

Regional Watershed Permit Implementation Project for Pleasant Bay

Fact Sheet: Lonnie's Pond Shellfish Feasibility Project

Introduction/Project Objective

The Town of Orleans developed a nitrogen management strategy through their comprehensive wastewater management program (CWMP). This strategy included evaluation of non-traditional approaches, such as using oyster aquaculture to remove nitrogen within impaired estuaries. In 2016, the Town launched a three-year effort to evaluate the details associated with the implementation of an enhanced aquaculture program through the Lonnie's Pond Shellfish Feasibility Project. This evaluation included quantifying in detail the nitrogen removed by the oysters, evaluating strategies to maximize nitrogen removal, and the regulatory and financial issues associated with an on-going oyster program to address TMDL compliance.

In 2018, the Town worked with the Coastal Systems Program at the School for Marine Science and Technology, University of Massachusetts Dartmouth (CSP/SMAST) to develop a Lonnie's Pond Aquaculture and Nitrogen Management Plan. The Plan included details for a public/private partnership with a Town Request for Proposals (RFP) to select a private grower based on capabilities to implement the aquaculture portion of the Town Plan and a town-funded monitoring contractor to measure the nitrogen removal and associated water quality changes. The Town also worked with CSP/SMAST to develop a Quality Assurance Project Plan (QAPP) that detailed the nitrogen-removal monitoring steps. MassDEP approved the QAPP in 2019, ensuring that any documented nitrogen removed by the Lonnie's Pond aquaculture could be counted as part of the Town's compliance with the nitrogen thresholds of the Pleasant Bay nitrogen TMDL.



Above: Floating Oyster bags in Lonnie's Pond

As part of the Southeast New England Program (SNEP) grant issued to the Pleasant Bay Alliance, the Town of Orleans used SNEP funds to assist in the development of a) the Lonnie's Pond Aquaculture and Nitrogen Management Plan, b) the 2019 monitoring based on the Management Plan, c) a synthesis report of the 2016 to 2018 assessment of the enhanced aquaculture, and d) the Town RFP that selected the aquaculture contractor under the Management Plan.

Management Plan Development and Aquaculture Contractor RFP

The Lonnie's Pond Aquaculture and Nitrogen Management Plan was approved by the Town Select Board and Shellfish and Waterways Improvement Advisory Committee. The Plan detailed a strategy of having a private grower selected by the Town to grow oysters in Lonnie's Pond and an independent monitoring contractor to measure the nitrogen removed by the shellfish. This Plan included the lessons learned during the 2016 to 2018 demonstration project assessment phase and included input from MassDMF. The Town selected Ward Aquafarms as the private grower through a RFP process and selected CSP/SMAST as the monitoring contractor for the 2019 growing season.

2016 to 2018 Synthesis Report

CSP/SMAST prepared a three-year synthesis report on the 2016 to 2018 Lonnie's Pond Demonstration Project monitoring. Monitoring included water column measurements, both snapshot sampling and

continuous recordings of oxygen and chlorophyll a, sediment interactions with biodeposits from the oysters, and stream flow and nitrogen inputs. The review of monitoring data included a number of important findings, including: a) oysters removed significant amounts of particulate organic nitrogen and chlorophyll-a (19 to 37%), b) moving oysters within Lonnie's Pond altered particulate removals, c) interannual differences in rain and stream inputs altered water column TN concentrations, d) oysters process 2X the nitrogen they incorporate and this directly impacts biodeposition of oyster feces and pseudofeces, e) water flow and oyster placement within the system impacts where biodeposition occurs and f) nitrogen removal from a single year's oyster deployment occurs over at least two years, as sediments and biodeposition in summer effect sediment nitrogen dynamics the following spring.

2019 Management Plan Implementation

In 2019, the Town began the public/private partnership implementation of the Lonnie's Pond Management Plan. Ward AquaFarms, the aquaculture contractor, deployed year one (seed) and year two oysters in mid-July. This constituted roughly 1.5 million oysters, weighing 1,359 kg live wet weight. Measurements by CSP/SMAST, the monitoring contractor, determined that these oysters had 4.2 kg N contained within their tissue and shell. Oysters remained in Lonnie's Pond until mid-December (average deployment of 144 days). Upon harvest in December 2019 there were 718,596 live year 1 and 69,427 live year 2 oysters containing a total N mass of 63.9 kg N in their tissue and shell. Accounting for the N content in the year 1 and year 2 oysters at the times of installation and harvest resulted in a net removal of 59.7 kg of nitrogen from Lonnie's Pond. This removal was 79% of the initial Management Plan goal (75 kg N) and 20% of the overall Lonnie's Pond TMDL nitrogen removal target. An additional 1.9 kg N was removed by year 3 and year 4 oysters retained in Lonnie's Pond from the 2018 demonstration project.

Working with the Town and Ward Aquafarms, CSP/SMAST recommended some changes that were implemented in 2020, including a) identifying the best 2 or 3 oyster strains to streamline oyster tracking, subsampling, and nitrogen removal efficiency, b) use the Orleans Transfer Station Scale "truck scale" for harvest weight determinations (cross-checked comparisons showed it was appropriate), c) allow the aquaculture contractor to install small year 2 oysters in spring and then replace them with larger seed in July (larger oysters prevent seed loss encountered in 2019 and may achieve increased N removal).

Implementation of the recommended changes resulted in a 2020 harvest that exceeded the 75 kg N removal goal in the Lonnie's Pond Management Plan. Oyster deployment and water quality monitoring resulted in 93 kg N removal by shellfish growth and an estimated additional removal of 18 kg N through sediment denitrification if estimates were extended into spring 2021. A total of 111 kg/yr N removal would be equivalent to removing the N discharge from 21 houses.

Reports cited:

Town of Orleans Lonnie's Pond Aquaculture and Nitrogen Management Plan. 2018. CSP/SMAST. New Bedford, MA. 128 pp.

Lonnie's Pond Shellfish Demonstration Project Three Year Synthesis Report. May, 2019. CSP/SMAST. New Bedford, MA. 105 pp.

Lonnie's Pond Aquaculture/TMDL 2019 Annual Report (Parts 1 & 2). January, 2020. CSP/SMAST. New Bedford, MA. 27 pp.

Lonnie's Pond Aquaculture/TMDL 2020 Annual Report (Parts 1 & 2). February, 2021. CSP/SMAST. New Bedford, MA. 36 pp.