift in response to changes in seal abundance. As a result, it is anticipated that the number of white shark sightings as well as seal interactions will continue to rise off the coast of Massachusetts and, in particular, Monomoy Island.

The white sharks tagged off Monomoy Island on Labor Day weekend will provide the first real insights into the ecology of this species in the North Atlantic. These tags will also allow us to examine site fidelity and residency in Cape Cod waters. In other parts of the world, these tags have shown that the white shark is not exclusively a coastal species and routinely exhibits broad offshore movements while diving to depths in excess of 2,000 feet. It should be fascinating to see what they do in the Atlantic.

Given the potential for more white sharks in Massachusetts waters, the *Marine Fisheries* Shark Research Program will continue to compile shark sightings data. We encourage the public to report such sightings. In addition, we will continue to actively study these sharks to collect information that will enhance our ability to advise local authorities and to improve state and federal management. *Marine Fisheries'* Shark Research Program and the white shark tagging activities are supported by Federal Aid in Sport Fish Restoration and a grant from the Massachusetts Environmental Trust. Additional information related to this project, including photos and video, can be found at: [www.mass.gov/dfwele/dmf/spotlight/white\\_shark\\_2009.htm](http://www.mass.gov/dfwele/dmf/spotlight/white_shark_2009.htm).

By Dr. Gregory Skomal, Shark Project Leader and John Chisholm, Shark Biologist

## Studying Sand Tiger Movements in Plymouth-Kingston-Duxbury Bay

The sand tiger (*Carcharias taurus*) is a coastal shark species that ranges from the Gulf of Mexico to the Gulf of Maine along the east coast of the United States. Historically, the species has been fished throughout its range, but recent implementation of the Interstate Shark Fishery Management Plan now prohibits harvest in both state and federal waters.

In the past few years, an increasing number of juvenile sand tigers have been caught by recreational fishermen in Plymouth-Kingston-Duxbury Bay, a 10,200 acre tidal estuary located on Massachusetts' south shore. Most of these fish are in the size range of 3-4 feet, which indicates that this bay provides important nursery habitat for newborn sand tigers that move north from southeastern US pupping grounds.

Working with UMass School of Marine Science and



Photo by Derek Perry, DMF

**The large awl-shaped teeth of the sand tiger distinguish it from spiny and smooth dogfish.**

Technology doctoral student Jeff Kneebone, *Marine Fisheries* has been tracking the behavior, movements, and habitat use of sand tigers in the Bay. Local fisherman Dave Lindamood has assisted Jeff and *Marine Fisheries* biologist John Chisholm to tag and release more than 60 sand tigers in the bay during the last two

summers. Over half were outfitted with acoustic transmitters that allow researchers to track real-time movements of the sharks within the bay.

Transmitters emit a high frequency sound pulse that can be detected and logged by any one of 25 receivers placed throughout the bay. By examining where and when sharks are detected after they are released, movement patterns may be defined as they relate to tide, temperature, depth, time of year, and location.

Ultimately, *Marine Fisheries* hopes to identify and quantify the characteristics of essential sand tiger habitat within the bay. In addition, this technology allows us to investigate the impacts of capture stress on behavior and survivorship after release, which is particularly important because release is mandated throughout the range of this species.

Results to date show that sharks remain within the bay during all tides and show fidelity to specific sites during most of the summer. By early October, sand tigers exit the bay and begin their migration to wintering grounds off North Carolina. One tagged sand tiger was detected in a receiver array near the entrance to Pamlico Sound off Cape Hatteras, NC in January 2009. All of the sharks tracked to date survived the capture event, thereby demonstrating that catch and release could be a viable conservation tool.

This research is supported by Federal Aid in Sportfish Restoration as well as a grant from the NOAA Proactive Species Conservation Grant Program. Jeff Kneebone is supported by Massachusetts Marine Fisheries Institute funds. Much of this work would not be possible without the logistical and hands-on support of the Jones River Landing Environmental Heritage Center, the office of the Duxbury Harbormaster, and numerous local fishermen.

By Dr. Gregory Skomal, Shark Project Leader