

Maine Dept. of Marine Resources

2024 Annual Update

Inshore White Shark Monitoring



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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 provide data in support of scientific research and to educate beach officials and the general public regarding trends in white shark activity in coastal areas.



Above: White shark scanning the surface of the water.

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 (or tag), which is inserted into back muscle near the first dorsal fin. Along the northeast US, organizations such as the Atlantic White Shark Conservancy (AWSC), Massachusetts Division of Marine Fisheries (MADMF), National Oceanic and Atmospheric Administration (NOAA) and others have been tagging white sharks for more than a decade. Acoustic transmitters can be programed to meet projectspecific needs, with some built to transmit for 10 years following deployment. When an acoustic transmitter comes within 1,000-2,000' of a compatible acoustic receiver, a detection event is recorded and stored locally on the receiver. Receivers are deployed underwater by the DMR each spring at fixed locations in the ocean, then recovered in the fall or early winter so scientists can download the detection event data. If a receiver is not found at the end of a season, scientists cannot access its data.



Left: A VR2Tx acoustic receiver and V16 acoustic transmitter. Right: Deployment of an acoustic receiver. Receivers are tethered а to marked fishing buoy and deployed from May through November.





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 2024, the DMR Inshore White Shark Monitoring (ISWM) program completed its fifth year and fourth full season of acoustic monitoring, deploying a total of 20 passive receiver sites from Ogunquit Beach to Reid Beach State Park. In addition, three passive receivers were deployed within western Muscongus Bay as part of DMR's grant project funded by the Maine Outdoor Heritage Fund(maine.gov/ifw/programs-resources/ grants/outdoor-heritage-fund.html), and four additional passive receivers were collaboratively deployed by Dr. John Mohan and his research program at the University of New England (UNE).

Receiver losses in 2024 were minimal, with only one device missing as of December 2024. An attempt was made to recover the device via dive operations in August when the receiver was discovered to be missing near Wells Beach, but the device was never found. While it can be difficult to determine the cause behind receiver losses, possible causes include strong weather events, rope fraying, biofouling, and interaction with fishing gear.

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 near Crescent Beach and in southern Saco Bay. As their name implies, these specialized devices use cellular towers to transmit detection alerts to beach officials and scientists in real-time. These receivers were funded by the Maine Outdoor Heritage Fund 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 in southern Saco Bay detected two sharks in 2024, while the receiver adjacent to Crescent Beach did not detect any sharks this year.

2024 Data Summary

While the IWSM program is most interested in sharks, the program's acoustic receivers detect other animals that have been outfitted with acoustic transmitters. Since inception, IWSM scientists have observed more than 379,000 detections from more than 540 unique



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

transmitters, belonging to more than 25 organizations. Across the 23 DMR acoustic receivers recovered in 2024, scientists observed detections originating 79.592 from 240 transmitters. Of those detections, > 5.000 can be attributed to white sharks. These detections were then broken down into distinct "visits" (n = 672), which began when a shark was first detected at a site and ended when the shark had not been detected for at least 60 minutes afterward (Bowlby et al., 2022). The duration of each visit was estimated by measuring the time between the first and last detection. In addition to DMR receivers, UNE receivers recorded multiple white shark detections in 2024. In total, 19 unique white sharks were recorded in 2024, (three of which were tagged in Maine) on 47 unique dates. A fourth shark which was tagged in Maine was not detected on the array. This brings the cumulative number of white sharks detected in our survey to 93. For reference, there approximately 300-350 white sharks are currently carrying detectable acoustic tags deployed by our partners. In 2024, the greatest number of sharks were detected at Hermit Island and Higgins Beach (n = 7 each), followed by Seal Cove in Phippsburg, Bumpkin Island, and Ragged Island (n = 6 each). Higgins Beach,

Scarborough Beach, and Cape Elizabeth observed the most days of activity in 2024 (n = 20, 17, and 16, respectively). Meanwhile, sites which have observed relatively high activity in previous years such as Hermit Island and Ragged Island observed 7 days of activity each in 2024.



Above: Map of 2024 DMR sites. Receivers which were not recovered are denoted by a red "X". Muscongus Bay sites and UNE sites not shown.

The overall quantity of detection activity from white sharks across the array was markedly lower compared to previous years (annual averages, 2021-2023: 28 unique sharks, 61 days of activity), in part due to the lower number of receivers deployed. However, even accounting for this decreased effort the data shows an overall decline. While the source of this decline in activity cannot be determined at this time, continued monitoring will help scientists and beach managers to interpret these results.

Survey Trends

Since inception, white shark activity from acoustic telemetry has been highest along Maine's coastline during the months of August and September, both by number of visits from sharks and by average number of days with detection activity (Figs 1A-B). Detected sharks have ranged in size from 7'0" - 16'0" total length (from snout to tail tip), with an average estimated size of 10'1". Of the 93 detected sharks, 37 were male, 49 were female, and the sex of the remaining seven were unknown. Using a combination of length and sex, white sharks can be classified into one of three maturity stages (Bruce and Bradford, 2012). It is estimated that 38 sharks were juveniles, 44 were subadult, and 7 were adult. While there were 7 individuals of unknown sex, 3 were of a length where life stage could be estimated confidently.



Figure 1. Plot of (A) total visits per month and (B) average monthly days of activity. Data from 2020-2024.

The amount of time that sharks spent by any one receiver varied greatly between visits. Rounding up to the nearest minute, visits from sharks ranged from lasting 1 min to nearly 24 hr; however, the weighted average time a given shark stayed within detection proximity of a receiver site was approximately 13 min. Different receiver sites showed different residency patterns, with some sites such as Stratton Island and Bailey's Island recording average visit times of 32 min and 23 min,

respectively. Meanwhile, other sites such as Kennebunk Beach and Wells Beach showed shorter average visit lengths (12 min and 10 min, respectively). Broadly, sites considered to be near sandy beaches had an average weighted visit length of 13 min vs. 12 min at islands or outcroppings.

While eastern Casco Bay sites have historically observed more sharks than other regions along Maine's coast, in 2024 the data was more evenly split. This was the first year in which Ragged Island and Hermit Island were not among the top three most active sites by number of visits. Instead, Higgins Beach, Scarborough Beach, and Cape Elizabeth observed the greatest number of visits (n = 51, 34, 28, respectively). Interestingly, 77.0% of those visits were made by a single shark which was tagged in Maine, and as of Dec. 2024, Maine-tagged sharks comprise approximately 18% of all white shark detections. However, this was not the first incident where a large portion of visits originated from one or a few individuals. For example, approximately 60% of all visits at Ragged Island in 2022 were from a single individual.

Of all recorded shark visits, 24.7% involved instances where a shark returned to a site it had previously visited within 24 hrs. Of those instances, 50% occurred at beach-adjacent sites, with the vast majority occurring at Higgins and Scarborough beaches and originating from primarily one shark. On only one occasion did a shark return to the same site (Bailey's Island) within one hour after leaving. Concerning larger timescales, the majority (n = 75, 80.6%) of sharks were detected during one year of surveying. Of the sharks which were detected for two (n = 13) or three (n = 5) years, 8 were detected at sites they had visited during a previous survey year. Only one individual has been detected at the same site for three consecutive years. To date, Head Beach and Bailey's Island have observed the highest rates of consecutive-year visits.

Sighting Reports

Sightings are compiled through three methods: the Maine DMR Shark Sighting Reporter (https://survey123.arcgis.com/share/54efc00f82 9a474b958321caf71ca578), the Atlantic White Shark Conservancy's Sharktivity phone app, and personal communication. White shark sightings are categorized as 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 foraging. 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. It should be noted that sighting reports are helpful, but they do not directly relate to the actual abundance or presence of white sharks.





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 DMR Shark Sighting Reporter Below: 2024 shark sightings from the DMR database.

2024 Sightings			
Basic	Predation	Wounded	Total
Sighting	Event	Mammal	Records
6	1	19	26

Beach Safety and Future Directions

Overall detection activity from white sharks remains relatively low compared to nearby Cape Cod, which is considered an aggregation area for the species. However, receiver coverage along the Maine coastline is relatively sparse. It is likely that a large portion of tagged sharks traveling through Maine waters went undetected because they were outside detection range. Furthermore, not all white sharks who enter the Gulf of Maine are tagged, and thus an unknown portion of the population remains undetectable. Still, while white sharks can pose potential risk to ocean users, negative interactions between white sharks and humans remain rare (Feretti et al., 2015), and at this time the general risk to water users in Maine appears to be generally low. However, to mitigate unwanted human-shark interactions, a collective of beach officials, emergency medical professionals, educators, and scientists from Maine to Massachusetts have formed the Marine Shark Working Group to improve public safety and messaging regarding shark activity at beaches. This effort, 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 throughout the state.

Moving into 2025, the IWSM program aims to continue deployment of the acoustic telemetry receivers along Maine's coast. The locations in 2025 will be similar to those of 2021-2024. Additionally, through funding provided by the MOHF, the DMR is partnering with Dr. Walt Golet and his Pelagic Fisheries Lab at the University of Maine to attempt vessel-based white shark tagging in Maine waters.

Acknowledgements

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Interested in survey participation, learning more, or sponsoring a new receiver site? Contact us! Maine Dept. of Marine Resources 194 McKown Point Rd West Boothbay Harbor, ME 04575 <u>Matthew.M.Davis@Maine.gov</u>