2019 OYSTER CONSERVATIONIST PROGRAM FINAL REPORT

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THE NATURE CONSERVANCY

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Introduction

The eastern oyster, *Crassostrea virginica,* is an important keystone species in the Great Bay Estuary, NH. As an ecosystem engineer, oysters provide several ecosystem services to both people and wildlife. Oysters filter excess nutrients and suspended solids from the water column improving water quality and clarity (Coen et al., 2007). In addition, oyster reefs provide important habitat for fish and invertebrates by building large vertical complex reef structures (Coen et al., 2007). Historically, Great Bay Estuary was filled with acres of healthy oyster reef. However, due to pollution, disease, sedimentation, and historical harvesting these numbers have decreased by over 90% resulting in only a little over a 100 acres of oyster reef today. With this drastic loss of oyster reefs, Great Bay has experienced a similar loss in the important ecosystem services that oysters provide to estuarine ecosystems. For this reason, The Nature Conservancy (TNC) of New Hampshire has been working collaboratively with The University of New Hampshire's Jackson Estuarine Laboratory (UNH-JEL) to restore oyster reefs to Great Bay since 2009. The Oyster Conservationist (OC) Program is an important community engagement component of oyster reef restoration in Great Bay.

An Oyster Conservationist is a community member in the coastal area of New Hampshire who advocates or acts for the protection and preservation of the environment and wildlife. 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. In 2019, the OC program had participants at 83 sites in New Hampshire. Spatially these sites are located across Great Bay, Little Bay, Piscataqua River, coastal NH, and its seven tributaries (Figure 1). The data collected provides information on conditions for oyster growth, survival, and wild oyster spat settlement to inform future oyster restoration efforts in Great Bay Estuary. In 2019, due to a settlement failure, we purchased oyster seed (1/2") from two oyster farms (Choice Oysters and Virgin Oyster Company) that were then placed in bait bags in each individual cage for OC's to care for over the course of the summer.

Methods

Recruitment and Training

OC volunteer sites in 2019 spanned across 12 towns in NH: Dover, Durham, Greenland, Newington, Stratham, Exeter, Portsmouth, Newcastle, Rye, Newmarket, Newfields, and Hampton (Figure 1). 75 of these sites were returning volunteers, with 8 new sites in Newmarket, Durham, Dover, Portsmouth, and Newcastle. New volunteers received one on one training during cage deliveries on cage management, data collection, oyster ecology, and restoration efforts. New volunteers heard about the OC program by word of mouth or recent press articles about the OC Program. Due to the high number of returning volunteers recruiting new volunteers was not necessary for the 2019 season. TNC's Coastal Conservation Coordinator, Brianna Group, was available throughout the season to answer questions and provide feedback to volunteers as needed.

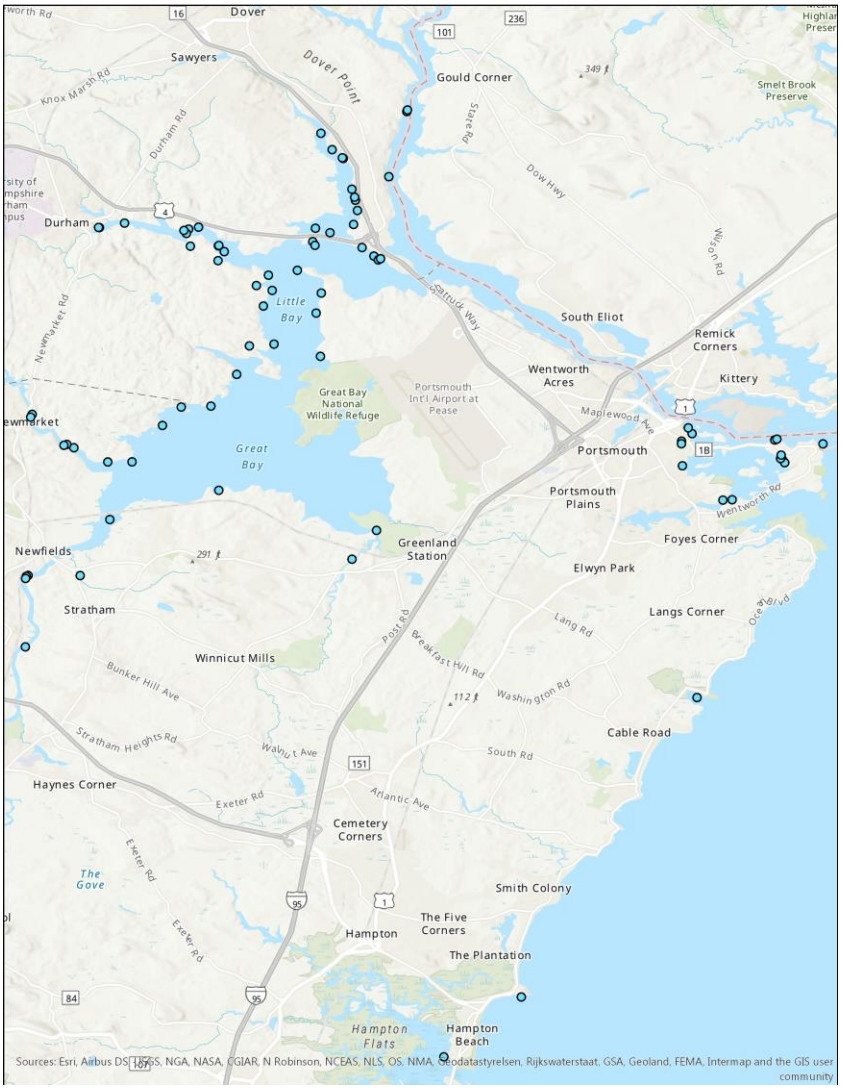

Figure 1. Map displaying general location of 83 Oyster Conservationist Sites (blue circles) across NH.

Oyster Spat Production

Permitting

The Nature Conservancy acquired the permits required for the Oyster Conservationist Program from New Hampshire Department of Fish and Game (Permit # MFD 1932) for growing oysters at OC sites in accordance with state shellfish regulations.

Shell collection and preparation

Recycled oyster shell was collected from local restaurants in NH and ME through the UNH Shell Recycling Program and Coastal Conservation Association, then quarantined for the necessary amount of time before being used. This recycled oyster shell was used to fill 164 UNH cages 1/2 to 2/3 full at the University of New Hampshire's Jackson Estuarine Laboratory (JEL) in May. Once filled, the cages were placed in 4 remote setting tanks at JEL. The 83 Oyster Conservationist cages were cleaned and repaired in preparation for the 2019 season. This recycled shell was also used to monitor for wild spat recruitment in each OC's cage.

Spat-On-Shell Production

In 2019, we experienced a settlement failure and did not use spat-on-shell for the OC program. Instead, TNC purchased 3,000 seed from Virgin Oyster Co (1/2") and 2,000 seed from Choice Oysters for the OC program in 2019. The seed was measured out to be about 50 seed to each cage and were placed in bait bags in each cage.

Program Delivery

Figure 2. OC cage (©Kara McKeton)

Once Oyster Conservationist cages were prepped, TNC staff distributed the cages to each OC site. Each site received a folder with caliper, brush, informational materials, permit, waiver, datasheet, and how-to use caliper sheet. OC cages contained 50 recycled shells (mainly oyster) and a bait bag with oyster seed (Figure 2). Some volunteers also received a float or screw anchor if needed. Throughout the eight-week season volunteers collected data on two days (August 16th and September 13th). OC volunteers measured 30 random seed and counted wild spat that had recruited onto the recycled oyster shells. Similarly, OC's monitored invasive species, predators, fouling agents, and wild spat (on the clam shell in the bait bag). In addition, OC's were asked to check on the cage weekly and to clean it to ensure water flow. The Coastal Conservation Coordinator, Brianna Group, was available to answer questions during this period. In late September-early October, the Coastal Conservation Coordinator picked up the OC cages and folders. Cages were kept at JEL until the second spat counting week from September 23rd-27th. Nature Groupie posted the event and assisted in recruiting volunteers. During this event, volunteers measured 30 random oyster seed (mm) and counted wild oyster spat on recycled oyster shells from each OC cage.

Once the oysters were measured they were put into a biodegradable coconut fiber bag. On October 8th, Alix Laferriere, Coastal Marine Director and Brianna Group staked the bag on the Nannie Island 2016 restoration site (Figure 3). These oysters will be monitored in the following year to measure survival and growth. This marked the end of the 2019 Oyster Conservationist Season.

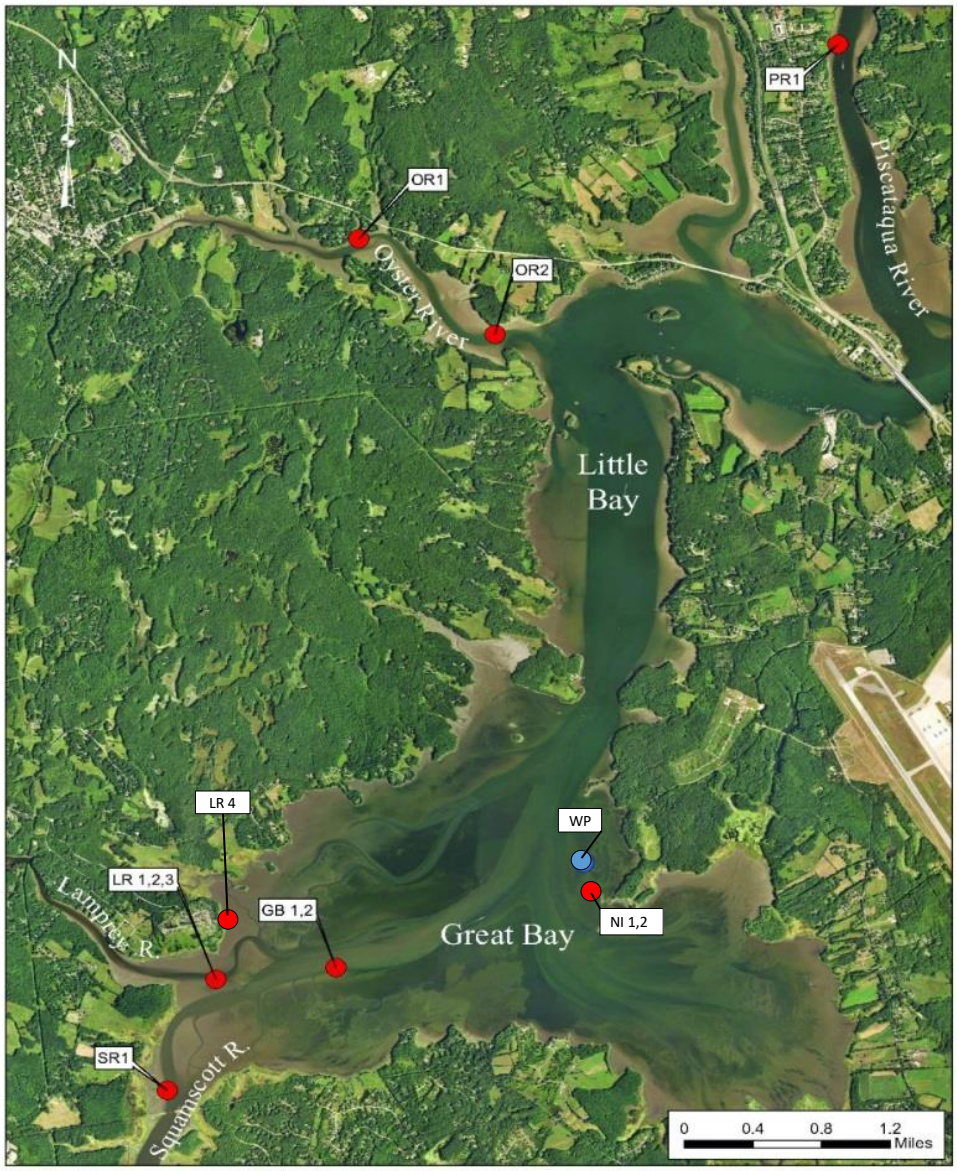

Figure 3. Map of Great Bay Estuary showing The Nature Conservancy's oyster reef restoration sites (red=historical restoration sites and blue circles =current restoration sites). Oysters grown by Oyster Conservationists in 2019 were placed on the oyster restoration site at the 2016 Nannie Island restoration site on October 8th (NI 1, 2, red circle).

Growth

Average growth (measured as average shell height in mm at the end of the OC season) across all sites was 42.41 ± 1.22 mm (mean ± standard error). The fastest average growth rate occurred at the mouth of the Bellamy River with 7.25 mm/week growth (average ending size of 58 mm). To analyze the data spatially, OC sites were grouped together by location. Sites in the Bellamy River, Oyster River, Great Bay, and Little Bay experienced the fastest growth. The Winnicut River had a high growth rate, however, a small sample size, therefore, it was not included. Slowest growth occurred at sites in the Lamprey River, Squamscott River, and South Mill Pond (Figure 6). We are unable to compare growth rates in 2019 to previous years due to the use of different methods (seed at ½" vs. spat on shell). However, all sites experienced excellent growth in 2019.

Figure 5. One oyster from OC cage in Oct.

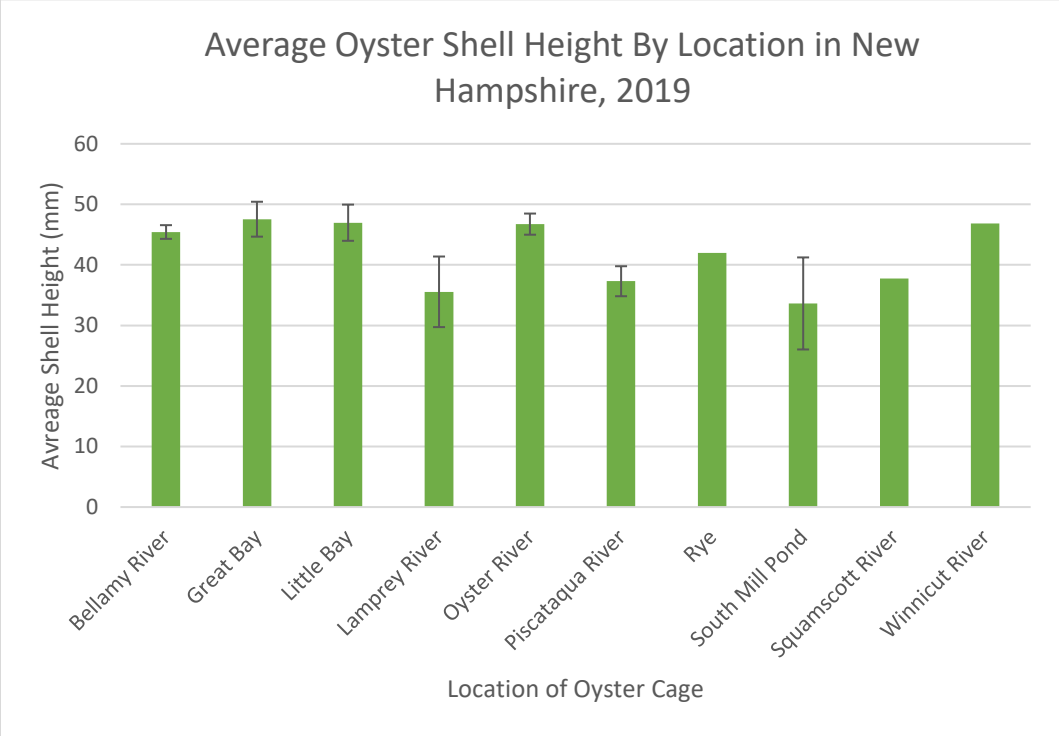

Figure 6. Average oyster spat shell height (used to measure growth) by location in New Hampshire, 2019 ± SE. Fastest growth occurred in Great Bay with an average shell height of 47.55 mm and the slowest growth occurred in the South Mill Pond with an average shell height of 33.6 mm.

Natural Recruitment

Wild spat recruitment onto loose oyster shells was monitored on the 50 loose oyster shells in each OC cage. Average spat recruitment was highest at sites in the Lamprey River with 8.17 spat per site (each cage contained 50 loose oyster shells) ± 3.39 (mean ± SE). We also saw recruitment at sites in the Oyster River (2.67 ± 0.88 spat) and one site with recruitment in Little Bay. Shell height ranged from 10mm to 50mm. Highest recruitment occurred at a site in the Lamprey River with 21 wild spat. Out of the 83 sites in 2019, 13 sites recruited wild spat. In the Lamprey River, 5 out of the 6 sites recruited wild spat. In the Oyster River, 6 out of the 11 sites recruited wild spat. And in Little Bay 1 out of the 7 sites recruited wild spat.

Survival

Due to the changes in 2019 to the OC program we did not track survival of the oyster seed quantitatively in each OC cage. However, we observed high survival qualitatively with most of the OC cages returning at least 30 oyster seed that were placed back into Great Bay Estuary.

Durham Community Oyster Garden

We partnered with the Town of Durham to engage with additional community members by establishing a community oyster garden at the town landing. Three OC cages were placed with oysters at this site with materials. Community members were invited to engage with the oysters and collect data, then submit that data via email to the Coordinator. The goal of this pilot project is to increase our engagement with the public and the accessibility of the OC program to all community members. In addition, a panel discussing the importance of oysters in the Oyster River and Great Bay Estuary was designed and constructed for the Durham Town Landing site. Installation is expected for late fall of 2019- early 2020.

Discussion

As a citizen science community engagement program, a major goal of the Oyster Conservationist Program is to create environmental stewards that advocate or act for the protection and preservation of the environment and wildlife. This program successfully met that goal this summer with 83 Oyster Conservationist sites and almost 300 volunteers of different backgrounds and ages that engaged with the program. Volunteers in the OC Program also collected important data regarding oyster growth that contributes to the 10+ years' worth of data already collected that can be analyzed spatially and temporally for long term trends. The Oyster Conservationist Program successfully supplemented oyster reef restoration by directly contributing live oysters to Great Bay. As a result of the OC Program, almost 250,000 oysters have been placed into Great Bay to begin contributing those important ecosystem services to people and wildlife since 2006 (Figure 7).

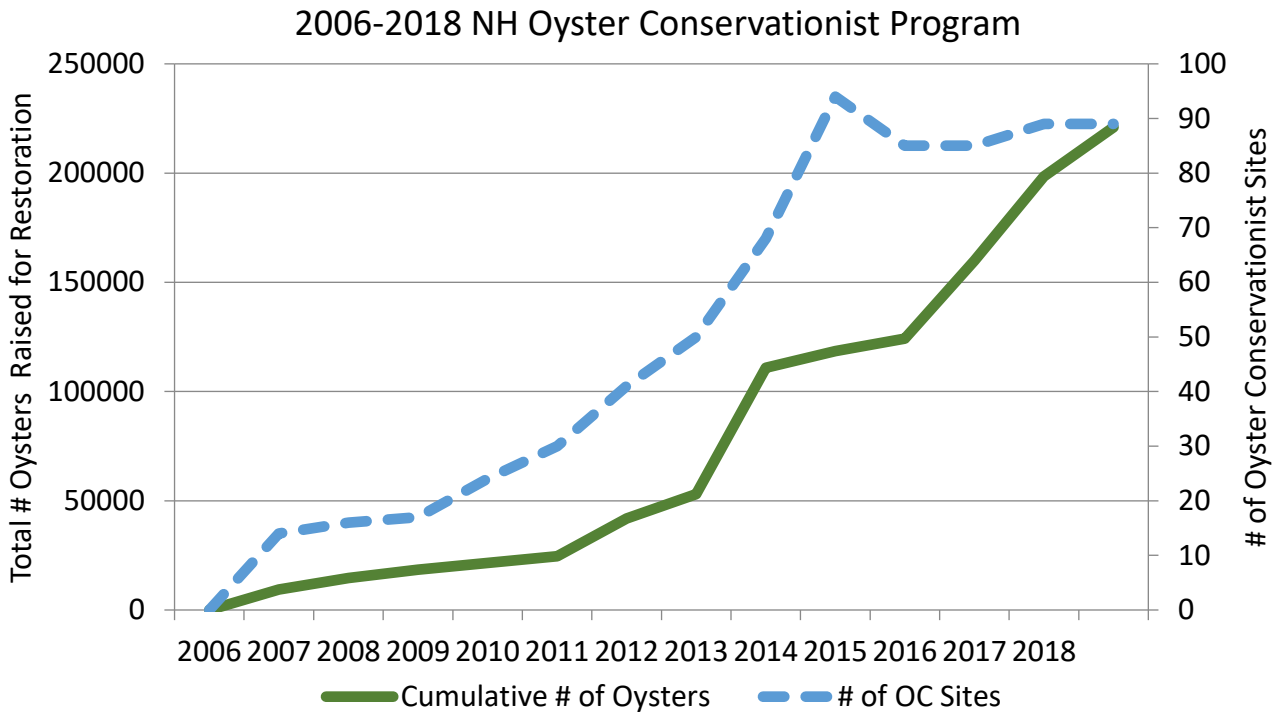

Figure 7. Cumulative number of oysters grown (solid green line) and the number of OC sites each year (dotted blue line) in the Oyster Conservationist Program in New Hampshire from 2006-2018.

The important benefits that the OC Program provides to Great Bay (community engagement, oyster production for reef restoration, and data collection) makes this program a valuable contribution to improving the overall health of this important estuarine ecosystem. Moving forward the program will continue to engage with new groups, collect important information for future restoration efforts, and continue to provide oysters for restoration.

Thank you & Acknowledgements

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Literature Cited

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