Maine Department of Marine Resources

2023 Annual Update

Inshore White Shark Monitoring

Maine Dept. of Marine Resources
194 McKown Point Rd
West Boothbay Harbor, ME 04575

About the Program

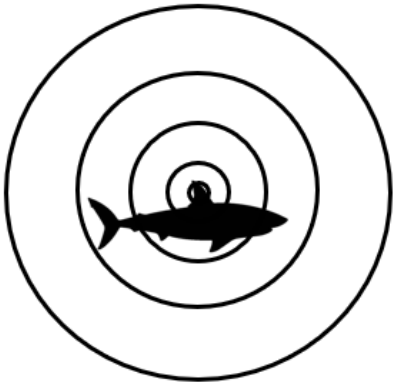
The Maine Department of Marine Resources (DMR) began monitoring white shark (*Carcharodon carcharias*) activity in the Gulf of Maine beginning late August of 2020 in response to increased public interest. The objective of this program is to investigate and improve our understanding of the distribution and habitat use patterns of white sharks in coastal Maine. This information is used to bolster public safety at beaches and provide data in support of scientific research and outreach.

Above: White shark scanning the surface of the water. Photo taken by Matt Davis.

How Monitoring Works

The primary method by which shark movements are recorded is via electronic tracking technology. In the case of acoustic telemetry, sharks are outfitted with a waterproof transmitter, which is inserted into the back of the shark. Transmitters are built to last for up to 10 years and remain on the shark throughout its lifespan. When one of these transmitters comes within 1000-1,500' of a compatible acoustic receiver, a detection event is recorded and stored locally on the receiver. Receivers are deployed at fixed locations in mid to late spring, then recovered in the fall or early winter so scientists can download detection data for analysis. If a receiver is not found at the end of a season, scientists cannot access its data.

Left: An acoustic receiver and transmitter. Right: Deploying an acoustic receiver into the Gulf of Maine. Receivers are tethered to a marked fishing buoy and deployed from May to November or December.

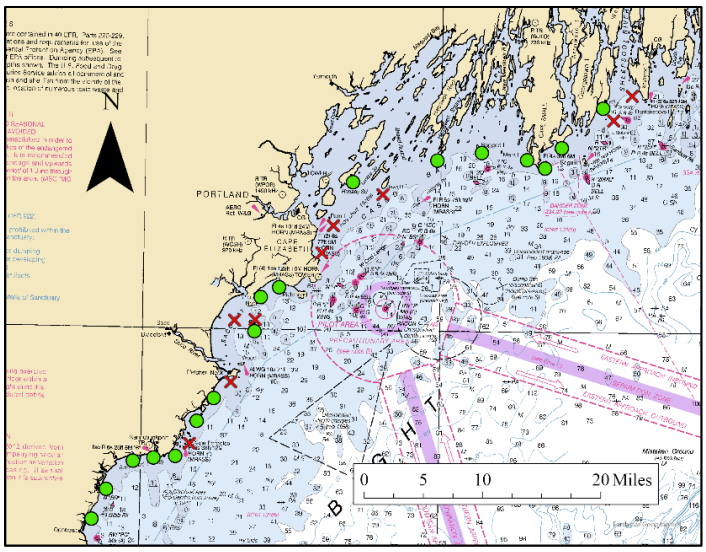


Left: A tagged shark swims near an acoustic receiver. Once close, the receiver will detect the tag and record its ID, along with a timestamp.

Passive Acoustic Receivers

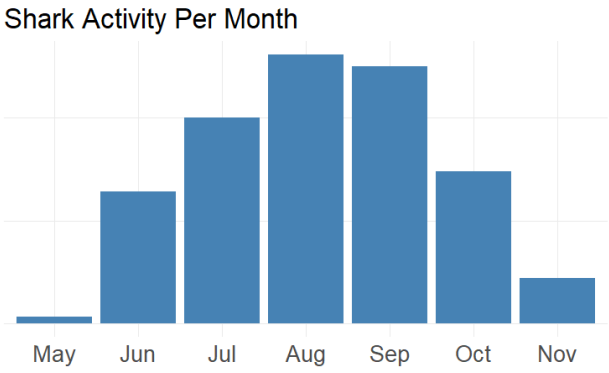
In 2023, the DMR White Shark Monitoring program completed its fourth year and third full season of acoustic monitoring, deploying a total of 26 passive receiver sites from Ogunquit to the Sheepscot River. Four additional passive receivers were deployed in a collaborative effort with Dr. John Mohan and his research program at the University of New England (UNE).

Receiver losses this year were greater than any other year in the survey's history, with nine of the 26 DMR receivers unrecovered. While it can be difficult to determine why any one receiver was not found, possible causes include strong weather events, rope fraying, biofouling, and interaction with fishing gear. Where possible, dive operations will be employed to search for missing receivers at sites during the subsequent spring while re-deploying for the next season of monitoring.



Above: Map of DMR sites. Receivers which were not recovered are denoted by a red "X".

Despite the high losses in equipment and data, across the 17 recovered DMR receivers we observed 105,351 detection events originating from 389 transmitters. Of those detection events, 1,700 were from white sharks; nearly 700 more than the previous highest year (2022, n = 1,042). Additionally, the four UNE passive receivers recorded 11 detection events from white sharks. Twenty-nine white sharks were recorded this year in total, bringing the number to 81 since the survey began in 2020. For reference, there are approximately 250-300 white sharks currently carrying detectable acoustic tags from New England. This year, the greatest number of sharks were detected at Hermit Island (n = 19) and Ragged Island (n = 13). These sites are historically among the most active, both by number of white sharks and by number of days where a shark was detected. Despite detecting less sharks than Hermit Island, the receiver at Ragged Island was visited nearly 40% more often and observed sharks on 29 different days. The receiver at Bailey's Island also observed notable white shark activity, with nine different sharks detected across 45 separate instances on 25 different days. (In this context, we consider each unique instance to be separated by more than 30 minutes between detections. Think of an instance as a 'visit'). Combined, these three sites observed more than 50% of all shark visits in 2023. With data combined across years, white shark activity has been highest during the months of July, August, and September. Detected sharks ranged in size from 7'0" – 16'0" from snout to tail tip, with an average estimated size of 10'3". Thus, most white sharks we observed were either subadults (n = 39) or juveniles (n = 30). The amount of time that sharks spent by any one receiver varied greatly between instances, although it seldom exceeded 30 minutes (mean = 615 ± 509 seconds [standard deviation]).



Real-Time Acoustic Receivers

In addition to the passive acoustic receivers, two real-time acoustic receivers were deployed by Maine DMR and Dr. John Mohan's research lab at Crescent Beach and in southern Saco Bay. As their name implies, these specialized devices use cellular towers to transmit detection alerts in real-time. These receivers were funded by the Maine Outdoor Heritage Fund (maine.gov/dacf/about/commissioners/outdoor_heritage_fund/index.shtml) and are coordinated with the help of the Department of Conservation, Agriculture and Forestry. Alerts are made publicly available on the Atlantic White Shark Conservancy's *Sharktivity* phone app (atlanticwhiteshark.org/ Sharktivity-app). The receiver at Crescent Beach detected one shark on July 31st, and the receiver in southern Saco Bay detected one on October 4th.

Above: The real-time acoustic receiver deployed in southern Saco Bay by Dr. John Mohan and his research lab.

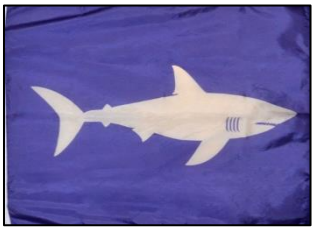
Sighting Reports

Sightings are compiled through three methods: submissions through the Maine DMR Shark Sighting Reporter (https://survey123.arcgis.com/share/54efc00f829a474b958321caf71ca578), submissions through the Atlantic White Shark Conservancy's *Sharktivity* phone app, and personal communication from collaborators. White shark sightings are categorized as either confirmed or unconfirmed and are broken down into the following categories: basic sighting, predation event, and wounded mammal. A record is categorized as a basic sighting when a white shark is physically seen by the observer but is not preying on an animal. A predation event occurs when a white shark is observed hunting an animal. A wounded mammal event is categorized as a marine mammal sighting where the animal displays wounds inflicted from a shark bite. Any instances of a marine mammal displaying wounds from a shark are reported to the Marine Mammals of Maine and/or Allied Whale.

2023 Sightings			
Basic Sighting	Predation Event	Wounded Mammal	Total Records
3	1	7	11

Maine Shark Working Group

The Maine Shark Working Group is a collective of beach officials, emergency medical professionals, educators, and scientists from Maine to Massachusetts working to improve public safety and messaging regarding shark activity at beaches. This effort, previously led by Arthur Howe of the Harpswell Department of Safety and Emergency Services, has been integral in forming the current shark sighting and shark encounter protocols at beaches throughout the state.



Above left: Shark warning flag flown at beaches. If you spot this flag, then a shark has been observed recently and you should seek beach officials for more information. Above right: QR code for the Maine DMR Shark Sighting Reporter website link.

Future Directions

In 2024, the White Shark Monitoring program aims to continue implementation of the inshore acoustic receivers along Maine's coast. When deploying receivers in the spring, scientists plan to dive several sites to recover lost receivers. The locations in 2024 will be the same as those of 2021-23, although there may be fewer sites if not enough receivers can be replaced.

Recently, the White Shark Monitoring program received grant funding from the Maine Outdoor Heritage Fund (MOHF) to expand monitoring eastward to include parts of Muscongus Bay. It is hoped that one day there will be capacity to cover the entire coast. The MOHF is also funding a grant for dedicated white shark tagging efforts in the Gulf of Maine with Dr. Walt Golet of the University of Maine to begin in 2024. Lastly, Staff are currently working on a peer-reviewed manuscript to summarize the findings of the White Shark Monitoring program in-depth.

Acknowledgements

Transmitter data used in this research are owned and maintained by the Massachusetts Division of Marine Fisheries (MADMF), the Atlantic White Shark Conservancy, the NOAA Greater Atlantic Regional Fisheries Office, OCEARCH, and Dr. James Sulikowski of Oregon State University. The acoustic receivers being used are property of the DMR, Dr. James Sulikowski, the University of New England, and MADMF. Deployments were made possible thanks to Justin Papkee of the F/V Pull n' Pray, and to Ed Hutchins and Riley Austin of the F/V Christina Mae II. Sightings reports are vetted with the support of John Chisholm of the Anderson Cabot Center for Ocean Life. Allied Whale and Marine Mammals of Maine opportunistically alerted this program of instances involving potential shark predation on seals. We also thank the fishermen, beach officials, and citizen scientists who make our sightings data and receiver work possible.

Interested in survey contract participation, learning more, or sponsoring a new receiver site? Contact us!

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