

Atlantic and Shortnose Sturgeon Monitoring in the Lower Kennebec River

January 2025

Background

This telemetry monitoring study managed by the Naval Undersea Warfare Center Division Newport (NUWCDIVNPT) was initiated in May 2021 to collect year-round occurrence data for Endangered Species Act (ESA) threatened Atlantic sturgeon (*Acipenser oxyrinchus*) and ESA endangered shortnose sturgeon (*A. brevirostrum*) in the lower Kennebec River (from north of Bath Iron Works to Fort Popham; **Figure 1**) and collect data during recurrent Naval activities. Specifically, a Biological Opinion issued by National Marine Fisheries Service (NMFS) for Maintenance Dredging of the Kennebec River (GARFO-2019-01719) specified Conservation Recommendations to conduct studies that further characterize year-round use of the lower Kennebec by Gulf of Maine Distinct Population Segment (DPS) Atlantic sturgeon and shortnose sturgeon. As a result, this effort marked the first year-round telemetry monitoring study in the Kennebec. This study also implemented monitoring stations offshore of Popham Beach to capture coastal movements of sturgeon and other species, including white sharks (*Carcharodon carcharias*). Offshore stations form a curtain between Fox-Seguín Islands and the Jackknife Ledge Dredge Disposal area.

The project objectives support data collection to inform and streamline future environmental planning efforts in the region, and to help identify dredging and disposal windows to ensure operational readiness while minimizing environmental impact. These include the following: 1) Monitor year-round presence and migration of Atlantic sturgeon in the lower Kennebec River; 2) Monitor year-round presence and migration of shortnose sturgeon in the lower Kennebec River; 3) Monitor sturgeon activity in the proximity of Bath Iron Works; 4) Add additional acoustic tags to the population of sturgeon occurring in the Kennebec River system; and 5) Document coastal movements of fish offshore from Popham Beach (sturgeon, white sharks, striped bass [*Morone saxatilis*], and other species designated by the National Oceanic and Atmospheric Administration (NOAA) as highly migratory species).

Collaborators on this project include State of Maine Department of Marine Resources (ME DMR), University of Maine (UMaine), U.S. Geological Survey (USGS), Portsmouth Naval Shipyard, and University of Maryland Center for Environmental Science. Data collected from this study will help to clarify/define/determine movement patterns in and out of the Kennebec basin, identify potentially new overwintering and/or foraging areas, and identify coastal movements of protected sturgeon between river systems that also contain compatible acoustic telemetry monitoring stations. Additional tagging efforts could create a large enough sample size to allow real time detection of fish to avoid or minimize take during dredging activities.

Forty (40) Atlantic sturgeon ranging from 57-168 cm fork length (FL) and twenty-three (23) shortnose sturgeon ranging from 54-87 cm FL were captured in June, July, and October 2022. To increase the population of tagged fish in the Kennebec, sixty-one (61) of these fish were acoustically tagged with surgically implanted transmitters (VEMCO Innovasea, models V16 or V13). These are the total number of tags for the project since its inception in 2020. As of December 2024, there are fifteen (15) year-round telemetry monitoring stations from Courthouse Point in Dresden to Fort Popham (including one in the Eastern River offshoot) and five (5) stations offshore (Figure 1 points labeled CRTHPT to FORTB). Seven (7) of the in-river stations are co-maintained by ME DMR (seasonally April - November) and NUWCDIVNPT. Downloads of telemetry stations occur on a bi-annual basis. In river, the array has detected both species of sturgeon, as well as tagged American shad (*Alosa sapidissima*), striped bass, and ESA endangered (Gulf

of Maine) Atlantic salmon (*Salmo salar*; captive-reared). Offshore data for the project thus far includes detections for both species of sturgeon, striped bass, white sharks, and Atlantic bluefin tuna (*Thunnus thynnus*).

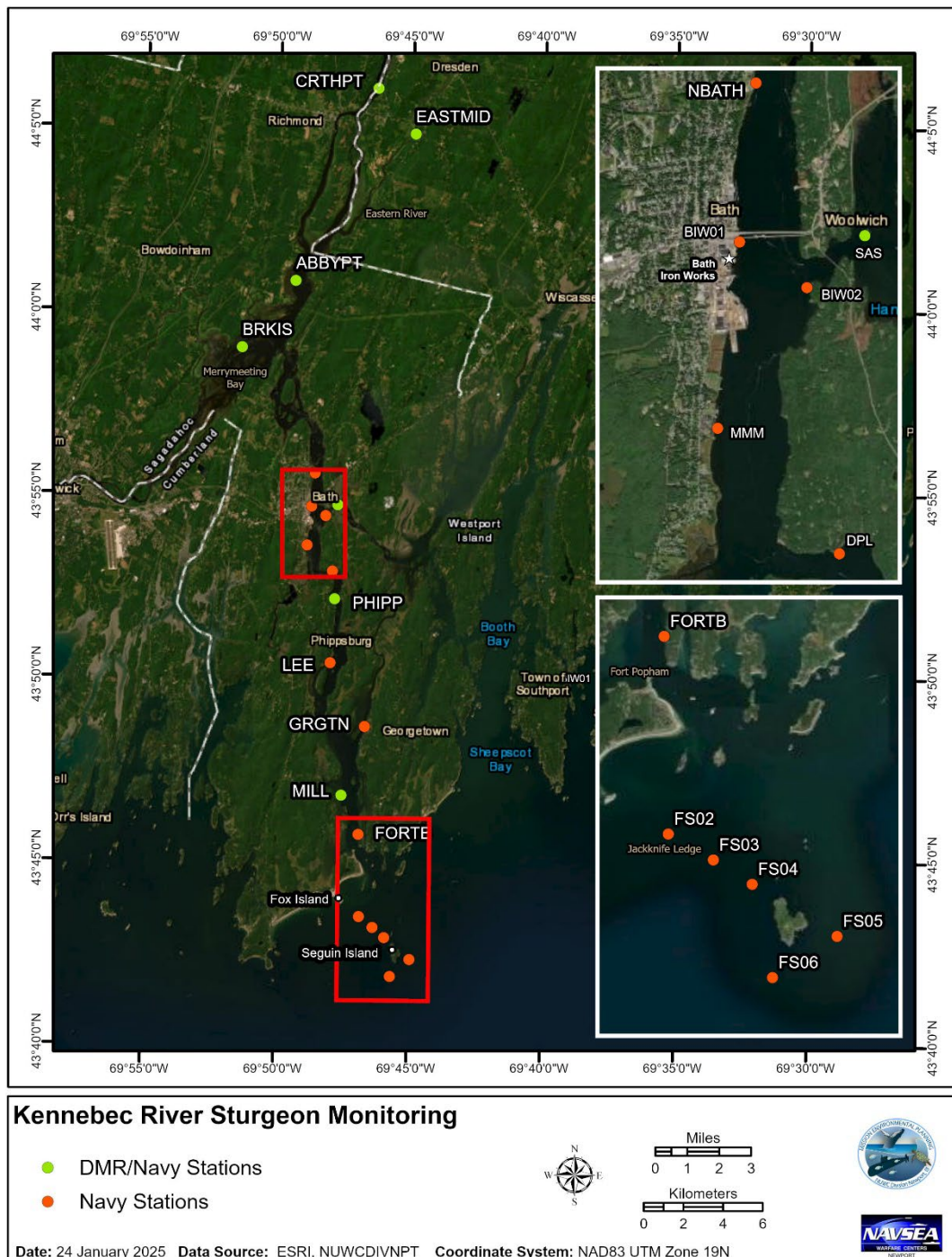


Figure 1. Location of current Navy and ME Department of Marine Resources monitoring stations in the lower Kennebec River basin extending to offshore Seguin Island. Stations beginning with “FS” (bottom inset) are considered “ocean,” while all others are “river.”

Data Summary November 2023 - October 2024

For the time period representing the last two download cycles (November 2023 – October 2024), 478,938 matched detections were recorded across all stations (**Table 1**), with the exception of Courthouse Point (label: CRTHPT) that is pending retrieval by divers in Spring 2025. Detections of fish tagged by other organizations were recorded from several different tagging projects in the Mid-Atlantic Acoustic Telemetry Observation System (MATOS; <https://matos.asascience.com>), a data portal that supports the collaborative sharing of the Atlantic Cooperative Telemetry (ACT) Network. These projects include Gulf of Maine Sturgeon (UMaine and USGS), University of New England Anadromous Striped Bass Project, Ocean Tracking Network (OTN) Canadian Atlantic Sturgeon, UMaine assessment of salmon migratory success, and ME DMR sea run fish tracking efforts.

The addition of new Navy-tagged sturgeon to the Kennebec system in 2022 significantly increased the dataset in-river. Of all detections matched in the MATOS database (tagged by Navy and/or other projects), the vast majority were Atlantic sturgeon (river: 430,321), followed by shortnose sturgeon (river: 37,400), striped bass (river: 9,190), and white shark (ocean [FS stations]: 182). However, the frequency of tag observations should not be interpreted as a proxy for population distribution or abundance, as the proportion of tagged individuals for each species is not equivalent. Notably, a higher percentage of Atlantic sturgeon are tagged in the Gulf of Maine region, as compared with shortnose sturgeon.

A summary of detections and unique IDs for detections matched in the MATOS database (all projects including Navy) is provided in **Table 1**. Mid-River stations are those located north of Bath, lower river stations are from Bath to Fort Popham, and ocean stations from Fox to Seguin Island. These data provide a unique comparison for the winter/early spring months compared to the warmer months leading up to fall. For Atlantic sturgeon, there were noticeably higher detections on mid-river stations during cooler months, consistent with data from prior years and where a portion of this species is known to overwinter. The opposite trend was found to be true for warmer months with greater detections in the lower river, when fish move further downstream (and offshore) with warmer temperatures. For tagged shortnose sturgeon, the abundance of detections was, again, higher mid-river during the warmer months, typical of this species known to overwinter in the vicinity of Merrymeeting Bay (see BRKIS **Figure 1**) and not as resident to the Eastern River (see EASTMID **Figure 1**). As with prior years, there was a fairly even split between mid- and lower-river detects for shortnose sturgeon during the two time periods, highlighting the widespread movement of this species in the Kennebec.

Notably, there were 17 unique white sharks detected that were tagged by Massachusetts Division of Marine Fisheries, an increasingly important dataset showing movements for this highly migratory species. These white shark detection data were recently included in a manuscript titled "Insights into the Habitat-Use Patterns of White Sharks (*Carcharodon carcharias*) Along the Maine Coastline" for consideration of publication in *Frontiers in Marine Science*, section Marine Megafauna. The objective of that paper is to characterize white shark patterns of spatial distribution in the Northern Gulf of Maine, utilizing data from multiple acoustic telemetry projects. Of note, the stations adjacent to Seguin Island between Seguin and Popham Beach had some of the highest intra-annual revisitation rates among all receivers at >50%.

Finally, 2024 represents the first year of Atlantic salmon detects of captive-reared fish tagged in the Penobscot River (75-80km distance from mouth of Kennebec River to Penobscot Bay). One of these fish was detected at station FS06 offshore Seguin in February 2024, while another was detected on five stations between Abby Point (ABBYPT) and Mill Cove (MILL) during April 2024 (moving south over a period of two days).

Table 1. Number of detections at river and ocean stations for each species across two (2) download cycles for the study period (November 2023 – October 2024).

Species	Date Range	Count	Mid-River	Lower River	Ocean
Atlantic sturgeon	Nov 2023–April 2024	Total Detects	26,382	133,750	173
		Unique IDs	15	16	8
	May 2024–October 2024	Total Detects	19,112	251,077	796
		Unique IDs	26	27	17
Shortnose sturgeon	Nov 2023–April 2024	Total Detects	5,994	11,103	0
		Unique IDs	13	14	0
	May 2024–October 2024	Total Detects	11,349	8,954	0
		Unique IDs	14	15	0
White Shark	Nov 2023–April 2024	Total Detects	n/a	n/a	7
		Unique IDs	n/a	n/a	1
	May 2024–October 2024	Total Detects	n/a	n/a	175
		Unique IDs	n/a	n/a	16
Striped bass	Nov 2023–April 2024	Total Detects	n/a	470	n/a
		Unique IDs	n/a	1	n/a
	May 2024–October 2024	Total Detects	730	7990	876
		Unique IDs	6	6	8

Detection Summary Figures

For Atlantic sturgeon, the highest frequency of observations and unique number of individuals detected was at riverine stations beginning at Maine Maritime Museum (MMM), including North Bath (NBATH), Bath Iron Works 1 (BIW1), and Bath Iron Works 2 (BIW2) during May and June (**Figure 2**). These stations had up to nineteen (19) unique Atlantic sturgeon documented in a single month. As with previous data, Atlantic sturgeon were recorded nearly each day at some of these stations during the month of May, indicating residential/feeding behavior rather than strictly transitory. Overall, the abundance of Atlantic sturgeon detections in this portion of the lower Kennebec was higher in early spring/summer (April-June) and lower in the summer (July/August). Towards the early fall (September), the overall number of fish observed declined on all stations in the lower Kennebec (south of Brick Island [BRKIS]). In the winter months (December-March), the prevalence of detects was noticeably higher upriver on stations NBATH and north, with detects recorded for only 1-2 fish in Feb/Mar on stations from Sasanoa to Phippsburg West (SAS-PHIPPW). These months represent that absolute lowest presence in the area around BIW and directly to the south. This reflects general life history trends of Atlantic sturgeon in the Kennebec, with sub-adults that remain in the system over-wintering further upriver, and returning adults moving upriver around the month of June prior to spawning. Data gaps remain for characterization of seasonal coastal movements for this species.

Total detections for shortnose sturgeon were much lower than Atlantic sturgeon, although differences are reflective of current number of active tags in the region. The highest number of detections/individuals were recorded in similar months as those observed for Atlantic (April – June), although there was a fairly even spread ranging from Doubling Point (DPL) in the lower river to ABBYPT in the mid-river. Shortnose sturgeon spawn earlier in the season than Atlantic sturgeon (approximate May), though many remain in the system and overwinter. Only one (1) shortnose sturgeon was detected on any station in the lower Kennebec shown in **Figure 2** outside of March – June (SAS and MILL). Also, one (1) shortnose sturgeon was detected on the BRKIS station in Merrymeeting Bay for the month of December, showing the need

for additional overwintering data for this species. Still, these data highlight shortnose sturgeon distribution during the warmer months and comparable prevalence at mid-river stations to Atlantic sturgeon. As with Atlantic sturgeon, more data is needed to further characterize coastal movements for shortnose sturgeon.

Overall counts and frequency of Atlantic sturgeon at offshore stations are unsurprisingly lower, with highest counts at these stations occurring May through August 2024, with notable detections also recorded in April. Offshore detections likely represent data for fish moving in and out of the system during those months (**Figure 2**). No sturgeon were detected on any station offshore in October through February.

The data for those sturgeon tagged by NUWCDIVNPT in 2022 overall reflected the trends of the larger dataset (Figure 3). There were only two unique Atlantic sturgeon detected in the vicinity of BIW in February/March, and there was a fairly even spread of detections for shortnose sturgeon from April-July for stations from DPL north to ABBYPT.

Note: Courthouse Point (CRTHPT) station was not recovered in two (2) successive attempts, but a new station was re-deployed in Oct 2024, with plans for diver recovery of the original station in May 2025. Also, PHIPPW was not recovered in October 2024, and MILL station was malfunctioning upon recovery in November 2024. These data gaps are reflected in **Figures 2 and 3**.

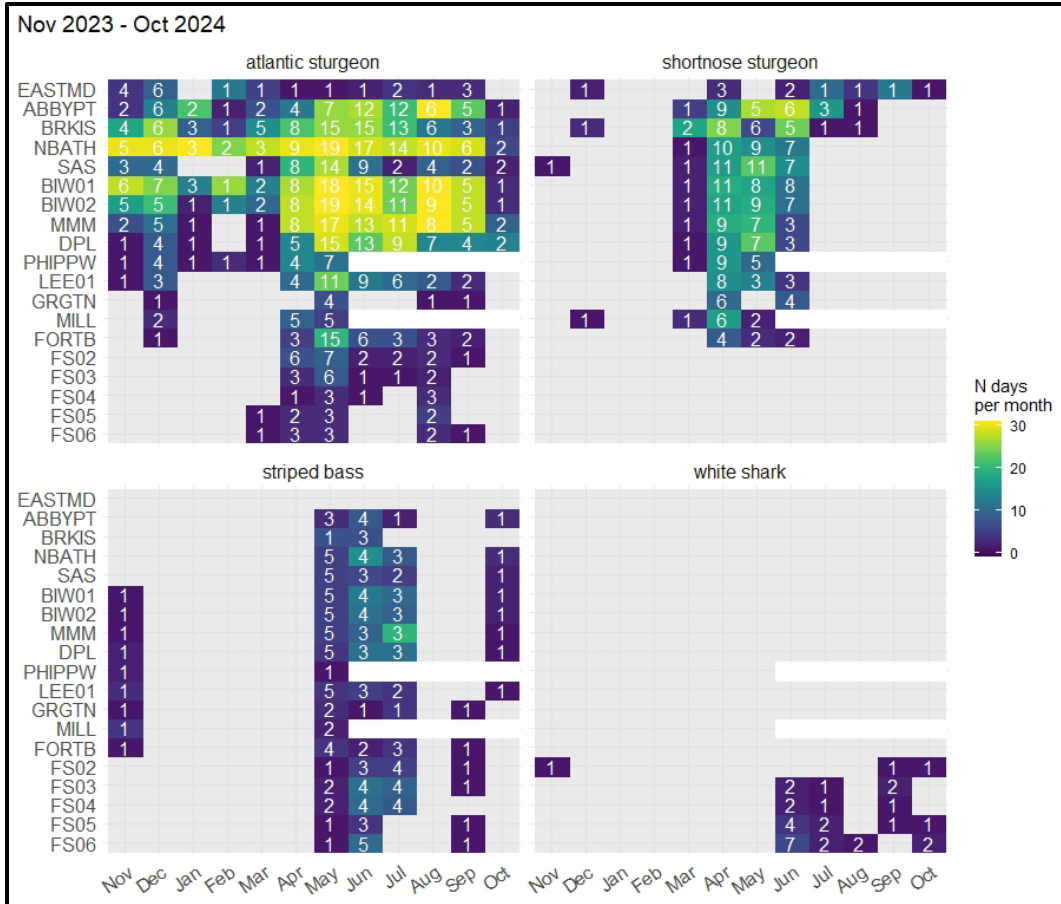


Figure 2. Species observed at each station during the monitoring period November 2023 – October 2024. Currently actively tagged fish is not uniform across species, so results can be used to infer presence and seasonality, but not relative abundance of species.

NOTE: there are two different data points for each month represented in this figure: 1) number of days per month (color ramp each cell) and 2) median number of unique individuals (numeric value each cell). Unshaded cells represent months with no coverage for that station.

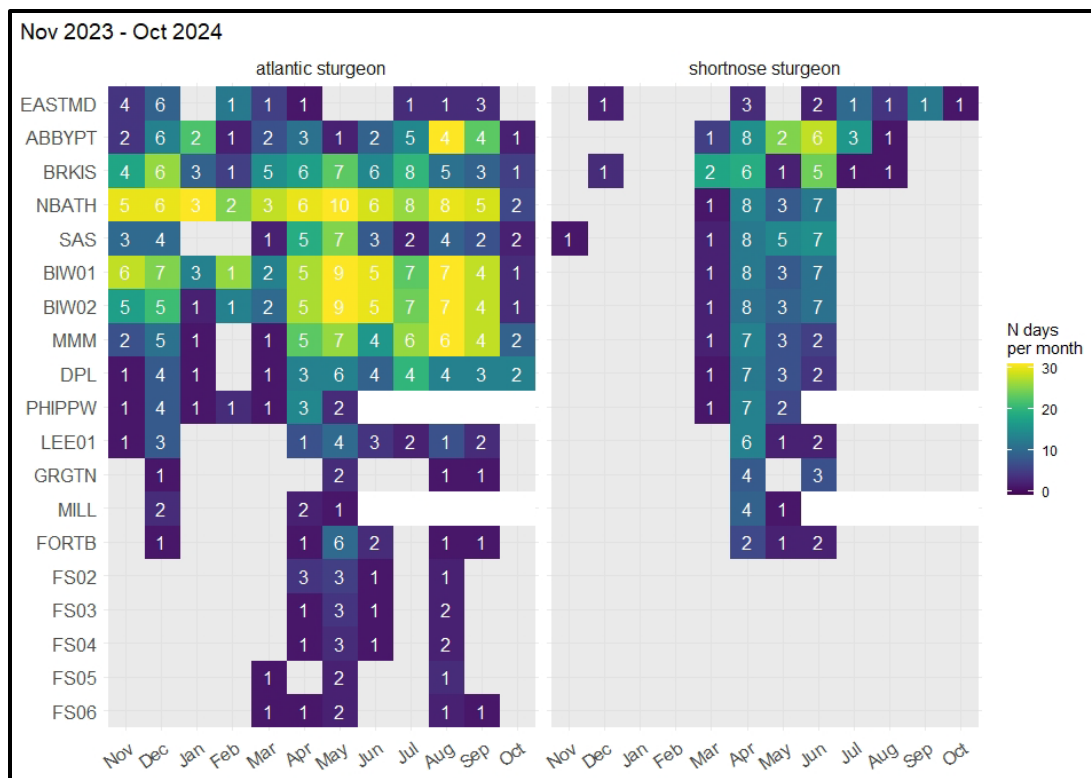


Figure 3. Individuals of each sturgeon species observed (only those fish tagged by NUWCDIVNPT) at each station during the monitoring period November 2023 – October 2024. Currently actively tagged fish is not uniform across species, so results can be used to infer presence and seasonality, but not relative abundance of species.

NOTE: there are two different data points for each month represented in this figure: 1) number of days per month (color ramp each cell) and 2) median number of unique individuals (numeric value each cell). Unshaded cells represent months with no coverage for that station.

Interactive Detection Maps

Interactive detection maps provide the ability to review seasonal and annual detection data for multiple years. When reading this document online, the reader can CTRL-Click on the interactive leaflet maps (**Figures 4-6**), which will open an html file with a summary of detections for Atlantic sturgeon, shortnose sturgeon, and white sharks (internet connection required). The layer options allow the user to choose their preferred basemap and the ability to filter detections for either individual years or seasons or separately choose "All Detects" for an overview of animal occurrence at Kennebec (designed for one selection at a time).

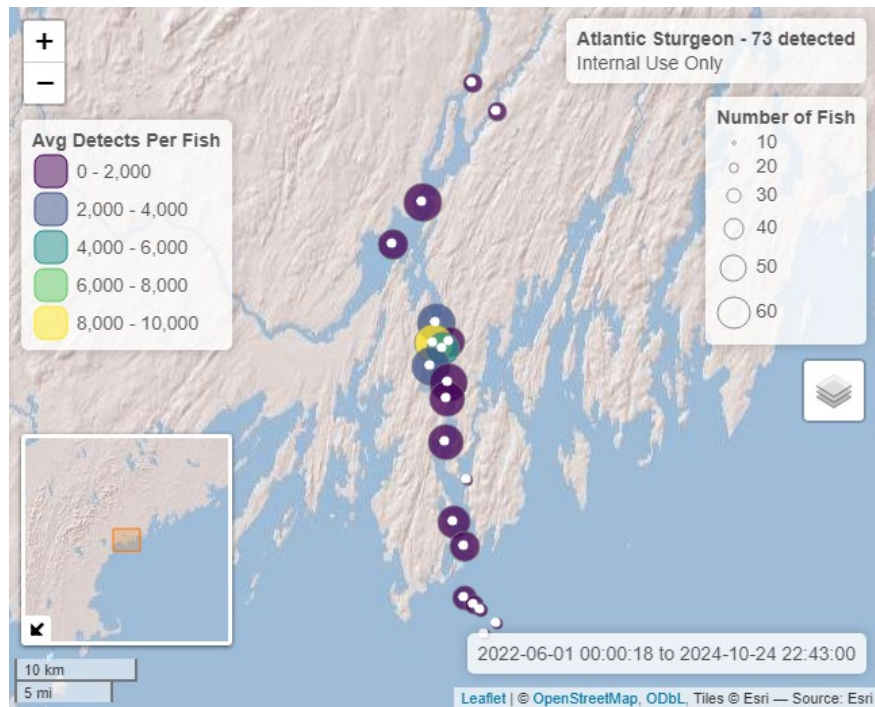


Figure 4. Atlantic sturgeon detects by year and season, since additional tagging in summer 2022.
(CTRL-CLICK to open in browser)

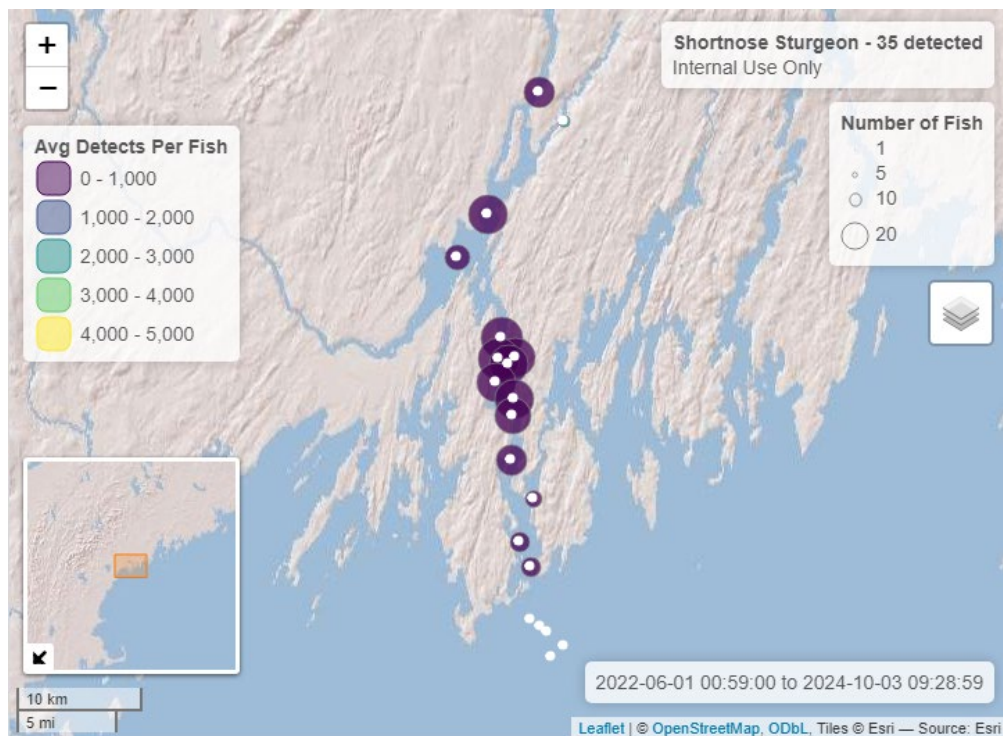


Figure 5. Shortnose sturgeon detects by year and season, since additional tagging in summer 2022.
(CTRL-CLICK to open in browser)

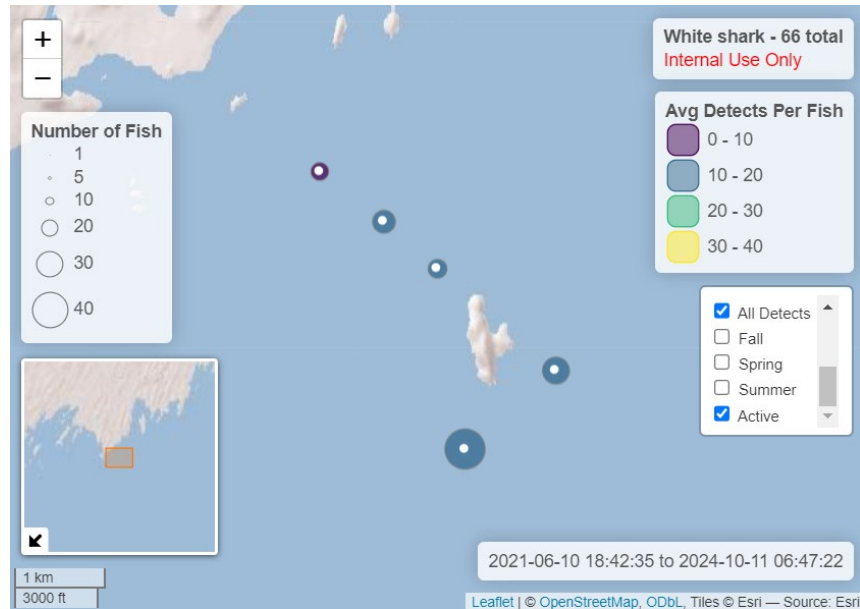


Figure 6. White shark detects by year and season. (CTRL-CLICK to open in browser)

Winter Trends

There are also several winter movement trends of interest, with additional data from mid-river stations. For Atlantic sturgeon during winter months (November-January), there were several unique individuals detected between 20 and 30 days per month on stations from BIW to the north Eastern River Middle (EASTMD) and ABBYPT stations, including BRKIS in Merrymeeting Bay. It is likely that some of these tagged Atlantic sturgeon move into the Eastern River for overwintering. These data are also indicative of higher rates of movement than expected during colder months, and as in prior years, these movements were followed by increased detections downstream beginning in April.

Detections on mid-river stations were very limited for shortnose sturgeon during the winter months. It is possible that shortnose sturgeon overwinter further upstream, and they begin to move around during April as a pre-spawn period. Additional year-round stations in the future may help identify key overwintering areas for this species.

Coastal Movements – NUWCDIVNPT tagged sturgeon

NUWCDIVNPT-tagged Atlantic sturgeon were detected coastally by several other organizations, including University of New Hampshire (UNH-CNEMBO), ME DMR Passive Monitoring Project (MEDMRPAM), and OTN-Canada, as shown in **Table 2** and **Figure 7**. In particular, the OTN stations are 288-319 km migration distance from Seguin Island off Popham Beach.

Table 2. Number of detections and unique Atlantic Sturgeon that were detected coastally in the Gulf of Maine in 2024.

MATOS Project	Detections	Unique Fish	Month Detected 1-12 (2024)	Same Fish Also Detected by Other Project(s)	Distance (km)
CNEMBON	36	1	4/5	MEDMRPAM	30
MEDMRPAM	209	8	2/3/4/5/6/7	1 (CNEMBON) 2 (OTN.MUSQMPA)	24 – 143 (range)
OTN.MUSQMPA	178	3	2/4/5/6	1 (OTN.PBSM) 2 (MEDMRPAM)	319
OTN.PBSM	293	1	1	OTN.MUSQMPA	288

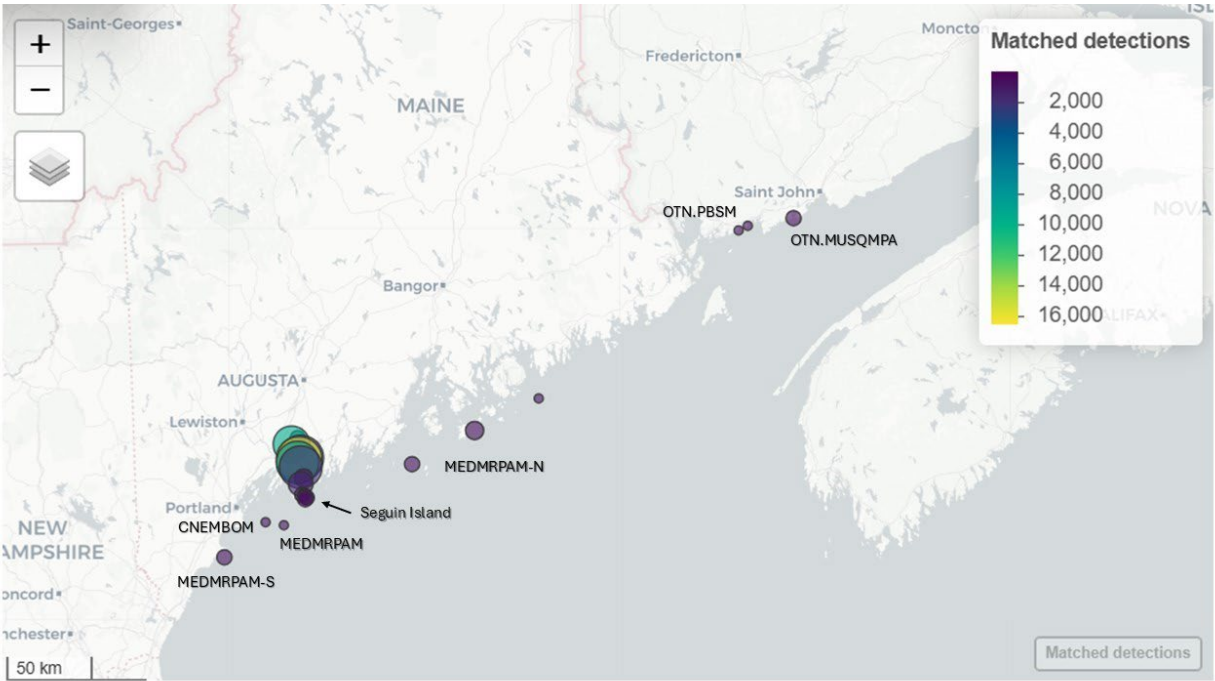


Figure 7. Stations for coastal detections of NUVCDIVNPT-tagged Atlantic Sturgeon in 2024.