Background

The eastern oyster, *Crassostrea virginica,* is an important keystone species in 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 and environmental steward 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 2018, the OC program had participants at 89 sites in Maine and New Hampshire. Spatially these sites are located across Great Bay, Little Bay, Piscataqua River, coastal NH, and its tributaries. 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.

Oyster Conservationist Season Process

Recruitment and Training

OC volunteer sites in 2018 spanned across 16 towns in NH and ME: Dover, Durham, Greenland, Newington, Stratham, Exeter, Portsmouth, Newcastle, Rye, Newmarket, Newfields, Hampton, Eliot, Kittery, Kittery Point, York, and the Isles of Shoals. New volunteers receive one on one training during cage deliveries on cage management, data collection, oyster ecology, and restoration efforts. TNC's Oyster Conservation Coordinator, Brianna Group, is available throughout the season to answer questions and provide feedback to volunteers as needed.

Oyster Spat Production

Permitting

The Nature Conservancy applies for the permits required for the Oyster Conservationist Program from New Hampshire Department of Fish and Game for growing oyster spat at OC sites in accordance with state shellfish regulations. Each site receives a copy of this permit.

Shell collection and preparation

Recycled oyster shell is 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 is 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 are placed in 4 remote setting tanks at JEL. The over 90 Oyster Conservationist cages are cleaned and repaired in preparation for the season.

Spat-On-Shell Production

Remote-setting of larvae occurs at JEL in Durham, New Hampshire under the supervision of Dr. Ray Grizzle and Krystin Ward. Larvae are purchased in previous years from Muscongus Bay in Bremen, ME and arrive via FedEx in late June. Krystin and Dr. Grizzle measure out and divide larvae between the four setting tanks based on tank capacity. During this process Dr. Grizzle and Krystin monitor spat settlement, water quality, and maintain notes on the process. Larvae settle on the oyster shells within a few days to produce live spat-on-shell. In early July cages are moved from the four tanks to the floating nursery raft at Adams Point for further growth until spat counting week.

For spat counting week, about 10 UNH cages with live spat-on-shell are moved from the raft to the dock for counting. Spat counting week is usually scheduled in mid-July. Nature Groupie posts the event and distributes it to various media outlets to recruit volunteers for the event. Volunteers that participate in spat counting include community members, camps, school groups, partner organizations, and Oyster Conservationists. Volunteers count shells and spat-on-shell on 30 random oyster shells for an initial data point for each Oyster Conservationist cage before delivery.

Figure 2. OC cage (©Kara McKeton)

Program Delivery

Once Oyster Conservationist cages are prepped and counted, TNC staff distribute the cages to each OC site. Each site receives a folder with caliper, brush, informational materials, permit, waiver, datasheet, and how-to use caliper sheet. OC cages contained 50 recycled shells (mainly oyster with some clam shells) with live spat-on-shell and a bait bag with only clam shell (Figure 2).

Some volunteers also receive a float or screw anchor if needed. Throughout the eight-week season volunteers collect data on two days (dates vary each season). OC volunteers measure 30 random spat and count spat on 30 random recycled oyster shells. Similarly, OC's monitor invasive species, predators, fouling agents, and wild spat (on the shell in the bait bag). In addition, OC's are asked to check on the cage weekly and to clean it to ensure water flow. The Oyster Conservation Coordinator, Brianna Group, is available to answer questions during this period. In late September-early October, the OC Coordinator picks up the OC cages and folders. Cages are kept at JEL until the second spat counting week in late September. Nature Groupie posts the event and assists in recruiting volunteers. During this event, volunteers measure 30 random spat (mm) and count spat on 30 random recycled oyster shells from each OC cage.

Once the cages are counted and measured they are condensed by town into fish totes. In early October, OC's place the oysters grown by the Oyster Conservationist Program on a shell pile at the oyster restoration site at Woodman Point in Great Bay from aboard the classic Gundalow Ship (Figure 3). This marks the end of the 2018 Oyster Conservationist Season.

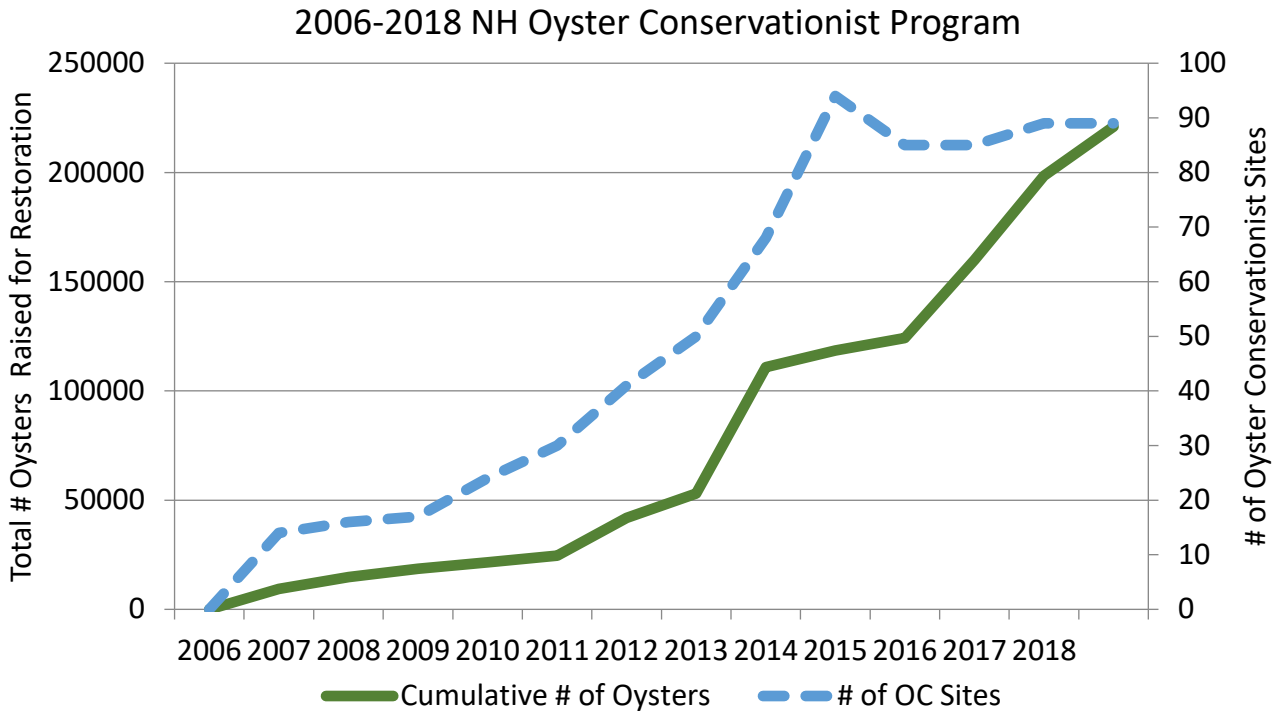

Figure 9. Cumulative number of oysters grown (solid green line) and the number of OC sites each year (dotted blue line) in the Oyster Conservationist Program in New Hampshire. In 2018 there were 89 sites that grew 22,482 oysters for reef restoration. Overall, the OC Program has grown 220,980 oysters since 2006.

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. 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.

Works Cited

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