



Evaluating Whether Oyster Aquaculture Can Help Restore Water Quality

Overview

For coastal communities, such as those on Cape Cod, Massachusetts, water quality and the overall health of coastal systems has been deteriorating due to nitrogen pollution, which can come from septic systems, fertilizers, and atmospheric deposition. Excess nitrogen leads to negative ecological and economic impacts on communities and coastal areas, including algal blooms, fish kills, and shellfish and beach closures. Towns along Cape Cod are under pressure to improve coastal water quality, but many approaches are very costly, such as developing centralized sewer treatment infrastructure for homes that currently have septic systems.

A number of towns are exploring the use of various shellfish aquaculture systems to remediate water quality. This project addresses a critical information gap identified by water quality managers and regulators, specifically: how much nitrogen is removed from coastal waters by common oyster aquaculture methods, and what culturing practices should be adopted to maximize benefits for water quality?

Anticipated Benefits

- This project will increase knowledge and awareness about using shellfish aquaculture for nitrogen remediation.
- Study results will help towns select the most cost effective and environmentally responsible strategies for restoring water quality along their coastline.
- Project findings will be used to update existing water quality planning tools and processes to more accurately represent the potential water quality benefits of aquaculture.
- Project meetings and workshops will lead to stronger collaboration and coordination among researchers, reserve staff, government officials, and others working on local water quality issues.

Project Location

Waquoit Bay, Massachusetts

Project Duration

November 2017 to October 2019

Project Lead

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Project Type

Collaborative Research – generating science that informs decisions

Project Collaborators

- Town of Falmouth
- Science Wares Inc.
- Waquoit Bay National Estuarine Research Reserve
- Woods Hole Oceanographic Institution

Project Approach

The project team will install and closely monitor three aquaculture systems in Waquoit Bay, Falmouth, Massachusetts. Three popular oyster culturing practices will be compared: a floating bag system, a mid-water system, and a bottom cage system. Personnel from the Town of Falmouth and their consultant, Science Wares, will be responsible for placing and tending the aquaculture systems, and will support the data collection process. Collaboration specialists and expert facilitators from the Waquoit Bay National Estuarine Research Reserve will coordinate an End User Advisory Team, consisting of key state and local officials and shellfish managers who will review plans and draft research products. This Team will be a key mechanism to ensure that the research goals and management applications from this study are well linked.

The research team will characterize the ways that oyster aquaculture operations could be remediating nitrogen pollution. For example, as oysters grow, they incorporate nitrogen into their shells and tissue, and this nitrogen is removed from the coastal ecosystem when the shellfish are harvested. Additionally, the team will study what is happening in the sediment below oyster culture operations, which is currently not well understood and could have a significant impact on water quality. Nutrient-rich waste products from the oysters may be buried in the sediment, where these products may stimulate microbial processes that transform problematic forms of nitrogen into a benign gaseous form of nitrogen (a process known as denitrification). The research team will use a number of geochemical and molecular techniques to measure fluxes of nitrogen and monitor microbial activity and community composition in the sediment. In addition to quantifying the nitrogen removal efficiency of each type of aquaculture, the team will also identify indicators and monitoring protocols that could be used by others.

Targeted End Users and Anticipated Products

Research products will be designed to benefit state, regional, and local agencies that help manage fisheries and water quality on Cape Cod, including the Cape Cod Commission, Massachusetts Department of Environmental Protection, Massachusetts Division of Marine Fisheries, coastal towns, and project partner organizations. Anticipated products include the following:

- A best practices guide for municipalities, growers, and state agencies;
- A new grower training workshop for municipal and private shellfish growers;
- An educational video for the public and local officials;
- A regional conference for resource managers and aquaculture professionals; and
- Enhancements to reserve training and education programs, including an oyster culture demonstration site, new visitor center signage, presentation materials, and web content.

About the Science Collaborative

The National Estuarine Research Reserve System's Science Collaborative supports collaborative research that addresses coastal management problems important to the reserves. The Science Collaborative is managed by the University of Michigan's Water Center through a cooperative agreement with the National Oceanic and Atmospheric Administration (NOAA). Funding for the research reserves and this program comes from NOAA. Learn more at coast.noaa.gov/nerrs or graham.umich.edu/water/nerrs.