Vertical Integration of an Oyster Farm in a Broader Business Model

Justine Sauvage and Perry Raso

The Matunuck Oyster Bar's raw bar offers a variety of Eastern oysters Crassostrea virginica *grown in Rhode Island, alongside local hard clams* Mercenaria mercenaria*, shrimp and lobster.*

Introduction

Over the past 20 years, the tiny state of Rhode Island, USA, has embraced oyster aquaculture. Perry Raso, a former shellfish digger, then oyster grower, and now restaurateur, has spent a career advocating for sustainable aquaculture and the advancement of his trade. The integration of different components of food systems (Pond-to-Plate, Farm-to-Table, and soon Hatchery-to-Nursery), led him to the development of a local sustainable food system, showcasing the economic potential of local food businesses. This article features that operation, its development and future direction.

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Rhode Island Shellfish Aquaculture

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Perry Raso, founder of the Matunuck Oyster Farm (MOF) and part of this early wave of shellfish growers, grew up wild-harvesting shellfish and scuba diving for hard clams before starting a

Perry Raso, founder and operator of the Matunuck Oyster Farm and Matunuck Oyster Bar.

Raso inspecting second year oysters in the bottom tray system.

commercial oyster farm. That 0.4-ha farm was gradually expanded and is now intrinsically integrated with the Matunuck Oyster Bar (MOB). "In Rhode Island we have a lot of advantages," says Raso. "The climate allows year-round harvest of our product; we are located between two major markets, Boston and New York; we have the advantage of established infrastructure for shipping seafood with Point Judith being the second largest producer of seafood on the East Coast. Finally, our oysters are sought after and have very strong demand in these major markets."

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— *Perry Raso*

The Matunuck Oyster Farm

The MOF started as a 0.4-ha farm in 2002 with some foundational support from the State of Rhode Island's Aquaculture Education Initiative. The farm is located on Potter Pond, one of the state's southern brackishwater coastal ponds. The 1.2-m water depth, quiet waters, daily tidal influx of algae and ease of access makes it a fitting site for the establishment of a shellfish nursery and grow-out operation. In a few years the farm expanded to 1.2 ha and is now a 2.8-ha shellfish farm. The Eastern oyster *Crassostrea virginica* is the primary farmed species, with some sections of the farm dedicated to bay scallops *Argopecten irradians*. At any given time, from 12-17 million shellfish are present on the farm.

In collaboration with Salt Pond Oysters (SPO), another Rhode Island oyster grower, MOF acquires yearly about 20 million oyster seed (1-mm shell length) from hatcheries and raises them in a nursery system. The nursery is located in an adjacent brackishwater pond (Point Judith Pond) and consists of a combination of traditionally FLUPSY-style upwellers and a paddlewheel upweller. Seed are deployed in the nursery system in early May and maintained between 7 and 16 weeks until juvenile oysters are sufficiently large to be transferred to the farm (about 15-mm shell length). The phytoplankton-rich waters of the pond support optimal growth in the nursery system with seed mortality rates around 20-40 percent.

Two oyster grow-out technologies are currently utilized on the farm: an in-house designed floating cage system and a bottom tray system. Floating cages (1.8 m long × 0.75 m wide × 0.6 m deep) can accommodate from 6 to 9 ADPI bags. This system is primarily used for rearing first-year oysters. At the start of the growing season (early summer) juvenile oysters from the nursery are transferred to 9-mm mesh bags and stocked with 1,200 animals per bag. In addition to isolating oysters from mudcrabs, the main predator on the farm, this system also takes advantage of turbulence from waves and tides to move the oysters within the bags, creating a natural and gentle tumbling that promotes uniform oyster shell growth and a desirable

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The Matunuck Oyster Farm and Matunuck Oyster Bar, located on Potter Pond in southern Rhode Island.

Workers from the Matunuck Oyster Farm heading to the production site to maintain oyster bags. This consists of sorting oysters by size with a mechanical tumbler, removing any mortalities, and restocking bags at a specific stocking density according to oyster size.

deeply-cupped shape. At the end of the first growing season, oyster densities are reduced to 700 animals per bag and bag mesh size is increased to 14 mm. At the start of the following summer, oysters are transferred to the bottom tray system, 0.9 m × 0.9 m, with 12-mm mesh size and no cover, positioned 15 cm from the bottom. This system minimizes attenuation of water flow from the gear, allowing water to move over and under trays, assuring optimal access to algal food and enhancing oyster growth. Oysters are stocked at approximately 2,000 per tray and maintained in this system until harvest. Twice annually, oysters are sorted by size using a mechanical PVC tumbler.

The relatively low flow environment in Potter Pond resulting from the 0.9 m tides limits the number of oysters that can be held on the farm at any given time and extends the time required for oysters to reach market size. The MOF has established a market for "cocktail oysters" with market-size oysters averaging 6-8 cm in shell length. Matunuck Oysters are harvested year-round, resulting in a yearly harvest of about one million animals. Fastest growing oysters are harvested by the end of the second growing season, while average and slow growers are harvested in the course of the following year.

Matunuck Oyster Farm, Potter Pond, Rhode Island. Alternating rows of floating cages and bottom tray systems. Workers maintain the farm and harvest oysters year round with the use of different barges and a mobile work platform.

Upon harvest, oysters are shipped to restaurants nationwide. Distribution is handled by the Ocean State Shellfish Cooperative that Raso founded in collaboration with fellow Rhode Island growers. Additionally, MOF and SPO collaboratively also sell between 4-5 million oyster seed of 13-37 mm shell length to other growers. Dr. Robert Rheault, who was one of the early pioneers the Rhode Island oyster industry and now leads the East Coast Shellfish Growers Association, notes that, "Rhode Island growers saturated local markets years ago, and now compete with hundreds of other oyster farmers in the national marketplace. East Coast oyster production has doubled in just the past five years and appears poised to double again in the next five years. We hope we can continue to develop markets at a similar pace."

Vertical Integration: Pond to Plate and Farm to Table

To accommodate its expanding shellfish growing operation, in 2009 MOF bought a piece of land adjacent to the oyster farm with the only commercial docks available on the pond. This property also included a run-down restaurant, representing a new opportunity for vertical integration of the oyster farm. After renovation of the restaurant, the Matunuck Oyster Bar (MOB) was opened, uniting fresh, locally grown produce with farm-raised and wild-caught seafood. The restaurant features a raw bar offering a wide selection of local shellfish, including the on-site grown Matunuck oysters, alongside other Rhode Island varieties, crisp cherrystone clams, littleneck clams and lobster. The MOB philosophy for customer dining experience is: "fresh products, food simply prepared, fairly priced, and making sure everybody leaves happy." Widespread appreciation for locally-sourced, high-quality and fresh seafood makes the MOB one of the busiest restaurants in Rhode Island, employing over 200 people in the peak season.

To increase the farm-to-table and pond-to-plate appeal of the restaurant, Raso started a vegetable farm on two 2.4-ha fields located within a few miles of the restaurant in 2011. The farm follows rigorous green agricultural production standards and received U.S. Department of Agriculture organic certification in

Workers restock oysters on bottom-tray systems. Even dispersal of oysters on the tray promotes optimal feeding and growth as oysters are exposed to water flow with limited obstruction by gear.

In early summer, oyster seed are brought from a nursery to the grow-out site at Matunuck Oyster Farm and placed in a floating cage system.

2015. Today, the farm produces over a dozen varieties of vegetables, herbs and berries, and about 20 tons of fresh produce yearly. Some of the farming practices include raised beds, row covers and drip irrigation. Crops are grown in greenhouses and under low tunnels during winter to ensure year-round supply to the restaurant. The vegetable and shellfish farm also directly supply the local community with fresh organic vegetables and seafood products through local farmers markets.

In keeping with its commitment to the local waters and Rhode Island's natural resources, the MOF/MOB team promote green initiatives across operations. These include sustainable aquaculture practices, responsible and organic growing methods on the vegetable farm and avoidance of single-use plastics in the restaurant. The MOF and MOB also contribute towards a variety of state-wide restoration projects by recycling empty shells originating from the farm and restaurant. The shells are used by The Nature Conservancy and the RI Department of Environmental Management for the construction of oyster reefs to rehabilitate wild populations.

As a relentless advocate for the environmental, economic, social and cultural role of sustainable aquaculture, MOF also serves an array of educational initiatives. Its core mission is to transparently inform the community on the importance of sustainable aquaculture in providing essential ecosystem services, creating resilient and local food production systems and contributing to reaching global sustainable development goals. The main avenue for these educational initiatives is through the organization of regular and free farm tours of the MOF. Demand and interest are high and MOF is currently expanding the farm tour fleet to accommodate a growing number of visitors.

The MOF and MOB have played a fundamental role in promoting Rhode Island's oysters nationally and internationally and in fueling local ecotourism. The yearly steady increase of out-of-state and international visitors emphasizes the importance of food tourism in sustaining and building regional community identity. One the eve of its tenth anniversary, the MOB has established itself as one of the best places to experience oysters in the US and received recognition through publications such as USA Today, The Week and the Boston Globe.

Oyster bags are sorted manually to remove mortalities.

Product Diversification and the Future

The availability of shellfish seed is a fundamental requirement to support the growth of the shellfish aquaculture industry. The rapid growth of this industry in the northeast USA over the last two decades (about 10 percent per year in RI since 1999; Beutel 2019), combined with periodic production challenges due to disease and water quality issues, has led to a shortage of seed, with demand exceeding supply. There are about 55 commercial hatcheries along the East Coast of the US, the majority limited to production of oysters and clams. Rhode Island lacks a routinely operating commercial hatchery and therefore growers solely rely on out-of-state hatcheries for their supply of oyster seed, resulting in uncertain availability on a yearly basis. Moreover, aquaculturists are increasingly seeking to diversify their crops to increase production and dissipate the impact of severe losses due to weather, pathogens and other biological and/or environmental factors.

In this context, Raso is currently developing a state-of-the-art shellfish hatchery able to produce a variety of species, including oysters, bay scallops and seaweeds. This initiative is sponsored by a RI Innovation Voucher, with support from regional hatchery experts and academics. The advantages of adding a hatchery

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The Matunuck Oyster Bar, located on the inlet to Potter Pond, offers a year-round patio dining experience. The mechanical tumbler used to sort oysters is operated from the dock adjacent to the restaurant.

The Matunuck Oyster Bar offers a casual seafood dining experience, with views overlooking Potter Pond and the Matunuck Oyster Farm.

to MOF's enterprise are numerous. First, it will help fulfill the existing demand for oyster seed in RI and neighboring states, thus fostering expansion of the industry. Second, it will diversify the line of seafood products served at MOB that are locally produced at the farm. Finally, it will contribute to the vertical integration of the MOF and MOB so the company does not have to rely on external sources of seed and can self-sustain the restaurant's demand for oysters and other seafood products. The hatchery will also play an important role in Rhode Island's oyster reef restoration activities by providing seed for restoration initiatives such as the remote setting of oyster spat on oyster-shell substrate.

Through the hatchery, MOF also aims to produce bay scallop seed to introduce farming of this species in Rhode Island. Bay scallops are in high demand but wild populations in the northeast USA have collapsed since the 1980s following widespread brown tide events. Wild bay scallop abundances have not returned to historic levels, resulting in the import of most of the US bay scallop supply, with China, Japan and Canada as leading exporters to the US (NOAA, 2016). Locally-sourced scallops represent an untapped niche market in Rhode Island that MOF is planning to pursue in the next phase of its operation.

To this end, MOF is applying to add an additional 1.2-ha lease to its existing shellfish farm. The proposed site is located in a deeper part of the pond to accommodate submerged lantern nets for the culture of bay scallops. The lease application, currently being processed by the RI Coastal Management Resources Council, faces numerous objections, with waterfront property owners and other users pointing to the competing interests between recreational (e.g. waterskiing, wakeboarding or power boating) and aquaculture usage of state waters.

In this complex social-economic landscape Raso advocates for the expansion and support of aquaculture. The farming of Rhode Island waters is going to be an integral part of the balance between recreational and commercial use of our waterways. Raso sees Rhode Island's coastal ponds as multipurpose, where aquaculture ventures can be established in harmony with other users. As farmers it is not only our job to come up with innovative ways to grow our product, we must also be responsible and engage in dialogue, education, and compromise to meet the goals to create a more resilient and local food production system. Prof. Barry Costa-Pierce, an expert on ocean food systems notes the "Perry has built one of the best examples of the United Nations Food and Agriculture Organization's Ecosystem Approach to Aquaculture which guides aquaculture development to be a strategy for the integration of the activity within the wider ecosystem such that it promotes sustainable development, equity and resilience of interlinked social-ecological systems." By continually adapting to the environment and markets, the ambition of Matunuck Oyster Farm to produce local farm-raised bay scallops might be realized in the near future.

Notes

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— *Barry Costa-Pierce*