



# The Oyster Conservationist Program

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2023 Final Report

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### Introduction

The Great Bay Estuary, a vital resource for coastal New Hampshire and the Gulf of Maine, provides numerous ecological, economic, and cultural benefits to the surrounding communities. Central to the health of the estuary is the Eastern Oyster (*Crassostrea virginica*), a keystone species in Great Bay that plays a pivotal role in its well-being. Oysters contribute significantly to wildlife ecosystems by enhancing water quality and providing critical habitat for various fish and invertebrate species (Coen et al., 2007).

Historically, Great Bay Estuary boasted thriving oyster reefs, but factors such as pollution, disease, sedimentation, and over-harvesting have led to a staggering 90% decline in the oyster population. This reduction not only impacts the estuary's biodiversity but also diminishes the benefits it offers to local communities. To counteract this decline, The Nature Conservancy of New Hampshire (TNC) collaborates with The University of New Hampshire's Jackson Estuarine Laboratory (UNH-JEL) and local oyster farmers to restore healthy oyster reefs in the Great Bay ecosystem. A crucial element of TNC's strategy is the Oyster Conservationist (OC) Program, a community science volunteer initiative.

OC Program participants actively contribute to the enhancement of Great Bay's health by nurturing juvenile oysters, referred to as spat, for TNC's reef restoration projects. Volunteers undertake the responsibility of caring for a cage with spat on shell over an eight-week period, collecting data on survival, growth, invasive species, and wild oyster spat settlement throughout the summer. In 2023, the OC program engaged participants at 51 sites across the estuary, located in Great Bay, Little Bay, Piscataqua River, coastal New Hampshire and Great Bay's seven tributaries. The program's primary objectives are to gather data on spat on shell for future oyster reef restoration initiatives in Great Bay and to establish a network of volunteers dedicated to advocating and acting for the protection of Great Bay.

### Methods

#### *Recruitment and Training*

In 2023, 51 sites hosted oyster cages for the program. The sites were spread throughout the Great Bay estuary, encompassing 10 towns: Dover, Durham, Greenland, Newcastle, Newfields, Newington, Newmarket, Portsmouth, Rye, Stratham. Three of these sites were designated as Community Oyster Gardens and were hosted by towns in public parks in Dover, Durham, and Newmarket. Each Community Oyster Garden hosted four cages that were open to the public to increase the accessibility of the volunteer program. The Durham and Dover oyster gardens had participated in previous years and the Newmarket oyster garden was new this year. To maintain effective communication, the Habitat Restoration Coordinator regularly sent updates via email to volunteers, ensuring they received monthly communications. These emails included information about the ongoing restoration season and served as

reminders for crucial data collection dates. Throughout the season, both the Habitat Restoration Coordinator and the Great Bay Program Manager remained accessible to address any questions or concerns from the volunteers.

### ***Oyster Spat Production***

#### *Permitting*

The Nature Conservancy acquired the permits required for the Oyster Conservationist Program from the New Hampshire Department of Fish and Game (MFD 2336) for growing oyster spat at OC sites in accordance with state and shellfish regulations.

#### *Shell Collection and Preparation*

At UNH-JEL, approximately 200 oyster cages were filled with recycled oyster shells from the UNH Shell Recycling Program and Coastal Conservation Association in June 2023. The shell was shoveled into the cages until they were about half full and then sprayed with a hose to clean off excess dirt. The filled cages were then placed in 4 remote setting tanks outside JEL and filtered with water to prepare for settling the oyster larvae.

#### *Spat on Shell Production*

For spat on shell production, 12 million oyster larvae were purchased from Muscongus Bay, a hatchery located in Bremen, ME. These larvae arrived in early July and were carefully overseen by long-time partners of TNC and experienced practitioners of oyster reef restoration at UNH, Dr. Ray Grizzle and Krystin Ward. The larvae were measured, divided among the four settlement tanks, and closely monitored for both spat settlement and water quality throughout the process. Within a few days, the larvae settled on the shells within the cages, resulting in the production of live spat-on-shell. Subsequently, the cages were relocated to a floating raft at Adams Point to facilitate further growth.

### ***Program Delivery***

Several public volunteer events were hosted at JEL to count the spat that would then be delivered to the host sites. Volunteer activities included counting the number of spat on each shell and placing 30 shells into each Oyster Conservationist (OC) cage, accompanied by a bait bag containing 10 blank oyster shells to observe wild recruitment throughout the season. In previous years, the cages have been filled with 50 shells but due to a lower oyster settlement in 2023, the number was lowered to 30.

The Habitat Restoration Coordinator delivered the OC cages to each site, providing a caliper for oyster measurement, a cage-cleaning brush, a data sheet for specified collection days, a permit, and informational materials. New volunteers received training on cage maintenance and data collection either during delivery or through email instructions. Depending on site requirements, some volunteers were also equipped with a buoy, extra rope, or a screw anchor.

Three community oyster gardens were established in Dover, Durham, and Newmarket. The Durham Community Garden is outfitted with a pulley system designed by an Eagle Scout to enhance cage accessibility. One community event was held at each site throughout the season. The Newmarket community event was held in partnership with The Town of Newmarket Conservation Commission as part of a local series of events called Oyster Week. The Durham and Dover events were both held at the end of the season to count the final number of spat in the cages and each attracted new volunteers interested in learning about oysters and assisting with counting.

The entire counting and delivery process spanned approximately two weeks, taking place between July 24th and August 3rd, 2023. The OC spat counting dates occurred on August 14th and September 11th, during which volunteers tallied the number of spat on 30 shells and measured the length of 30 spat. Throughout the summer, OCs monitored for predators, invasive species, and wild spat. From September 25th to October 5th, the Habitat Restoration Coordinator retrieved all cages from volunteer sites. Several public volunteer spat counting events were held again at JEL during this period to determine the final count of spat on 30 shells and perform a final measurement of 30 spat in each cage. Afterwards, the oysters were consolidated into larger cages and suspended on the dock at JEL.

On October 13th, The Nature Conservancy (TNC) and UNH staff deployed the oysters on a shell pile at the Woodman Point oyster restoration site in Great Bay. To express gratitude and celebrate the conclusion of the 2023 season, an end-of-season party was organized for OC volunteers the following week. The event gathered several new and returning volunteers to discuss the oyster season and present preliminary results from the program.

## **Results**

### ***Initial Spat***

The oyster spat for this season underwent their first count during public counting events in July, where volunteers recorded the number of spat seen on the shell. However, due to their size (<5mm), they were too small for accurate measurement. The initial count revealed a range of 0 to 86 oyster spat per shell, with an overall average of 1.54 spat per shell  $\pm$  0.06 (mean  $\pm$  standard error). Typically, the oysters that are counted for the volunteer program are from a variety of remote setting tanks at JEL, however, this season the oysters were all taken from Tank D. In July, TNC delivered an estimated total of 2,586 oyster spat to OC Program volunteers, a notably lower number compared to previous years due to a low settlement rate.

### ***Growth***

Across all sites, the average growth at the end of the OC season was 19.05  $\pm$  1.45 mm (mean  $\pm$  standard error), representing the average spat shell length. The final size of spat ranged from 2mm to 59mm. For spatial analysis, OC sites were grouped by location (Figure 1). The Lamprey River exhibited the fastest growth, with an average shell length of 28.5mm, while Great Bay showed the slowest growth at an average shell length of 11.84mm.

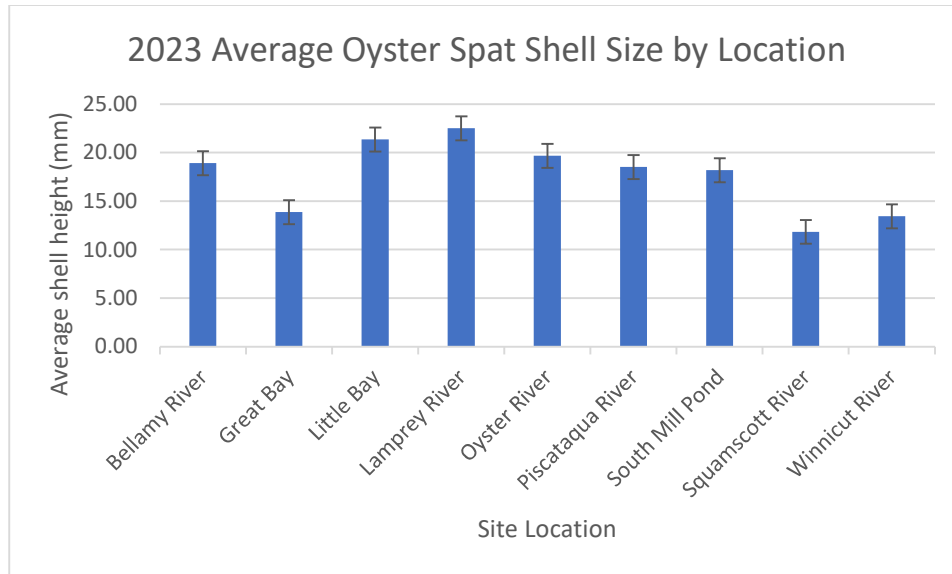


Figure 1. Average oyster spat shell length in mm by location in the Great Bay Estuary in New Hampshire.

**Survival**

In July, OC volunteers collectively received an estimated 2,586 oyster spat, and by September, they returned approximately 1,821 oyster spat, resulting in an overall survival rate of 74%. This survival rate is higher than the last two years, with 2022 at 67% and 2021 at 52%. Sites with the highest survival rates included the Winnicut River, Great Bay, and the Oyster River, while the Lamprey River, Squamscott River, and the Bellamy River exhibited the lowest survival rates (Figure 2). Some sites experienced survival rates exceeding 100%, possibly due to the settlement of wild spat on OC cages. Volunteers observed various predators throughout the season, particularly green crabs and oyster drills, along with increased algae growth on the cages, likely contributing to lower survival rates at certain sites.

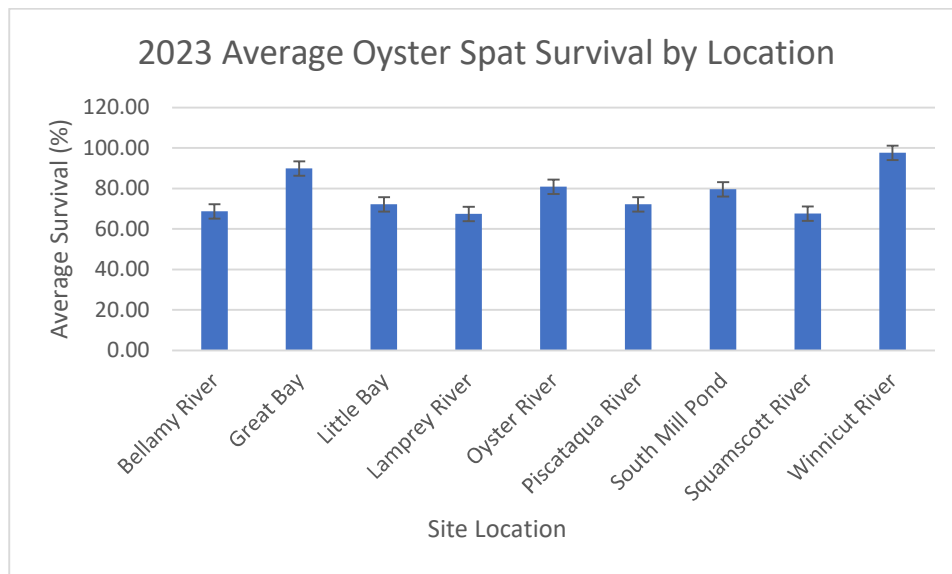


Figure 2. Average oyster spat survival (%) by location in the Great Bay Estuary.

## Discussion

As a community science initiative, a primary objective of the OC Program is to engage the community surrounding the Great Bay Estuary, fostering environmental stewards who actively advocate for and protect the environment and its wildlife. This season, the program achieved this goal by establishing 51 volunteer sites and organizing 12 public volunteer events and workshops, engaging over 100 community members collectively. OC volunteers played a pivotal role in collecting crucial data on oyster growth and survival, contributing to over fifteen years of research that facilitates the analysis of long-term temporal and spatial trends of oysters in the Great Bay Estuary.

The OC Program made a successful contribution to oyster reef restoration efforts by growing an estimated 2,586 oyster spat that were released into Great Bay. Although the number of oyster spat counts this year was notably lower than in previous years, anecdotal evidence suggests that the 2023 season presented challenges not only for oysters but for the entire Great Bay estuary. Eelgrass beds diminished, osprey chick survival rates declined, fish counts were reduced, and saltmarsh compositions changed. Record rainfalls in the New Hampshire seacoast during the summer likely contributed to higher runoff into the system and decreased water quality. Future research is needed to fully understand the causes and impacts these changes had on the estuary.

Summers like these highlight the importance of conservation efforts in Great Bay. Enhancing the resilience of the system as a whole and increasing its ability to adapt to uncontrollable changes, such as climate change, is crucial. Over 17 years, the OC Program has contributed approximately 325,144 live oysters to restore the vital ecosystem services they offer to Great Bay, benefiting both people and wildlife. By combining community engagement with reef restoration, the OC Program continues to be a valuable initiative in New Hampshire, successfully contributing to the broader goal of enhancing the overall health and resilience of this critical estuarine ecosystem.

## Thank you & Acknowledgments

The Nature Conservancy in New Hampshire would like to thank the following organizations for participating in 2023 Oyster Conservationist Program and oyster restoration activities in Great Bay: University of New Hampshire's Dr. Ray Grizzle and Krystin Ward, Jackson Estuarine Laboratory, Nature Groupie, The Town of Durham, The City of Dover, The Town of Newmarket, and the dedicated team of Oyster Conservationist Volunteers, without whom, the success of this program would not be possible.

## Works Cited

Coen, Loren D., et al. "Ecosystem services related to oyster restoration." *Marine Ecology Progress Series* 341 (2007): 303-307.