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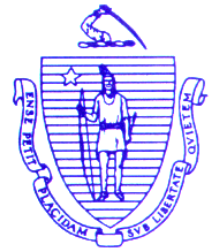
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MEMORANDUM

TO: Marine Fisheries Advisory Commission (MFC)

FROM: Paul J. Diodati, Director *Paul J. Diodati*

DATE: May 9, 2013

SUBJECT: Proposal to Adopt Emergency White Shark Regulations and an Update Research

Background

Despite a well established presence in the North Atlantic, scientific efforts to study white sharks have been limited until recently. Whereas researchers in the Pacific and Indian Oceans, because of high seasonal abundances of white sharks near seal and sea lion colonies, have been able to track white shark movement and behavior over fine and broad scales; researchers in the North Atlantic have not been as fortunate. Until recently, most of our knowledge of its life history and ecology has been dependent on the analysis of distribution records, as well as opportunistic observations and the examination of dead specimens. However, with the protection of marine mammals and the consequential growth of the North Atlantic gray seal population along Cape Cod, we now have predictable access to white sharks during the summer and early fall months. As a result, we can begin to sharpen our knowledge and understanding of the behavior and movements of these white sharks.

Update on Research

Over the last four summers (2009-2012), Division of Marine Fisheries (*Marine Fisheries*) staff have observed and tagged a total of 34 white sharks off the eastern coast of Cape Cod, primarily in the shallow near-shore waters from Orleans south to the tip of Monomoy Island (Figure 1). *Marine Fisheries* uses numerous tagging technologies including: conventional tags, acoustic transmitters, autonomous underwater vehicle transponders, pop-up satellite tags (PSAT), and real-time satellite tags (SPOT). All sharks tagged were between 2.4 and 5 meters in total length (mean of 4 meters); of the 13 that could be sexed, 12 were female.

On a broad-scale, PSAT, SPOT and acoustic tags indicate that most sharks exhibit a coastal migratory pattern – moving from Cape Cod in the early fall to the more southerly waters between South Carolina to Florida during the winter (Figure 2). Moreover, most of these sharks remained on the continental shelf, moving daily between the surface and bottom (<50 meters). This indicates that the shelf waters along the southeastern US represent an important winter habitat for this species. However, not all the tagged sharks remained in coastal waters. The largest female shark tagged with PSAT technology was observed leaving the coastal waters in the early winter, spending the remainder of the winter in the Sargasso Sea (Figure 2). This shark also made daily descents from the surface to depths as great as 800 meters (Figure 3). Similarly, Mary Lee, a large female tagged with SPOT technology, was observed showing similar behavior (Figure 4). She was tracked moving southeast along the continental shelf in the late fall/early winter, moving back north to New England in January, and then southwards and offshore to spend the balance of the winter off Bermuda and in the Sargasso Sea. Staff speculates that the different migratory behavior exhibited by these large females may be linked to reproductive biology.

Marine Fisheries has also been tracking fine-scale movements. Acoustic tags have been critical in improving our understanding of white shark habitat use, site fidelity, residency, and localized movements.

To date we have compiled 25,454 detections from 17 white sharks along the eastern seaboard from Halifax, Nova Scotia to Cape Canaveral, Florida (Figure 5). A substantial amount of these detections have come from the eastern coast of Cape Cod, particularly between Orleans and Chatham. While this may be related to feeding behavior, it is also a function of acoustic receiver coverage. In 2012, five sharks, which were resident in Cape Cod waters for 39-124 days accounted for 68% of the detections to date (Figure 6). In 2012, two female sharks, #28366 and #32314, were detected over periods of 86 to 124 days, respectively, and appeared to exhibit site fidelity to areas north and south of the Chatham Inlet, respectively (Figure 7). Staff have indicated that the lack of spatial overlap, despite temporal overlap, may be indicative of habitat partitioning between these two females, and this will be the subject of future research and analysis.

Also, through work with the Woods Hole Oceanographic Institution, we were able to successfully deploy an autonomous underwater vehicle (AUV) to track a marine animal for the first time. While the track durations were short, the tracked sharks were vertically active moving in the water column between the surface and the seafloor (~30m in depth) (Figure 8). This movement may be associated with predatory hunting in close proximity to seal haul-outs. Additionally, the AUV was able to collect hydrologic data including: water temperature, current profiling, salinity, and conductivity. The analysis of these data will allow for fine-scale habitat modeling. Lastly, the AUV was outfitted with a video camera that facilitated the observation of sex, individual markings, and behavior – for example, a large female tracked on July 27, 2012 showed relatively fresh mating wounds indicating recent mating activity (Figure 9). In addition to continuing tracking broad- and fine-scale movements, *Marine Fisheries* is collaborating on several projects to better our understanding of white shark physiology and genetics, life history, and behavior.

Management

At present, our only regulations affecting white sharks is a prohibition on the harvest of this species. However, as the presence of - and attention paid to- white sharks in our waters is increasing, there is concern regarding the unconstrained expansion of human interaction with this species. Not only does this put the public at risk, as evidenced by the shark attack last summer, but increased interactions between humans and white sharks may alter white shark behavior.

Specifically, there are two over-riding concerns that put both sharks and humans in danger. First, is that an increase in activity to attract white sharks may alter white shark feeding behavior, and white sharks may begin to associate the presence of humans on the water with feeding opportunities. Second, is that businesses and individuals, whether trained or untrained, may want to become involved in independent white shark capturing and research activities. These concerns are echoed in a letter to me from 11 Cape Cod municipalities, the Town of Nantucket, and the Cape Cod National Seashore, which urges the Division of Marine Fisheries to take action and regulate activity around white sharks (attached).

Proposal

DMF is proposing the Marine Fisheries Advisory Commission support emergency regulations (attached) to constrain activity aimed to capture and attract white sharks to only those persons with a special white shark permit issued by *Marine Fisheries*. We proposed similar regulations in the past and have maintained a “wait and see” approach. However, considering the continued near-shore presence of these animals and the substantial interest in this presence, we believe it is important to take action at this time.

Attachments:

- 1) Figures 1 – 9;
- 2) Draft emergency regulations; and
- 3) Letter from regional working group