

2022 Oyster Conservationist Program Final Report



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FINAL REPORT

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Introduction

Providing many ecological, economic, and cultural benefits to the communities surrounding it, The Great Bay Estuary is key resource of coastal New Hampshire and the Gulf of Maine. As a keystone species to Great Bay, the Eastern Oyster (*Crassostrea virginica*), plays a crucial role in the health of the estuary. Oysters provide several ecosystem services for people and wildlife including improving water quality by suspending solids from the water column and providing habitat for other important fish and invertebrate species (Coen et al., 2007). Historically, Great Bay Estuary was filled with acres of thriving oyster reef. However, due to pollution, disease, sedimentation, and over-harvesting, the number of oysters in the Bay has decreased by over 90%. The decrease in the number of oysters in the estuary has also resulted in a decrease of the benefits that they provide to the water and communities. To combat this loss, The Nature Conservancy of New Hampshire (TNC) partners with The University of New Hampshire's Jackson Estuarine Laboratory (UNH-JEL) to restore healthy oyster reefs to the Great Bay ecosystem. The Oyster Conservationist (OC) Program, a community science volunteer initiative, is a crucial component to TNC's strategy.

Participants in the OC Program work towards improving the health of Great Bay by raising oyster spat for TNC's oyster reef restoration projects. Volunteers adopt a cage with spat on shell for an eight-week period cleaning and caring for the cage while also collecting data throughout the summer on survival, growth, invasive species, and wild oyster spat settlement. The cages are delivered to the volunteers by a TNC team member, and they receive training on care and data collection at the time of delivery. In 2022, the OC program had participants at 62 sites in New Hampshire. Spatially these sites are located across Great Bay, Little Bay, Piscataqua River, coastal NH, and its seven tributaries. The two main goals of this program are to collect data on the spat on shell to inform future oyster reef restoration efforts in Great Bay and to create a network of volunteers to build a community of people who advocate and act for the protection of Great Bay.

Methods

Recruitment and Training

In 2022, there were 62 OC sites that spread across the Great Bay estuary in 10 towns: Dover, Durham, Greenland, Newcastle, Newfields, Newington, Newmarket, Portsmouth, Rye, Stratham. This includes two Community Oyster Garden sites in Durham and Dover that hosted four and three oyster cages respectively. Higher capacity this season and word of mouth from our volunteers helped recruit 8 new sites. Habitat Restoration Seasonal, Kimberly Arlen, sent communications through email at least once a month to the volunteers. This provided the volunteers with updates on the restoration season and reminders for data collection dates. She and Great Bay Program Manager, Brianna Group, were available throughout the season to answer questions as needed.

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 (Permit # MFD 2242) for growing oyster spat at OC sites in accordance with state and shellfish regulations.

Shell Collection and Preparation

At the UNH Jackson Estuarine Laboratory (JEL), approximately 110 oyster cages were filled with recycled shells from the UNH Shell Recycling Program and Coastal Conservation Association in May 2022. 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. 70 of those cages were separated, cleaned, and repaired to prepare for the OC season and spat counting volunteer events.

Spat on Shell Production

Six million oyster larvae were purchased from Muscongus Bay, a hatchery located in Bremen, ME. The larvae arrived in early July and their settlement was overseen by Dr. Ray Grizzle and Krystin Ward, experienced practitioners of oyster reef restoration at UNH. Dr. Grizzle and Ward measured and divided the larvae between the four settlement tanks and monitored the spat settlement and water quality throughout the process. The larvae settled on the shells in the cages within a few days to produce live spat-on-shell. The cages were then moved to a floating raft at Adams Point to continue growing.

Program Delivery

Volunteers counted 50 shells, with live spat-on-shell, into each OC cage. A bait bag with 10 blank shells was also placed into each cage to look for wild recruitment throughout the season.

As the OC cages were counted, they were delivered to each OC site by the Habitat Restoration Seasonal. Along with the oyster cage, each site was given a caliper to measure the oysters with, a brush to clean the cage, a data sheet to be filled out on the specified data collection days, a permit, and informational materials. New volunteers received training on cage maintenance and data collection at the time of delivery or instructions over email. Depending on the needs of the site, some volunteers also received a buoy, extra rope, or a screw anchor. Additionally, two community oyster gardens were installed in Durham, a garden that begun in 2019, and in Dover, a new garden created in partnership with the City of Dover. The Durham cages were tied to a new pulley system built by an Eagle Scout, who designed the system to make the cages more accessible. Workshops at the Dover oyster garden were hosted once a week and saw several new volunteers come out to learn more about oysters and help with counting.

Due to the deliveries being staggered with the volunteer spat counting events, the full delivery process took about three weeks. All cages were delivered from July 20th - August 8th, 2022. The OC spat counting dates were August 22nd and September 12th, on these dates the OC's counted the number of spat on 30 shells and measured 30 spat. Throughout the summer, the OC's also monitored for predators, invasive species, and wild spat. From September 19th – October 3rd, the Habitat Restoration Seasonal picked up all cages from the volunteer sites. Several spat counting volunteer events were held during that time to count the final number of spat on 30 shells and do a final measurement of 30 spat in each cage. The oysters were then condensed into larger cages and hung on the dock at JEL. On October 26th, TNC and JEL staff deployed the oysters on a shell pile at the Woodman Point oyster restoration site in Great Bay.

An end of season party was held the next evening for the OC volunteers to show our appreciation and to celebrate the end of the 2022 season.

Results

Initial Spat

Oyster spat were first counted during the volunteer spat counting events in July. The oysters were clearly visible on the shell, however, they were too small to measure as they were <5mm in size. The initial spat per shell count varied with a range of 0 to 175 oyster spat per shell and an overall average of 23.87 spat per shell \pm 1.42 (mean \pm standard error). The initial spat per shell count also varied depending on the remote setting tank at JEL they originated from (Figure 1). Tank A had the highest average count at 35.19 spat per shell and Tank D had the lowest at 19.09 spat per shell. In total, TNC delivered an estimated total of 75,183 oyster spat to the Oyster Conservationist volunteers in July.

Tank	Avg spat/shell
A	35.19
B	15.94
C	21.33
D	19.09

Figure 1: Average spat per shell by remote setting tank during July spat counting week (A, B, C, D).

Growth

The average growth across all sites was 20.7 \pm 0.97 (mean \pm standard error). This represents the average shell length in mm at the end of the OC season. The ending size of spat ranged from 3mm to 59mm. To analyze the results spatially, OC sites were grouped together by location (Figure 2). The Lamprey River experienced the fastest growth with an average shell length of 28.5mm and the slowest growth occurred in Great Bay with an average shell length of 7.5mm.

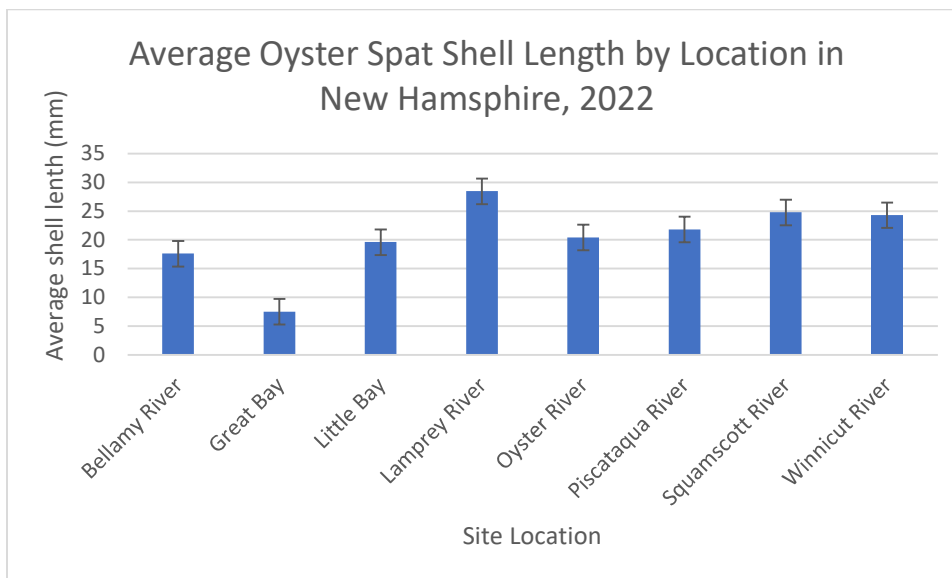


Figure 2: Average oyster spat shell length in mm by location in the Great Bay Estuary in New Hampshire.

Survival

The OC volunteers were cumulatively given an estimated 75,183 oyster spat in July and returned an estimated total of 42,123 oyster spat in September. This gives an overall survival rate of 67%. Notably, that percentage does not account for the six cages that were either lost over the season or not returned that would have contributed to the total number of spat returned, therefore affecting the average survival rate. The survival rate in 2022 falls in the middle of the past three years with 2021 at 52% survival and 2020 at 72% survival. The sites with the highest level of survival were the Squamscott River, Little Bay, and the Piscataqua River. Sites with the lowest survival rates were in the Great Bay, Bellamy River, and Lamprey River (Figure 3). Several of the sites experienced a survival rate over 100% which may be attributed to wild spat settling on the shells in the OC cages. Several volunteers reported sighting many predators in the cages throughout the season, most commonly green crabs and oyster drills. This likely contributed to the lower survival rates at some of the sites.

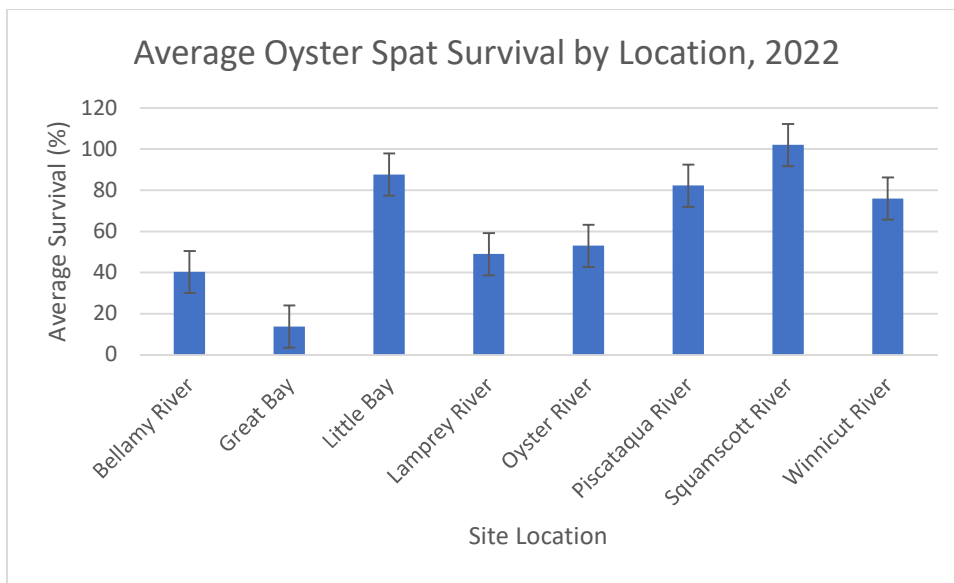


Figure 3: Average oyster spat survival (%) by location in the Great Bay Estuary.

Discussion

As a community science program, a main goal of the OC Program is to engage with the community around the Great Bay Estuary to create environmental stewards that advocate and act for the protection of the environment and the wildlife it sustains. This season of the program successfully met that goal with 62 volunteer sites and nearly two dozen volunteer events that together engaged around 300 community members. The OC volunteers collected valuable data on oyster growth and survival that contributes to over ten years of research that can be used to analyze long-term temporal and spatial trends of oysters in the Great Bay Estuary. Additionally, the OC Program successfully contributed to oyster reef restoration by providing an estimated 42,123 oyster spat that were released to Great Bay. To date, the OC Program has contributed approximately 322,558 live oysters over 16 years in order to restore the important ecosystem services they provide to Great Bay, benefitting people and wildlife. By combining community engagement and reef restoration, the OC Program continues to be a valuable program within New Hampshire and is making successful contributions to the effort to improve the overall health and resilience of this important estuarine ecosystem.

Thank you & Acknowledgments

Funding for the 2022 Oyster Conservationist Program was provided by Fish America Foundation. The Nature Conservancy would like to thank the following organizations for participating in 2022 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 Children's Museum of New Hampshire, The Boy Scouts, 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.