Expanding Quahog and Oyster Polyculture in Maine

Final report for ONE19-341

Project Information

Project Type: Partnership
Funds awarded in 2019: $29,575.00
Projected End Date: 03/31/2021
Grant Recipient: Manomet, Inc.
Region: Northeast
State: Maine
Project Leader:
Dr. Marissa McMahan
Manomet

Summary:

The Gulf of Maine is warming faster than 99% of the world's oceans, threatening the livelihoods of thousands of Mainers who make a living from the sea. Marine resource diversification is essential for adapting to this rapid change and ultimately promoting economic resilience for Maine's coastal communities.
Manomet and our shellfish farmer partners tested the viability of quahog and oyster polyculture as a way to diversify shellfish farms by using the vertical space of the water column. Overall, we found that growing quahogs on an existing oyster farm as a crop diversification strategy does appear to be economically viable, although there are many factors that can influence production and revenue. For example, the mortality events observed on Winnegance farm in 2020 greatly reduced profits from 2017-2018 cohorts. Furthermore, our results indicate overall greater growth and survival for quahogs grown on the surface, rather than submerged beneath floating cages (although this can also vary by site). This could be an issue for farms with limited space that need to prioritize space for higher value oysters on the surface. Growing quahogs on the bottom may still be viable, but potentially more risky if mortality events occur. However, using the cost-revenue estimator, even the highest amount of mortality we observed (42%) would still result in a net gain of $2,800. Environmental factors that correlate with growth, such as temperature and chlorophyll content (i.e., food) are important considerations

when selecting a site or considering adding quahogs to an existing site (i.e., warmer temperatures and higher chlorophyll concentrations promote faster growth). Further exploration and experimentation to determine how site variability impacts growth and survival is warranted.

Project Objectives:

This project seeks to build upon Kramer's efforts to develop a method for growing quahogs within the footprint of a floating oyster farm. We aim to replicate this work on three additional oyster farms in midcoast Maine, as well as to continue monitoring Kramer's 2017 and 2018 quahog cohorts.

Objective 1: Test quahog grow out using oyster aquaculture techniques.
Objective 1.1 Farmer orientation and training

Objective 1.2 Quahog deployment

Objective 1.3 Monitoring quahog growth and survival

Objective 1.4 Measuring environmental variables

Objective 2: Continue to monitor Kramer's 2017 and 2018 quahog cohorts.

Objective 2.1 Monitoring growth and survival

Objective 2.2 Harvest 2017 cohort

Objective 3 Quantify farm-scale production costs and model potential revenue.

Objective 4: Conduct outreach to grow industry knowledge and market demand.

Objective 4.1 Existing farmer outreach

Objective 4.2 Industry outreach

If successful, we will have demonstrated that the incorporation of quahogs as a secondary crop is both viable and replicable across the midcoast Maine region. Furthermore, we will have provided three additional farmers with the knowledge and technology transfer needed to grow this species on their own farms and provided additional farmers the opportunity to see the technique first-hand through field trips.

Introduction:

The Gulf of Maine is experiencing rapid climate-driven environmental change that threatens the livelihoods of thousands of Mainers. Simultaneously, the diversity of Maine's fisheries resources is at an all-time low (Steneck et al. 2011). The marine economy is over 75% dependent on the American lobster, which is showing signs of decline in the southern Gulf of Maine (Wahle et al. 2013). Marine resource diversification is essential for adapting to a rapidly changing ecosystem and ultimately promoting economic resilience for Maine's coastal communities.

We believe that incorporating sub tidal quahog (littleneck clams) aquaculture into the existing footprint of an oyster farm is an opportunity for sea-farmers to diversify their crops by utilizing the vertical space of the water column. Most sea farms are mono-cultures using only the portion of the water column that maximizes growth. Adding a species with different environmental needs allows a farmer to expand in-place and benefit from additional products and increased resilience to disease and pests. This proposal builds upon Jordan Kramer's effort to develop quahog and oyster polyculture (SARE projects FNE17-877, FNE18-901) by further testing and expanding this research to three additional farms. We have found that sea farmers are eager to engage in this work and believe diversification will be important to the future success of their farms.

Eastern oysters and quahogs are a good pairing for both husbandry and market. Small, intensive oyster farms (a large proportion of the region's aquaculture) use floating equipment to grow oysters in the top few feet of the water column where strong currents deliver the most suspended plankton. Quahogs optimally grow in soft sediments and can be placed in rigid-plastic bags below an existing oyster farm (Fig. 1). In this arrangement, oysters and quahogs do not compete for food or space and the added species offers backup income if disease or pests decimate one crop.

The contained, sub tidal method of growing quahogs proposed by this project offers environmental and social benefits over the established aquaculture methods used on the east coast. In inter-tidal culture, clams are planted in netted plots on exposed mudflats, an area traditionally used for recreation and wild-harvest of clams and marine worms, leading to resistance from fishers and shore-front property owners. Growing clams below an existing oyster farm would avoid these conflicts. In traditional sub tidal culture, loose seed clams are harvested by dredging, disturbing bottom-dwelling species and habitat. Using sub tidal bags avoids the need for dredging.

Finally, quahogs are unique because they are most valuable at a small size, making them an attractive secondary crop for oyster farmers. Both oysters and quahogs are sold in the per-piece half-shell (raw) market, offering a considerably better price than the per-pound commodity market (where other clams and mussels are sold). Additionally, the raw market offers a premium for farm-grown over wild-harvested shellfish. A 2016 market analysis of Maine farmed shellfish found that seafood buyers prefer shellfish from the northeast and will pay a premium for Maine brand shellfish, indicating positive market growth potential for this sector (GMRI 2016).

In 2005, Northeast SARE funded a project that focused on the subtidal culture of surf clams (Spisula solidissima) and included a sub tidal polyculture of these clams with eastern Oysters (Baldwin 2005). In this study, both species were bottom-grown and shared space. Several approaches were tried to varying degrees of success, including growing clams in fabric mesh bags, shellfish trays, modified litter-boxes, and large nets to protect stock from predators. Adequate growth was seen in all but the fabric bags, but shellfish trays and litter-boxes were not

economically viable. Though the Baldwin project had similar aims to this proposal, surf clams have a very different biology from quahogs, preferring sand bottoms in high-energy systems (prevalent wave action) instead of soft mud. Furthermore, surf clams have a very different market from quahogs and command a lower price.

Sub tidal culture of quahogs (in the absence of oysters) has been attempted here in Maine as a portion of a USDA SBIR grant in 2010 (Porada 2010). In this approach, large plots were netted in the shallow sub tidal zone of Goose Bay. This project took place at the northern edge of the clam's natural range, with marginal environmental conditions likely tempering growth (the study site proposed for this project is much warmer and sits within a highly productive wild quahog fishery area). The project did show that contained sub tidal culture of quahogs is possible in the state, albeit in waters incompatible with floating oyster gear.

Large-scale studies of polyculture (or multi-trophic aquaculture) are widespread, but focus on mitigating the negative effects of industrial fin fish or shrimp farming. In these trials macro-algae, marine worms, and/or shellfish are grown to filter and sequester waste from fish or shrimp. These systems have large outside food inputs and are not comparable to dedicated shellfish farms, where crops rely solely on naturally occurring plankton for food. Smaller scale approaches to polyculture in the region have focused on finding off-season crops, namely sea- vegetables, which typically need processing for sale and have an entirely different distribution from live shellfish.

The University of North Carolina Wilmington is currently testing polyculture of quahogs and oysters. However, this region has vastly different environmental conditions and the technique being tested uses a bottom-mounted rack and bag oyster growing system. In this approach, oysters and clams share equipment space on the bottom in both inter-tidal and sub tidal field sites. They are not segregated to different portions of the water column and, therefore, compete for food. Project results are not yet available.

Building on previous SARE projects:

SARE projects FNE17-877 and FNE18-901 tested the feasibility of growing quahogs in a polyculture with oysters in both sediments and surface waters (Kramer 2018, 2019). Results from this research showed commercial promise with clams projected to reach market size in two years, a favorable market price, low equipment costs, little labor burden, and acceptable seed retention/survivorship (40% for the 2017 cohort and 87% for the 2018 cohort). However, these projects were limited in their temporal and geographic scope. Fieldwork was conducted on one farm for just over 17 months, which was not long enough to follow the first crop to market. This proposal would test the suitability of this technique at multiple sites and would quantify underlying environmental differences. It would continue monitoring the original site to establish a firmer understanding of seasonal growth patterns (at both the surface and in sediments) and would follow the original clam crop to market, ultimately testing the economic assumptions presented in the original study.

CITATION LIST

Baldwin J (2005) Sub-tidal aquaculture of surf clams. USDA SARE project FNE05-542. https://projects.sare.org/sare_project/fne05-542/

GMRI (Gulf of Maine Research Institute). 2016. Maine Farmed Shellfish Market Analysis. Report.Gulf of Maine Research Institute, Portland, Maine. https://www.gmri.org/sites/default/files/resource/gmri_farmed_shellfish_final_with_cover_10.13.16.pdf

Kramer JM (2018) Integrated oyster and littleneck clam aquaculture to increase seafarm yield. USDA SARE project FNE17-877. https://projects.sare.org/project-reports/fne17-877/

Kramer JM (2019) Littleneck clam and American oyster polyculture: Economic viability and nursery Technique. USDA SARE project FNE18-901. https://projects.sare.org/project-reports/fne18-901/

Porada J (2010) Hard clam farming in eastern Maine: field experiments to evaluate biological & economic efficacy of field-based nursery and grow-out phases. USDA SBIR project 2010-02596. https://www.sbir.gov/sbirsearch/detail/16591

Stanley JG (1985) Species Profiles. Life Histories and Environmental Requirements of Coastal Fishes and

Invertebrates (Mid-Atlantic). Hard Clam. Maine Cooperative Fishery Research Unit Orono.

Steneck RS (1997) Fisheries-induced biological changes to the structure and function of the Gulf of Maine ecosystem. In: Wallace GT, Braasch EF (eds). Proceedings of the Gulf of Maine Ecosystem Dynamics Scientific Symposium and Workshop. RARGOM Report. p 151-165.

Steneck RS, Hughes TP, Cinner JE, Adger WN, Arnold SN, Berkes F, Boudreau SA, Brown K, Folke C, Gunderson L, Olsson P (2011) Creation of a gilded trap by the high economic value of the Maine lobster fishery. Conservation biology, 25:904-12.

Wahle RA, Brown C, Hovel K (2013) The geography and body-size dependence of top-down forcing in New

England's lobster-groundfish interaction. Bulletin of Marine Science, 89:189-212.

Cooperators

- Jordan Kramer

  jordan@winneganceoysterfarm.com

  Oyster/hard clam farmer

  Winnegance Oyster (Commercial (farm/ranch/business))
- Mike Gaffney

  meg8@cornell.edu

  Oyster farmer

  Eros Oyster (Commercial (farm/ranch/business))
- Mark Gaffney

  markgaf@msn.com

  Oyster farmer

  Eros Oyster (Commercial (farm/ranch/business))
- Lincoln Smith

longreachoysters@gmail.com
Oyster farmer
Long Reach Oysters (Commercial (farm/ranch/business))

- Chad Campbell
chadcampbell@myfairpoint.net
Oyster Farmer
Georgetown Oyster LLC (Commercial (farm/ranch/business))

Research

Materials and methods:

Objective 1: Test quahog grow out using oyster aquaculture techniques.
Objective 1.1 Farmer orientation and training: Project leaders organized an initial meeting with farmer partners in August 2019 to discuss methodology, gear requirements, data collection, etc. This was also an opportunity for farmers to informally exchange information and experiences related to shellfish aquaculture. Two additional oyster farmers who were not involved in the project also attended because they had heard about the project and were interested in learning about quahog aquaculture. Dana Morse from Maine Sea Grant was also in attendance and was able to share what he learned throughout his extensive aquaculture network. All gear and quahog seed required for the project was distributed to farmers at this meeting.

Objective 1.2 Quahog deployment and grow out: Each farmer received 20,000 quahogs ranging in size from 5-15 mm shell length at the August 2019 training. We then worked with each farmer to prepare their gear/farm for deploying the quahogs. Initially, the quahogs were evenly split (10,000/bag) among two 2 mm plastic diamond mesh oyster bags (32 x 18 x 3 in). These bags were placed in floating cages on the surface for the first month of the project. We had expected to deploy surface and bottom treatments immediately; however, slower growth rates over the summer of 2019 delayed the deployment of our split treatments until late September. Once the quahog seed had reached a larger size, each farmer graded their seed using a 6 mm plastic mesh screen.

All quahogs that retained on the screen were equally split into four 4 mm plastic mesh bags which were then divided into surface and bottom treatments. Each bottom treatment bag was weighted with an 18 in piece of rebar that was secured to the bottom of the bag and allowed the bags to quickly sink to bottom. All treatments were overwintered (i.e., sunk to bottom) in early December 2019 and brought back to the surface in April 2020. This is a common practice for shellfish aquaculture in Maine, where cold winter temperatures can cause gear issues related to ice buildup.

Objective 1.3 Monitoring quahog growth and survival: Quahog growth and survival was measured monthly from September-November 2019 and May-November 2020 (growth was not expected to occur from December-March when water temperatures fall below 5-6°C (Stanley 1985)). We were unable to take measurements in April of 2020 due to COVID19 shelter-in-place restrictions. Growth and survival were determined from 100 randomly sampled quahogs from each treatment (i.e., surface and bottom). Shell length was measured to the nearest millimeter and the weight of each group of 100 individuals was measured to the nearest gram. Weight measurements were not used in the growth analysis due to the difficulty of accurately measuring the weight of small, wet quahog seed. Empty shells were used to calculate percent mortality.

Due to COVID19 restrictions and safety concerns, we were not able to travel to each farm and take monthly measurements in 2020. Two of the participating farmers, Jordan Kramer and Lincoln Smith, offered to take their own monthly measurements. We mailed them data sheets and calipers for shell length measurements. Weight measurements could not be taken. The remaining two participants/farms were able to bring their quahogs to a dock accessible by land for project PIs to take length and weight measurements.

Average quahog shell length was calculated for each farm and treatment each month. Daily growth rates were calculated as millimeters of shell growth per day for intervals between sampling. Daily growth rates were analyzed using a 3-factor analysis of variance with farm (Winnegance, Long Reach, Eros, and Campbell), treatment (surface and bottom), and month as fixed factors.

Objective 1.4 Measuring environmental variables: We deployed a temperature logger on each farm that recorded hourly temperature measurements. Temperature data was downloaded each month when growth measurements were taken. In addition to this, we took monthly measurements of salinity, pH, turbidity, and chlorophyll on each farm from September-November 2019 using a Sonde, and we collected surface and bottom water samples with the intent of analyzing them at the University of Southern Maine using a fluorometer.

However, the fluorometer ended up malfunctioning and the costs associated with repairing and recalibrating the machine prohibited us from using it in 2019. We were also unable to use the fluorometer in 2020 due to the pandemic. We were able to partially resume Sonde measurements in the summer of 2020; however, we could not access all of the farms to take measurements due to safety concerns. Given the inconsistencies in when and where we were able to take Sonde measurements, we were unable to analyze environmental variables as we had intended, and instead just present some interesting patterns found in the results section.

Objective 2: Continue to monitor Kramer's 2017 and 2018 quahog cohorts.

Kramer's 2017 and 2018 cohorts were monitored from September-November 2019 and from May-November 2020. A portion of the 2017 cohort was harvested and sold at Harbor Fish Market in Portland, ME in the fall of 2019 and summer of 2020.

Objective 3 Quantify farm-scale production costs and model potential revenue.

Project leader Jordan Kramer developed a model to estimate the potential production and costs of growing quahog clams in the sediments below a subtidal oyster farm in contained culture. The model uses growth rates, stocking densities, and survivorship of quahogs grown between 2017 and 2020 on the New Meadows River, Long Reach, and Robinhood Cove in southern Maine. This work represents the trial and error of a new technique, and shows a range of outcomes that include failed treatments. The cost and revenue estimate model, as well as detailed instructions on how to use this tool, can be found in the Information Products section of this report.

Objective 4: Conduct outreach to grow industry knowledge and market demand.

This portion of the project was scheduled to be conducted in the summer/fall of 2020. Unfortunately, we were unable to host outreach events and farm tours due to the COVID19 pandemic. However, we did present project findings at the Milford Aquaculture Seminar and the Maine Aquaculture R&D&E Summit in January 2020, the Maine Fishermen's Forum in March 2020, and the Regional Association for Research in the Gulf of Maine Annual Meeting in October 2021. We also had informal conversations with over a dozen farmers interested in quahog and oyster polyculture, and in November 2020 we distributed quahog seed (purchased outside of this project) to 7 new farmers. We will continue to provide guidance and support to these new farmers, in addition to the farmers who participated in this project.

Research results and discussion:

Table 1

Figure 1

Figure 2

Figure 3

Figure 4

Objective 1.

Average shell length varied by farm and treatment, with the largest sizes observed at Winnegance Oyster, and overall larger sizes in the surface treatments (Figure 1). The greatest difference in growth among treatments was seen at the Long Reach/Harpswell site, where surface quahogs grew much faster. However, there was an initial mix up of treatments on this farm in the fall of 2019, which may have impacted these results. Daily growth rates were significantly impacted by treatment (ANOVA, $F_{1,40} = 5.2$, $p = 0.03$) and month (ANOVA, $F_{7,40} = 4.9$, $p < 0.01$). Daily growth was significantly greater in surface treatments (Tukey's HSD, $p = 0.01$), and there was a significant increase in growth rates in July compared to other months (Tukey's HSD, $p < 0.05$ for all comparisons). Interestingly, there was also a late summer/early fall spike in growth at both Georgetown farms and Winnegance/New Meadows (Figure 2).

From the observed growth rates, we estimate the quahogs grown in this project will reach market size in the summer/fall of 2021, 4 growing seasons after they were purchased at the size of 1 mm. However, growth rates vary significantly among individuals, and the fastest growing quahogs may actually reach market size in 3 growing seasons (our estimate of 4 seasons is based off of the average growth rates).

Overall, we observed higher survival rates in surface vs. bottom treatments. The average mortality for surface treatments ranged from 0.5-1.9% and for bottom treatments ranged from 0.4-4.7%, while the cumulative mortality for surface treatments ranged from 5-17% (average = 8.75%) and for bottom treatments ranged from 3-42% (average = 21.25%) (Table 1). There was a mortality event on the Campbell and Eros farms in the spring of 2020 where we observed a spike in mortality of the bottom treatments on both farms that ranged from 15-20%. We are not aware of any environmental variables that may have correlated with this mortality event (e.g., extreme rainfall events, temperature fluctuations, algal blooms, etc.). One possible explanation may be that there was a shift in sediments in Robinhood Cove where both farms are located that may have impacted survival.

Overall, water temperature was highest at Winnegance/New Meadows (Figure 3). Summer water temperature was highest at the Winnegance/New Meadows and Long Reach/Harpswell sites, but also lowest at the Harpswell site in the winter. We were unable to take Sonde measurements as we had originally planned; however, we did manage to take some measurements in Robinhood Cove (Eros and Campbell farms) and the New Meadows (Winnegance Oyster) and found the chlorophyll measurements were consistently higher in the New Meadows (Figure 4). The combination of higher temperatures and higher chlorophyll (i.e., food) concentration may explain the faster growth rates seen at the Winnegance site.

Objective 2.

In an attempt to reduce handling losses seen in near-harvest-size clams (as evidenced by broken shells with intact meats in 2018 and 2019) handling was greatly reduced in 2020. Clams were brought to the surface in early May to take advantage of the early season growth seen in surface-treatment clams in prior years, and were kept at the surface until July, when they were first picked for harvest and culled. During the surface phase, a single cage of clams was air dried to control fouling, and clams in two bags were contained/compressed in mesh sleeves to attempt to mitigate mechanical damage. After handling/culling, clams were homogeneously mixed and moved into clean bags and deployed in the sediments until mid November, when they were again picked and culled.

High levels of loss were observed in 2020 at all stages. Bags of clams (and oysters) overwintered from late Nov. 2019 until May 2020 were infested with large numbers of rock crabs. Rocks crabs were observed in bags with and without mesh “gaskets” at door ends and were associated with high levels of mortality.

An unusual amount of fouling was also observed on the farm, primarily (but not exclusively) effecting surface bags. Large sets of sea vases appeared twice over the course of the season (in June and Sept, instead of the single typical July set). New sets of colonial tunicates were observed throughout the latter half of the season. An exceptionally large sea grape set was observed in July in both surface and sediment bags. The extent and unpredictability of fouling likely contributed to losses noted in July.

A final wave of mortality was observed in the fall. Crabs (predominantly rock) were again prevalent in the sediments of the farm after a summer lull. Deep burial in sediments also created problems (even in areas that were historically stable). A large storm that coincided with astronomical tides may have contributed to conditions where bags were deeply buried in a short amount of time (by stirring up sediments in flats just upstream of the farm). The weekly task of pulling bags out of the mud was much more difficult after this event.

Just 1000 clams were picked for harvest in 2020 season, with only 500 actually reaching the market. Order picking was timed around dealer orders, and on two occasions buyers canceled orders on the day of delivery due to restaurant-staff Covid outbreaks. The majority of clams from these canceled orders were given away as samples (due to poor the survivorship in pre-harvest storage seen 2019). 200 individuals were kept in on farm wet storage to test the efficacy of 2 storage techniques. Clams stored in compressed tubular mesh bags stayed in good condition for just over three weeks. Clams stored in trays began to show mortality after just one week of storage.

A large number of the clams lost during the fall were harvestable or near harvestable and could partially account for the low productivity seen in 2020

Objective 3:

See attached cost-revenue estimator model. Cost-Benefit-model

Objective 4:

This portion of the project was scheduled to be conducted in the summer/fall of 2020. Unfortunately, we were unable to host outreach events and farm tours due to the COVID19 pandemic. However, we did present project findings at the Milford Aquaculture Seminar and the Maine Aquaculture R&D&E Summit in January 2020, the Maine Fishermen’s Forum in March 2020, and the Regional Association for Research in the Gulf of Maine Annual Meeting in October 2021. We also had informal conversations with over a dozen farmers interested in quahog and oyster polyculture, and in November 2020 we distributed quahog seed (purchased outside of this project) to 7 new farmers. We will continue to provide guidance and support to these new farmers, in addition to the farmers who participated in this project.

Research conclusions:

Overall, we found that growing quahogs on an existing oyster farm as a crop diversification strategy does appear to be economically viable, although there are many factors that can influence production and revenue. For example, the mortality events observed on Winnegance farm in 2020 greatly reduced profits from 2017-2018 cohorts. Furthermore, our results indicate greater growth and survival for quahogs grown on the surface, rather than submerged beneath floating cages. This could be an issue for farms with limited space that need to prioritize space for higher value oysters on the surface. Growing quahogs on the bottom may still be viable, but potentially more risky if mortality events occur. However, using the cost-revenue estimator, even the highest amount of mortality we observed (42%) would still result in a net gain of $2,800. Environmental factors that correlate with growth, such as temperature and chlorophyll content (i.e., food) are important considerations when selecting a site or considering adding quahogs to an existing site.

Participation Summary

5 Farmers participating in research

Education & Outreach Activities and Participation Summary

4 Consultations

1 Curricula, factsheets or educational tools

1 On-farm demonstrations

5 Published press articles, newsletters

4 Webinars / talks / presentations

1 Workshop field days

1 Other educational activities: We had many informal conversations and exchanged information with farmers during this project. As a result, 7 additional farmers are now growing quahogs as a secondary crop on their oyster farms.

PARTICIPATION SUMMARY:

7 Farmers

1 Number of agricultural educator or service providers reached through education and outreach activities

Education/outreach description:

September growth and survival measurements of quahog seed on Winnegance Oyster Farm.

Marissa McMahn and graduate student Erica Ferrelli helping to deploy quahog experiments on Eros Oyster Farm.

A tool was developed to help estimate the potential production and costs of growing quahog clams in the sediments below a subtidal oyster farm in contained culture: Cost-Benefit-model

We have received media coverage for this project from the following outlets:

- Associated Press: Environmentalists propose Mainers farm quahogs to beat pests: https://apnews.com/61bf6a06cdda4045a113c493f04b9076
- Heated: How to make the best fried clams ever: https://heated.medium.com/how-to-make-the-best-fried-clams-ever-35872b0ad0d3
- Maine Public Radio: Maine's clam harvest: what is being done to improve health of Maine's clam population? https://www.mainepublic.org/post/maines-clam-harvest-what-being-done-improve-health-maines-clam-population
- Landings: Quahogs tested as new Maine species: https://mlcalliance.org/2019/12/20/quahogs-tested-as-new-maine-species/
- Wicked Local: Plymouth-based Manomet Inc. tests hard-shell clams for replenishing Gulf of Maine fisheries: https://plymouth.wickedlocal.com/news/20191114/plymouth-based-manomet-inc-tests-hard-shell-clams-for-replenishing-gulf-of-maine-fisheries

Conferences:

- Presentation at Milford Aquaculture Seminar, Shelton, CT, January 14th, 2020
- Presentation at Maine Aquaculture R&D&E Summit: Belfast, ME, January 17th, 2020
- Presentation at Maine Fishermen's Forum, Rockport, ME, March 5th, 2020
- Presentation at Regional Association for Research in the Gulf of Maine Annual Meeting, virtual, October 16th, 2021

Education:

We began working with the Bowdoin College Marine Biogeochemistry class on targeting the most pressing questions for farmers and developing sediment and water chemistry sampling protocols to address those questions. However, the COVID19 pandemic interrupted this work.

Workshops/field days:

We conducted the farmer orientation and training workshop in August 2019. The training was led by Kramer (farmer) and attended by the 4 farmers who are part of the project, as well as 2 additional farmers who are interested in growing quahogs. Dana Morse from Maine Sea Grant also attended the training.

Learning Outcomes

12 Farmers reported changes in knowledge, attitudes, skills and/or awareness as a result of their participation

Key areas in which farmers reported changes in knowledge, attitude, skills and/or awareness:

The farmers involved in the project (other than Kramer) had never grown quahogs before, so gained an entirely new set of knowledge and tools for culturing this species. The 7 additional farmers who we connected with during the course of the project ended up also experimenting with growing quahogs starting in 2020.

Project Outcomes

12 Farmers changed or adopted a practice

1 Grant applied for that built upon this project

1 Grant received that built upon this project

$65,000.00 Dollar amount of grant received that built upon this project

6 New working collaborations

Project outcomes:

This project successfully integrated a new shellfish species on 3 existing oyster farms, and as an offshoot of what we learned during this project, 7 additional farms are now growing quahogs. This approach is providing some measure of diversification and economic resilience to these farms, as well as producing a new cultured seafood product in the state of Maine.

Assessment of Project Approach and Areas of Further Study:

Obviously COVID was a huge challenge, and greatly reduced our ability to conduct planned outreach events. However, we found that one-on-one conversations with farmers, often unscheduled and unstructured, made up for the loss of hosting events. Indeed, we probably shared as much information in conversations at public boat launches and town wharfs as we would have hosting farm tours.

It was the dedication of our farmer partners that allowed this project to succeed despite the pandemic. They went above and beyond to ensure that we could still collect data each month, often taking the measurements themselves, or transporting quahogs to a dock that could be safely accessed from land.

We did answer the questions we set out to study, and generated a bunch more along the way! One particular challenge that we faced was fouling in the quahog bags that reduced water flow and caused mortality. Continued exploration of how to deal with fouling is warranted. Furthermore, the nursery phase (not addressed in this project) continues to be a challenge for quahog aquaculture; however, with the increasing interest from the aquaculture community in culturing this species, we anticipate more hatcheries will begin to supply quahog seed, and at a larger size that will reduce issues associated with nursery rearing techniques.

We plan to continue this work in 2021, sharing knowledge gained from this project with the additional farmers now growing quahogs, as well as with new farmers interested in incorporating quahogs on their farms.

Information Products

- **Cost-benefit model** (Workbook/Worksheet)