January 2023 -
December 2024

# Citizen Science Monitoring Report

North and South Rivers
Watershed Association
MassBays South Shore Region

NSRWA

Massachusetts Bays NATIONAL ESTUARY PARTNERSHIP

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# Who We Are

**The North and South Rivers Watershed Association (NSRWA)** is a non-profit, grassroots environmental organization located on the South Shore of Massachusetts.

- Founded in 1970
- 1,400+ household members
- 12 towns within the watershed: Abington, Duxbury, Hanover, Hanson, Hingham, Marshfield, Norwell, Pembroke, Rockland, Scituate, Weymouth, and Whitman

The NSRWA's purpose is to improve the health of our watershed through education, citizen engagement programs, and restoration projects.

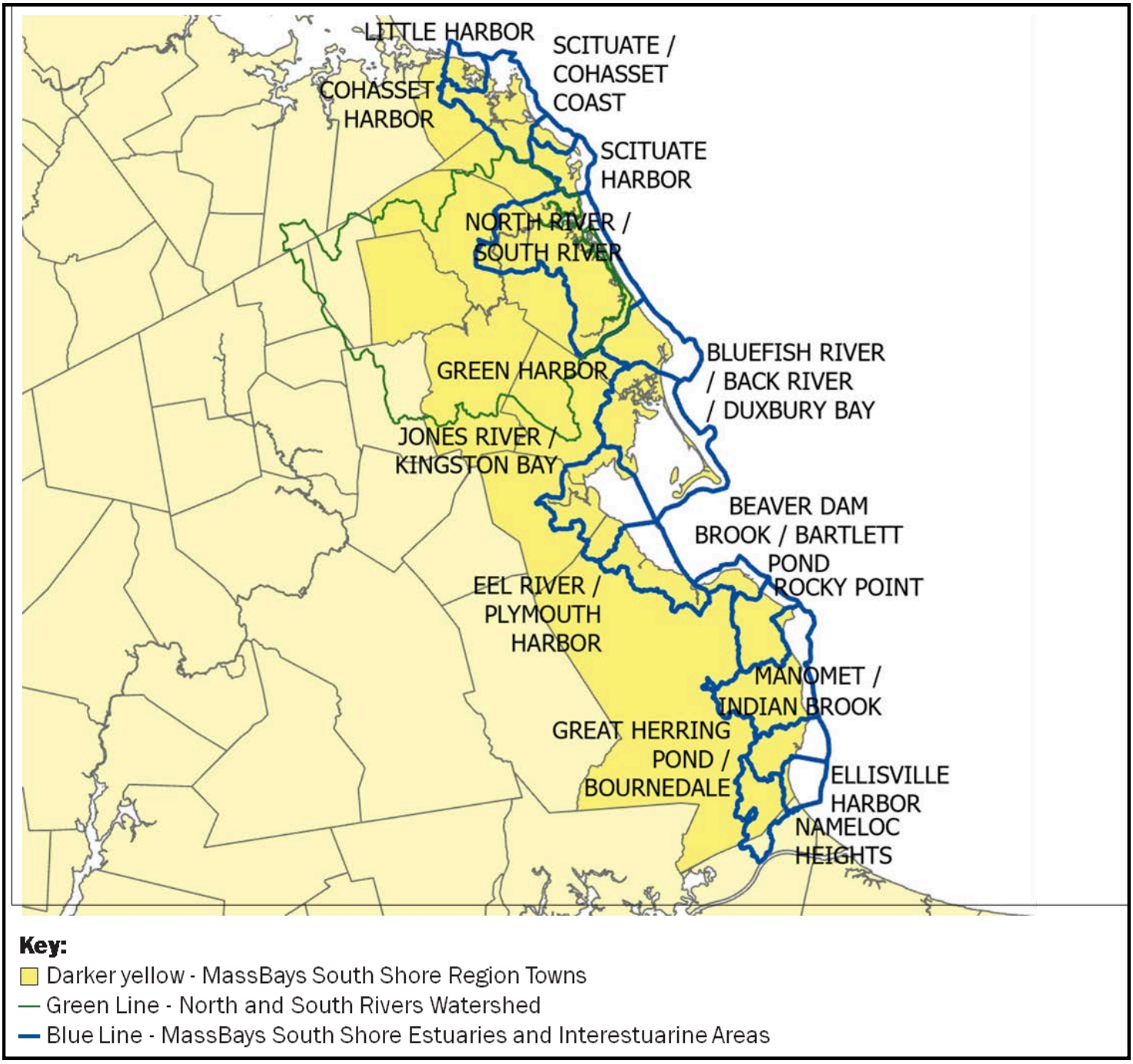
**The Massachusetts Bays National Estuary Partnership (MassBays)** is an EPA National Estuary Program dedicated to protecting, restoring, and enhancing the estuarine resources of Ipswich Bay, Massachusetts Bay, and Cape Cod Bay.

MassBays has five regions – NSRWA serves as the South Shore regional host and works in 9 coastal communities. The South Shore region includes the communities of Cohasset, Scituate, Norwell, Hanover, Marshfield, Pembroke, Duxbury, Kingston, and Plymouth and the estuaries within them.

Both organizations work in tandem and provide support to our partnering communities and nonprofits to protect, restore, and monitor the waters of the South Shore from their headwaters to the coast.

# Where We Monitor

The NSRWA monitoring focuses on the North and South Rivers and its tributaries. As host of the MassBays South Shore program, the NSRWA provides technical support and volunteers to the MassBays South Shore communities and nonprofit partners.



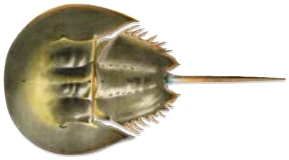
# Our Monitoring Programs

Our monitoring programs take two forms – programs that are primarily conducted by volunteers with the guidance of our Watershed Ecologist and South Shore Regional Coordinator for MassBays, Alex Mansfield, and those that MassBays/NSRWA staff conduct. The following programs in bold are included in this report.

## Volunteer Programs

### River Herring

### Horseshoe Crabs



### Water Quality

### Marine Invasives

### Eelgrass

## NSRWA/MassBays Monitoring

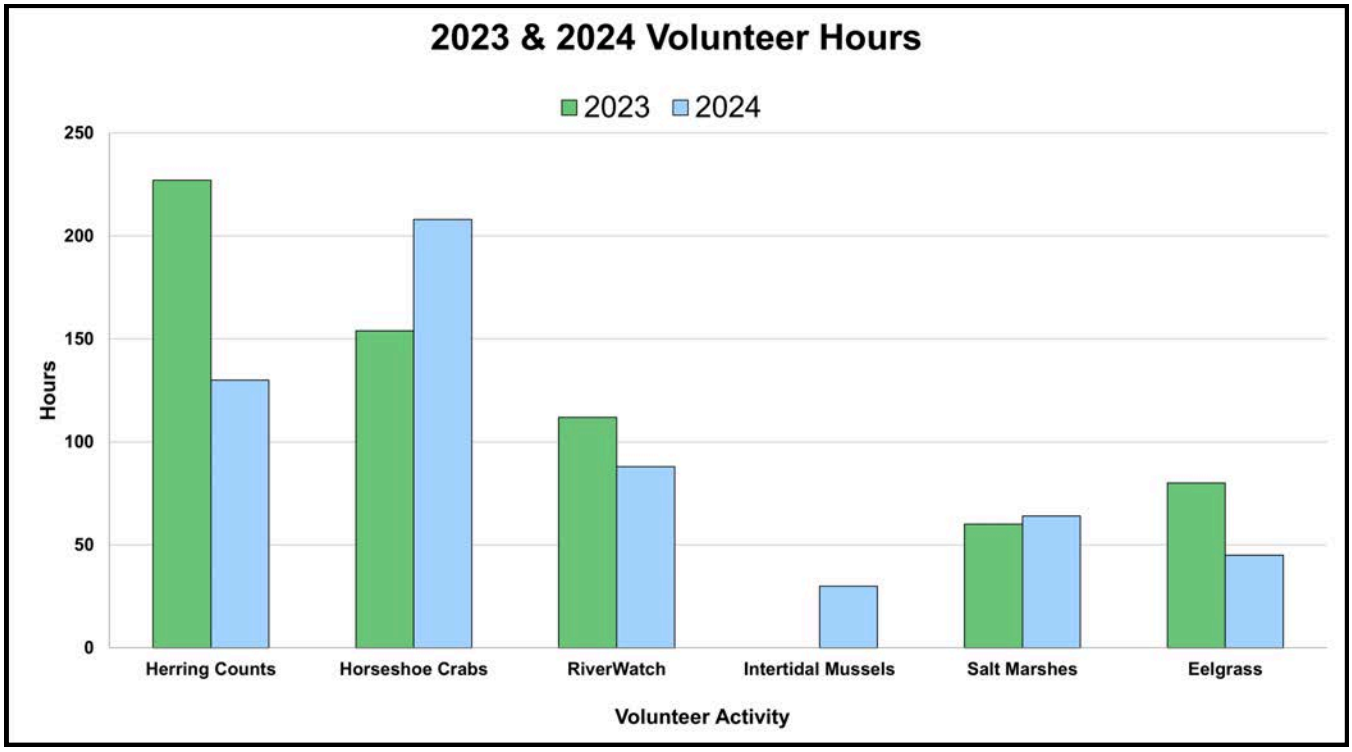
### Temperature

### Salt Marshes

### Mussels

# Our Projects and People

We have over a dozen monitoring projects, some of which we've been working on for almost three decades, and others that are brand new. We wouldn't be able to accomplish all these years of consistent monitoring without our volunteers and partners.

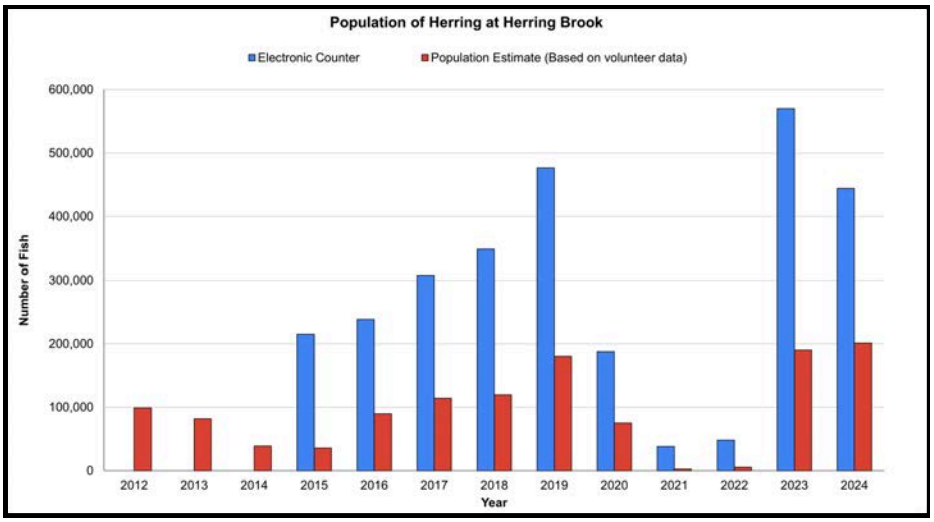


# River Herring

## What We Do

River herring populations had declined sharply in the early 2000s. As a result, in 2006, the Massachusetts Division of Marine Fisheries implemented a ban on the harvest of herring. While the harvest ban was intended to reduce stress on these fish, they still faced a series of threats including drought, changing climate, shifts in predation, and an inability to get to spawning grounds due to dams or non-operational fish ladders. Our volunteers count migrating herring at five locations in the watershed.

In 2023 and 2024, volunteer counts in our watershed rebounded strongly at our most successful run, Herring Brook in Pembroke. This site is monitored by volunteers as well as an electronic counter. Based on the electronic counter data, Herring Brook was the largest run in the state with 570,000 fish passing up the ladder.




Our other runs have had mixed success. Raw counts are the number of individual fish that are directly observed and recorded by volunteers: not the entire local population, but instead a tool to then determine the population. Our raw count data is sent to the Division of Marine Fisheries to be aggregated into an algorithm that estimates population size.

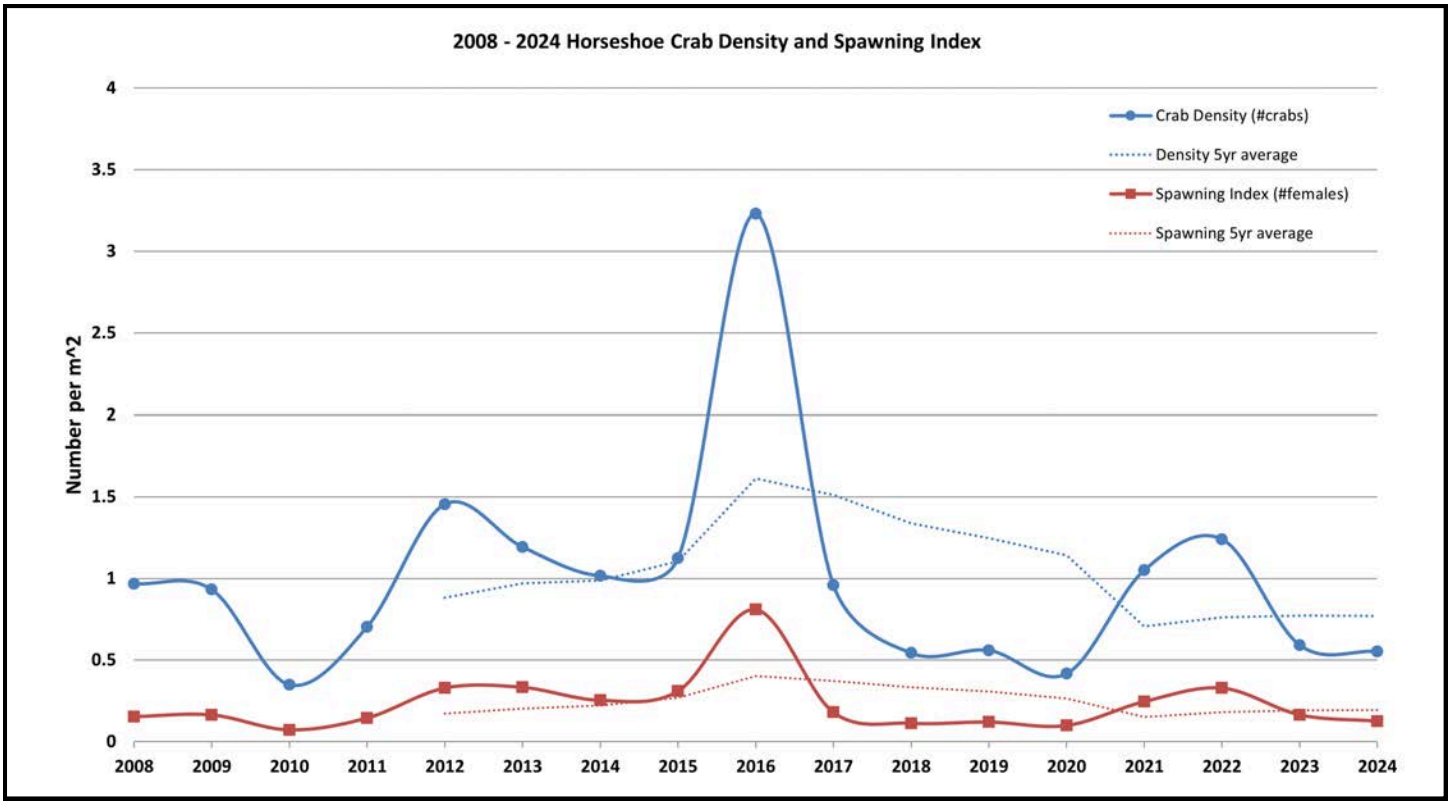
| Location | Raw Counts 2023 | Raw Counts 2024 | Peak in the Last 10 Years |
|---|---|---|---|
| Bound Brook | 0 | 0 | 4 (2020) |
| First Herring Brook | 0 | 2 (Many additional fish were seen below the dam and likely passed up the ladder at off times.) | 40 (2021) |
| Herring Brook | 6,248 | 11,009 | 11,009 (2024) |
| South River | 4 | 11 (Many additional fish were seen below the dam and likely passed up the ladder at off times.) | 73 (2021) |
| Third Herring Brook | 19 | 0 (Note: counting site moved in 2024) | 345 (2020) |

# Horseshoe Crabs

## What We Do

Every spring, in May and June, horseshoe crabs move shoreward to reproduce on our local beaches. Horseshoe crabs are harvested for bait for the whelk fishery as well as for their blood, which contains a compound that the biomedical industry uses to test the sterility of injectable drugs.

2024 was a particularly critical year for these surveys since DMF adopted a new restriction on the harvest of horseshoe crabs just this April. The new regulation prohibits the harvest of horseshoe crabs from April 15-June 7 (during the crab's spawning season) in all Massachusetts waters. This change is critical in protecting this species during their most vulnerable and critical life stage.



# Horseshoe Crabs continued

For 2024 crab density (0.55 crabs/m2) was nearly the same as 2023 and slightly lower compared to the 5-year rolling average of 0.77 crabs/m2. The spawning index (0.13 females/m2) was close to both 2023 and the 5-year average. We anticipate that it would take several years before the new regulations result in any changes to our local horseshoe crab populations.

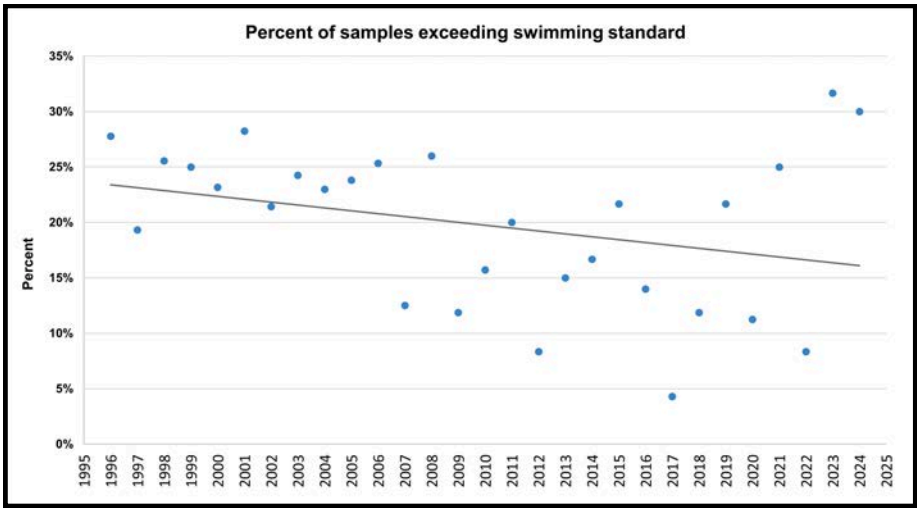
To monitor their populations NSRWA and MassBays put out a broad call for citizen science volunteers. Partner organizations such as Duxbury Beach Reservation helped broaden that call throughout the community. At least 35 volunteers attended a series of training sessions and then conducted surveys through May and June. The surveys occur on the high tides around the new and full moons. Beaches are surveyed at both high tides during a given day.

This means that about half the surveys are conducted in the middle of the night from 11 pm to 3 am. This makes for some incredibly unique experiences under moonlit or moonless nights out on the beach!

# RiverWatch Water Quality Monitoring

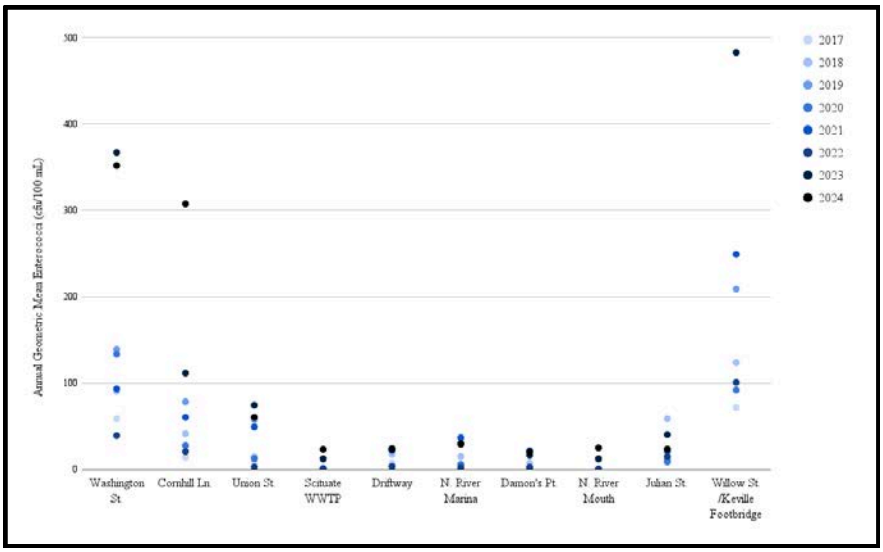
## What We Do

Since 1994, we have monitored bacteria and other water quality indicators like temperature, dissolved oxygen, salinity, and conductivity at ten sites in the North and South Rivers every other week from June through August.



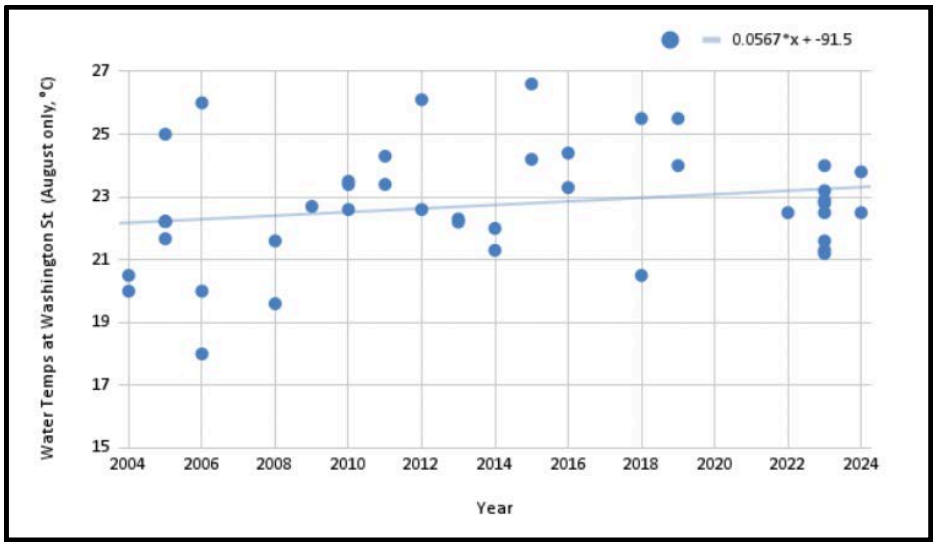

Since we have started sampling, the percentage of bacterial samples that have exceeded the swimming standard each summer has decreased, from 22-24% in the 90s and 2000s to 15% in the 2010s and 2020s. This is due to a reduction in stormwater pollution as well as increased sewerage along the South River that reduced wastewater pollution.

In 2017, we started testing enterococcus bacteria at all ten RiverWatch sites. In 2023, only 4 sites occasionally did not meet the swimming standard; Washington St. Bridge, Keville Footbridge, Cornhill Bridge, and Union Street Bridge. In 2024, only three sample sites didn't meet the swimming standard (35 cfu/100mL); those sites included the Washington Street Bridge, Cornhill Lane, and the Union Street Bridge.



# Temperature

Measuring temperature is a part of almost every monitoring effort we do. We were curious whether we could detect any increases in temperature due to climate change in our RiverWatch temperature record, which is the most reliable and consistent. There were no trends looking at all the data pooled together over time, nor looking at each site's data for an entire summer over time. However, we did find a significant trend in the August water temperature at the Washington Street Bridge site on the North River in Pembroke and Hanover.




As of 2024, August water temperatures at Washington Street Bridge have **increased an average of 0.0567°C annually or 1.13°C (~2°F) since 2004.**

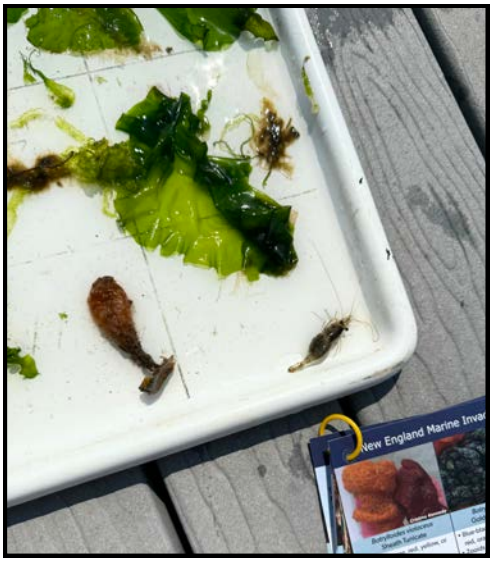
# Marine Invasives

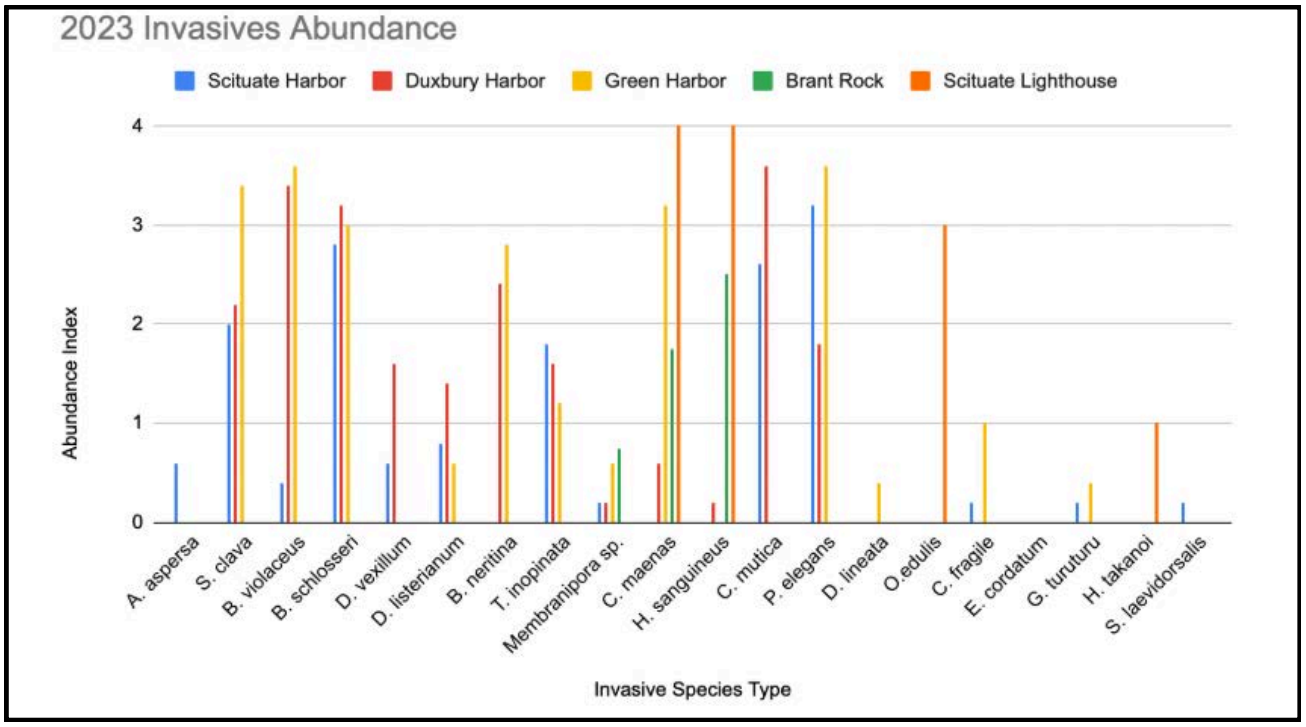
## What We Do

Our marine invasives volunteers monitor both intertidal sites (Third Cliff, Fourth Cliff, and Brant Rock) and docks (Scituate Harbor, Green Harbor, and Duxbury Harbor) for the presence and relative abundance of non-native creatures like crabs, tunicates, and algae. We are part of a larger group coordinated through Massachusetts Coastal Zone Management (CZM). The Marine Invader Monitoring and Information Collaborative, collects similar data along the New England coastline. https://www.mass.gov/info-details/marine-invader-monitoring-and-information-collaborative-mimic

In 2023, five locations were monitored:

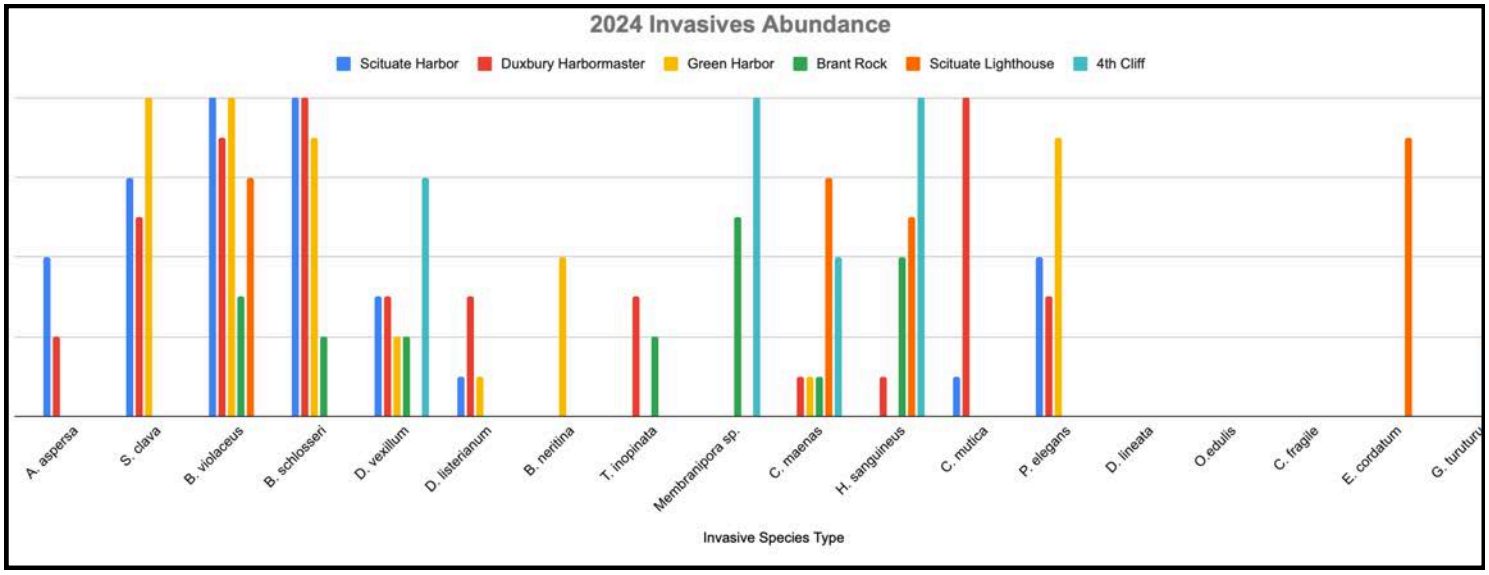
- Scituate Harbor
- Duxbury Harbor
- Green Harbor
- Brant Rock
- Scituate Lighthouse





# Marine Invasives continued

Six locations were monitored in 2024: Scituate Harbor, Duxbury Harbormaster, Green Harbor, Brant Rock, Scituate Lighthouse, and Fourth Cliff. Compared to 2023, the abundance factor for multiple species increased to an abundance index of 4. Both the European Green Crab and the Asain Shore Crab maintained an abundance factor of 4 in both 2023 and 2024. MIMIC surveys will continue to keep track of the abundance factors of these marine invasive species in years to come.




**Most abundant species in 2023:**
European Green Crab *(Carcinus maenas)*
Asian Shore Crab *(Hemigrapsus sanguineus)*

**Most abundant species in 2024:**
Asian Shore Crab *(Hemigrapsus sanguineus)*
Sea Squirt *(Styela Clava)*
Sheath Tunicate *(Botrylloides violaceus)*
Star tunicate *(Botryllus schlosseri)*

# Eelgrass

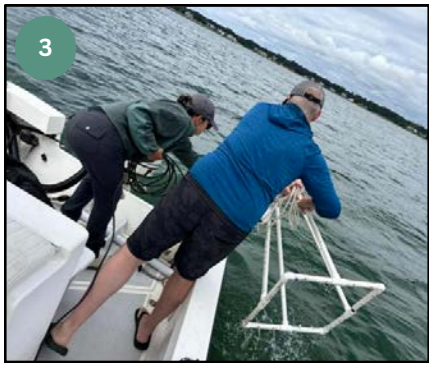
## What We Do

Duxbury, Kingston, and Plymouth Bays have experienced severe declines in eelgrass coverage over the last several decades. Monitoring these changes allows us to assess the health and current status of eelgrass within the embayment and find out what might be driving the losses.

How we collect this data:

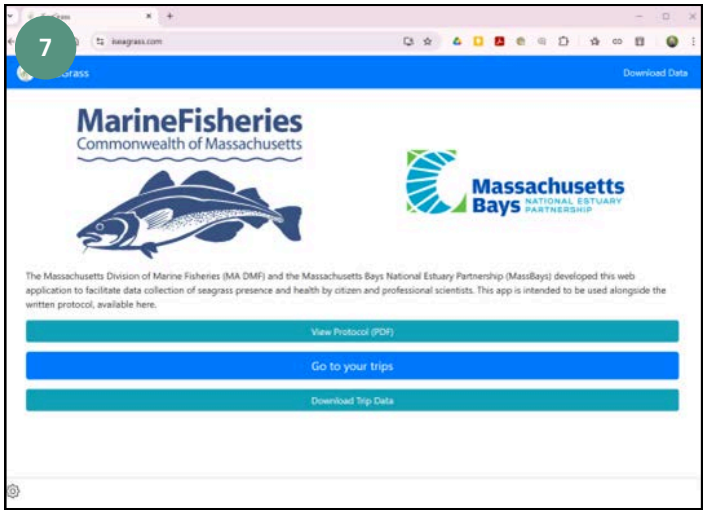
1. NSRWA interns and volunteers
2. Go out on boats provided and captained by volunteers
3. A drop camera is lowered from the boat to the seafloor
4. The team leader evaluates the camera images
5. A topside recording unit captures and stores the images
6. The camera images are used to determine eelgrass percent cover
7. The data is entered into the iSeaGrass app, which was created in partnership with Mass. Division of Marine Fisheries (DMF).







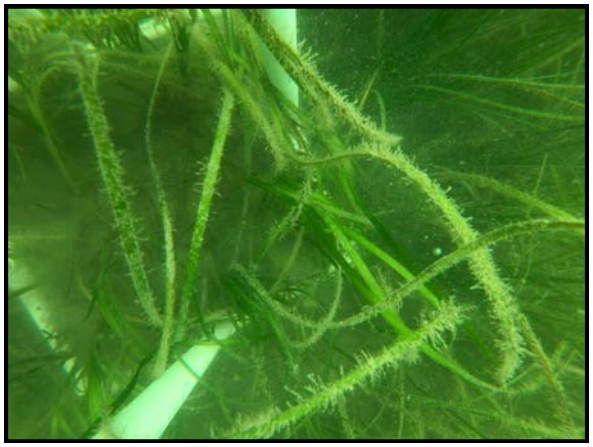


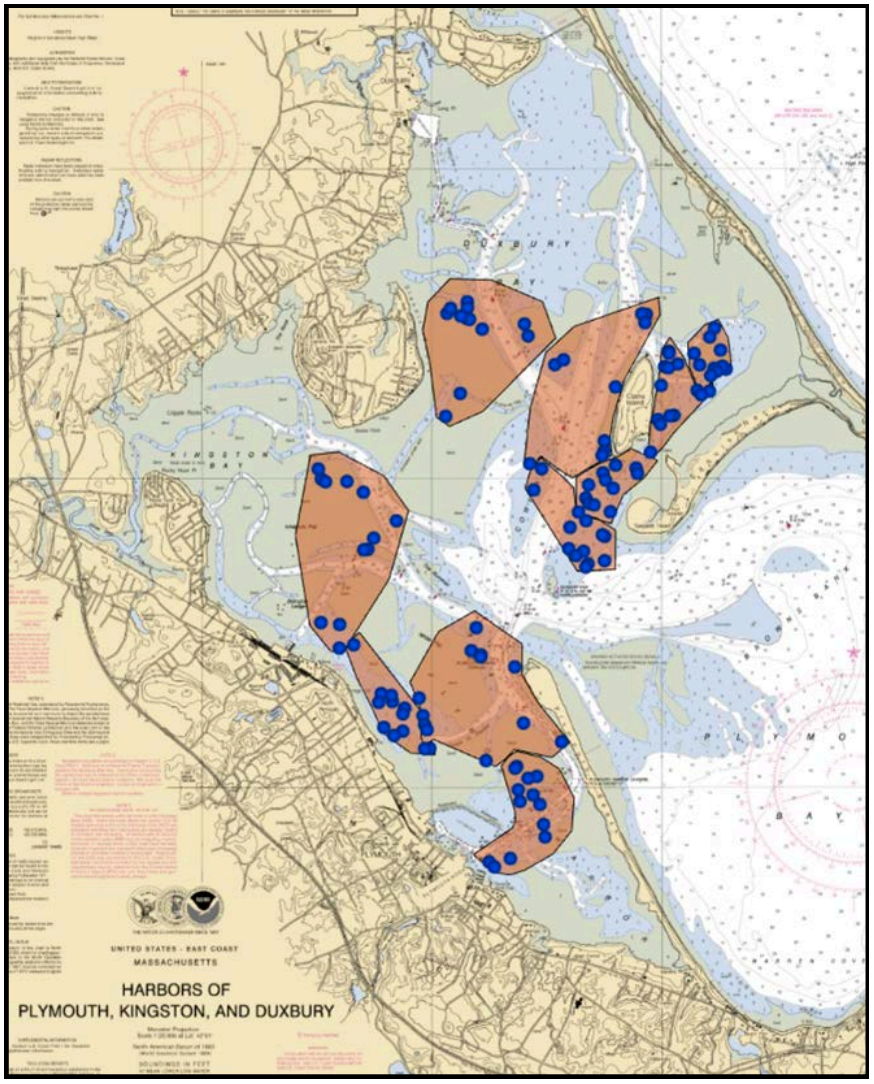


# Eelgrass continued

The sampling is conducted at up to 119 sites throughout the bays. The sampling sites are arranged into 10 distinct clusters with 10-13 stations per cluster.

We also selectively collect and measure eelgrass shoots and assess them for wasting disease and growth of organisms on the eelgrass blades.






The 2023 eelgrass surveys were highly successful, with eight sampling days between July and August. In total, eight boat captains and 12 citizen scientists participated, assisting 5 NSRWA staff members to collect the data. Since the last year that NSRWA and MassBays were able to complete the entire survey was 2019, that was considered the main point of comparison for the 2023 data. From 2019 to 2023 eleven stations increased in eelgrass coverage, eleven decreased in coverage and forty-two stayed the same (often remaining at 0% coverage).

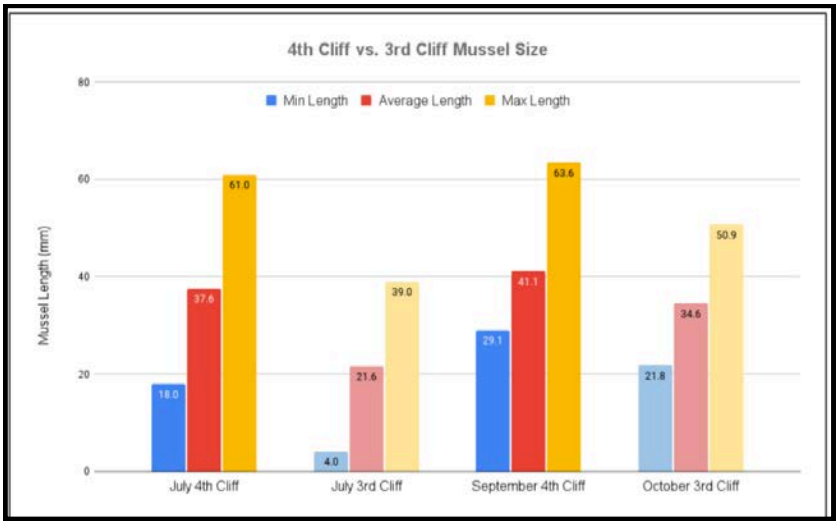
In 2024, the surveys were repeated using 6 volunteer captains, NSRWA interns, and MassBays staff. While a total of 119 sites were visited, the analysis focused on a subset of 64 sites that has consistent data from 2019, 2023, and 2024. From 2023 to 2024 thirteen stations increased in coverage, thirteen stations decreased, and thirty-eight stayed the same.

# Blue Mussels

## What We Do

The blue mussel beds in the North and South Rivers have significantly declined since the 1980s. Invasive crab predation may currently be playing a role in reducing mussel abundance. Food availability for migrating shorebirds is crucial as these birds head south from their nesting territories. In particular, Rufa Red Knots (*Calidris canutus rufa*), a federally-designated threatened species, rely heavily on blue mussel spat as a primary food source during their fall southward migration. Mass Audubon has been monitoring Red Knot and other shorebirds during their fall migration at Third and Fourth Cliffs since 2015. Monitoring of blue mussels is increasing to protect the food supply for Red Knots, and ensure better marine ecosystems. In 2023 and 2024, blue mussel populations at Third and Fourth Cliffs in Scituate were monitored to determine mussel density and length.

In 2024, the approach was targeted at monitoring the success of the newly identified mussel beds. This included efforts to track changes in the overall area and location of the mussel bed(s). The density of mussels, distribution, and size of mussels were tracked throughout the year. Additionally, there was a focus on identifying predators, predation rates, and timing of predation.

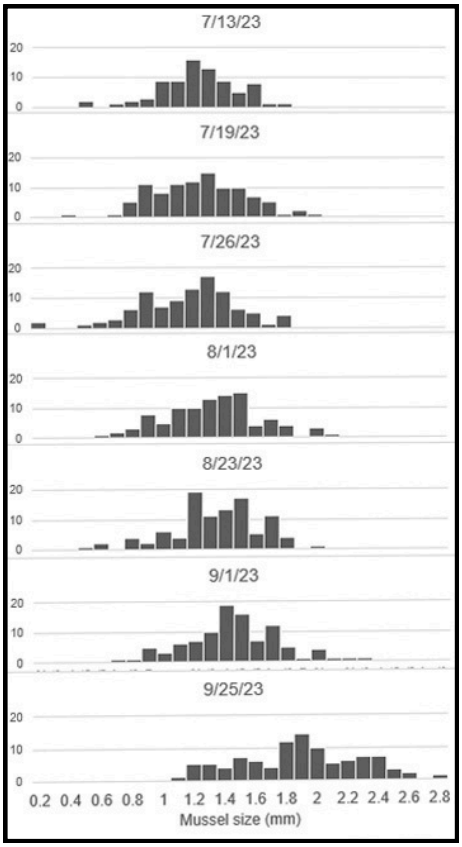




Surveys were conducted at Third Cliff as well as Fourth Cliff to provide 'reference' points and a more regional view. The surveys were conducted from March through October 2024. Mussels at all areas showed consistent growth in terms of minimum, average, and maximum shell length, but mussels in Fourth Cliff were significantly longer than mussels in Third Cliff. From April to September the minimum shell length increased by 94%, the average length by 44%, and maximum length by 44%.

# Mussels continued

In 2023, NSRWA conducted studies on one mussel bed on Fourth Cliff. The chart shows the length of mussels visited over the course of a couple of months. Overall, the mussels grew about ~ 0.7 mm over the course of the measurement period. It was found that the mussels were predated on by both gulls and green crabs.




Blue mussel beds stabilize shorelines, positively impact water quality and the ecology of the estuary, and may provide an additional local shellfish resource. As storms increase in frequency and strength due to climate change and rising sea levels, protecting salt marsh shorelines is becoming even more vital. With the increasing need to protect and monitor blue mussel populations, this project is set to continue through 2025.

# Salt Marshes

In 2023, salt marsh surveys were conducted over the summer for 5 days, 6/23, 7/11, 7/6, 7/25, and 8/1. These surveys monitored the following locations; Driftway (Scituate), Musquashicut (Scituate), and Coast Guard (Marshfield). No official conclusive results came from these surveys, but they greatly influenced the salt marsh report of 2024.

During 2024 there was an abundance of salt marsh work that was conducted by NSRWA in marshes around the South Shore. 8 key marshes spanning 3,400 acres: Kingston Harbormaster, Kingston Calista Property, Duxbury, Green Harbor, Coast Guard (Marshfield Conservation), Musquashicut (Scituate), Peggotty Marsh (Scituate), Scituate Conservation (Driftway), and Scituate Third Cliff were evaluated for multiple key factors that support marsh resiliency and overall conservation. To measure these factors, vegetation surveys, sediment monitoring, as well as GIS analysis were all conducted. The primary goal of this study was to identify marsh vulnerability, evaluate restoration potential, and provide actionable recommendations to enhance marsh resilience in the face of accelerating sea level rise and anthropogenic pressures.

This project was partially financed with funding from the Massachusetts Office of Coastal Zone Management under the Coastal Habitat and Water Quality (CHWQ) Grant Program.

Groups who aided in the creation and success of this project were MassBays, Mass Audubon, UMass Amherst College of Natural Sciences, Cohasset Center for Student Coastal Research (CSCR), and UMass Boston School for the Environment. Having these groups collaborate on this project, and bring a special set of skills, allowed for this project to truly flourish.

# Salt Marshes continued

## Key Findings

There were multiple key findings that came from this study, first was marsh loss. Between 2011 and 2021, approximately 36 acres (1.2%) of salt marsh were lost across all study sites, with the South River experiencing the greatest relative and absolute loss (1.86%, 14.2 acres). Next, Duxbury Bay exhibited the highest percent of resilient marsh (89.6%), while the North River Mid-Upper Reaches showed the lowest (29.4%). Average resilience across all sites was 70.1%. Sediment findings showed that deposition rates were ample to support marsh accretion at most sites. Marine-derived sediment is the primary source due to low river sediment inputs.

As sea level rises, marshes will need to migrate upland in order to avoid being inundated by excess salt water. The Gulf River and Peggotty marshes exhibited the greatest potential for marsh migration under projected sea level rise scenarios, with gains of up to 47% and 43% respectively by 2100. Finally, most field sites were dominated by traditional salt marsh plant species, although signs of stress such as panne formation, invasive species invasion, and surface instability were observed at several locations, particularly at Green Harbor and the Kingston Harbormaster sites. The sites that were surveyed were then put into two categories.

**High-Priority Restoration Sites:**

- Scituate Conservation (North River Lower Reaches)
- Green Harbor (Marshfield)
- Kingston Harbormaster Site

**Protect-and-Monitor Sites:**

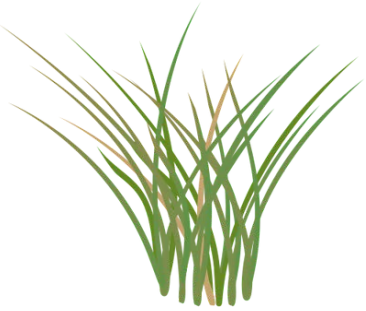
- Duxbury Bay Complex
- South River
- North River Mid-Upper Reaches

Restoring and monitoring sites with high public visibility, such as the Driftway in Scituate and Green Harbor in Marshfield, will be perfect for community outreach and education opportunities. Overall, this study was a good foundation for the conservation and restoration of important salt marshes on the South Shore of Massachusetts. By increasing monitoring of sediment dynamics, as well as vegetation changes, we are able to make more adaptive management decisions. The findings of this study will hopefully drive near-term restoration and long term resiliency against increasing climatic pressures.

# Looking Forward

In 2025, there are multiple projects that NSRWA is working on.

**Salt Marsh Restoration**
We are currently in the early stages of desktop and field work that will ultimately lead to the restoration of Driftway Marsh in Scituate, Green Harbor Marsh in Marshfield, and Kent Street Marsh in Scituate. Using the latest restoration techniques, we hope to improve hydrology, sediment retention, and increase marsh area, as well as vegetation density.




**Mussel Surveys**
We are working with Hanscom AFB at the Fourth Cliff Recreation Area and Mass Audubon to enhance and restore blue mussels in shorebird migration areas. Blue mussels provide important food for migratory shorebirds but have declined over the past few decades. However, new hope has arrived in this project with an abundance of small mussels found at the start of spring 2025.

**Weir River Culvert Assessment**
**In** cooperation with the Weir River Watershed Association. we are planning to survey culverts within the Weir River to assess fish passage potential. This surveying is being done through sensor data that is collected at 30+ culverts through the Weir River watershed. The dissolved oxygen is mostly what is being analyzed, to determine if it is a habitat where fish, especially brook trout, could potentially live and get through to spawn. We are also collecting eDNA samples to determine the presence of fish species.

**Other Work**
Other work that will continued throughout 2025 includes river herring data counts, horseshoe crab surveys, river water quality sampling, marine invasive surveys, and eelgrass surveys!

# How To Volunteer

If you are enthusiastic about the watershed and are looking for a way to get involved locally, volunteer with our citizen science programs! The best way to know about our citizen science opportunities is to sign up for our e-news, where we post our project signups throughout the year. In addition, you can sign up through VolunteerLocal, which will add you to the lists for the projects that interest you.  Use the QR code to to access the VolunteerLocal sign up page.

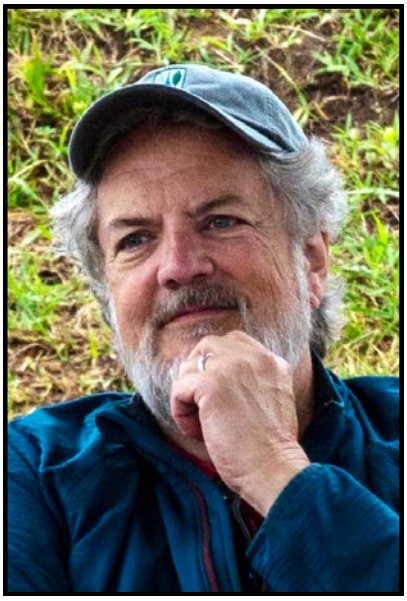
**Sign up for our e-news at the bottom of our website home page.**

# 2023-2024 Citizen Science Volunteers of the Year

These past two years have yielded so much great work from our many, many volunteers.

In 2023, we honored our Citizen Science Volunteers of the Year Ralph Perotta and his Scituate High School students for their remarkable salt marsh field work (see photo below).

In 2024, we honored Ernie Cormier as our Citizen Science Volunteer of the Year. Ernie has generously applied his expertise to improve our operations. In the past year he took on the task of finding a better volunteer database platform, thoroughly researching alternatives, participating in demos, and presenting recommendations. Ernie chose VolunteerLocal and helped implement it, working closely with the company to tailor the system to our needs. Despite launching this platform during our busiest citizen science season, Ernie ensured a smooth transition, keeping communication open with staff and volunteers throughout. His tireless efforts have streamlined our volunteer management, allowing us to focus more on our core mission.



# Thank You!

## Partners

- Charles River Watershed Association
- Cohasset Center for Student Coastal Research
- Duxbury Beach Reservation
- Jones River Watershed Association
- Living Observatory
- Marine Invader Monitoring & Information Collaborative
- Marshfield Veterans
- MA Coastal Zone Management
- MA Department of Environmental Protection
- MA Division of Marine Fisheries
- MA Seagrass Working Group
- MA Salt Marsh Working Group
- Mass Audubon
- Mystic River Watershed Association
- Nashua River Watershed Association
- Neponset River Watershed Association
- OARS: For the Assabet, Sudbury and Concord Rivers
- Plymouth Harbormasters Office
- Scituate Water Division
- Situate Chair Company
- Stone Living Labs
- Town of Cohasset
- Town of Duxbury
- Town of Hanover
- Town of Kingston
- Town of Marshfield
- Town of Norwell
- Town of Pembroke
- Town of Plymouth
- Town of Scituate
- University of Massachusetts, Amherst
- University of Massachusetts, Boston
- X-Cel Conservation Corps

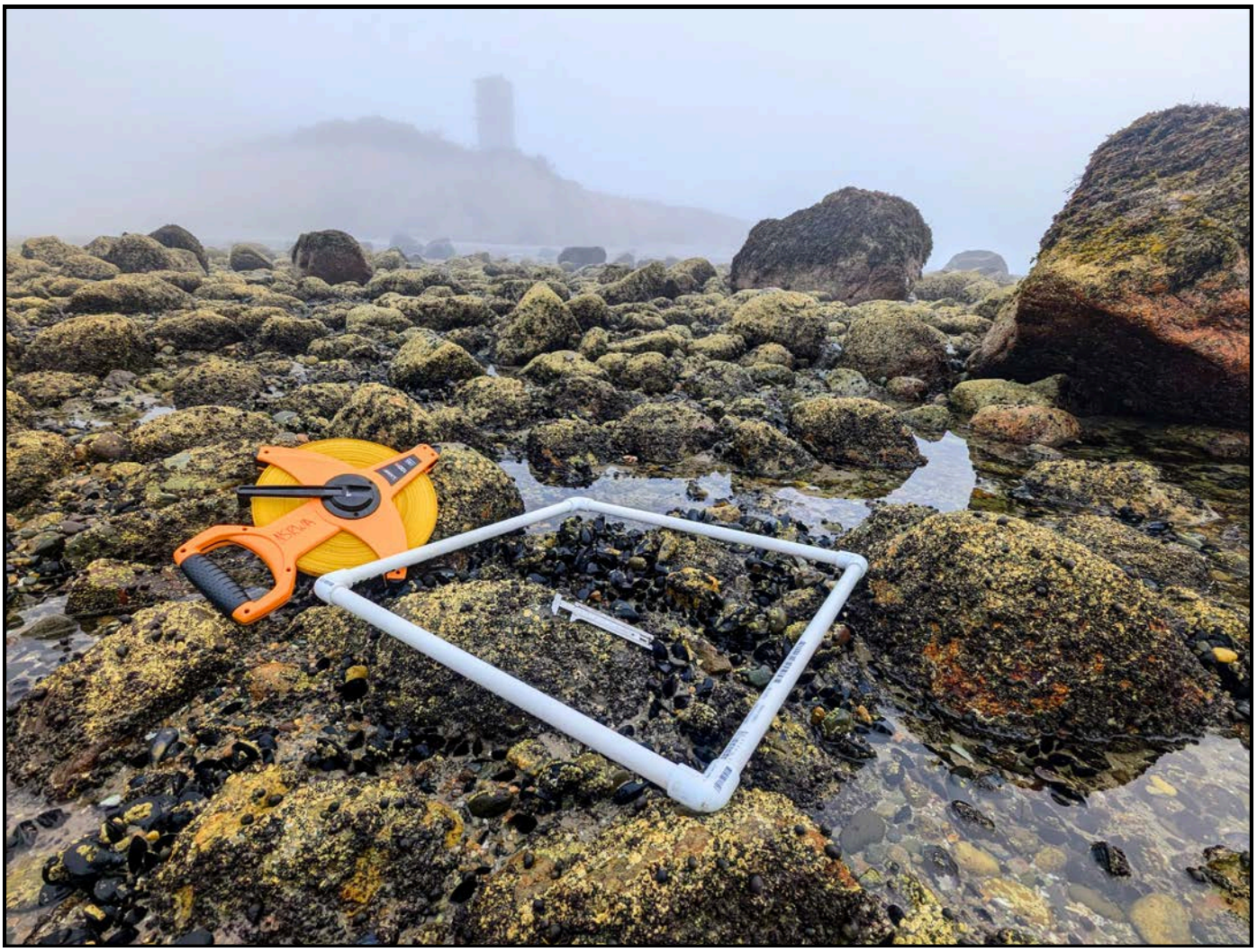
## Funders

- Anonymous Donor
- MA Coastal Zone Management
- MA Department of Environmental Protection
- MA Division of Marine Fisheries
- MassBays National Estuary Partnership
- NOAA Restoration Center
- Norwell Conservation Commission
- Norwell Community Preservation Committee
- Norwell Women's Club
- NSRWA Members
- Veolia

## And Thank You Interns!

**2023** - Molly Frattasio, Isaac Mann, and Patrick Scott

**2024** - Curtis Waisgerber, Avery Sands, and Molly Ryan



# Image credits

**Photos and graphs are by NSRWA/MassBays unless otherwise noted/specified below.**

**Cover:** Kathy Harrington
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- River herring - https://www.fisheries.noaa.gov/species/river-herring
- Horseshoe crab - https://thewildlife.blog/2022/01/28/the-wild-life-of-the-horseshoe-crab/
- Water quality - https://www.istockphoto.com/illustrations/water-quality-icon
- Marine invasives - https://www.vecteezy.com/png/46934649-dock-wooden-pier-on- transparent-background
- Eelgrass- https://www.vims.edu/research/units/programs/sav/species/eelgrass.php
- Temperature - https://www.taylorusa.com/products/8-875-x-2-25-wall-thermometer

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- **Salt** marsh - https://www.pngkey.com/maxpic/u2q8u2q8u2i1t4a9/#google_vignette
- Blue mussels - https://www.fisheries.noaa.gov/species/blue-mussel

**Page 8:** Daytime survey, Shannon Keith
**Page 19:** Trout photo: https://fishspecies.dnrec.delaware.gov/FishSpecies.aspx?habitat=1&species=26