2020 OYSTER CONSERVATIONIST PROGRAM FINAL REPORT

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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 2020, the OC program had participants at 61 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 2020, the OC Program was modified for the impacts of COVID-19. Those changes are described below. We are thankful for the volunteers who continued to be a part of the program and to be flexible and adaptable to the many changes that were implemented to ensure safety while participating in our OC Program to raise oysters for restoration.

Methods

Recruitment and Training

OC volunteer sites in 2020 spanned across 12 towns in NH: Dover, Durham, Greenland, Newington, Stratham, Exeter, Portsmouth, Newcastle, Rye, Newmarket, Newfields, Hampton, (Figure 1). Due to the high number of returning volunteers recruiting new volunteers was not necessary for the 2020 season. TNC's Coastal Conservation Coordinator, Brianna Group, was available throughout the season to answer questions and provide feedback to volunteers as needed.

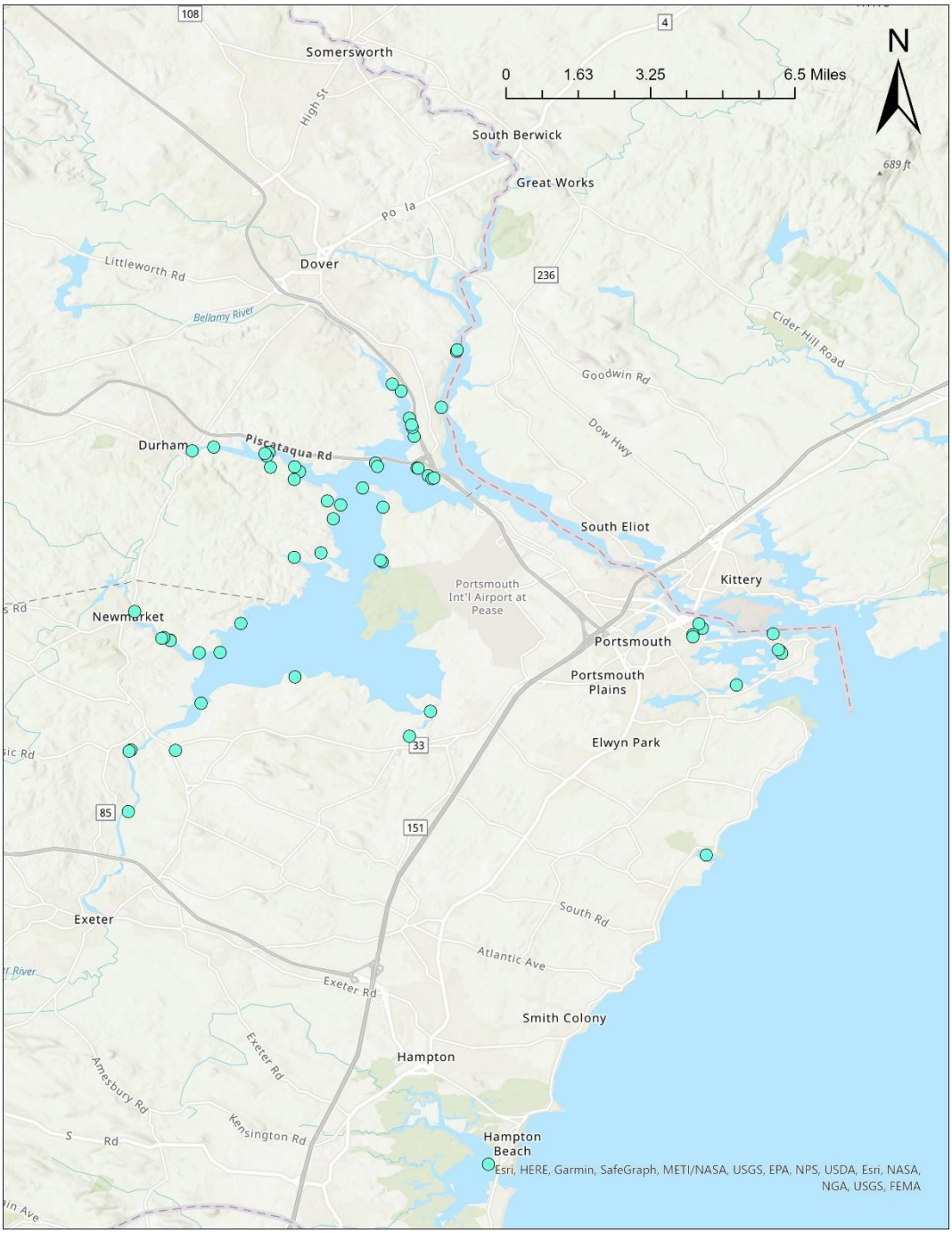

Figure 1. Map displaying general location of 61 Oyster Conservationist Sites (blue circles) across NH.

Changes with COVID-19

Due to the challenges of COVID-19, we modified the OC program to ensure safety for TNC staff and volunteers in the program. We eliminated the folder of materials typically given to volunteers. Instead volunteers only received a brush, caliper, and data sheet. OC's were instructed to submit their data digitally (email, text, or a photo). In addition, during all interactions between TNC staff and OC's masks were worn, 6 feet distance maintained, and gloves and hand sanitizer used. Only OC's at private sites were able to participate in the program, and we were not able to have cages on public docks. In addition, the oyster community garden at the Durham Town Landing was postponed. Spat counting weeks were cancelled and instead TNC staff helped with the counts and measurements. With these safety precautions in place we were able to coordinate and run a successful and safe OC season in 2020.

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 2034) for growing oyster spat 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 128 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 3 remote setting tanks at JEL. The 61 Oyster Conservationist cages were cleaned and repaired in preparation for the 2020 season.

Spat-On-Shell Production

Remote-setting of larvae occurred at JEL in Durham, New Hampshire under the supervision of Dr. Ray Grizzle and Krystin Ward. Twelve million larvae were purchased from Muscongus Bay in Bremen, ME and arrived via FedEx on July 3rd. Krystin and Dr. Grizzle measured out and divided larvae between the three setting tanks based on tank capacity. During this process Dr. Grizzle and Krystin monitored spat settlement, water quality, and maintained notes on the process. Larvae settled on the oyster shells within a few days to produce live spat-on-shell. On July 6th-7th cages were moved from the three tanks to the floating nursery raft at Adams Point for further growth until spat counting week.

Spat counting week was cancelled due to COVID-19 restrictions. TNC staff counted shells and spat-on-shell on 30 random oyster shells for an initial data point for each Oyster Conservationist cage before delivery. Then staff helped with prepping cages before delivery.

Program Delivery

Once Oyster Conservationist cages were prepped and counted, TNC staff distributed the cages to each OC site. Each site received a caliper, brush, permit (through email), and datasheet. The informational materials were emailed instead of providing hard copies. In addition, a video was developed with the External Affairs team to show OC's how to identify and measure spat virtually because we couldn't have trainings in person. OC cages contained 50 recycled shells (mainly oyster with some clam shells) with live spat-on-shell and a bait bag with only oyster shell (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 14th and September 12th). OC volunteers measured 30 random spat and counted spat on 30 random recycled oyster shells. Similarly, OC's monitored invasive species, predators, fouling agents, and wild spat (on the oyster 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 Coordinator picked up the OC cages and materials. TNC staff helped with the spat counts and measurements at the end of the season. During this event, staff measured 20 random spat (mm) and counted spat on 20 random recycled oyster shells from each OC cage.

Figure 2. OC cage (©Kara McKeton)

Once the cages were counted and measured, they were condensed by town into fish totes. On October 5th, TNC and JEL staff deployed the oysters grown by the Oyster Conservationist Program on a shell pile at the oyster restoration site at Woodman Point in Great Bay (Figure 3). This marked the end of the 2020 Oyster Conservationist Season.

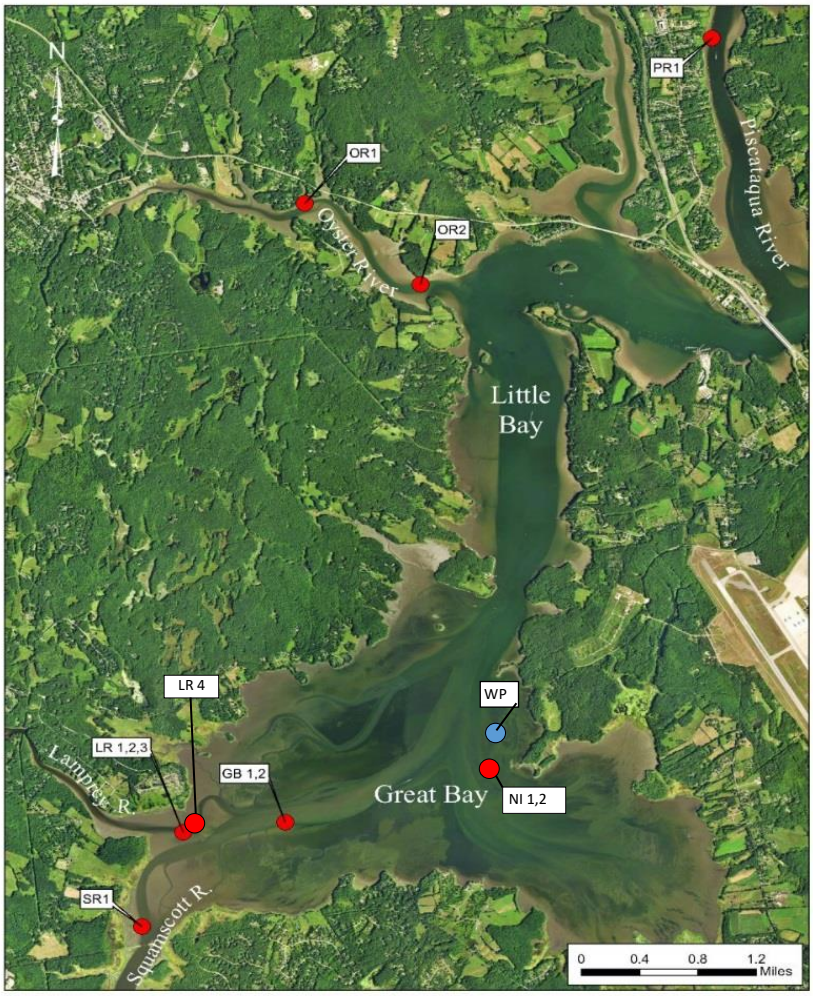

Figure 3. Map of Great Bay Estuary showing The Nature Conservancy's oyster reef restoration sites (red=historical restoration sites and blue circles =current restoration sites). Oysters grown by Oyster Conservationists in 2020 were placed on the oyster restoration site at Woodman Point on October 5th (WP, blue circle).

Results

Initial Spat

Oyster spat were counted in July by TNC staff before delivery to the OC volunteers for an initial count. While these oysters were visible, they were too small to measure at <5mm in size. Initial spat per shell varied with a range of 0 to 206 oyster spat per shell and an overall average of 26.47 spat per shell ± 0.49 (mean ± standard error). Initial spat per shell counts varied according to the remote setting tank at JEL they originated from (Figure 4). Tank A had the highest average spat per shell count (30.69 spat per shell ± 0.89 SE), while Tank C had the lowest spat per shell count (17.82 spat per shell ± 0.72 SE). TNC delivered an estimated 82,405 oyster spat to the Oyster Conservationist volunteers in July. OC's measured and counted their oyster spat twice throughout the 8-week period.

Tank	Average spat per shell ± SE
A	30.69 ± 0.89
C	17.82 ± 0.72
D	24.57 ± 1.29

Figure 4. Average spat per shell by remote setting tank during July spat counting week (A, C, D). Tank A had the highest average, Tank C had the lowest average spat per shell.

Growth

Average growth (measured as average shell length in mm at the end of the OC season) across all sites was 26.9 ± 0.89 mm (mean ± standard error). The ending size of spat ranged from 15 mm to 53 mm. The largest spat shell length recorded was 53 mm from a site in the Bellamy River. To analyze the data spatially, OC sites were grouped together by location. In contrast to previous years, sites in the Bellamy River, Lamprey River, and Squamscott River experienced the fastest growth. Slowest growth occurred at sites in South Mill Pond, Rye, and Great Bay (Figure 6).

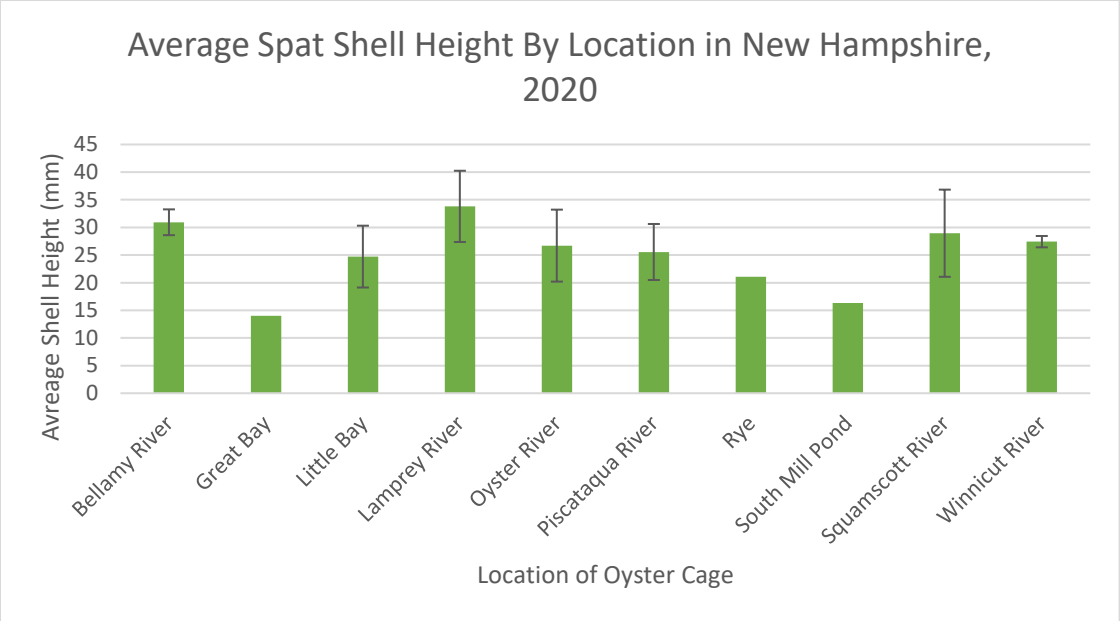

Figure 6. Average oyster spat shell length (used to measure growth) by location in New Hampshire, 2020 ± SE. Fastest growth occurred in the Lamprey River with an average shell length of 33.31 mm and the slowest growth occurred in Great Bay sites with an average shell length of 14 mm.

Survival

Oyster Conservationists were given an estimated 82,405 oyster spat in July and returned an estimated total of 59,455 oyster spat in September with an overall 72% survival rate. The sites with highest survival occurred in the Bellamy River, Oyster River, and Winnicut River. Sites with lowest survival were in Great Bay, South Mill Pond, and Rye (Figure 7). However, number of OC's at these sites were low. Some of the sites experienced over 100% survival (Bellamy, Lamprey, Winnicut) which can be attributed to wild spat settlement on oyster shells in the OC cages.

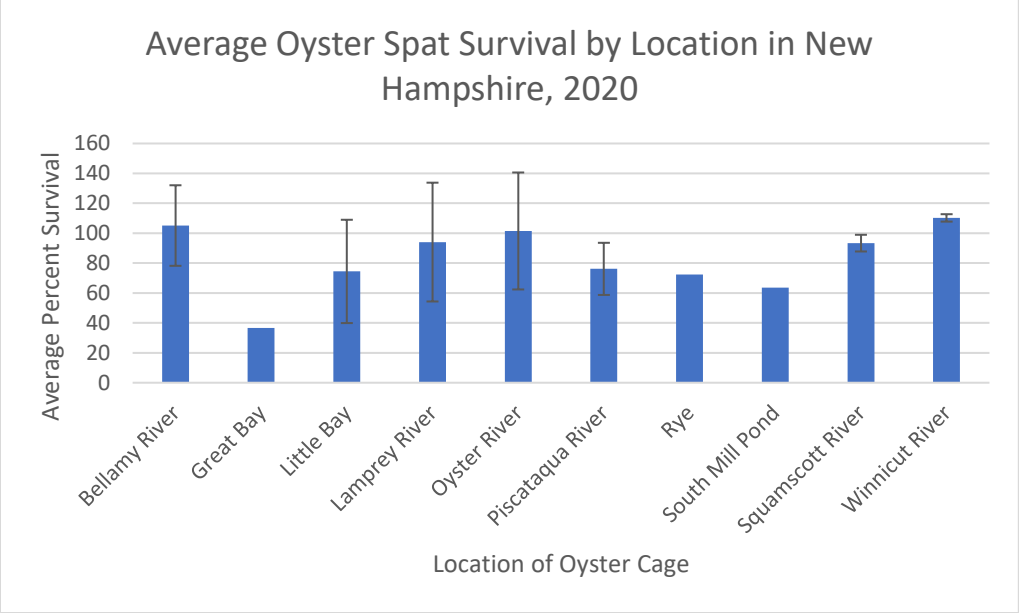

Figure 7. Average oyster survival by location in New Hampshire, 2020. Highest average survival occurred at sites in the Winnicut River and Lamprey River (110% and 105% survival) and the lowest average survival occurred at sites in Great Bay (36.7% survival). Survival over 100% can be attributed to settlement of wild spat in the OC cages.

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 61 Oyster Conservationist sites and over 200 volunteers of different backgrounds and ages that engaged with the program. Volunteers in the OC Program also collected important data regarding oyster growth and survival 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 300,000 oysters have been placed into Great Bay to begin contributing those important ecosystem services to people and wildlife since 2006 (Figure 9). This year the OC Program raised it's highest number of spat on shell for restoration during the entirety of the program. We experienced excellent survival and growth, making this year a huge success!

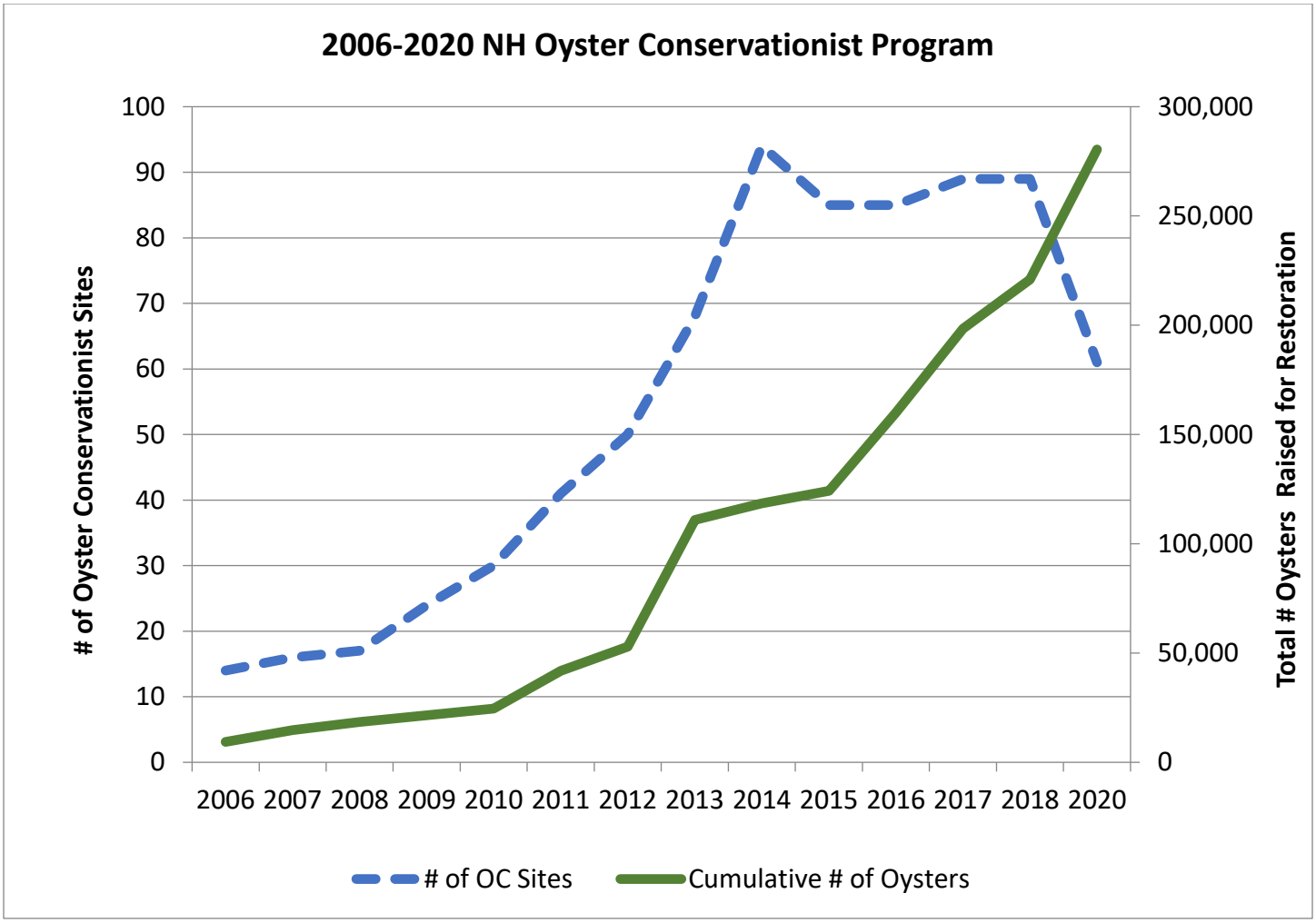

Figure 9. Cumulative number of oysters grown (dotted blue line) and the number of OC sites each year (solid green line) in the Oyster Conservationist Program in New Hampshire. In 2020 there were 61 sites that grew 59,455 oysters (SOS) for reef restoration. Overall, the OC Program has grown 280,435 oysters since 2006.

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.

Thank you & Acknowledgements

The Nature Conservancy would like to thank the following organizations for participating in 2020 oyster restoration activities in Great Bay: University of New Hampshire Jackson Estuarine Laboratory's Dr. Ray Grizzle and Krystin Ward, Coastal Conservation Association, New Hampshire Sea Grant Program, Nature Groupie, The Gundalow Company, and the dedicated team of Oyster Conservationist volunteers.

Works Cited

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