

Opportunities for Aquaculture on the Massachusetts South Coast: A Sector Analysis



Report prepared for the Garfield Foundation and Santander Bank
and the Communities of New Bedford, Dartmouth, Fairhaven,
Marion, Mattapoissett, Wareham & Westport

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About CEI

Coastal Enterprises, Inc. (CEI) helps to grow good jobs, environmentally sustainable enterprises, and shared prosperity in Maine and in rural regions across the country by integrating financing, business and industry expertise, and policy solutions. CEI envisions a world in which communities are economically and environmentally healthy, enabling all people, especially those with low incomes, to reach their full potential.

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GARFIELD FOUNDATION



The authors are solely responsible for the accuracy of the statements and interpretations contained in this publication.

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Opportunities for Aquaculture on Massachusetts's South Coast: A Sector Analysis

EXECUTIVE SUMMARY

Aquaculture is an activity that occurs in and on the water and can, in part, provide an ideal occupational alternative for displaced fishermen. Its development can preserve the character and ambience of seaside fishing communities, utilize the local acquired knowledge and skills of the coastal folk, and allow the local denizens to remain economically and culturally tied to the marine environment.¹

Coastal Enterprises Inc. (CEI) was contracted by the Garfield Foundation and Santander Bank to perform a sector analysis of the current and future economic opportunities for sustainable aquaculture specific to the South Coast of Massachusetts. This area is comprised of the City of New Bedford and the towns of Dartmouth, Fairhaven, Marion, Mattapoisett, Wareham and Westport. This growing and emerging industry holds potential for the Commonwealth of Massachusetts and the South Coast and is an area of interest for future job growth and economic prosperity for the region. CEI conducted research which included interviews of regional shareholders and data research. The findings are assembled in this report. More information about Coastal Enterprises Inc. (CEI), the Garfield Foundation and Santander Bank can be found in Appendix 1.

Purpose and Intent

This document is intended to lay a foundation for regional stakeholders and communities to consider several possible initiatives that we believe could contribute to the expansion and economic growth of aquaculture in the South Coast region. These outputs could include short-term and long-term initiatives, such as:

- The report can stimulate a platform for local people to initiate new businesses in sustainable aquaculture.
- Encourage cooperation among industry policy groups to assist in shaping current and future aquaculture policy for MA.
- Implement a regional aquaculture and fisheries strategy to invest in sustainable aquaculture and commercial fishing practices.
- Promote and continue to deliver educational and technical assistance to fishermen and other new entrants to aquaculture.

¹ Best Management Practices for the Shellfish Culture Industry in Southeastern Massachusetts, Version 09-04a, p 83

- Provide business assistance for job creation and the expansion of economic opportunity for regional aquaculturists and wild harvest fishermen.
- Create clusters of community aquaculture businesses drawing the attention of fishermen and infrastructure support businesses to the growing opportunities.
- Contribute to the local economies of Massachusetts' coastal communities by offering an alternative livelihood or supplemental economic activity for coastal people.
- Increase the resiliency of coastal communities to a changing ocean ecosystem by creating an alternative economic opportunity as well as an alternative to more traditional wild harvesting practices.
- Improve the quality of life in coastal communities that serves as an example both in New England and nationally.

We hope this report will serve as an industry resource for those engaged in, or hoping to begin, aquaculture operations in the South Coast region of Massachusetts.

METHODOLOGY

Coastal Enterprises Inc. (CEI) staff spent several months researching online resources and publications to better acquaint ourselves with the Massachusetts aquaculture industry. We were tasked with reviewing the following information:

- Inshore & offshore commercial fisheries based on the South Coast
- Previous studies of aquaculture relevant to economic opportunities on the South Coast
- The types and sizes of aquaculture developing on the South Coast
- The number of companies, locations, species grown, size of operations
- State and municipal leasing, permitting and oversight structure
- Spatial availability for future aquaculture lease sites
- Competing uses, commercial and recreational
- Barriers to growth for the aquaculture sector
- Types of aquaculture in nearby regions

Interviews

In addition to online research we were tasked to engage and interview key stakeholders in the South Coast. Our primary goals were to visit harbor masters and shellfish growers who live and work in the South Coast towns of Massachusetts to better understand the current aquaculture landscape. A series of questions were developed for harbor masters and active shellfish growers to guide our conversations. These questions can be found in Appendix 2. We also had several conversations with other knowledgeable people including municipal and state employees, non-profit entities, equipment suppliers, financiers and economic development professionals. We conducted two visits to the South Coast and one visit to Boston where we interviewed over a dozen people in person. Other people were contacted via email with specific questions while others were interviewed over the phone. These

candid and in-depth conversations have enabled us to build trust in the communities we visited as all participants were open and transparent when speaking with us. We only encountered one instance where a shellfish grower did not wish to talk. A list of all people we contacted and/or spoke with can be found in the Appendix section of this report. We appreciate the time, local knowledge and information granted to us for this study. All participants were contacted and provided an opportunity to review a draft of this publication prior to release its final release.

Deliverables

We have assembled a report that outlines several key findings that are meant to spur and encourage further efforts to develop strategies for aquaculture opportunities on the South Coast. The report findings and resources assembled can be used by local leaders and groups along the South Coast to help grow the industry. The report includes the following resources at the end of the publication:

- Education and Training Opportunities
- Aquaculture Equipment Manufacturers and Distributors
- Access to Capital (Loans and Grants) that can help Drive Innovation
- Aquaculture Hatcheries, Locations and Outputs
- Municipal, Regional, State and Federal Resources

KEY FINDINGS

1. Aquaculture in the South Coast Region is in an Infancy Stage

South Coast towns are building and developing a relatively young aquaculture industry when compared to other regions of the state except for some larger acreage growers who have been active for over 20 years. Most growers are “new” to the industry, with grant site permitting growing only over the past 5-10 years. As a comparison, scalable aquaculture on Cape Cod has been in operation for decades, with the number of growers and acreage far outnumbering those on the South Coast.

2. Most Aquaculture Operations are Small Producers

Most farms now operating on the South Coast are “owner/operator” businesses: a single employer operating with few or no employees, often a family venture, producing income that is supplemental to another full-time position held by the farmer. Operations of this model may be limited by restrictive acreage opportunities, lack of profit, and reliance on a small workforce or single person. There are however some larger scale farms operating with several employees that have been operating successfully for several years. We envision a commercial scale operation to be one that produces enough output and income to be a primary employer for at minimum a household and optimally several employees. Such businesses display the capacity to have sustained a culture capable of growth in the long term.

3. Future Growth and Development is Heavily Contingent upon Removal of Cultural and Policy-driven Barriers

Barriers facing aquaculture expansion are significant but not unsurmountable. The foremost hurdle is the combination of “Not in My Back Yard” viewpoints coupled with conflicts over existing uses, predominately recreational, for priorities of the waterways. Municipal control of the aquaculture leasing process heavily favors competing town interests and biases and can stifle the opportunities for expanded growth or new entry. The requirement that a grower seeking a grant site must be a town resident further presents a barrier to outside interests investing in the sector.

4. Proposed Aquaculture Development in New Bedford presents the Greatest Opportunity for Growth in the Immediate Future

In early 2018 the New Bedford Port Authority (NBPA) released a Request for Information (RFI) to gauge interest about opening areas of the Port to aquaculture. They released this statement: “with our commercial fishing preeminence, it is the City’s hope that we can attract aquaculture in New Bedford waters in an efficient, sustainable and scalable way.” Feedback to the RFI was positive enough that the NBPA is optimistic in advancing the process to the next stages. With a proposed allotment of almost 8,400 acres, coupled with the potential of their waiving a residency requirement to draw in outside growers, the city without any aquaculture now presents the biggest opportunity for commercial scale growth, with the potential to attract larger-scale, multiple worker farms to the area.

5. Leadership and Cooperative Interests Exist in the Sector

We are impressed by the leadership and advocacy of growers, shellfish wardens, harbormasters, educators, public officials as well as state regulators and law enforcement. These folks are unsung heroes working to advance the growth of industry on the South Coast. We sensed a significant amount of cooperation and sharing of information among growers. Some of the more established growers are lowering the bar to entry by helping new growers with information about equipment and grow out techniques, community relationships and consistent access to markets through wholesale buying.

Recommendations for sector growth follow at the end of this report.

REGIONAL OVERVIEW

The proposed system of shellfish culture aims to develop the latent wealth of the tidal waters, to increase the output of tidal flats already productive, and to make possible the reclamation of large portions of the waste shore areas of our Commonwealth. It is further designed to foster dependent and allied industries; to extend the shellfish market, both wholesale and retail ; to multiply opportunities for the transient visitors and shore cottagers to fish for clams and quahaugs for family use, and to ensure fishermen a reliable source of

bait supply; to increase the earnings of the shore fishermen, and to furnish work to thousands of unemployed; to increase the value of shore property; to add to taxable property of the shore towns and cities of the State; to secure to all the citizens of the State a proper return from an unutilized State asset; to furnish the consuming public with a great quantity of sea food of guaranteed purity; and in every way, both in the utilization of present and in the creation of new resources to build up and develop the fast-declining shellfish industries of the Commonwealth.²

While much has changed in the 100 years since D.L. Belding first issued his “Report Upon the Mollusk Fisheries of Massachusetts”, it remains remarkable that many of his observations and recommendations regarding the planting and harvesting of native shellfish remain true to this day. Managed cultivation of shellfish has existed in Massachusetts for centuries – the Native Americans introduced it to the European settlers - and the shellfish species found in its waters then like now make up the balance of commercially farmed species statewide. In the 19th century, the planting and cultivation of such species as oysters and clams was common.

The towns along the South Coast of Massachusetts have a history of fishing that is core to their culture, and perhaps it is no surprise the greatest port in the country, New Bedford, resides in its geographic center, and its booming commercial fisheries provide a staple to the region’s economy. Equally noteworthy is the region’s love of recreational shellfishing – a tradition of centuries – with literally thousands of permits issued every year throughout the towns of the South Coast.

Aquaculture has been identified as the fastest-growing food sector in the world³, as well as the fastest-growth industry within U.S. agriculture⁴. The East Coast shellfish industry has reportedly doubled in the past five years alone⁵. The aquaculture of shellfish in Massachusetts – especially that of the oyster – represents a viable, and growing industry that compliments that of the wild harvest fisheries. Division of Marine Fisheries (DMF) data collected from 2005 to 2014 indicate a massive 526 percent growth in aquaculture for Mass.⁶ In the mid 80’s there were only about 30-40 people conducting aquaculture in Massachusetts, there are now about 360 permitted growers in the Commonwealth. There are about 1,250 acres in production and the entire farm gate value – or net value of product once it leaves the farm – was a substantial \$23 million in 2016⁷.

² Report on the Mollusk Fisheries of Massachusetts, D.L. Belding, 1909. p 4.

³ <https://projectearth.us/aquaculture-the-fastest-growing-food-sector-in-the-wor-1800675704>

⁴ <https://www.seafoodsource.com/news/aquaculture/us-shellfish-farmers-could-get-relief-from-insurance-requirements-under-new-bill>

⁵ <https://www.seafoodsource.com/news/supply-trade/us-eu-propose-resuming-shellfish-trade>

⁶ <http://www.southcoasttoday.com/article/20151025/NEWS/151029593>

⁷ Personal communications with Chris Schillaci, DMF.

The Massachusetts' aquaculture industry is rooted in coastal fishing traditions and the opportunity is undeniable. The Commonwealth "enjoys a competitive advantage for aquaculture in terms of access to fresh and marine waters, excellent port and processing facilities, world class research institutions, a highly educated work force, and established markets and distributions links"⁸. It is positioned to offer alternative or supplemental work for those who have worked in commercial catch fisheries – some of which, such as lobstering, have fallen into decline in the past decade. Aquaculture can provide the sustained opportunity for many watermen and marine-dependent businesses to remain on the water. Many of Belding's observations about the advantages of aquaculture in the early 1900's remains as viable today as they did then.

Substantive growth, however, is not without its challenges. The South Coast region once had a hearty shellfish fishery. However, cultivation during the turn of the 19th century seemingly faded away due to pollution, overfishing and the risk of shellfish diseases and harmful bacteria such as vibrio.⁹ Today, aquaculture on the South Coast has a toehold, but faces multiple barriers until it can reach a viable commercial scale, such as found on Cape Cod. Factors that growers are facing range from competing uses of the coastline, stringent regulations and an extending permitting process, and a misunderstanding of aquaculture by the public and fishing communities.¹⁰ But despite these hurdles, we believe the potential for steady growth over the long term can exist. As South Coast Today, a regional newspaper, best observed: *The South Coast is not yet a hotbed of aquaculture activity but efforts are underway and attitudes seem to be changing.*¹¹

⁸ Aquaculture White Paper & Strategic Plan, Mass Coastal Zone Management, 1995 p. 7

⁹ <http://www.southcoasttoday.com/article/20140817/NEWS/408170309>

¹⁰ Aquaculture White Paper & Strategic Plan, Mass Coastal Zone Management, 1995 p. 7

¹¹ <http://www.southcoasttoday.com/article/20151025/NEWS/151029593>

MA SHELLFISH AQUACULTURE REGIONS

• North Shore Towns

- ESSEX
- IPSWICH
- ROWLEY

• South Shore Towns

- DUXBURY
- KINGSTON
- PLYMOUTH

• Cape Cod Towns

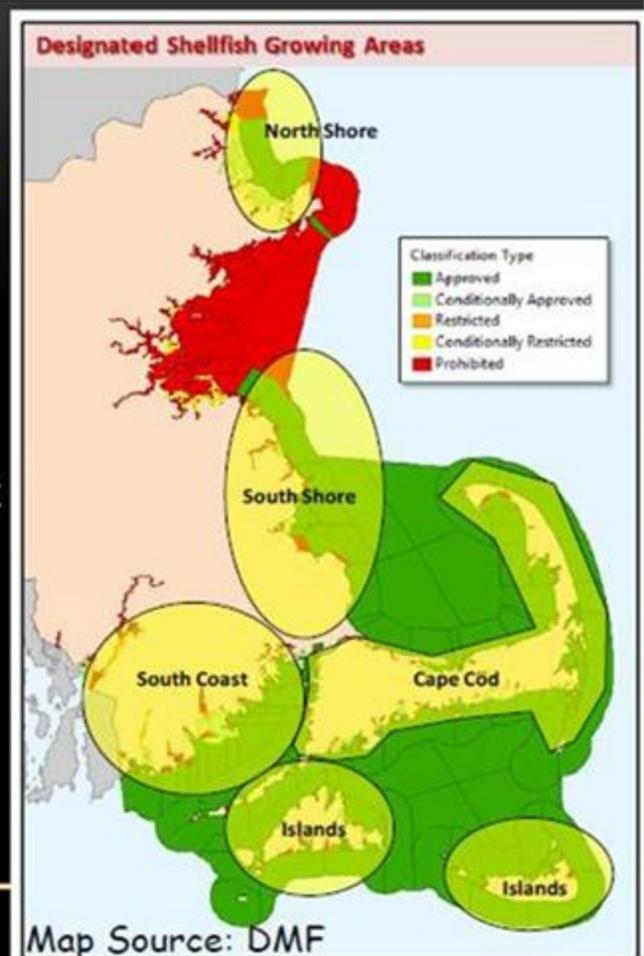
- BARNSTABLE
- BREWSTER
- CHATHAM
- DENNIS
- EASTHAM
- FALMOUTH
- MASHPEE
- ORLEANS
- P-TOWN
- WELLFLEET
- YARMOUTH

• Islands

- AQUINNAH
- CHILMARK
- EDGARTOWN
- GOSNOLD
- NANTUCKET
- OAK BLUFFS

• South Coast

- FAIRHAVEN
- MARION
- MATTAPOISETT
- NEW BEDFORD
- WAREHAM
- WESTPORT
- DARTMOUTH



City and Towns of the South Coast Region

We visited the following South Coast municipalities of Massachusetts: Fairhaven, Marion, Mattapoisett, New Bedford, Wareham, Westport and Dartmouth.

The Massachusetts communities we studied are within two different counties (Bristol and Plymouth). All census tracts in New Bedford, Fairhaven, Mattapoisett and Wareham are below low or moderate-income levels. The other communities we studied (Westport, Dartmouth, Marion) are above low or moderate-income levels. Four out of the seven towns we studied – or 57% – are low or moderate-income levels. Shellfish aquaculture grant sites in these towns are situated along the seacoast and in brackish rivers and estuaries. Waterfront properties have higher real estate values, which tends to translate to more affluent residents. This dynamic of expensive shoreline homes drives up the cost of living in these communities.

Due to the municipal requirement that leases are only issued to persons living in the township (New Bedford being the exception), those looking to initiate an aquaculture business, or expand a current one with other sites, must be a resident. Low or moderate-income individuals could face challenges due to the costs of housing in the more expensive municipalities. Equally, areas that may be ideal for optimal shellfish grow out may compete with existing and established community recreational or fishing uses. Growth opportunity is ultimately a factor of being issued the best suitable grow out sites available (along the coast).

The summaries below are intended to give a snapshot of commercial fishing, municipal shellfish programs and commercial aquaculture operations within the different communities.

New Bedford

New Bedford is the most valuable fishing port in the U.S., and the leading seafood hub on the East Coast. Its total economic value in 2016 was approximately \$9.8 billion – representing 2% of Massachusetts’ entire GDP. This success has been built upon the back of wild-harvested seafood – now primarily scallops – and no aquaculture operations currently exist within New Bedford’s jurisdiction. Currently, the New Bedford Port Authority and the Mayor’s office are working with the Massachusetts Division of Marine Fisheries (DMF) on an effort considering opening a substantial 8,400 acres of New Bedford’s coastal waters to aquaculture.

As the leading seafood hub on the East Coast, New Bedford’s industrial waterfront contains an astounding resource of seafood infrastructure that certainly could be integrated into a burgeoning aquaculture industry. Resources such as a labor force, fuel, ice, packaging, cold storage, vessel repair and aquaculture equipment supplies are already abundant to scale in the City. Access to marketplace is a daily occurrence, with a large number of established seafood processors and wholesale dealers offloading, processing, storing and shipping tons of products annually, with channels ranging from regional to international. New Bedford is proposing aquaculture at a larger scale than other South Coast towns that may attract investment. The job creation and/or diversification opportunities and economic multiplying effect could be significant. The City of New Bedford is working with the Massachusetts Division of Marine Fisheries to structure a management framework that provides guidance to growers interested in working in New Bedford waters.

<http://www.portofnewbedford.org/>

Westport

The waiting list for moorings in Westport is several years. The town “Pier 88” has ~1,000 feet of linear berthing space and is used by commercial fishermen and the aquaculture industry. Recreational fishing and a few charter boats operate from the pier and boat ramp (striped bass, blue fish, tau tog). Because of the Bouchard oil spill in 2003 (described later in this report), the town annually purchases and plants 800 bushels of quahogs for recreational harvest. Site specific relay areas are seeded and then left “closed” for a year before they are opened for recreational harvest where anyone can dig and a boat is not necessary. At one time the town ran its own shellfish hatchery on the town wharf but it proved to be costly and the program ended. The municipal shellfish budget has been reduced in recent years and this past year there were no funds from the town’s “general fund” dedicated to the town shellfish

program. In 2016 there were 500 family and senior citizen recreational shellfish licenses issued and 70 commercial shellfish licenses. In recent years Westport submitted and won a grant award to invest \$100K a year for 5 years to purchase oysters and quahogs. With these funds the town currently purchases 5,000 bushels of relay quahogs from the Taunton River (annually). Funds are also used to purchase seed from a commercial hatchery to put in town owned tidal powered upwellers in the river for quahogs and oysters.

The town of Westport has a "Shellfish Gift Fund", which accepts (100% tax deductible) donations from the public to fund the towns commercial & recreational shellfish program. The town also holds a fundraising festival "Shellstock" to celebrate music and shellfish in the region." There are five, 1-acre active aquaculture grant sites on the Westport river. The town of Westport approved 200 acres off Gooseberry Island for commercial aquaculture development. If a grower is approved to operate within this area, the business must start operations within two years or DMF is brought back in to reassess the site. The town of Westport has the capacity to accommodate a few more grant sites but any development off Gooseberry Island will take significant investment to start a farm. The town requires grant sites be "bonded" with an upfront fee. The funds are held in escrow and in the event a grant operator abandons a site, the town has resources to draw on if a "clean up of the site" is needed; insurance is also required for all grant sites. The town does not want the industry to become a monopoly and there is fear of foreign investor's taking over operations. Westport has many wealthy second home owners and there is some opposition to aquaculture and the perception of "visual pollution.

<https://www.westport-ma.com/shellfish-wharfinger>

Dartmouth

The town of Dartmouth has a handful of commercial fishermen who fish for conch, lobster and quahog. It's very much a sailing community with fuel and support services catering to recreational boat use. There is currently a wait list (200 names) to secure a mooring. Waterfront access is a problem for fishermen and aquaculturists who are limited to the use of the town boat ramp. Waterfront properties have been claimed for other uses and available space to access the water is an expensive impediment. Commercial aquaculture is relatively new to Dartmouth, prior to 2016, the town did not have regulations in place to support and guide the development of aquaculture. The harbormaster attended an aquaculture class offered at Roger Williams University to learn about the industry. The town selectmen have been supportive of aquaculture development and Dartmouth will issue ½ acre grant licenses to growers who successfully make it through the permitting requirements. The town is supportive of creating aquaculture jobs, improving water quality and growing local food. There are a limited number of spots suitable for aquaculture due to competing uses with the recreational boating community, eelgrass and boat moorings. The Slocum River and Little River areas have been closed to shellfish harvesting due to health risks (bacterial pollution) since ~1990. If these rivers could be opened to harvesting, it could provide space for up to 10-12 more grant sites. The town takes advantage of the Bouchard oil spill money to improve recreational shell fishing activities. The town issues 250 family permits annually for recreational shellfish harvest, primarily for wild bay scallops with a season open from October through April.

<http://www.dartmouthharbormaster.com/about.php>

Fairhaven

The town of Fairhaven is a major hub for the commercial fishing industry as it is across the Acushnet River from New Bedford. Most of the fishing activities are related to offshore scallop vessels. There are ~15 lobster boats that operate from Fairhaven. The town currently has two shellfish aquaculture grant sites. One is 44 acres and has been in place since the 1970's, historically the site primarily produced bay scallops but has since changed to oyster production. The second grant is a one-acre oyster farm. In 2013 the town initiated a moratorium on future aquaculture development until regulations could be established for the town. The regulations were approved in 2017 and there are currently three pending grant requests seeking approval from the town Marine Resource Board. One is seeking a 1.5-acre oyster grant and two other individuals are each seeking 1-acre quahog grant sites. Opposition to aquaculture is reportedly strong in Fairhaven.

There are perceived challenges with the recreational boating community and many people "don't want to look at" aquaculture sites. At the same time, many in the community support shellfish farming and understand the importance of food production, job creation and improved water quality. There is significant interest to further developing aquaculture grant sites but the town residency requirement limits many of the inquiries. As a result, the town does not expect to see rapid growth soon but there is room to further accommodate new grant sites. The preapproval of specific areas to conduct future aquaculture activities is of interest to the harbor master. The town has a robust recreational shellfish harvest program. With funds from the Bouchard oil spill, the town continues to invest in infrastructure and seed to support both recreational and commercial harvest. The town's budget for the shellfish program has historically been \$17,500 annually; they intend to increase this to \$20,000 next year. In 2017 the town issues 1,018 resident recreational, 9 commercial and 25 non-resident shellfish permits. <https://www.fairhaven-ma.gov/harbormaster-shellfish-departments>

Mattapoisett

There are very few commercial fishing boats in Mattapoisett. The few fishing boats that are moored in the area do not land their catch in Mattapoisett (most go to New Bedford) for access to markets, infrastructure and vessel services. The town has accessed Bouchard oil spill money for their municipal shellfish program to take quahogs from the Taunton River and relay them in local waters. In recent years quahogs were being raised at the town dock with a flowing seawater system. The quahogs were not feeding enough and the seed was discarded (released to the wild) subsequently discontinuing the effort. Going forward the town would like to construct an upweller in the town float system and do more to support future growth of recreational shellfish opportunities. There is a wait list to secure a mooring. Town residents receive priority and the current wait is ~1 year in the inner harbor for non-residents. The town of Mattapoisett currently has 5 commercial shellfish grants, 2 of which are relatively new (2-acre sites).

In general, aquaculture is not the primary income for active growers in the area, most have another occupation and are running a farm as a supplemental income side business. Although aquaculture is not at significant scale, the town is supportive. The town will consider allowing more aquaculture if it does not interfere with recreational boating. Sailing and recreational boating are important activities in Mattapoisett. The public has been tolerant of aquaculture aside from some issues with one large grant

site that was abandoned. The site was good but it was neglected by the operator. The site was constantly moving around, corners were not always well marked or lit up at night, gear became fouled and it would break away. Pleasure boats were becoming entangled in the gear and as a result there were many complaints from the public. The town intends to revoke the grant and cleaned up the site. Unfortunately, the town could not collect for damages or cleanup costs because there were no “bond funds” held in escrow before the site had been approved. Going forward the town selectmen will make decisions about what may or may not be allowed to happen at that site again.

<https://www.mattapoisett.net/harbormaster>

Marion

Commercial fishing is relatively small and there are 3-4 fishermen who work out of small boats and fish scup and conch traps. With funding from existing sources combined with the Bouchard oil spill funds the town raises 200-400K oysters a year in upwellers which are then dispersed for recreational harvest. The town also purchases 100K soft shell clams for seeding. There is a relatively large amount of interest in recreational shellfish harvesting. Several hundred permits are issued annually but most people will still buy their shellfish rather than dig or collect from the wild. Marion is limiting commercial grant sites to ½ acre and as a result there are four, ½ acre lease sites all of which are growing oysters. This small-scale approach will likely discourage a professional scale industry and primarily attract recreational growers. If an aquaculture operation is treated as a “hobby”, it can become less of a priority which can lead to failure. The geography is a bit limiting (ideal sites) and seasonal closures in many areas make it prohibitive to grow and harvest shellfish year-round. Having said that the town could handle 1-2 more sites for aquaculture. In general, the Marion community is not supportive of aquaculture. Marion is driven by upland landowners. The year-round population is 6K people which then doubles in the summer. Most of the harbor is occupied by moorings dedicated to recreational boaters. There are 2,300 boats and most of them are sailboats.

<https://www.marionma.gov/harbormaster>

Wareham

The Town of Wareham Department of Natural Resources issues approximately 1,400 recreational and 18 commercial shellfish harvesting permits per year. The town purchases disease resistant "diploid" oysters which will reproduce and survive long enough to productively spawn for 5-6 years. In 2016, the Town of Wareham suspended the commercial harvesting of wild oysters due to depleted oyster stock and the additional concerns from overharvesting potential egg producing oysters to allow animals the opportunity to spawn and reproduce. The Town of Wareham continues to allow the recreational harvesting of shellfish for personal consumption but has restrictions in place to manage the oyster stock. The town has one of the most robust municipal shellfish programs found on the South Coast. With funding from the sale of shellfish permits and the Bouchard oil spill settlement the town has invested in upwellers, oyster and quahog seed, contaminated shellfish transplants and creating an oyster reef in cooperation with the Natures Conservancy. The Town of Wareham was a strong advocate for how the Bouchard oil spill funds should be used to support the sustainability of municipal shellfish programs. A typical year includes purchasing a 1000 to 1800-bushel quahog relay, 100K 8mm quahog seed, one million 2mm oysters placed in (FLUPSY) upweller systems and 150K 13mm oysters that are placed in Oyster-Gro® cages.

The town has negotiated a 99-year lease with the Buzzards Bay Coalition to renovate and create the headquarters for the Buzzards Bay Coalition's Educational Outreach Center which will essentially turn Onset Bay into an outdoor classroom to include shellfishing and aquaculture programs (for oysters and quahogs) in a waterfront building located at the Onset Town Pier. In addition to the multifaceted education center, the Buzzards Bay Coalition purchased the uninhabited 7-acre island within Onset Harbor and 15 acres of waterfront property to help in expanding their outdoor educational outreach. In a partnership with the Department of Natural Resources an aquaculture site and shellfish management area was created to help grow shellfish and create a volunteer aquaculture program with the Town. Currently there are 7 commercial shellfish grants located in Wareham, shellfish grants in the town range from 2 to 13 acres. Historically, a majority of Wareham's coast was shellfish grants. Over time the number significantly reduced and in the recent past maintained approximately 108 acres. One of the contributing factors within the Wareham River was the creation of wastewater treatment facility. It resulted in more rigorous and expensive testing. Over time the Division of Marine Fisheries closed portions of the Agawam and Wareham River due to water quality forcing shellfish grants to move and some of the grants closed.

The town believes there is room for more oyster production. The town is proactive to create volunteer opportunities for students and the general public to get involved with municipal shellfish stocking and restoration efforts. College and high school students regularly serve as interns to keep the program staffed. The Department of Natural Resources has four full time Natural Resource Officers and from May through October there are 11 full time seasonal deputies overseeing, 1,634 moorings/slips and an approximately 2,700 boats registered to the town. The Director of Natural Resources which is also the Harbormaster oversees many town responsibilities in addition to the shellfish program and on the water enforcement. For the 2018 season the town has approved a dedicated aquaculture staff person that will be hired for the seasonal position with hopes to justify it as a future full-time position within the department. The town contributes 20% of all recreational license fees and 100% of all commercial license fees into a dedicated "shellfish aquaculture revolving account" to support the sustainability of their shellfish program. Through the approval of spring town meeting the department may expend up to \$20K of available funds.

<http://www.wareham.ma.us/dept-natural-resources-harbormaster-and-shellfish-division>

Commercial Fisheries on the South Coast

The National Marine Fisheries Service reported the following MA commercial fisheries landings for 2016 (see table below)^[1]. New Bedford remains the number one fishing port in the country for value of fisheries at landing \$326M^[2]. The significant landings in New Bedford make this port an ideal site along the South Coast for resources related to labor force, landing points, processing, packing, ice, transport etc.

Year	Metric Tons	Pounds	\$
2016	110,776.7	244,218,245	550,754,916

Aquaculture Practices and Production in Southern New England States

To establish some scale to the operations underway along the South Coast, it is worthwhile to look at other shellfish aquaculture in nearby Rhode Island and Connecticut. These states were selected due to their proximity to the South Coast for comparative analysis. For further context, it is equally valuable to compare production in Massachusetts’ five coastal aquaculture regions to better understand the South Coast’s impact on the overall industry within the Commonwealth.

It is important to note that like most growers along the South Coast, shellfish aquaculture in Southern New England is also “primarily a business of small, family owned companies”¹⁴. In many cases, aquaculturists come from the commercial fishing industry in coastal communities with a long fishing heritage, and may have turned to aquaculture to either supplement or replace a reliance on wild catch species.¹⁵ An example of this is the struggling lobster industry which has had a severe impact on lobstermen from Long Island Sound to Buzzards Bay.

A summary of key findings follows, which are further elaborated upon in the section below.

- Massachusetts’ has a “home rule” municipal issuance of shellfish leasing, the impact of which may lengthen the permitting process and make sites more vulnerable to town “NIMBYism”.
- We did not find any stand out innovations or practices conducted in nearby states that would afford transfer of policy or technology to impact practices along the South Coast

¹² https://www.st.nmfs.noaa.gov/pls/webpls/MF_ANNUAL_LANDINGS.RESULTS

¹³ https://www.st.nmfs.noaa.gov/pls/webpls/MF_LPORT_YEAR.RESULTS

¹⁴ NROC White Paper: Overview of the Aquaculture Sector in New England, 2013 p.7

¹⁵ NROC White Paper: Overview of the Aquaculture Sector in New England, 2013 p.7

- Despite relatively high regional acreage allotted for aquaculture, the South Coast’s average farm value sales per acre is noticeably lower in value than other regions in Massachusetts and the states of Rhode Island and Connecticut
- Oyster is king throughout Southern New England; South Coast is no exception. Species diversification is not significant enough to merit recommendations or investigation at this stage

Licensing (Leasing)

Except for Massachusetts, which places the primary authorization of licensing permission within the municipality of the applicant, the surrounding coastal states in New England instead utilize state control – often through a variety of agencies. In Maine, the process is managed by the Department of Marine Resources, in New Hampshire, the Department of Fish and Game, and in Rhode Island through the Coastal Resources Management Council. In Connecticut, aquaculture is managed through the Department of Agriculture, Bureau of Aquaculture. However, in Connecticut, like Massachusetts, areas defined as “local waters” (inside the State Jurisdiction Line) are subject to municipal input through localized Shellfish Commissions who provide local review of applications for placement of aquaculture structures within town waters. Although these local decision-makers do not have legal authority to permit aquaculture structures (including gear), the Commissions play a role in the review process for potential social and use conflicts and does have authority for leasing commercial shellfish grounds that have no associated structures or gear (bottom culture).¹⁶

Massachusetts stands alone in the empowerment of municipal governments to determine who and where aquaculture leases are granted. Growers along the South Coast remain subject to this authority as do all aquaculturists in the Commonwealth. There are towns where the licensing process is highly protracted and a state-based licensing authority works comparatively more quickly and efficiently, but it is likely that the direct social conflict experienced in the South Coast could be bypassed with higher frequency under State, not local, control. We investigate this further later in this report.

Acreage

Utilization of able resources – such as the amount of allowable acreage available to shellfish aquacultural sites – is essential for commercialization of the industry. Equally, acreage versus sales can put a perspective on the accompanying value per acre, and indicator of output, management and scale.

¹⁶ http://ct.gov/doag/lib/doag/aquaculture/2017/SeaGrant_PermitGuide2017.pdf

Massachusetts

2016 Private Shellfish Propagation Acreage Under Cultivation, by Municipality. DMF.

Municipality	Acres
Wellfleet	261
Barnstable	139
Mattapoisett	109
Wareham	87.7
Plymouth	84.6
Duxbury	77.5
Nantucket	73
Westport	55
Fairhaven	46
Falmouth	43
Dennis	32
Gosnold	32
Provincetown	24.5
Yarmouth	24
Orleans	23.3
Chilmark	23
Eastham	22.5
Truro	20
Mashpee	18
Edgartown	17
Brewster	9.5
Kingston	8.5
Rowley	8
Chatham	7
Bourne	5
Marion	2.5
Ipswich	2
Oak Bluffs	2
Aquinnah	1.6
Dartmouth	0.5
Grand Total	1258.7

For purposes of analysis, the Mass DMF divided the State into five unique “Shellfish Regions”. The total acreage and as a percentage as of 2016 is as follows:

- South Coast:** 300 total acres, or 23% of total cultivation
- Cape Cod:** 628.8 total acres, or 49% of total cultivation
- Islands:** 148.6 total acres, or 11% of total cultivation

North Shore: 10 total acres, or less than %3 of total cultivation

South Shore: 170 acres, or about 14% of total cultivation

It is interesting to note the higher percentage of acreage found along the South Coast, which does not include any permitted areas operating within New Bedford. South Coast aquaculture represents almost a quarter of the state's total cultivation, a high percentage given it has only about 5% of the total growers operating there. However, it should be noted that of the 300 total acres permitted, 104 of Mattapoissett's acreage are currently not being utilized for production.

Connecticut

For scale, Connecticut in its entirety spans approximately 70,000 acres of shellfish cultivation (oysters and hard clams). About 22,422 acres of this are franchise oyster grounds (bottom culture) that are over 100 years old. Floating gear culture (more common along the South Coast) leases total over 30,000 acres. Connecticut vastly dwarfs Massachusetts in total acreage, and zones for active bottom culture that has been a core resource for the state for centuries. Connecticut protects vast acreage of zoned "Designated Natural Seed Beds" for the purpose of aquaculture, drawing juvenile oysters and clams from these areas and transferring them to private grow areas. Unlike Massachusetts, the State of Connecticut has a minimum lease acreage allotment of 4 acres, which stands in contrast to the ½ to 2-acre parcels commonly issued in towns along the South Coast. Additionally, gear culture sites in Connecticut average 5 to 10 acres; by comparison the average acreage per lease in South Coast is about 6.5 acres.

Rhode Island

In 2016, Rhode Island's Coastal Resources Management Council reported 274.53 acres of total cultivation, slightly less than 2016 reported acreage of South Coast lease total of 300. For comparison, Rhode Island had 70 farms while (in 2018) the South Coast reported 25 individual leaseholders. Estimated farm lease averages in Rhode Island are approximately 3-4 acres. Rhode Island does not practice "prezoning" areas for aquaculture, and limits aquacultural operations to 5% of total water surface area on coastal ponds.

Production and Values

In 2016, Rhode Island reported a total production of 7.8 million oysters produced for consumption (does not include seed). By comparison, the South Coast produced 1.8 million. Perhaps most interestingly, Rhode Island with less utilized acreage than reported in the South Coast, produced farm gate value of aquaculture products for consumption at \$5,325,703; South Coast towns reported \$1,872,483 for oysters. The farm gate value per acre average (for all aquaculture products, but the majority is oyster) was about \$19,399 - substantially over the South Coast's 2016 estimated average oyster sales of \$9,553 per permitted acre.

The Connecticut shellfish industry (both wild and farmed) overwhelms both the Commonwealth of Massachusetts and Rhode Island with a whooping estimate of \$300 million in farm gate sales – more than the output of both states combined. Based upon the best available data from the CT Department of Agriculture, the State Leasing Program consists of 674 franchise oyster grounds (more than 100

years old) totaling 22,422 acres and generating annual revenue of \$88,808.48. More notable for terms of comparison are the 326 Shellfish leases totaling 30,669.07 acres averaging \$25,630 per acre and generating \$827,856.24 in annual revenue.

Southern New England Cultured Species and Diversification

Despite reported leases for mussels, bay scallops, and sea vegetables in both Connecticut and Rhode Island, they like Massachusetts rely on oysters and hard clams for the majority of both production and revenue. Unlike Maine that has explored greater diversification of species in aquaculture, with larger commercial outputs of blue mussels and more recently farmed kelp, Massachusetts is aligned with its neighbors in its reliance on oysters as the main crop. Oysters in Rhode Island remained the number one aquaculture product with 7,818,194 sold for consumption in 2016. Farmed hard clam production remains marginal due to the wealth of wild hard clams for harvest combined with restrictions on intertidal farming, while sea vegetable production remains extremely limited now. Mussel culture is at best at an “experimental” stage while in Connecticut there is virtually no culture at this time. Interest in producing seaweed (kelp) has grown in both states but only a handful of operations exist and have not reached a point of notable commercial scale. In Connecticut and Rhode Island, culture of bay scallops remains in an “experimental” trial stage.

In state, Cape Cod (Barnstable County) produces the highest quantity of quahogs, but relative to the Cape’s oyster values, still cannot compete with oyster aquaculture. In 2015, over 19 million oysters were landed with a value of \$11.3 million dollars. Over 6.5 million quahogs (hard clams) were landed with a value of approximately \$1.5 million dollars.¹⁷ The geography of Cape Cod’s intertidal zone is far superior for clam harvesting than in the South Coast, so a relative scale is not comparable. While permits for quahogs in the South Coast have been issued and there is interest in their cultivation, it remains to be seen how strong production will be to make quahogs a sustainable harvest to compliment oyster production in the region.

We did not see any strong indicator of successful diversity in either RI or CT to draw a conclusion or recommendation of shortfalls in South Coast’s focus on oyster aquaculture. Oyster in all states remains the most economically viable product for culture and harvest.

Cultured Species and Diversification on the South Coast

Oyster is “King”

Farms on the South Coast are primarily growing oysters. In fact, they account for well over 90 % of the shellfish production on the South Coast. There are several advantages to oyster production – foremost that there is strong demand in the marketplace and the economics of production are generally scalable and achievable – even for smaller farms that exist as supplemental income to the growers. However, as in agriculture production, raising only one crop comes with its risks. Equally, typical oyster growout

¹⁷ <http://www.capecodextension.org/marine/semac/production/>

takes two years or longer to reach market size and bring in sales, leaving the beginning farmer without farm income during this time period.

Oysters are the species of choice for growers along the South Coast for many practical reasons: oysters are naturally occurring and are biologically appropriate to be grown in the area, the estuarine waters are warm and food is abundant in most sites. These factors can accelerate growth to market size, and farmed oysters can thrive in both deep and shallow waters, without being restricted to intertidal zones as clam species are. The techniques to grow-out and harvest in the region are developed and proven, regional training programs are available, and cooperation among area oystermen seems positive. Additionally, oyster seed is readily available from several commercial hatcheries and oyster grow out gear is nearby and available for purchase. Oysters are a “gateway” species to starting a farm and can generate revenue within a couple of years.

In addition to the advantages of raising oysters versus other shellfish species, the most crucial factor is the value of the oysters themselves. The current demand for oysters can often outweigh supply, and they usually command a profitable 50-65¢ each, sometimes more depending upon the quality and the buyer. However, access to markets and seasonality fluctuates. In addition to summer months, during Thanksgiving through January oysters are very popular in Massachusetts and regional markets beyond. However, early November is a slow time for oyster production. Most growers must pull their gear before winter temperatures and ice set in. If a grower can hold their product (in deeper water) during the winter period it allows them to have oysters available for sale in March and April when supply is low. Not all growers have access to deep water overwintering, however. For those that do not, they are more vulnerable to seasonal low production periods of in-shore harvesting.

Several growers articulated concerns over what appears to be an ongoing “boom” in the marketplace: waiting for the potential “bust”. Production is soaring and demand remains to be steady, but many worry about how long this cycle can last. There is fear of driving prices down with market saturation, and some established growers acknowledged that there is pressure associated with new growers entering the marketplace. Equally, growers can be vulnerable to buying cycles and the whims of wholesalers. A wholesaler can shut markets off for a grower. The wholesaler may buy for a few weeks and then stop buying during a slow time of year or “penalize” a grower for not having production during the overwintering months. Experienced growers indicated the necessity of having multiple buyers to waylay the risk of being overly dependent on just one purchaser.

Disease-causing parasites affecting oysters, such as MSX and dermo, are threats to production and consequently sales. Growers must be aware of this threat and its potential to upend their business. The state of Massachusetts allows growers to sell petite oysters – those that are 2.5 inches long – instead of the prior requirement that oysters reach a 3-inch size for market. It’s well understood that diseases can typically kill an oyster in its second or third year of growth. Now that the state allows growers to sell smaller “petites” a grower can sell an oyster before the disease becomes a problem. Massachusetts state law requires petites to be 2.5” but some growers are selling 1.5” petites. There is an apparent lack of law enforcement on this issue (checking oyster sizes in restaurants), but it solves a potential problem for some growers to sell their product.

While oystering may be putting all the grower's "eggs in one basket", the rewards remain higher than the risks for many. Besides scallops, oyster values per piece are the highest return for farmed shellfish. While diversification into other species may help waylay a dependency on oysters alone, other species cultivation present other challenges that may be hard to overcome (discussed below).

Diversification

An issue of interest to aquaculturists is the development of new species for aquaculture production. New species production would allow for expansion into new markets, possible diversification within companies and states, and expansion into areas that may be less suited for the commonly produced aquaculture species.¹⁸

Many of the growers and harbormasters we spoke with see aquaculture as an important way to diversify and/or supplement their income now and in the future. As natural oyster populations have declined and the lobster resource is almost non-existent on the South Coast, people are looking for ways to stay working on the water. Aquaculturists are true "farmers" and in the wake of declining wild fisheries, growers can be proactive towards taking some control of their economic future. A few common strategies we heard of that growers use to start an aquaculture business include:

- Starting small and testing an area with hopes of expanding in the future if conditions are right
- Have a grant site approved for multiple gear types and species to avoid having to keep seeking permissions from the municipality or state.
- Keeping a day job with an eventual goal of the aquaculture business part of their "retirement plan"
- Developing and growing a business with an eventual plan of selling the business and assets for a profit

Unlike efforts on Cape Cod and in states such as Maine, the South Coast of Massachusetts is doing very little to diversify into other species and forms of aquaculture. There is some interest in the culture of soft shell clam, quahogs, surf clams and bay scallops, but the absence of an intertidal zone (as found in Cape Cod) places some practical restrictions on clam culture. Mussel and sea vegetable (kelp) production are currently non-existent on the South Coast.

¹⁸ NROC White Paper: Overview of the Aquaculture Sector in New England, 2013 p. 7

2016 Private Shellfish Propagation Permits and Acreage Under Cultivation, by Municipality. DMF.

Municipality	# Growers	Total Acres	Species Grown
Dartmouth	1	0.5	Oyster
Fairhaven	2	46.0	Oyster, Quahog
Marion	3	2.5	Oyster
Mattapoissett	2	109.0	Oyster, Bay Scallop
Wareham	4	87.7	Oyster, Quahog
Westport	6	55.0	Oyster, Quahog
Grand Total	18	300.7	

The Table above shows the limited diversity of cultivated species in the South Coast. Besides oysters, other species common to aquaculture in New England include:

Quahogs (Hard Clams)

Quahogs are naturally occurring and are biologically appropriate to be grown in the area. It takes about three years to reach maturity although MA growers has seen a slowdown in their growth in recent years which could be related to a lack of food availability, water temperate and/or disease. Several harbormasters reported difficulties in recent years securing quahog seed for their municipal shellfish programs. One harbormaster believes that seeding quahogs when the water temperature is above 45 degrees is critical so they will dig into the mud resulting in fewer losses to predation. The market price for quahogs is low when compared to oysters. One grower mentioned that the price for littleneck clams is the same as it was in the 1980’s. There is interest from some wild quahog commercial harvesters who are pursuing grant sites to raise quahogs so they are not 100% reliant on a wild harvest.

Bay Scallops

Historically bay scallops have grown quite well on the South Coast. One large commercial farm focused on bay scallops for several years and they were the only producer in the state. The business has since ceased bay scallop production and refocused on oysters. There is a desire to grow them and one farm on the South Coast is permitted grow them. There is a grower in nearby Falmouth working on growing a 50-count bay scallop with intentions to sell it live and wholesale shucked market. The Nature Conservancy is involved with a bay scallop reseeding project in the town of Bourne that involves holding brood stock and allowing them to spawn. Natural spat set for bay scallops are can be sporadic, hatchery production could help alleviate this challenge. The gear and technology needed to grow bay scallops is also more intense than it is for oysters. Bay scallops are a sensitive species with growers experiencing significant overwintering mortality. Hatcheries are more likely to produce oysters and quahogs for growers that are established and need their seed early in the season. If a hatchery produces a run of bay scallops and they are not available until July, that puts the animals late into the season for overwintering and at a risk of high mortality. Growers would need seed in May to get the animals to appropriate size for overwintering.

Surf Clams

Massachusetts recently changed the minimum size limit for farmed shellfish. Cultured shellfish can now be sold that was previously considered undersized, this includes intertidal surf clams. Butter clams (small surf clam) can grow to market size in approximately 18-24 months and are great substitute for pasta clams. South Coast growers can now seek permission to grow surf clams to meet this market.

Soft Shell Clam

One of the major limitations on the South Coast for raising soft shell clams is a lack of significant intertidal area, unlike the north side of Cape Cod which has 8-foot tides and long stretches of intertidal zone which are more conducive for soft shell clam and quahogs. Softshell clams can be difficult to transplant without significant mortality. A 1-acre soft shell clam farm would be considered secondary income, a grower would need to scale the operation to make it profitable and intertidal area on the South Coast is a limiting factor.

Mussels

Currently there is no blue mussel production on the South Coast. Mussel culture requires deeper water (typically > 60 feet) and as a result is not typically a near shore activity. The scale of an offshore operation must be quite large (10 to 100 acres to support two or more employees) with significant equipment and infrastructure (\$20K to \$100K not including boat) needed to accommodate rafts or long lines. There are relatively few places to escape wave and wind energy in Buzzard's Bay. If a grant site is in turbulent waters, floating raft culture is not a wise method to use as mussels will slough off the lines, fall to the bottom and result in lost revenue. Warmer water temperatures during the summer months can sometimes weaken the byssal threads also resulting in lost product. Having said that, there are proper ways to suspend mussels using a sub-surface longline system to escape the high energy zone and grow the mussels in cooler water temperatures.

The price point of mussels is low per pound relative to other shellfish species that are sold per animal. If not properly managed, there are predation challenges with birds from above and crabs and starfish from below. The use of predator nets and keeping the lines up off the bottom at all times will alleviate these concerns. Wild mussel seed can be sporadic and unreliable although hatchery production could help alleviate this challenge. In nearby Rhode Island there is a deep-water mussel site that has been in place for a few years. It's based on the setup and technology used on New Zealand mussel farms. The site is very exposed and oysters and kelp have recently been added. There is also a submerged longline mussel farm located in Vineyard Sound. Due to its offshore location there have been fewer spatial conflicts and it allows for larger commercial scale. In deeper waters the water quality is more consistent and more suitably cool in the summer. The farm is experimenting with Woods Hole Oceanographic Institution's design for a dual longline setup that allows for an efficient use of space to grow kelp with the mussels. Efficiencies are also gained by shared use of capital and permitting costs, and diversification of product offering.

Kelp (Sea Vegetables)

There currently are no farms growing macroalgae on the South Coast but there is some interest. To avoid navigation hazards, long lines used to grow sea vegetables should be placed in water with a minimum depth of 10 feet and be properly marked. If navigation isn't an issue, 4-6 feet of water is sufficient as long as the sea vegetables don't dry out a low tide. Many feel that the industry is still in a research and market development stage and culturally it will take time for culinary public acceptance. As the market develops in neighboring states (RI and Maine), this winter crop with a spring harvest could be a diversification tool for commercial fishermen and growers alike. One company on the Vineyard is growing, harvesting and would like to sell direct to restaurants as a fresh product due to its short shelf life. However, at this time all seaweed sales must be directed through licensed seafood distributors as per shellfish. There are ongoing conversations between seaweed farmers and DMF and the Department of Agriculture about possibly relaxing these rules to be more like the sale of market garden crops like spinach or lettuce. Farming kelp is healthy for the environment as well. Like terrestrial plants, kelp relies on photosynthesis to generate energy. In the process it absorbs nitrogen, phosphorus, and carbon dioxide, all of which are at high levels in bays and coastal waters. Therefore, when kelp is grown and harvested, these excess nutrients are taken out of the water in the form of a nutritious vegetable.

CHALLENGES TO AQUACULTURE GROWTH ON THE SOUTH COAST

A summary of findings is framed below, which we elaborate on in the text that follows:

- The “Not in My Backyard” attitude towards aquaculture in the region is substantial and is stifling to larger, commercial scale growth
- The permitting process on a state and local scale is time intensive and poses a major hurdle to any but the most serious and patient aquaculturist
- Municipal control of the permitting process makes aquaculture growth vulnerable to NIMBYism and detractors. Requirement that farmers be a town resident is a barrier to commercial scale operations.
- South Coast is comprised of relatively small owner-operated farms, and are netting lower farm gate average values per acre than other regional producers in the Commonwealth.
- Jobs associated directly to aquaculture operations remain minimal, with seasonal work offering the most potential in its current scale
- Competing maritime uses - predominately recreational – as well as geographic restrictions are limiting optimal siting for some aquaculture farms on the South Coast.

NIMBY

“In many cases, they have instituted a massive effort where they propagate misinterpreted and blatantly incorrect information in order to poison the public’s perception of specific aquaculture activities and to prevent permits from being awarded in their backyards”¹⁹

The NIMBY (“Not in My Backyard”) attitude towards aquaculture is rampant along the South Coast towns and based upon our conversations tops the list of challenges for growers in the region. NIMBY is a form of public resistance to the issuance of town aquaculture permitting often stemming from self-interest, misinformation, or outright fear that aquaculture operations could “take over” communal waters. Most common protests generally stem from area homeowners’ objections or fears of having water views interfered with floating gear and watermen farming the area near their homes. Another major complaint is the fear that the farms will obstruct navigational access for recreational boating such as sailing or kayaking. Coastal access may also be a challenge as some homeowners forbid land access to coastal sites adjacent to their property.

NIMBY is a social and community issue, and one that has powerful implications for not just sustaining existing farms, but also future growth of commercial aquaculture farms in the Region. Many of the towns boast affluent coastal homeowners, both seasonal and year-round, and there is a long-standing culture of swimming, sailing and yachting in most all the communities - New Bedford harbor being the exception (the New Bedford Yacht Club is located nearby in South Dartmouth). Because of “town rule” in the Commonwealth whereby the town Board of Selectmen have control over aquaculture permit issuance, residential opposition can readily be vocalized in municipal proceedings, making their protests both public and more intimate in these small communities.

Unfortunately, regional NIMBYism has grown to severe proportions, even to the degree that we learned that some residents go as far as threatening, or actually engaging in, lawsuits against the farmers. The threat itself can deter aquaculturists who simply do not have the financial resources to engage in a legal battle for a 1-acre oyster farm. NIMBYism in Marion became a minor headline when Hollywood actor James Spader, a Marion resident whose family has owned property there for “over a century”, attended a Selectmen’s meeting in July of 2016 to heartily oppose a proposed ½ acre lease site that would be in view of his home. Spader said he didn’t want to view a “pasture of oysters”.²⁰ The applicant went as far to appease the town by proposing he change his growout method from visible floating gear to submerged cages in the hopes it would not interfere with surface views or navigation. The permit was ultimately not awarded by the town and was unanimously voted down by the Selectmen the following October.²¹

¹⁹ Dale Leavitt, biology professor at Roger Williams University.

²⁰ <https://sippican.villagesoup.com/p/james-spader-selectmen-chair-concerned-about-shellfish-farm/1547844>

²¹ <https://sippican.villagesoup.com/p/james-spader-selectmen-chair-concerned-about-shellfish-farm/1547844>

Because of NIMBYism along the South Coast, many growers we spoke with shared some tactics they've adapted to ensure quality community relations. Foremost, a majority shared their approach to site selection. Many relinquished applications for the "easiest" sites (be it easement, water access and even potential water and nutritional quality for shellfish growth) when they knew they could potentially stir conflict with residents and recreational users. As some put it, it is "best to stay off people's radar" and choose sites away from any homes or heavy boat traffic. Others made efforts to be conscientious – adding extra poles to mark areas to clearly notify boaters of the farm, always checking their shorelines for any loose gear on the beaches – all to extend goodwill and not to arm the community with grievances against their operations. In some cases, farmers gave oysters away free to neighbors and kayakers to help bolster their enthusiasm for aquaculture. Finally, some advised that when attending the town hearing for lease application to "be prepared well in advance – try not to give residents a reason to show up!"

NIMBYism is a genuine force to be reckoned with in these communities, one that many aquaculture shareholders acknowledged as the largest impediment to expansion, be it large or small. Based upon the measures many have employed just to get a site and maintain "good standing" with the community, it is evident that the burden of starting and maintaining a shellfish farm in South Coast waters is very often upon the aquaculturist and their ability to accept appeasement as a strategy to achieve their goals. Until these communities and their homeowners accept the value of aquaculture and can share their waters, NIMBY will likely to continue to reign as a major barrier of entry and growth.

Navigating the Municipal and State Grant Permitting Process

The leasing, licensing or permitting system that controls aquaculture siting and monitoring in State waters in New England is seen by some aquaculture interests as slow, expensive, and cumbersome which retards expansion of aquaculture.²²

To conduct shellfish aquaculture on the South Coast there are five licenses and/or permits required. A grower needs to work with both the town municipality and the Massachusetts's Division of Marine Fisheries to have an application approved and permitted. For many, this can be an incredibly daunting and time-consuming process that is a barrier to entry. The logistics and time involved often contributes to suffocating progress.

The costs in fees are not overly expensive but it can take 8-12 months to get a grant site permitted - assuming the applicant stays on top of all that is required to keep it moving through the local and state

²² NROC White Paper: Overview of the Aquaculture Sector in New England, 2013 p.16

protocols. Many people new to the application process likely throw up their hands but several established growers gave high praise for the resources available (education, training, municipal and state expertise) to help navigate the process. Some growers mentioned having their application materials previewed by municipal and state employees before formally submitting for approval, allowing them time to correct application shortfalls without an outright denial of a grant site approval. The regulations are in place for good reason and following the rules ultimately provides a business owner legal cover for their business.

Home Rule

Massachusetts has a “home rule” approach sanctioning each municipality to have oversight for aquaculture grant leasing and permitting in their waters. Licenses are issued by the Board of Selectmen and are renewed or transferred at the discretion of the Board. The terms of each grant agreement are set by each town. Committed growers often seek longer license terms which are more conducive to investment when a grower is not worried about renewing – or losing- their license every couple of years. This is a lingering concern and shorter license terms can be a barrier to investment. The harbormaster must be consulted for a grant site and will write a letter with their opinion to support or not support an application. The grower needs to be diligent on the front end of an application to have a good chance of making it through the process.

Town Residency

Many Massachusetts towns also have a requirement that the applicant be a town resident to receive a grant site. This immediately limits those interested in pursuing aquaculture in the South Coast region to a pool of people who already reside in one of the seven towns, and restricts them to operating only in the waters of their town’s jurisdiction. Moving to a town does not guarantee a grant license will be issued. Many of the estimated median house and household values in the area are significantly above state averages. Consider the 2016 estimates for Mattapoissett: house/condo median average was \$455,658 (state average was \$366,900) and the estimated median household income was \$91,707 (state average for 2016 was \$75,297)²³. Given the relative affluence of some of the communities along the South Coast, residence alone for incoming parties may present a formidable barrier to coastal town access.

Massachusetts Division of Marine Fisheries

The municipal selectmen decide to support or not support an application. If approved, the application then goes to the state Division of Marine Fisheries (DMF) for their review, due diligence and approval or not.

DMF shellfish aquaculture responsibilities cover two major areas:

- Certification and issuance of aquaculture licenses by municipalities

²³ <http://www.city-data.com/city/Mattapoissett-Center-Massachusetts.html>

- Permitting of commercial aquaculturists, towns and hatcheries to obtain, possess and sell sub-legal shellfish (seed) used for transplant and grow-out to legal size.

Massachusetts state statute requires DMF to certify that municipally issued aquaculture licenses and associated culture activities will cause no substantial adverse effects on the shellfish or other natural marine resources of the city or town where they are located. DMF reviews gear type, species to be grown and a description of proposed activities on the grant site. DMF application requirements will also follow what is required by the Army Corps. The DMF conducts a site survey (state pays for this cost). Applicants should do their best to avoid user conflicts and avoid delays. A site must be 25 feet away from eel grass. If an area has a significant amount of wild shellfish on the bottom and/or is actively harvested it will likely be denied. DMF will either issue the license as is or specify any additional conditions (examples could include: maintaining taught lines, report entanglements, remove floating gear during certain times of the year).

Once DMF has completed a survey of a site and is satisfied with the results, DMF will issue a letter to certify the site. The grower will then take the DMF letter to the Army Corps for approval which can take approximately six weeks for their review. The applicant then goes back to the town, presents an application that meets the requirements. A town has 60 days to respond to a complete application. Once reviewed by the town a public hearing is scheduled and posted (advertised) 10 days prior to the hearing date.

If approved at the hearing, the town will issue a license and send a letter to DMF seeking certification. The application then goes back to the municipality for final approval. A municipal hearing can potentially be a confrontational process should participating residents have objections to the permit. Applicants who are well prepared and have put in the time to meet with nearby neighbors to discuss their plans in advance may have a better chance of approval. In most towns a grower can appeal a municipal decision if the grant is turned down.

In short, the state owns the waterways and the towns are stewards of the waterways. The relationship between town and state in this capacity is long-standing and unique to the Commonwealth. Town Selectmen have significant power in issuing licenses, renewing or transferring aquaculture grant sites approval process. If a town anticipates significant user conflicts in a community (with aquaculture) issuing grant sites becomes less of a priority.

Management and Fees

South Coast towns charge per acre fees for shellfish grant licenses, but these are minimal (\$5.00 to \$25.00 per acre, as specified in Massachusetts General Law) and do little to cover the actual management costs. Some towns have historically charged an excise tax. One consideration is to increase the license fees statewide. Large scale commercial growers with significant production would be better positioned to absorb an increase in fees than a smaller operation. In Maine, when a grower is applying for a lease site the applicant must pay for a \$1,500 survey fee. The Maine Department of Marine Resources conducts the survey and passes the cost along to the grower, regardless of the outcome (approved site or not). As a result, very few farms approach the state with an application that

has eel grass anywhere near it. The costs are real to the grower if the lease is turned down. In general people will pay more attention to the details if there are fees associated with their application.

Because permit fees bring no true revenue to the town, they are vulnerable to concerned residents who oppose aquaculture because it brings no financial value to the town as a whole.

New State Regulations Package

The state of Massachusetts has some positive efforts underway to enhance and promote the growth of sustainable aquaculture in the region. Progress is being made to make Commonwealth aquaculture regulations more visible and easier to understand.

We were told that the DMF is planning to conduct Environmental Impact Assessments for common aquaculture gear, and if the applicant meets certain performance criteria, they may be exempt from significant regulatory review. In principal, this should remove some of the barriers for new entrants.

Under current state regulations aquaculture permits can only be issued to persons holding a municipal aquaculture license. These permits only authorize the named individual to possess seed and conduct culture activities. This means the license holder is required to be on-site for most activities. DMF is proposing to move in a direction similar to shellfish dealer permits, where the permit authorizations extend to the business, rather than an individual person. This would create the ability for permitted growers to extend their permit authorizations to permanent employees, who can then conduct activities on behalf of the license holder.

Scale of Operations are Small

The majority of the members of the Massachusetts aquaculture community are small, family-run farms, often operated on slim margins. Any improvements in profitability (e.g., production of triploid oysters, disease resistance stocks, alternate species) can have dramatic effects upon this community, and therefore warrant our attention.²⁴

In the South Coast region there is a disparity in the production acreage if one looks at it town by town. There is interest in aquaculture but people don't always have a clear picture of what's involved to run a farm or the economics. Some towns with a few strong growers may harvest tens of thousands of dollars off a farmed acre; other sites might produce only several thousand dollars from an acre. Output and sales depends heavily upon the grower's skills, use of space and quality of their grant site and product. Simply looking at the acreage of a farm can be misleading – the average South Coast site in aggregate runs at about 6 acres, but that average is skewed by the larger grant sites operating in Westport and Wareham. Many operate at 2 acres or less. Today the snapshot of South Coast aquaculture tends towards "hobbyist", family-run small entity operations with a minimum of

²⁴ Aquaculture Situation and Outlook Report 2009: Massachusetts, p 2

employees and are commonly a secondary source of income with the owner/operator having another full-time occupation.

The implication however that very large-scale operations are the solution to substantive job creation and profitability is not without challenge. Large scale, multiple acreage farms require larger capital for seed, equipment and vessels, and incur the same risks – and NIMBYism - associated with smaller operations. If operating efficiently with equipment, larger automated operations could streamline the number of employees versus the labor (at least seasonally) that may be required on small farms. The owner/operator model is prevalent due to multiple factors that are the basis of reality on the South Coast. Large sites are not generally plentiful, and issued sites may have a variable degree of productivity due to nutrients, water quality, etc. Given the relatively long time of market growout of oysters (typically two years in optimal conditions), growers must have a source of income in the interim, which usually translates to a primary occupation, relegating the farming to a supplemental “job”. If operating successfully, the profit per acre can be scalable for the owner/operator engaging one or more full or part time employees. Expansion of existing small farms, or the introduction of multiple, new farms supporting a household or supplementing its income, may ultimately prove to have the most economic impact in the near future.

Acreage and Sales

The amount of acreage needed for a profitable and self-sustained oyster farm (one with competitive output, profitable sales, reliable jobs) can be substantial. We received feedback that in order to even break even or make marginal profit for oysters, a minimum of an acre per one person (owner/operator) is needed. A commercial scale likely requires farms operating at or above the regional average of 6 acres to create a true regional aquacultural economy.

When compared to the other four Shellfish Regions in Massachusetts, the South Coast had a high percentage of leased acreage, approximately 23%. However, the number of growers only represented 5% of total state growers. This would indicate that relatively larger operations are leased to only a few growers. Of the 24 listed growers provided by the DMF in 2018, only 5 companies (7 individuals) held permits with acreage of 12 acres or more. The average acreage for the remaining leaseholders was 2.17 acres.

In a comprehensive study conducted in 2015 titled the “*Massachusetts Shellfish Aquaculture Economic Impact Study*”, shellfish leaseholders throughout the Commonwealth were surveyed, with a high response rate (35%) and statistically accurate +/- 6.5%. The data showing scale compared to operations in the other regions of the State are telling, especially in terms of value per acreage production. Despite its substantial percentage of leased acreage, the study shows the South Coast as producing the lowest value of sales per acre in the state. Acreage on the South Coast accounted for 31% of the total surveyed acreage. However, only 6% of all respondents held acreage in this region, again indicating that individual leaseholders in this area possess larger sums of acreage. Respondents in this region generated average sales of \$13,000 per farmed acre – the lowest of any region in the Commonwealth:

Comparisons, Average Sales per farmed acre by Region²⁵:

- Cape Cod = \$29,000
- North and South Shore Towns = \$30,000
- Island Region = \$13,500
- State Average = \$18,845

Consider also farm gate value by acre in neighboring states:

- Rhode Island (2016) = \$19,400
- Connecticut (best available data) = \$25,600

South Coast producers are netting comparatively – and alarmingly – lower values for their production. This could be attributed to the smaller scale inefficiencies of harvesting when conducted on limited acreage on what translates to a largely “part time” basis. Quality of product is generally perceived as high in the region and most growers indicated that demand currently exceeds supply. Relative to the permitted acreage, there is a modest number of growers in the region: 2018 numbers put them at 24 in total, whereby for scale other major oyster-producing towns alone dwarf them: Wellfleet in 2016 had 81 aquaculturists producing 7.75 million oysters and the town of Duxbury had 28 – producing over 10 million oysters compared to South Coast’s reported 2.2 million.

²⁵ Massachusetts Shellfish Aquaculture Economic Impact Study, 2015 p.18

Table 12. 2016 Aquaculture Landings and Value.

American Oyster		
Town or Region	Pieces	Reported Value
Barnstable	6,412,096	\$3,656,989
Brewster	361,330	\$207,731
Chilmark	74,865	\$46,197
Dennis	2,365,022	\$1,361,091
Duxbury	10,107,280	\$5,708,971
Eastham	441,480	\$254,913
Edgartown	3,081,966	\$1,785,712
Fairhaven	285,725	\$175,071
Falmouth	410,504	\$260,116
Kingston	255,720	\$142,094
Marion	69,055	\$36,002
Nantucket	378,771	\$249,684
Orleans	1,136,550	\$663,299
Plymouth	1,383,617	\$745,698
Provincetown	67,761	\$39,010
Wareham	1,478,255	\$846,396
Wellfleet	7,760,428	\$4,253,771
Yarmouth	368,051	\$206,747
Other Areas	1,812,883	\$1,072,191
Total	38,251,358	\$21,711,683

Table: Mass. DMF

Raising the average value per acre through responsible husbandry can lead to higher production, and sustained harvest of the highest quality oyster, which in turn can command top dollar. Product marketing can also lead to higher prices once a demand has been established. We also learned that it's important for growers to communicate annual expansion plans to their wholesalers so the wholesaler can accommodate. If a wholesaler is not informed about future product volume, it can be difficult for the wholesaler to pay a negotiated rate to the grower. Once the wholesaler deducts a shipping fee and a box fee there's little room left for the wholesaler for mark up. This may make the wholesaler not want to purchase the product and leave the grower scrambling for another buyer. More open communication between the grower and wholesaler could help alleviate this problem.

Jobs

Aquaculture in its many manifestations offers jobs ranging from the highly technical to the basic and supports numerous spin-off and support industries. The aquaculture industry and the jobs it creates are also sustainable, which means that aquaculture activities, if implemented using good husbandry practices, can be carried on indefinitely.²⁶

²⁶ Aquaculture White Paper & Strategic Plan, Mass Coastal Zone Management, 1995 p. 8

The “*Massachusetts Shellfish Aquaculture Economic Impact Study*” provided some insights into the make-up of aquaculture labor along the South Coast. Respondents within the South Coast region had a total of 45 employees. Of those, 10 worked full-time throughout the year, 7 worked part-time throughout the year, 8 worked full-time on a seasonal basis and 20 worked part-time on a seasonal basis. Full time workers were 22% of total South Coast workforce – below their reported statewide “Full Time, All Year” percentage of 40%.²⁷ Again, the model of an owner/operator working full or part time seems prevalent, with larger operations engaging local part-time or seasonal help to meet scale or harvest time demands.

Most farms tend to remain as small-scale operations with only 2-5 employees. We encountered two larger shellfish companies on the South Coast with between 20-25 employees. To achieve this scale, both companies had been in business for over 25 years. High school students with little to no background in aquaculture are often the first employees of choice for a small farm preparing to scale up. Low or moderate-income individuals from the commercial fishing industry also make good employees as the jobs are entry level positions that don’t require highly skilled employees but value those who are familiar with working on the water. Entry level jobs include farm attendant, farm worker, laborers and low-level fisheries technicians.

Each of the shellfish aquaculture businesses we spoke with for this project started out as owner/operator businesses conducted on a part-time basis. Based on their early success of selecting good growing areas with space to achieve enough volume to generate positive cashflow, they indicated they will invest in the business and seek growth. We encountered small shellfish farmers operating part-time and generating up to \$15,000 in the first couple of years; once they became more established they saw revenues increase to \$25,000-\$30,000/yr. Upon achieving this size, many considered hiring other employees.

Workforce accessibility via public transportation varies by community. Within New Bedford and Fairhaven area, public transportation is better than is offered in the surrounding coastal towns. Shellfish aquaculture businesses support many of the same industries served by the commercial fishing industry. These industries include: fuel, ice, engine repair and sales, marine equipment, cold storage, transportation, wholesale and retail markets. Aquaculture in the region can be also be viewed as an alternative form of employment for members of the commercial fishing industry who may be faced with fewer opportunities for employment due to declines in wild catch availability, most notably lobstering and groundfishing.

²⁷ Massachusetts Shellfish Aquaculture Economic Impact Study, 2015 p. 12

Competition for Space and Geography are Impacting Optimal Site Selection

Many aquaculturists express the concern that they are the “last priority use”, i.e. that they are only able to get use of areas that nobody else is interested in and that they are held to a higher standard of review and monitoring than other, more traditional ocean users. They believe that this results in benign neglect or actual discrimination by legislators and policy makers toward aquaculture interests.²⁸

Site selection for a shellfish farm is extremely critical for growout, sustained health, and consequently profitability. Water quality, depth, salinity, and temperature all can impact the nutrients required to sustain robust growth and produce quality oysters. An effective site must also allow the farmer relative ease of access to perform required husbandry efficiently. Finally, to achieve commercial production, a scalable amount of acreage – ideally adjacent to maximize husbandry – needs to be available.

Infancy and Attitudes

Because of its relative newness, gear culture arrived in the South Coast long after the advent of coastal summer residences and the regional focus on using the water for recreation. By comparison, areas in Cape Cod such as Barnstable and Wellfleet had an aquaculture presence before people were purchasing homes with water views. Aquaculture operations were essentially part of the landscape, and became accepted socially as the norm. While NIMBYism still impacts aquaculture progress along the Cape, many communities there, as well as in Duxbury, have come to embrace these operations and their value to local employment and economy.

Unfortunately, these attitudes have not translated to the South Coast, where there are coastal access limitations in most of the towns that stem from perception of competition with other uses. An extreme example of this was witnessed in the town of Marion. There are a few shellfish growers who have been trying to grow their businesses but have been limited by the spatial availability for aquaculture grant sites. There is an apparent, strong NIMBY opposition in Marion. It happens to also be one of the most popular sailing harbors in all of Massachusetts. Half acre grant sites are extremely difficult to get through the town and state leasing process primarily due to strong property owner opposition and lawsuits.

The Best of the Worst Sites

Site selection along the South Coast has been described as “the best of the worst sites” – the last priority given amidst other priorities – namely recreational activities such as sailing and moorings, fishing and recreational clamming, swimming and bathing, and kayaking – as well as commercial fishing and recreational navigation. Near shore oyster aquaculture is best amidst estuaries and rivers, and along inshore sheltered coastline that is open. Unfortunately, many spots are in areas where there is already significant recreational boating, beaches or commercial fishing and are often perfect places to

²⁸ NROC White Paper: Overview of the Aquaculture Sector in New England, 2013 p.16

build houses to overlook the water scenery. Sometimes, a permit application can be derailed simply for presenting a potential gear “eyesore” to a water view from a residence.

Areas suitable for growing shellfish are also often ideal for providing protected shelter (mooring areas) for high end yachts. As a reference, the swing radius of a single mooring for a sizeable recreational vessel can be around ½ acre – the same size as many grant sites. Geography can quickly become a limiting agent if all the good sites are taken up by recreational boating activities. While many growers see the necessity to work with their neighbors to accommodate their concerns if possible, many have had to go as far as picking an alternative, likely less productive site “out of sight” of trafficked areas or coastal homeowners.

Open Water Aquaculture

Given the frequent restrictions of securing ideal aquaculture sites inshore, it would follow that open water operation situated farther offshore – with larger available acreage and out of sight of the shoreline homeowners - would offer the best solution to site competition. “Open water” sites in Buzzards Bay are those located within 3 miles of shore – still considered inshore as leasing still falls within a town’s jurisdiction and does not encroach into Federal Waters. Unfortunately, outside of a few operations in Westport, open water aquaculture is non-existent for the other South Coast towns of Buzzards Bay as the challenges presented by both nature and infrastructure overwhelm the economic feasibility for most small-scale growers and make it impractical when compared to coastline operations.

During our conversations we learned about some of the barriers to having farms offshore. Some of the gravest concerns lay within the ecology of Buzzards Bay itself. The Bay is exposed to a very strong energy zone of extremely hard winds in the summer and icing in the winter, making husbandry difficult and putting gear security at risk. While the Bay is generally shallow, most of the more sheltered areas closer to shore lay above a long shelf with very little depth that is essential to grow out. Perhaps more concerning, growers found that ideal nutrition lay only at the topmost layer of the water column, requiring gear to be at the surface and in the energy zone, while still resulting in much slower oyster growth than found inshore. Those that attempted bottom-culture were frustrated by bottom predation, poor nutrition, strong currents and the labor of deep scuba diving to reach the shellfish. Vibrio and dermo are present as well.

Further, access to conducting operations farther offshore entails the necessity of significant investment, namely larger boats, more substantial anchoring systems, fuel, and in some cases davits, pot-haulers or even cranes. Some feel there is opportunity for deep water aquaculture while others say it is too impractical to be a commercial option for small-scale farmers like those found in the region. Offshore conditions are far from ideal for nursery grow-out so growers would have to have inshore upwellers prior to transplanting shellfish farther out in the Bay, creating multi-site operations from the start. More labor would also be required to manage these deep-water farms given the distances to reach them.

Despite the challenges facing open water aquaculture in the South Coast, some were optimistic that it is feasible and presented the most likely scenario for commercial scale operations. In fact, given the resources needed to conduct some operations on large acreage would likely require a sizeable company, not the small-scale operator paradigm found in the South Coast. Some said that advancements in deep water aquaculture gear (anchors, etc.) could be game-changers for further feasibility. The positive reality of is that the scale of open water aquaculture can be substantially larger in acreage and have more employees, creating both jobs and volume of product needed to be highly profitable and recoup gear and vessel investment.

Shellfish Classification Areas and Closures

The Division of Marine Fisheries (DMF) classifies areas for shellfish harvest. Permit holders should review classification information prior to harvesting shellfish. Buzzards Bay is one section of the DMF's Shellfish classification area and there are several charts that can be found online to review this information. The website is: <https://www.mass.gov/service-details/shellfish-classification-areas>

For the most current classification and closure information, harvesters should contact their local town shellfish constable.

It's important to note that many areas along the South Coast are closed to shellfish harvesting and cultivation. As an example, approximately 90% of Marion's inner harbor is closed to shellfish harvesting during the summer months. As a result, that same area is unsuitable for aquaculture production. To qualify for a permitted site, the area must be open year-round. If an area has seasonal closures that occur year after year, the site is not suitable for aquaculture production outside of upweller nurseries. In the Marion example, this results in approximately 10% of area that could be considered for aquaculture. When waterfront property owners, eel grass and recreational boating concerns are factored in, there is no "easy acreage" for aquacultural sites. In recent years, Westport has had a transient skyrocketing bird population that settles in at the mouth of the river. Flocks of 1,000 birds (cormorants, geese, swan, ducks, seagulls) are not uncommon. This has led to high bacterial readings and harvest closures from December through February. Spatial availability for aquaculture operations can be influenced by factors described previously (competition, geography, ecology) but can be further hindered by closures in certain areas due to runoff, pollution, etc.

ASSETS AND OPPORTUNITIES

A summary of findings is framed below, which we elaborate on in the text that follows:

- New Bedford's 2018 Aquaculture Initiative offers the strongest potential for commercial scale aquaculture in the entire region.

- Municipal and institutional shellfish restoration projects are an asset to showing the public the value of aquaculture – and a gateway to change misconceptions that often interfere with regional growth.
- Harbormasters and Shellfish Wardens are pivotal to the process of aquaculture leasing and expansion, and their advocacy is not to be undervalued.
- A robust amount of resources – including training, equipment, seed, and financing – is available to aquaculturists on a regional and state scale.

Aquaculture in New Bedford

With our commercial fishing preeminence, it is the City's hope that we can attract aquaculture in New Bedford waters in an efficient, sustainable and scalable way.²⁹

In January of 2018, under the direct initiative of New Bedford Mayor Jon Mitchell, the Harbor Development Commission – now the New Bedford Port Authority (NBPA) - issued a Request for Information (RFI) seeking feedback from individuals and businesses interested in leasing acreage from the City for aquaculture operations – most likely for shellfish (oysters) although the type of aquaculture has not been specified. This RFI represents New Bedford's first step in evaluating the potential for commercial aquaculture within the jurisdiction of their waters and to further develop a possible management structure that will attract and sustain successful aquaculture there. Their published intent is to determine how they can “best partner with and support commercial aquaculturists in the same way the City partners with the wild-caught commercial fishing industry.” No other municipality in Massachusetts has ever issued such an RFI.

This is a potentially groundbreaking measure for New Bedford, which is the most valuable fishing port not just in New England but in the U.S., and the leading seafood hub on the East Coast. Its total economic value in 2016 was approximately \$9.8 billion – representing 2% of Massachusetts' entire GDP. This success has been built upon the back of wild-harvested seafood – now primarily scallops – and no aquaculture operations currently exist within New Bedford's jurisdiction. To pursue a course of attracting aquaculture to the City/Port's waters raises regional – if not national - awareness of aquaculture's potential to create jobs, expand existing businesses and diversify opportunities.

The potential for aquaculture in New Bedford is extremely positive. Mayor Mitchell has provided the vision and support for the concept and has proactively directed the NBPA to gauge interest from both the industry and the public in a transparent, collaborative manner – seeking to forge partnerships that can facilitate aquaculture in an “efficient, sustainable and scalable way”. The NBPA has taken the approach of asking existing growers what they want to see happen, not inflicting a restrictive mindset that only considers the interests or agenda of the City. Their intent is to collect enough data and

²⁹ New Bedford Aquaculture Request for Information, 2018, p.1

community feedback to not just establish a strategy of successful implementation, but to engage the community at large to educate them about both the economic potential and how aquaculture can exist amidst the more traditional fisheries and shared waterways, effectively addressing their “fears” or misinformation. They are progressive in that they are seeking guidance from both the industry and regulators, with an approach of “having a management framework in place before opening the door” to a new industry.

Equally promising is their preliminary engagement and work with the DMF. This has resulted in identifying lease locations for healthy shellfish nurseries and commercial growout operations in their waters, and by all indications the DMF is enthusiastic of their vision and the potential for growth in the area. Recommended site selections in these waters are already approved or conditionally approved for shellfish harvest, and are all within reasonable distance to access points/boat ramps.

New Bedford boasts two assets that poise them for potential success that may not exist anywhere else in the state: plentiful acreage and an existing seafood infrastructure. They are considering opening a substantial 8,400 acres of their coastal waters to aquaculture. With such an abundance of acreage that could be committed to aquaculture, the NBPA feels there is an opportunity for larger scale operations (contrasted with the smaller, limited size acreage permits in other towns on the South Coast) that could attract larger investors to the region. Aquaculture companies (as opposed to the single owner/operators found along the coast) may be enticed to move to an area with enough space to produce volume of scale. Equally, it may also open the door to a large number of small owner/operator farms, further contributing to the economy.

As the leading seafood hub on the East Coast, New Bedford’s industrial waterfront contains an astounding resource of seafood infrastructure that certainly could be integrated into a burgeoning aquaculture industry. Supplies such as fuel, ice, packaging, storage, and repair are already abundant to scale in the City. Access to marketplace is a daily occurrence, with many established seafood processors and wholesale dealers offloading, processing, storing and shipping tons of products annually, with channels ranging from regional to international. Successful aquaculture operations could have a multiplier effect upon this localized economy of supply and services.

When taken as whole, the multiple existing components of resources, acreage, infrastructure, innovation, and municipal leadership by Mayor Mitchell all add up to the highest potential level of true economic development and job creation of aquaculture along the South Coast. Coupled with New Bedford’s long history in wild fisheries, and capitalizing on the recent New Bedford seafood branding campaign introduced by Mitchell (www.newbedfordseafood.org), the introduction and integration of aquaculture could have a substantial economic multiplying effect, increasing profitability and capitalizing on a waterfront workforce who may be displaced in downturns in wild fisheries and some of the restrictions they may face in the future. At the time of this report being published, NBPA was initiating a robust public process to discuss the potential and future course of action, while concurrently beginning efforts to open targeted areas to shellfishing. We remain enthusiastically optimistic and supportive as the NBPA continues its due diligence that these efforts may meet with success in the coming years.

Municipal Support for Shellfish Programs

To the extent that the main inhibition for aquaculture growth is social and political as opposed to environmental and logistical, efforts to educate officials and the public at large to its great advantages seem like a smart, forward-looking effort that could be coordinated at a local or county level.³⁰

The calamity of an oil spill in Buzzards Bay in 2003 has ultimately resulted in multiple restorative shellfish programs throughout the South Coast that have positive impacts for aquaculture on a community basis. As evidenced by the high numbers of residential shellfish permits issued by the towns, there is a legacy and passion for recreational harvest in the region. Following the damage to the ecosystem caused by the spill, restorative efforts to support populations of oysters, quahogs and bay scallops has utilized aquaculture in a very public way, showcasing its value to many area residents who can experience direct benefits from its output.

The Bouchard Transportation Barge-120 spilled about 98,000 gallons of fuel oil into Buzzards Bay in April of 2003, spreading along more than 90 miles of shoreline, inclusive of the towns along the South Coast. Damage to habitat and natural shellfish beds was significant. Several years later, a settlement valued at \$6 million was reached to introduce restorative measures to the shoreline and its wildlife. A Trustee Council was established to fund projects designed to aid in the regional recovery – inclusive of shellfish restoration programs headed by the Nature Conservancy and Massachusetts Division of Marine Fisheries. Local municipalities also received funds to develop upwellers and purchase seed for growout and planting of both quahogs and oysters. These projects began in 2015 and are currently underway in the region.³¹

We believe that the restorative output of shellfish upon water quality, coupled with the benefits of recreational and commercial harvest, is an asset to aquaculture at large. The South Coast towns in our area of study are situated in Buzzards Bay – a body of water with a strong conservation interest and support. We met with a key project manager at The Nature Conservancy (TNC) to learn more about efforts being made in the waters of South Coast focused on the restoration and preservation of water quality and habitat.

The **Massachusetts Aquaculture Association**, MAA, is a non-profit Trade Association formed in 1986. Its purpose is to promote the continued development of shellfish and fish farming, and to improve conditions affecting aquaculture in Massachusetts.³² The MAA has a strong membership comprised of

³⁰ Cape Cod Aquaculture Profile & Opportunity, 2016 M. Low, p 6

³¹ <http://www.southcoasttoday.com/special/20160804/southcoast-shellfish-restoration-projects-get-funding>

³² <http://massaquaculture.org/>

approximately 80 growers throughout the entirety of the state, with a working Board of Directors whose focus is the advancement of the industry within the Commonwealth through working relationships with industry and state and local government. The MAA works with lawmakers, the Division of Marine Fisheries, and with the Massachusetts Shellfish Initiative to work on removing barriers to growth and address issues to further support expansion of aquaculture statewide. They have had several legislative successes to advance the industry, and collaborate with the East Coast Shellfish Growers Association's lobbying efforts for regional representation in Washington DC.

The Nature Conservancy

Substantive work in Buzzards Bay began back in 2015 by the Massachusetts chapter of TNC with two oyster bed restoration sites in the South Coast town of Fairhaven with restoration projects in Wareham and Bourne to follow later in 2018. The Conservancy joined state and town agencies including the Division of Marine Fisheries, along with fellow nonprofits – most predominately the Buzzards Bay Coalition– as well as volunteers to participate in the “planting” of both oysters and native bay scallops. These efforts are intended address the injury to recreational shellfishing opportunities caused by the 2003 Bouchard oil spill. TNC has leveraged these projects to identify proper permitting channels and are providing technical assistance to South Coast municipalities as the organization has done similar work in the region and across the country.

What is notable about these efforts is the utilization of the aquaculture industry in supporting restoration. The oyster seed used in the demonstration projects was purchased from a Massachusetts commercial hatchery, and a private commercial grower was contracted to hold the seed during intermediate growout prior to planting on the restoration site. In 2015, TNC was part of a coalition who invested funds to protect a hatchery badly in need of an upgrade, and with its restoration it now continues to supply private industry with the seedlings needed for aquaculture to thrive in Massachusetts

Our contact suggested that if more commercial aquaculture farms can develop along the South Coast, TNC in Mass could potentially reach their water quality and habitat restoration goals. TNC in MA is actively working toward increasing the science that aquaculture can provide valuable ecosystem services such as water quality improvement and provision of habitat. As the evidence that shellfish farms are markedly beneficial to the environment is not yet conclusive, they intend to work with industry to bolster the science to better support that claim/or not, should the evidence bear out differently.

This partnership of restoration and conservation efforts leveraging commercial expertise is important not just for science, but also in its potential to influence public perception of how aquaculture can impact their community's waters positively. We are optimistic that the co-existence of both commercial and restorative aquaculture could be a step for future development and increased leased acreage in the South Coast.

Massachusetts Shellfish Initiative

Another group promoting aquaculture on a statewide basis is the Massachusetts Shellfish Initiative (MSI). It began in 2017 under the collaborative leadership of three key shareholders in the Commonwealth's aquaculture industry: the Massachusetts Aquaculture Association, the Cape Cod Commercial Fishermen's Alliance, and The Nature Conservancy. Its primary mission is to develop a state-wide holistic shellfish plan which could maximize the economic, environmental, and social benefits of the Commonwealth's shellfish resources, inclusive of commercial production through aquaculture.

Despite strong statewide growth in shellfish production (oysters are the third most valuable fishery in the state), Massachusetts hasn't planned the future of its shellfish resource. The last effort to do so was an aquaculture plan that launched in 1995 with a 5-year vision timeframe. The formation of the MSI to fill this void represents a collective, innovative approach to improve communications from diverse shareholders in the shellfish industry, ranging from commercial producers, recreational and wild harvesters, to local and state agencies, NGOs and environmental institutions. Ultimately, we believe MSI is poised to be a leader in the responsible expansion of shellfish resources for Massachusetts, and certainly the South Coast region.

MSI has made progress during 2017 to initiate the collection of feedback for the purpose of creating a strategy to be shared with stakeholders and the public. They have conducted a third-party survey (results pending) of shareholders (inclusive of the general public) with the intent of formulating an overarching strategic plan based upon its feedback. Additionally, they have conducted several open forum outreach meetings to form cooperation and communication among a variety of interested and involved parties. These meetings are to continue into 2018. The impact of MSI has yet to be seen, but as in the case of the aquaculture initiative in New Bedford, we believe that MSI represents substantial progress in moving the needle for future aquaculture planning and development with a unique "grassroots" focus on inclusion of multiple interests and needs. For more information see the website: <http://www.massshellfishinitiative.org/>

In all instances, we see efforts being made statewide to effectively "lift all boats" for commercial aquaculture endeavors. We found the institutions to be sensitive to public reactions, which at best have been mixed over the past decade, if not negative. Because the issuance of lease sites is ultimately controlled by the municipalities, and public hearings are part of the leasing process, the ability of these groups to positively raise the public perception, provide education and appeal to community volunteerism around "aquaculture" and its value may strongly impact the commercial feasibility of future operations along the South Coast.

The value of the towns' Harbormaster and Shellfish Wardens to both municipal and commercial aquaculture operations is not to be undervalued. We spoke with Harbormasters from each of the seven towns and found that their energy and enthusiasm about aquaculture was high. We found most to be true advocates for supporting localized recreational and commercial shellfish harvest programs and are leaders in interacting with the boating and fishing public. In towns such as Wareham, Marion

and Westport, clam and oyster upwellers are in public view on the municipal docks, furthering exposure to aquaculture methods to recreationalists. While the Harbormasters/Wardens must follow direction from Town Management, their ability to advise, allocate resources from budgets, recommend siting, enforce laws and interact with growers and the public alike make them invaluable to the potential success of restorative, recreational and commercial aquaculture in their respective towns.

SUPPORT RESOURCES

Education and Training

Several of the growers and harbormasters we spoke with for this study indicated that had attended aquaculture training courses offered in close proximity to the South Coast region of MA. Some growers indicated taking more than one training or attending the same course offering more than once. Some growers mentioned take a course to learn about aquaculture and then once they had a permitted site, taking the course again with a strong emphasis on commercialization. There's no shortage of class offerings and they were all spoken of highly for their content and applicability. Several growers mentioned the importance of going to meetings, talking with other growers and making efforts to connect with helpful resources. Many growers have in fact worked on existing farms as a way to volunteer or serve as an intern to learn the basics of running a successful aquaculture business. Given all the interest in training opportunities, there are not enough lease site opportunities on the South Coast for everyone taking the classes to start their own farm. This will result in more farm workers and managers on existing farms rather than individual license holders starting new farms.

Roger Williams University Center for Economic and Environmental Development offers a 14-week non-credit course during the winter/spring semester titled "**Applied Shellfish Farming**" It's intended to teach both aspiring shellfish farmers and aquaculture professionals how to commercially grow oysters, quahogs, scallops and mussels. The course is led by Dale Leavitt, Aquaculture Extension Specialist and Professor of Marine Biology at Roger Williams University. The fee for the course is \$75 per student. Since 2017, this course has been offered in an on-line webinar type broadcast and is now offering training to national and international attendees.

<https://www.rwu.edu/news/news-archive/roger-williams-university-course-will-equip-shellfish-farmers>

Roger Williams University offers a **major and a minor in Aquaculture and Aquarium Science** which is offered in partnership with the New England Aquarium in Boston.

<https://www.rwu.edu/undergraduate/academics/programs/aquaculture-and-aquarium-science>

Roger Williams University offers Rhode Island coastal homeowners a **Dockside Aquaculture Program** in an effort to allow local residents with the knowledge, tools and official license to safely farm oysters on their waterfront property for the personal consumption of the license holder. The \$1,500 fee for the course includes registration, guidance through the application process, submission of the application, gear required to grow the oysters, and 2,000 seed oysters. Although this course is no

longer being offered (due to time constraints for the managers of the course), this is an interesting model worth considering, although not allowed in Massachusetts.

<https://www.rwu.edu/academics/schools-and-colleges/fssns/ceed/dockside-aquaculture>

The Community Boating Center, Inc. in New Bedford is in the initial stages of planning an effort with the Greater New Bedford Workforce Investment board to target youth that are out of school with apprentice opportunities for boatbuilding, offshore wind, marine trade and aquaculture. Curriculum will be developed with existing growers to create opportunities primarily for people who live and work in the New Bedford area. The Center is also working with the New Bedford Port Authority to help develop a workforce training component for the New Bedford Aquaculture Initiative.

www.communityboating.org

Woods Hole Sea Grant and the Cape Cod Cooperative Extension Marine Program offer a course titled “**The Fundamentals of Shellfish Farming**”. The course is taught by Marine Program staff and guest speakers who make their living growing shellfish. The fee for the 8-week course is \$150.00. The Extension often posts other Aquaculture Workshops, Technical Advice and Outreach.

<https://www.capecodextension.org/>

Massachusetts Maritime Academy offers a **Shellfish Constable Training Program** at the Maritime Academy campus. This is an 80-hour training program (over a two-week period) that includes the basics of shellfish biology, environmental parameters and shellfish management as well as various topics in law enforcement, CPR training and will include an exam and certificate of completion for successful enrollees. The fee for the course is \$495.00 per person.

<https://www.maritime.edu/maritime-training-courses>

The **East Coast Shellfish Growers Association** (ECSGA) represents over 1,000 shellfish farmers along the eastern seaboard from Maine to Florida. The ECSGA maintains a website and list serve with valuable information for growers and others in the industry. <https://ecsga.org/>

Tabor Academy Oyster Farm. Tabor Academy (in Marion MA) has started a program for students called “Oyster Farm”. This is a collaborative project with the Town of Marion which started in 2013. Students support the existing shellfish propagation program in Marion by raising oysters to seed shellfish beds and oysters’ natural ability to clean the water.

<https://www.taboracademy.org/page/school-by-the-sea/oyster-farm>

The **School for Marine Science and Technology at University of Massachusetts Dartmouth** conducts world class education, research and policy development related to fisheries, coastal preservation, ocean modeling, underwater robotics, climate change and related fields. SMAST offers Ph.D. and Master’s programs in marine science. SMAST is the lead campus for the UMass Intercampus Marine Science graduate program. In late 2017, UMass Dartmouth officially opened a new \$55 million, 64,000 square foot marine science facility known as the School for Marine Science & Technology East (SMAST East). This new facility located on Clark’s Cove has tripled the University’s marine science presence in New Bedford. <https://www.umassd.edu/smast/>

Quincy College has an Aquaculture Certificate Program consisting of 22 semester hours of introductory courses in shellfish aquaculture and business management. Classes include a combination of hands-on practical experience, applied science and business courses. Students learn hands-on skills throughout the aquaculture practicum series such as water quality testing, system construction and maintenance, treatment, feeding, and breeding technology. The focus of the program is on salt-water shellfish species. Graduates of the certificate program may find employment on private farms, commercial hatcheries or begin their own aquaculture production.

<https://quincycollege.edu/program/aquaculture/>

University of Massachusetts, Boston offers an online aquaculture course, “**Introduction to Sustainable Marine Aquaculture**”. The course is open to anyone with a high school diploma interested in a career in the aquaculture industry. UMass Boston students can take the course for credit; for people outside UMass Boston there are for-credit and non-credit options. Two other online aquaculture courses, “Aquaculture Production” and “The Business of Marine Aquaculture”, will be offered at a later date.

https://www.umb.edu/academics/environment/professional_development/aquaculture

Salem State University offers an undergraduate BS degree program with an **Aquaculture Concentration** option. The aquaculture concentration focuses on the controlled cultivation and harvest of aquatic plants and animals. Students will gain practical skills in the husbandry of aquatic organisms through applying knowledge gained from courses in biology, chemistry, business, and other disciplines. Skills learned will provide graduates a hands-on appreciation of the aquatic environment and aquaculture systems. Graduates will have the skills needed to set-up and operate their own facility, to work at a private or public hatchery and to pursue employment in a parallel field such as resource management, fisheries biology, marine, or environmental science.

<https://www.salemstate.edu/academics/colleges-and-schools/college-arts-and-sciences/biology>

Local and Regional Resources

The **Buzzards Bay National Estuary Program** is an advisory and planning unit of the Massachusetts Office of Coastal Zone Management. Established in 1985 as the Buzzards Bay Project, our mission is to protect and restore water quality and living resources in Buzzards Bay and its surrounding watershed through the implementation of the Buzzards Bay Comprehensive Conservation and Management Plan.

<http://buzzardsbay.org>

The **Cape Cod Commercial Fishermen's Alliance (CCCFA)** was launched in 1991 by a group of local commercial fishermen who saw the need for better fisheries management and wanted their experiences to inform it. The organization is rooted in first-hand knowledge of ocean life and committed to sustaining the tradition of small-scale fishing. Their work—on fisheries management, scientific projects and community education—is all aimed at protecting fish and fishing for future generations. <http://capecodfishermen.org>

The **Cape Cod Cooperative Extension (CCCE)** mission is to improve the health and well-being of youth, families and communities; conserve and enhance natural and marine resources; and strengthen agricultural and food systems. Cape Cod Cooperative Extension is the education department for Barnstable County. <http://www.capecodextension.org/>

- **Barnstable County Municipal Shellfish Program** Barnstable County although to the east of the South Coast, has an impressive Municipal Shellfish Program where all fifteen towns within the county annually purchase young oysters, quahogs, and other shellfish from hatcheries that are then planted in coastal waters for the benefit of shellfish programs. A bid program was established to provide greater buying power as a group (similar to how a co-op operates) while reducing costs and improving the reliability and delivery of the shellfish. Through this collaborative effort that started in the late 1990's the MA Division of Marine Fisheries, Barnstable County, Woods Hole Sea Grant, and the individual towns have all invested significant funds to support the purchase of shellfish seed in bulk. <https://www.capecodextension.org/marine/propagation/>

The **Community Economic Development Center of Southeastern Massachusetts, Inc. (CEDC)** is a Community Development Corporation in the City of New Bedford. They focus on innovative community-based economic development programs and affordable.

<http://cedcnewbedford.org/about/110-2/>

The **Massachusetts Office of Coastal Zone Management (CZM)** is the lead policy, planning, and technical assistance agency on coastal and ocean issues within the Executive Office of Energy and Environmental Affairs (EEA) and implements the state's Coastal Management Program under the federal Coastal Zone Management Act.

<https://www.mass.gov/orgs/massachusetts-office-of-coastal-zone-management>

The **Massachusetts Aquaculture Association, MAA**, is a non-profit Trade Association formed in 1986. Its purpose is to promote the continued development of shellfish and fish farming, and to improve conditions affecting aquaculture in Massachusetts. The goals of this organization are to promote a high quality of aquaculture product, continue to grow a thriving aquaculture industry, develop and transfer technology and to maintain an effective network between industry, government, and researchers. This organization is self-motivated and believes that the strength between the aquaculture industry and local and state governments is essential. Because of this strong relationship and understanding over the years there have been many legislations passed advancing the aquaculture industry.

<http://massaquaculture.org>

The **Massachusetts Department of Agricultural Resources Aquaculture Specialist's Office** provides a variety of services aimed at the promotion and development of Massachusetts aquaculture. The Aquaculture Program, located within the Division of Agricultural Conservation and Technical Assistance, fosters development of the Massachusetts Aquaculture Industry through efforts aimed at implementation of the Commonwealth's Aquaculture Strategic Plan.

<http://www.mass.gov/eea/agencies/agr/about/divisions/aquaculture-program-generic.html>

The **Massachusetts Division of Marine Fisheries** (DMF) manages the state's commercial and recreational saltwater fisheries and oversees other services that support the marine environment and fishing communities.

www.mass.gov/orgs/division-of-marine-fisheries

The **Massachusetts Lobstermen's Association** is a member-driven organization that accepts and supports the interdependence of species conservation and the members' collective economic interests. <http://lobstermen.com/>

The **Massachusetts Marine Trades Association** is an institution whose purpose is to establish an organization of dedicated men and women who are employed in the marine industry. The organization provides the framework for furthering the interests of the marine trades and the boating public through the promotion of boating, participation in legislation, and professional improvement programs. <https://www.boatma.com>

Massachusetts Regional Aquaculture Demonstrations Centers

- The **Southeastern Massachusetts Aquaculture Center** (SEMAC) is an agency of Barnstable County, but the Center supports aquaculture interests in all southeastern Massachusetts, including Barnstable, Bristol, Dukes, Nantucket, and Plymouth Counties. Funding is received from the Massachusetts Department of Agricultural Resources, and the budget is administered through the offices of Cape Cod Cooperative Extension. Priorities are determined by a thirteen-member Board which meets twice a year. The SEMAC staff conduct research and monitoring, organize outreach and education events, administer grants, and serve as an unbiased source of information for shellfish and finfish growers in the region. <http://www.capecodextension.org/marine/semac/aboutus>
- The **Northeastern Massachusetts Aquaculture Center** (NEMAC) at the Cat Cove Marine Laboratory supports aquaculture and marine biology programs at Salem State University. <https://www.salemstate.edu/catcove>
- The **Western Center for Sustainable Aquaculture** is located at the University of Massachusetts Amherst (WEMAC). The center typically works with freshwater aquaculture efforts. <https://eco.umass.edu/people/faculty/danylchuk-andy-j/>

The **New England Aquarium** (NEA) is a global leader in ocean exploration and marine conservation. With more than 1.3 million visitors a year, the Aquarium is one of the premier visitor attractions in Boston and a major public education resource for the region. The New England Aquarium is a catalyst for global change through public engagement, commitment to marine animal conservation, leadership in education, innovative scientific research, and effective advocacy for vital and vibrant oceans.

<http://www.neaq.org/>

The **NOAA Office of Aquaculture** seeks to foster marine aquaculture through policy, science, technology transfer, outreach, and international collaboration.

<https://www.fisheries.noaa.gov/about/office-aquaculture>

The **Southeastern Regional Planning and Economic Development District (SRPEDD)** plans for the future of southeastern Massachusetts, including the expansion of economic opportunity, the protection of natural and historic resources and the development of excellent physical and cultural amenities. They conduct research, providing technical assistance, prepare bylaws and ordinances. Two areas of focus that have implications for the future of the South Coast aquaculture industry are: Economic Development and Environment. <http://www.srpedd.org/what-we-do>

SRPEDD works with several other institutions and partners in the South Coast region and a comprehensive list can be found here: <http://www.srpedd.org/partners>

The **Westport Fishermen's Association** goals are to preserve, protect and improve the water quality and marine habitat of the Westport River, marshes, tributaries and all surrounding water.

<http://westportriver.org/>

Aquaculture Gear and Equipment

Ketcham Supply

111 Myrtle Street

New Bedford, MA 02748

(508) 997-4787

<https://ketchamsupply.com/product-category/aquaculture/>

Ketcham Supply located in New Bedford has long been a supporter of the aquaculture industry including R&D when the industry was just getting started. The business has 20 employees and supplies aquaculture gear from Chesapeake Bay up into Maine. They business equally supports commercial fishing and aquaculture industry. Ketcham manufactures and supplies wire mesh trays, racks, and cages. They also carry several other products and accessories used in oyster aquaculture. Oyster-Gro® is available through Ketcham Supply.

Cape Fishermen's Supply Inc.

67 Depot Road

Chatham, MA 02633

(508) 945-3501

<http://www.capefishermenssupply.com>

Commercial Fishing and Aquaculture Supplies

Plastic Pipe & Supply Inc.
Coastal Aquaculture
100 Glen Road
Cranston, Rhode Island 02920
(401) 467-9370

Although they do not have a website, they house a significant inventory of aquaculture gear.

Atlantic Aquaculture Supply
100D Elm Street
Warren, RI 02885
(401) 247-1661
Atlantic@AtlanticAquaculture.com
www.atlanticaquaculture.com
Aquaculture gear and supplies

R.A. Ribb Company, Inc.
P.O. Box 1319
Harwich, MA 02645
(508)432-6974
<http://www.ribbrakes.com>
Clam rakes

Brooks Trap Mill
211 Beechwood Street
Thomaston, ME 04861
(800) 426-4526
www.brookstrapmill.com
Aquaculture gear and supplies

Specialty Agricultural Products
628 Chestnut Ridge Road
Orange, CT 06477
(203) 387-3458
<http://www.nodeer.com/index.html>
Aquaculture netting

Chesapeake Bay Oyster Co.
Wake, VA
(804) 338-6530
www.bayoyster.com
Oyster culture equipment, tools, and accessories.

Hooper Island
Oyster Aquaculture
Fishing Creek, MD
(410) 397-3664
www.hioac.com

Manufacture and sell equipment for hatchery, nursery, farming, sorting and grading.

BST Oyster Supplies
Sales Distributor for the United States is:
Glen Chaplin
Chaplin Oyster Services
Mobile, Alabama
(251) 423-2347
glenchaplin@hotmail.com

Offers a range of products to grow oysters using an Adjustable Longline System.

C.E. Shepherd
2221 Canada Dry Street
Houston, Texas 77023
(800) 324-6733
<http://ceshepherd.com/aquaculture-mesh>

C.E. Shepherd manufactures a variety of wire mesh for the aquaculture industry including stainless steel, galvanized, PVC coated, twisted wire and several other products.

Go Deep International
(North America): (877) 446-3337
<http://godeepaquaculture.com>

Go Deep International manufactures navigation buoys and shellfish aquaculture equipment.

Industrial Netting
[7681 Setzler Pkwy N.
Minneapolis, MN 55445](http://www.industrialnetting.com/applications/aquaculture.html)
(800) 328-8456
<http://www.industrialnetting.com/applications/aquaculture.html>

Industrial Netting manufactures plastic netting for a variety of aquaculture applications.

Riverdale Mills Corporation
130 Riverdale Street
Northbridge, MA 01534
<https://riverdale.com/applications/>

Riverdale manufactures stainless, copper alloy and PVC coated welded wire mesh used shellfish aquaculture.

SEAPA

US sales rep is: Matt Will

Phone: (817) 776 2147

matt@seapausa.com

<https://seapa.com.au>

Seapa is an Australian based company that has been making equipment for the oyster industry since 1998. They specialize in molded plastic aquaculture products including oyster baskets, attachment systems and accessories.

Zapco Aquaculture

Minying Industrial District

Yanxi Town,

Zhangzhou, Fujian, China

info@zapcoaquaculture.com

<http://www.zapcoaquaculture.com/>

Zapco Aquaculture evolved from the merger of a group of Australian oyster farmers with an Australian plastic manufacturing company based in China. They manufacture floating bag cultivation products.

Access to Capital, Grants & Loans

One of the biggest challenges for new aquaculturists is they often don't have substantial collateral to offer when borrowing money. Typically, their home or other real estate is their most valuable asset and some people are reluctant to pledge it as collateral for fear of losing it, should their business fail. Many growers will self-fund their business operation for the first few years while they are learning to become farmers. Gear and boats are typically the items that may need some financial assistance. Grants can be an effective way for growers to offset some of their capital expenses and explore areas of innovation in the aquaculture sector.

Grants

Massachusetts Seaport Economic Council grants help the economic growth of coastal communities. Grants help to create jobs and build resilience to the impacts of climate change. Seaport Economic Council grants are awarded on a competitive basis, and offer flexible funding to empower communities to bring forward the best ideas and projects for cultivating and stimulating the maritime economy and job growth. Generally, five types of grants are encouraged and prioritized with maximum awards of about \$1 million. Most grants, however, are anticipated to be much smaller.

<https://www.mass.gov/seaport-economic-council-grant-program>

Associated Grant Makers (founded in 1969) is a diverse and vibrant membership association of highly engaged philanthropic organizations and individuals with interests in Massachusetts and surrounding areas. They connect new and established donors, their trustees and staff to each other, to their communities and to emerging and relevant issues in the field. As a 501(c)(3) nonprofit, AGM delivers

excellent opportunities in learning, networking, access to resources and tools, skill-building, and community-building and serves as a bridge between funders and fund applicants for better understanding, efficiency and impact.

<http://www.agmconnect.org/>

Woods Hole Sea Grant lists several grant funding opportunities on their website which often include aquaculture. <https://web.whoi.edu/seagrant/funding-opportunities/>

The U.S. Department of Agriculture's (USDA) **National Institute of Food and Agriculture** (NIFA) offers several grant programs applicable to the aquaculture industry. Best to use the search engine on their website. <https://nifa.usda.gov/grants>

National Oceanic and Atmospheric Administration (NOAA) Grants Programs are listed on Grants.gov. This website is used by federal agencies to announce and process grant opportunities including the Office for Coastal Management. www.grants.gov Also explore NOAA's Small Business Innovation Research Program at www.techpartnerships.noaa.gov/SBIR More info specific to Aquaculture funding is available at:

<https://www.fisheries.noaa.gov/national/aquaculture/aquaculture-funding-opportunities-and-grants>

Saltonstall-Kennedy Grants Program provides financial assistance (grants or cooperative agreements) for research and development projects to benefit the US fishing industry and is administered by NOAA's National Marine Fisheries Service. www.nmfs.noaa.gov/mb/financial_services/skhome.htm

National Sea Grant Program provides a variety of funding opportunities based on its work in four focus areas: [Healthy Coastal Ecosystems](#), [Sustainable Fisheries and Aquaculture](#), [Resilient Coastal Communities and Economies](#), and [Environmental Literacy and Workforce Development](#). Funding opportunities include National Strategic Investments, Special Projects, focused opportunities through each of the 33 Sea Grant programs, and more. Most funding opportunities require applying through or to one of the [33 Sea Grant programs](#).

<http://seagrant.noaa.gov/Funding>

The **Massachusetts Department of Agricultural Resources (MDAR)** offers several grant programs that are inclusive of aquaculture.

Agricultural Food Safety Improvement Program (AFSIP) supports agricultural operations (including aquaculture) that are looking to upgrade their food safety practices. Practices that help the operation to maintain or to increase their market access while reducing food safety risks. Participants selected to participate in the program will be reimbursed up to \$25,000 or 75% of their total project costs. The program will fund practices that help minimize the risk of microbial contamination and food-borne illnesses. In addition, eligible upgrades will increase competitive market access by meeting buyer demands for demonstrated practices that work towards protecting public health and food safety. Project examples include packing shed walls, ceilings and light fixtures, field harvest systems, hand washing sinks, portable restrooms,

drainage systems, water systems, Insulated Vats, Ice Machines Walk-in Coolers, Stainless Steel Tables. <http://www.mass.gov/eea/agencies/agr/about/divisions/afsip.html>

Agricultural Energy Grant Program (Ag Energy) is a competitive grant program that funds agricultural energy projects (including aquaculture) to improve energy efficiency and the adoption of alternative energy by Massachusetts farms. The goal of the program is that farms can become more sustainable and the Commonwealth can maximize the environmental and economic benefits from these technologies. One funded project included a barge containing solar electric photovoltaic panels and battery storage capacity with a conventional floating upwelling system (FLUPSY). The system can be placed in a desired location without the confines of connecting to shore power.

<http://www.mass.gov/eea/agencies/agr/about/divisions/ag-energy.html>

Agricultural Environmental Enhancement Program (AEEP) is a competitive, reimbursement grant program that funds materials and labor for conservation practices that mitigate or prevent negative impacts to the state's natural resources that may result from agricultural practices. Practices funded include those that prevent direct impacts on water quality, ensure efficient use of water, and address agricultural impacts on air quality. Reimbursement grants up to \$25,000 will be awarded on a competitive basis. The program has funded an oyster business that built an eco-conscious building for its operations. Funded improvements included: photovoltaic systems, addressing runoff on a property, incinoleet toilet, replacement of a two-stroke outboard motor with a four-stroke engine.

<https://www.mass.gov/service-details/agricultural-environmental-enhancement-program-aEEP>

Urban Agriculture Program to support and promote commercial urban farming enterprises (including aquaculture). Funding through the program targets infrastructure needs, innovative food production, zoning ordinances, technical assistance, land acquisition, and youth leadership development. <http://www.mass.gov/eea/agencies/agr/urban-agriculture-program.html>

Matching Enterprise Grants for Agriculture (MEGA) program assists beginning farmers who are between 1 and 5 years in business by providing technical and business planning assistance and grant funds for farm improvement strategies. Funding provided from this Program is available on a one to one matching cost reimbursement basis with the maximum award \$10,000. It is the objective of MEGA to assist farmers whose goal is to raise agricultural products and who aspire to develop their farms into commercially viable operations. Funds are typically used for equipment, infrastructure or other capital improvements to implement strategies recommended through the planning process.

<https://www.mass.gov/service-details/matching-enterprise-grants-for-agriculture-mega>

Loans

USDA Farm Service Agency offers several loan products available to aquaculture businesses. South Coast businesses are relatively close to the West Wareham office. There is also an office in Warwick RI. <https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/index>

Federal Fisheries Finance Program provides long term financing for the cost of construction or reconstruction of fishing vessels, fisheries facilities, and aquacultural facilities. http://www.nmfs.noaa.gov/mb/financial_services/ffp.htm

New Bedford Economic Development Council (NBEDC) has a portfolio of lending products to assist business needs. Their financing programs include but are not limited to: Entrepreneurial Loan Fund, Fishing Assistance Loan Fund, and a Community Loan Fund. Additionally, they are a Micro-Loan lender for the U.S. Small Business Administration. <http://www.nbedc.org/loan-programs/>

Farm Credit East through their Farm Start Program offers working capital investments for northeast agricultural ventures showing promise of success. The innovative program targets startup farmers and ag businesses with limited financial resources and who are not generally eligible for conventional lending programs. These are 5-year loans for up to \$75,000 for new business start-ups to be used for gear, capital, downturns in the industry.

<https://www.farmcrediteast.com/products-and-services/new-farmer-programs/FarmStart>

Cape Cod Community Development offers a **Shellfish Loan Fund** that is a collaboration between the CDP and Wellfleet Shellfish Promotion and Tasting, Inc. (SPAT). The loan fund was created to specifically meet the needs of shellfishermen and aquaculturists in Wellfleet and on the Lower Cape. The two organizations manage the fund as a partnership with SPAT providing the shellfish expertise and the CDP providing the lending expertise. The maximum loan amount is \$20,000 and CDP provides technical business assistance is available to potential borrowers when completing an application. Business assistance includes increasing financial literacy, developing marketing strategies, managing cash flow, grasping the importance of collateral, and understanding credit scoring. Unfortunately, the program does not apply to South Coast towns but is a good model that could be replicated on the South Coast. <http://www.capecdp.org/local-business/fishing/shell-fish-loan-fund>

Crop Growers LLC assists customers with risk management planning and appropriate use of the Federal Crop Insurance Program. They offer crop insurance for clams but not oysters. <http://www.croptgrowers.com/insurance-products/>

Lenders

Several commercial lenders are located along the South Coast towns including:

Dartmouth

Bank of America

BankFive

BayCoast Bank

Bristol County Savings Bank
Citizens Bank
Santander Bank
Webster Bank

Fairhaven

Bank of America
BankFive
BayCoast Bank
Bridgewater Credit Union
Citizens Bank
Rockland Trust
Santander Bank
St. Anne's Credit Union
Southern MA CU

Marion

Cape Cod Five Cents Bank
Commonwealth Utilities Employees CU
Eastern Bank
First Citizens FCU
Pilgrim Bank
Webster Bank

Mattapoisett

Bank of America
Cape Cod Five Cents Bank
Eastern Bank
First Citizens FCU
Pilgrim Bank
Webster Bank

New Bedford

Bank of America
BankFive
BayCoast Bank
Bristol County Savings Bank
Citizens Bank
New Bedford CU
Rockland Trust
Santander Bank
St. Anne's CU
Webster Bank

Wareham

Bank of America
BayCoast Bank
Cape Cod Five Cents Bank
Eastern Bank
First Citizens FCU
Citizens Bank
PCT Federal Credit Union
Rockland Trust
Santander Bank
Steep Bridge Bank
TD Bank

Westport

Bank of America
BayCoast Bank
Cape Cod Five Cents Bank
Mechanics Cooperative Bank
PCU FCU
Santander Bank
Westport FCU

Hatcheries and Seed Sources

The economics of raising hatchery shellfish up through nursery culture requires various gear types for each step of the growout cycle. This can become quite expensive and for a small company, may be too much to take on. Better to purchase larger seed from a hatchery and raise them to harvest size in a shorter amount of time. More than 50% of the oyster seed used in MA is coming from Maine hatcheries. Many growers have upwellers and will purchase 3mm seed in the spring and raise it in an upweller before putting it in an oyster bag. A few private businesses in MA purchase seed oysters from ME and put them in upwellers in MA where the oysters are tempered to MA waters before being resold to local growers. Other growers will purchase anything from 8mm to 25mm seed that has been overwintered and is ready for planting.

The **East Coast Shellfish Growers Association** provides a comprehensive list of shellfish seed suppliers along the East Coast of the United States and Canada. The hatcheries are listed by state and includes details about the distinct species available at each hatchery. State Extension Aquaculture Specialists are also listed. This list is updated annually and can be found at the following link:

<https://ecsga.org/wp-content/uploads/2017/11/EastCoastHatcheryNurseryList.pdf>

RECOMMENDATIONS FOR DEVELOPMENTAL STRATEGIES

We found that the South Coast aquaculture efforts are comprised of a cluster of farms in a small commercial scale in the owner/operator model. Given the restrictions we discovered, it may be ambitious to assume a scalable company employing a large workforce is eminent in the region, excepting the potential in the New Bedford area.

We believe, however, that consideration of the following initiatives could strengthen and extend aquaculture development in the region over the next five years.

Statewide Initiatives

Expand Massachusetts Farm Viability Enhancement Program to include Coastal Properties that support aquaculture activities. <http://www.mass.gov/eea/agencies/agr/about/divisions/fvvp.html>

Issue short -term Limited Purpose Aquaculture (LPA) siting permits. LPAs afford growers the opportunity to trial site selection/gear for positive results, while allowing town residents and property owners to try adjustment to aquaculture operations.

Charge applicants a fee for grant site review to assure legitimacy of intent of the prospective grower. This measure will aid in promoting serious diligence among applicants and free up DMF resources to focus on those applications with the greatest potential of success.

Municipal Initiatives

Municipal and Regional Shellfish restoration projects must continue to function successfully to gain public trust for commercial aquaculture. Town programs should correct any discrepancies in production for grow out, utilize commercial hatcheries, invest in larger seed to secure survivability. It is important to avoid “failure” aquaculture in public view along town docks.

Municipalities should require performance bonds for new growers to assure that lease sites are cleaned up should a grower abandon a site. This protects town waters, as well as protecting the reputation of the industry not just in the town but potentially the region. One grower that abuses permitting can impact the perception of aquaculture on a larger scale. Another alternative is to establish Town Shellfish Gift Funds, 100% Tax Deductible contributions from the community.

In the interest of a funding further or ongoing restoration in their communities, Municipalities can create an “Aquaculture Account” – for example a percentage of recreational shellfish fees go in, 100% of commercial fees go in. This creates a budget with dedicated funding.

Harbormasters/shellfish wardens play a critical role in both municipal and commercial aquaculture: they serve as community liaisons, deal with all aspects of waterways, resolve user conflicts, and heavily

influence site selection process. We suggest Harbormasters/ Wardens take aquaculture training courses if they haven't done so already to further their education and understanding.

Ideally, Towns could dedicate and map territories set aside for aquaculture availability. This would preapprove acreage zones earmarked for aquaculture use (ala Westport) that set parameters of site selection for permit applicants. Advantages are that it would allow the town to proactively site in those areas with a minimum of anticipated conflicts to recreational use, navigation, commercial fishing etc. and allocate a finite amount of acreage the town is willing to offer. Equally, siting could be made in areas with no known eelgrass, shellfish conflicts which advances the likelihood of permit approval for the aquaculturist.

Education

Recognize the recreational sailing and boating community as a group with interests in the use of public waters - the size and scale is established and widespread. It's important to promote public aquaculture educational programs to help raise awareness on how aquaculture and boating can coexist on the waterways. The Community Boating Center of New Bedford (www.communityboating.org) is considering such a program and working with the New Bedford Port Authority.

Organize town oyster/clam festivals to showcase and celebrate the value of local aquaculture.

Reach out to local and regional press to highlight restoration efforts as they progress. Coverage of such operations can raise awareness about the positive value of community aquaculture.

Production and Husbandry

Data indicates that South Coast growers on average are not being paid the same farm gate value per acre as other regional areas. Oyster quality in the South Coast does not appear to be lacking; growers may want to evaluate their market pricing and address any shortfalls in husbandry that may be affecting their production.

It is our contention that ½ acre lots are not scalable. Production is low, efficiency is lost and consequently promotes a part-time, "hobbyist" perception. Growers entering the industry should consider more ambitious acreage requests to give them room to expand and realize volume and sales. Towns should also recognize the economic restrictions imposed upon growers when limiting allotments to areas less than 2 acres.

The economics of raising hatchery oysters up through nursery culture requires various gear types for each step of the growout cycle. This can become quite expensive and for a small, owner/operator may be too much to take on initially. We encourage growers and municipalities to consider purchasing larger seed from a hatchery and raise them to harvest size in a shorter amount of time.

Build a coalition specific to the region, directly representing the growers along South Coast or the entirety of Buzzards Bay. This group could affiliate with such larger groups as the Massachusetts Aquaculture Association or East Coast Shellfish Growers Association, but would meet independently at biannual meetings. This “Growers Group” could incorporate other regional shareholders and welcome and educate new or prospective growers and showcase developments in husbandry, education and training opportunities, and state policy. As an entity, the Group could seek funding for multiple projects (protecting working waterfronts, economic development assessments, new gear testing and trials, localize training sessions, etc.) and could have a larger impact in community relations throughout the region through marketing, press, etc.

Consider leveraging interested private or non-profit parties to fund an economic assessment related to shellfish production capacities for scaled acreage (i.e. ½ acre increments) along with costs and labor associated with achieving maximum output/profit in inshore and open water growing scenarios. Such an assessment would provide valuable benchmarking for current and future operations along the South Coast.

Monitor Falmouth, Massachusetts’s “Rotational Aquaculture Plan” as it develops. The purpose of the Plan is to “both define specific locations that are potentially suitable for private shellfish aquaculture and to present an approach for managing aquaculture sites in a way that does not negatively impact other stakeholders.” If successful once implemented, there may be transferable applications for efforts specific to South Coast communities. Info here:

<http://www.falmouthmass.us/862/Falmouth-Rotational-Aquaculture-Plan>

APPENDIX 1: Project Partners

About CEI

CEI is a Maine-based, private non-profit 501(c)(3) Community Development Corporation (CDC) and Community Development Finance Institution (CDFI) with extensive experience with Maine's aquaculture industry. Based in Brunswick, Maine, CEI ranks among the nation's leading rural community development corporations CDCs/CDFIs. CEI's involvement in Maine's fisheries and marine trades sector spans our 40-year history. CEI has successfully managed a Fisheries Revolving Loan Fund originally capitalized by many private and public sources including the Economic Development Administration (EDA) in 1994. To date we have capitalized 237 loans in the sector amounting to \$17 million in direct loans and leveraging an additional \$55.6 million. These investments have created over 1,837 full-time jobs, and 265 part-time jobs and have supported harvesters, seafood processors, wholesale dealers, working waterfront infrastructure and sustainable shellfish aquaculture.

CEI has a robust programmatic initiative that supports the development of fisheries and aquaculture businesses in Maine and the northeast. CEI staff specialize in working with early stage and high-risk entrepreneurs. CEI brings its investment expertise and business and sector development experience to the project. These initiatives include sector-specific programs as well as 12 business counselors in three business counseling programs. CEI provides financing and technical assistance to fisheries and aquaculture businesses to improve the long-term viability of companies, create and maintain quality jobs in the sector, nurture and protect marine-related infrastructure, and ensure access to local, fresh and healthy food for all people. We also help evaluate the commercial feasibility of promising aquaculture technologies and business models.

CONTACT:

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Nick Branchina, Associate Director Nick.Branchina@ceimaine.org

207-504-5900

<https://www.ceimaine.org/consulting/natural-resources/fisheries-and-waterfront/>

About Garfield Foundation

The Garfield Foundation is a private grantmaking foundation that funds innovative models for change in three program areas: Collaborative Networks, Environmental Sustainability, and Community Revitalization.

They believe that a healthy business sector is necessary for invigorating local economies that create jobs, income and wealth for local residents. The Foundation supports innovators and their projects that:

- Support the development and expansion of neighborhood commercial corridors that generate positive outcomes for communities that have been traditionally marginalized by development processes.

- Accelerate the development of inclusive business and industry sectors in distressed urban communities that have the potential to invigorate local economies.
- Utilize collaborative stakeholder and community engagement processes that address systemic barriers to community revitalization.

While the Garfield Foundation’s intent is to support innovative approaches wherever they may be, geographically the Foundation prioritizes projects in the older industrial cities of New Jersey and Massachusetts as well as projects that integrate environmental sustainability.

About Santander Bank, N.A.

Santander Bank, N. A., formerly Sovereign Bank, is a wholly owned subsidiary of the Spanish Santander Group. It is based in Boston and its principal market is the northeast United States. It has \$54.7 billion in deposits, operates about 650 retail banking offices and over 2,000 ATMs, and employs approximately 9,800 people. It offers an array of financial services and products including retail banking, mortgages, corporate banking, cash management, credit card, capital markets, trust and wealth management, and insurance.

Santander’s Charitable Contributions Program

Santander Bank, N.A. Charitable Contributions Program makes donations to charitable organizations in the neighborhoods where their customers and colleagues live and work. They partner with programs that make a measurable difference in the lives of low- and moderate-income individuals and communities.

In addition to grant support, Santander volunteers can provide financial education, technical assistance, serve on Boards and assist with other organizational development needs.

Santander accepts grant applications from not-for-profit organizations operating programs that serve low-to-moderate income households within their three areas of focus:

- **Affordable Housing:** Supporting a range of affordable housing programs from homelessness prevention to home ownership.
- **Financial Education:** Promoting financial education with a focus on helping individuals with basic banking and budgeting, and the transition into the workforce or to college.
- **Economic Development and Neighborhood Revitalization:** Providing assistance to small businesses and aspiring entrepreneurs that create and maintain jobs in customers’ neighborhoods.

APPENDIX 2: Questionnaires

HARBORMASTER INTERVIEW QUESTIONS

1. How many leases are available in your town? How many active growers?
2. Are the available lease areas the best to conduct successful aquaculture growth?
3. What species are they raising?
4. What do you think likelihood of new species being introduced in the next 3-5 years is?
5. What is the coastal access like for the growers? (docks, waterfront access and land storage, etc.)
6. What is your perception of the leasing process?
7. What is your perception of the community's feelings towards your town's aquaculture?
8. How does aquaculture compare to commercial wild fishing in your town?
9. Do you believe aquaculture has a favorable impact overall on your community? What is the economic impact if any?
10. Do you think the stage is set for growth (either more acreage for existing growers or new growers with leases) in your town?
11. How would you describe the scale of aquaculture in your town? (*Too Little - Just Right - Too Much*)
12. IYO, are there impediments to expansion?
13. Who else should we be talking to?

GROWERS INTERVIEW QUESTIONS

1. How long have you been involved with aquaculture? What training did you have?
2. How big, how many, where are your sites? Do you want more?
3. What species are you raising? Are you considering others in the future?
4. What are your outlets for sales? Can you supply the demand? Do you do any marketing?
5. What is the coastal access like for you? (docks, waterfront access and land storage, etc.)
6. What is your perception of the leasing process?
7. What is your perception of the community's feelings towards aquaculture in your town?
8. Do you believe aquaculture has a favorable impact overall on your community? What is the economic impact if any?
9. Do you think the stage is set for growth (either more acreage for existing growers or new growers with leases) in your town?
10. How would you describe the scale of aquaculture in your town? (*Too Little - Just Right - Too Much*). Room for more?
11. Any other species could be raised in the future?
12. What do you see the future of aquaculture looking like along your coastline?
13. IYO, what are the barriers to expansion?

APPENDIX 3: Project Participants

We want to thank the following individuals for their time and open sharing of information for the assembly of this report. Stakeholders are listed in alphabetical order.

P J Gerald Beaudoin	Assistant Harbormaster	Town of Mattapoissett
Michael Besse	Owner/Operator	Indian Cove Aquaculture
David Beutel	Aquaculture, Planning and Procedures	RI Coastal Resources Management Council
Sean Bowen	Aquaculture Specialist	Massachusetts Department of Agricultural Resources
Chris Bryant	Owner/Operator	Bryant Brothers Shellfish Co.
Nat Bryant	Owner/Operator	Bryant Brothers Shellfish Co.
Garry Buckminster	Harbormaster	Town of Wareham
Stephen Caravana	Owner/Operator	Padanaram Oyster farm
Erik Chapman	Acting Director, Fisheries and Aquaculture Program Leader	N.H. Sea Grant Director's Office/Fisheries and Aquaculture Extension
Timothy Cox	Harbormaster / Shellfish Warden	FAIRHAVEN Department of Natural Resources
Tameka Favors	Community Development Grant Manager	Santander Bank
Bob Field	Owner/Operator	Copper Beech Farms
Dorothy Garfield	Owner/Operator	Cuttyhunk Shellfish Farms
Seth Garfield	Owner/Operator	Cuttyhunk Shellfish Farms
Tessa Getchis	Shellfish Business Development, Permitting	Connecticut Sea Grant/UConn Extension
Andy Herlihy	Executive Director	Community Boating Center
Myron Horzesky	Chief Operations Officer	Ketcham Trap
Gregory Houdelette	Chairman, Marine Resources Commission	Town of Marion
Capt. Brian Joseph	Assistant Harbormaster-Interim Director of Operations	City of New Bedford
Robert Ketchel	Wharfinger	Town of Mattapoissett
Steve Kirk	Coastal Program Manager, The Nature Conservancy	Massachusetts Shellfish Initiative
Dale Leavitt, Ph.D.	Professor - Marine Biology & Aquaculture Extension Specialist	Roger Williams University
Chris Leonard	Director of Marine Services	Town of Westport
Scott Lindell	Principal Investigator - Biology Dept.	Woods Hole Sea Grant and Cape Cod Cooperative Extension
Gabe Lundgren	Aquaculture and Shellfish Specialist	Massachusetts Division of Marine Fisheries

Kevin Madley	Aquaculture Coordinator for the Greater Atlantic Region	NOAA
Laura Maul	Massachusetts Department of Agricultural Resources	Ag Food Safety Improvement Program
Catherine Medina-Perez	Community Development Associate Grant Manager	Santander Bank
Steve Melo	Harbormaster	Town of Dartmouth
Justin Mortensen	Loan Officer	Farm Credit East
Adam Murphy	Shellfish Warden	Town of Marion
Isaac Perry	Harbormaster	Town of Marion
Josh Reitsma	Owner/Operator	Crooked Cove Oysters
Gwen Robinson	Director, Corporate Social Responsibility, Chief Legal Office and Corporate Affairs	Santander Bank
Christopher Schillaci	Aquaculture and Vibrio Specialist	Massachusetts Division of Marine Fisheries
Chris Sherman	President	Massachusetts Aquaculture Association
Jill R. "Sarge" Simmons	Harbormaster	Town of Mattapoissett
Eleni Sotos	Director of Operations	Garfield Foundation
Matthew Thompson	Aquaculture Project Lead	New England Aquarium
Gary Tripp	Harbormaster Assistant & Shellfish Deputy	Town of Westport
Michael Ward	Owner/Operator	Mattapoissett Oysters
Ed Anthes Washburn	Executive Director, New Bedford Port Authority	City of New Bedford
Orson Watson, Ph.D.	Consultant	Garfield Foundation