Aquaculture Development Plan Update
New Jersey: 2021- 2026

Molluscan Bivalve Shellfish

This Plan Update has been approved by the New Jersey Aquaculture Advisory Council, 2021.

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Executive Summary

The New Jersey Aquaculture Development Plan (Plan), first released in 1995 by the Aquaculture Development Task Force, is a framework to guide the development of the state's aquaculture industry. The intent is to identify potential limitations to current industry development and propose solutions that could be implemented within the next several years. The 2021 update builds upon the original Plan as well as updates produced in 2002 and 2011.

The New Jersey Aquaculture Advisory Council (AAC) is mandated to produce a Plan Update every five years, however, other industry priority items delayed the release of the last two Plan Updates. To ensure greater focus from the AAC and industry on updating the Plan in a timelier manner in the future, this current version (2021) will be used to direct the AAC priorities over the next several years. The goal of this is two-fold: (1) to keep priority status on the items within this Plan Update even as other items may arise; and (2) to make sure the AAC periodically evaluates whether recommendations are adequately addressed by the appropriate entities. This will ensure the Plan Update is a working document and recommendations move towards implementation.

Recommendations
The recommendations contained within this Plan Update range from immediate actions (e.g., AAC form a marketing committee) to longer-term processes (e.g., changing the USDA specialty crop program to include farmed shellfish). This document is prepared for the Governor, the Legislature, and the citizens of the State of New Jersey.

Acting Authorities are identified in each sections recommendations and are entities that have the power (authority) to institute the recommended changes. Many of the Acting Authorities included with the recommendations were part of the Plan Update development process.

Many of the recommendations included in this Plan Update expressly call for further work to narrow down the specific needs of the industry. This Plan Update will serve as a template to guide future AAC meeting discussions, with the goal of resolving some recommendations and moving others to a final recommended action in a future Plan Update.

Marketing Recommendations

Recommendation: Form marketing committee in the AAC to develop immediate and long-term marketing options for the industry.

Recommendation: Regulatory amendment to include farmed fish and shellfish promotion under the Jersey Fresh program.

Recommendation: Support efforts that move farmed seafood under the specialty crop program or create a separate funding source within the USDA for this commodity group.

Recommendation: State legislature to appropriate and allocate funds to promote New Jersey farmed seafood over the next five years.

Recommendation: Aquaculture industry within NJ examine possible long-term funding solutions for marketing and promotion.

Recommendation: Develop guidance on shellfish aquaculture agritourism practices that complies with applicable regulations.

Leadership Recommendations

Recommendation: Continue to strengthen current efforts (e.g., SAWG) to recognize the NJDA Office of Aquaculture Coordination as the lead for industry development and coordination of regulatory interactions.

Recommendation: Fill vacancies on councils that oversee the shellfish aquaculture industry— Aquaculture Advisory Council, Delaware Bay and Atlantic Coast Shellfisheries Councils, and Tidelands Resource Council.

Recommendation: Review composition of AAC given changes to member agencies and industry since first created via NJ Aquaculture Development Act. Process of evaluating representation should consider potential increase in industry seats on the Council. Changes require statutory amendments.

Recommendation: Develop an appropriate method to have shellfish aquaculture interests represented and considered by the Tidelands Resource Council.

Recommendation: Support the engagement of members of the shellfish aquaculture community on County and State Agriculture Boards.

Permitting Recommendations

Recommendation: Consolidate state-level applications within a single common application using the Aquatic Farmer License application as a template.

Recommendation: Enact the same long-term renewal timeframes for DLRP permits and Tidelands Licenses, allowing growers to renew both items at the same time.

Recommendation: Modify Tidelands Policy relating to shellfish aquaculture activities to make the upland owner notification and objection process consistent and consolidated with that of the DLRP General Permit 30 public notice. Rather than require shellfish growers acquire public permission, require the objecting public to act, making their objections known during the review process.

Recommendation: Establish a clear and reasonable distance offshore from which landowner public trust rights extend for issuance of a Tidelands License.

Recommendation: Release the annual State Vibrio Control Plan 90 days in advance of the action start date.

Recommendation: Allow shellfish growers operating in subtidal waters to harvest immediately before inshore transport, provided appropriate time-to-temperature regime employed (e.g., 4 hours).

Recommendation: Determine process for, and implications of, allowing shellfish growers to harvest 7 days per week (e.g., enforcement changes & funding). Legislative change required to allow harvest on Sunday.

Hatchery & Nursery Recommendations

Recommendation: Develop a DLRP General Permit for in-water nursery activities. This needs to include consideration of nursery systems associated with areas outside of Commercial Shellfish Leases (e.g., boat slip, dock).

Recommendation: Provide financial incentives for nursery and hatchery development (e.g., low interest loans, grants, tax breaks, energy savings for hatchery and nursery operations).

Recommendation: Streamline seed importation permit process, via (1) State participation in Regional Shellfish Seed Biosecurity Certification Program; and (2) extension of acceptance time limits for seed health evaluations from 30 to 45 days. This will retain the high degree of disease testing and review but allow for a more appropriate administrative timeframe.

Recommendation: Explore options, particularly those already supported by the NJ Coastal Management Program, to enhance and develop resilient working waterfronts that can provide land-based infrastructure for shellfish aquaculture.

Recommendation: Develop guidance on building hatchery & nursery facilities within specific planning areas of CAFRA, and size and location conditions that may apply (e.g., impervious surface percentages). Include path to streamline permitting of land-based hatchery & nursery facilities within a General Permit during future rule amendments.

Lease Recommendation

Recommendation: Request a Shellfisheries Councilmember or NJDEP, Bureau of Shellfisheries staff member provide a periodic update on leasing and lease utilization to the AAC. Further discussions on the topic may result in additional ideas for lease use promotion as well as identification of potential conflicts (e.g., shellfish lease where finfish could be grown).

Agriculture Program Recommendations

Recommendation: Develop specific production value thresholds for shellfish farm operations under 5 acres.

Recommendation: Determine how to incorporate the spatially distinct components of shellfish aquaculture— hatchery & nursery systems, leases, dealer facilities— into a right to farm program.

Recommendation: Reevaluate the current aquaculture AMP document to determine what changes may be required to better suit the current industry.

Recommendation: Develop a differential tax program for aquaculture which mirrors programs provided for terrestrial agriculture (e.g., develop a "Coastal Conservation Program").

Research Recommendations

Recommendation: Conduct bi-annual research roundtable and needs assessment with the shellfish community to establish industry-based research priorities.

Recommendation: Conduct research to address industry needs, including, but not limited to biofouling control, reduction of vibrio public health risks, understanding wildlife interactions, disease processes, and specialization of gear for challenging grow out conditions.

Recommendation: Expand the state research capacity and facilities to maintain a genetics and shellfish disease program tailored to N.J. coastal environmental conditions and shellfish grower needs.

Recommendation: Develop a research program to understand how environmental shifts in temperature, salinity, wind, oxygen, freshwater inputs, storm frequency, and the interactions between these parameters will alter shellfish habitat, distribution, diseases, and food sources.

Recommendation: Develop a comprehensive spatial plan for shellfish aquaculture in New Jersey, based on current aquaculture suitability research as well as decades of work by the Shellfisheries Council/NJDEP.

Workforce Development Recommendations

Recommendation: Establish professional development programs for the recruitment and training of aquaculture entrepreneurs, managers, and workers. The Continuing Education short courses administered by Rutgers University may be a good style to replicate.

Recommendation: Establish career development opportunities, courses, and training programs for students (high school and undergraduate) to be exposed to career paths and jobs (internships) in aquaculture.

Recommendation: Review existing agriculture training programs in New Jersey to determine how those could be adapted, or applied, to aquaculture.

Recommendation: Explore the option of a mentorship program where prospective growers can learn from those already in the industry.

New Opportunity Recommendations

Recommendation: Develop a mechanism to enable pilot programs that advance aquaculture of native macroalgal candidate species in State waters.

Recommendation: The New Jersey Aquaculture Advisory Council should be considered a priority stakeholder for any discussions of aquaculture within the region's federal waters (e.g., waters off New Jersey and neighboring states). The AAC will keep up to date on national policy development for federal waters.

Outline of Plan Update

The 2021 Plan Update is formatted so that each topic area can be read and used independent from the entire Plan Update document. Any relevant references are included at the end of the section.

The Plan Update process commenced in 2019 and ran through 2021. This means that the impacts of Covid-19 restrictions were considered for inclusion within the recommendations. The industry requested that the Plan Update not focus on the 2020 impacts but rather focus on broader items that could aid through good and bad years. Since the impacts from market closures and other restrictions were so severe, the Covid-19 pandemic could not be entirely ignored in this Plan Update. To ensure some context was provided on impacts to NJ growers, a brief section on the industry under pandemic conditions is included after the topic area sections.

Introduction

Purpose of the Plan Update

The 2021 Aquaculture Development Plan Update for Molluscan Shellfish (Plan Update) is intended to review the current aquaculture industry in New Jersey and provide a roadmap for development based on industry needs. The Plan Update builds upon the original 1995 Aquaculture Development Plan as well as Updates provided in 2002 and 2011.

According to the 1995 Aquaculture Development Plan, the Plan and subsequent Updates are intended to:

- Identify the current status of the industry within the state,
- Examine the constraints to private sector aquaculture development,
- Formulate a strategy to remove or reduce the constraints,
- Outline a realistic development program for private aquaculture, and
- Provide for appropriate public sector assistance in its development.

This Update to the original 1995 Aquaculture Development Plan provides a framework for continued advancement of the shellfish aquaculture industry within New Jersey. It has been produced by the New Jersey Aquaculture Advisory Council (AAC) in consultation with the shellfish aquaculture industry. Initial materials for the Plan Update, including the outline of topic areas and administration of a grower survey, were provided by a Committee of the AAC that included industry representation as well as Councilmembers. The focus of this document is shellfish aquaculture; other species will be added to future Plan Updates. This document is prepared for the Governor, the Legislature, and the citizens of the State of New Jersey.

Vision

Advance the State's support of aquaculture, where the industry can 1) innovate according to market demands and environmental shifts; 2) develop specific to New Jersey's capacity for growth; and 3) succeed in marketing products to local and regional consumers.

Current Status

World Aquaculture Production

In 2018, world aquaculture production was estimated at 114.5 million tonnes (252.4 billion pounds) in live weight, with a total farmgate sales value of USD 263.6 billion.[1] That was a record high for worldwide production. Out of the total production, 82.1 million tonnes (180.8 billion pounds) were from the culture of aquatic animals (value of USD 250.1 billion).[1] Based on information for 2020, however, global aquaculture production is expected to fall by 1.3%, the first noted decrease from that sector in several years.[2] The COVID-19 pandemic-related impacts to commerce and labor as well as market changes experienced by the aquaculture sector (e.g., reduced demand for fresh fish) throughout 2020 are likely to continue to influence production levels for several years into the future.[3]

United States Aquaculture Status

Total aquaculture production— marine and freshwater— in the United States was estimated at 680 million pounds in 2018.[4] Although that accounts for a nearly 8% increase in production volume compared to 2017, the US remains 17th globally in terms of aquaculture production.[4] The value of US aquaculture remained unchanged from 2017 to 2018, with an estimated $1.5 Billion in value from all products.[4,5] Unfortunately, even with increased aquaculture production, the US increased the seafood trade deficit again in 2019 to $16.9 Billion.[4] (Of note, aquaculture production in the NOAA, NMFS report is for 2018 while the fisheries data is for 2019.)

At the time of this Plan Update, there was limited industry-wide data to capture national losses due to COVID-19 restrictions imposed in 2020. The best source of information related to aquaculture was from the Virginia Tech Seafood Agricultural Research and Extension Center and The Ohio State University Extension quarterly surveys of industry participants. The first survey had the highest response rate with "652 responses, of which 537 were sufficiently complete to be usable. Based on the 2018 Census of Aquaculture, this represents approximately 18% of all U.S. aquaculture operations."[6] Most significant from the first quarter survey was a reported 90% of respondents impacted by COVID-19.[6]

Long-term, the impacts to the industry from the on-going COVID-19 pandemic may be felt for several years. In the shellfish aquaculture sector for instance, the potential loss of planting in one year will be noticed years later due to the time required for these species to reach market size. This could depress industry sales until farmers can regain pre-pandemic crop rotations (e.g., yearly selling and buying cycle).

New Jersey Aquaculture Status

The United States Department of Agriculture (USDA) National Agriculture Statistic Survey (NASS) Census of Agriculture and Census of Aquaculture[7] provide the best long-term view of aquaculture trends within New Jersey. The USDA Census of Aquaculture provides species-specific sales figures, which are included below for oysters and hard clams. All sales data from the USDA NASS are reported in dollars for the year of the survey. To compare sales figures between the Census years, sales data in this section are also adjusted for inflation using yearly Consumer Price Index values.[8] The adjusted sales data are reported in 2018 dollars.

Two state-level sources of data can yield additional insight into molluscan shellfish aquaculture industry changes in recent years. These resources include: 1) The New Jersey Shellfish Aquaculture Situation and Outlook Reports produced by Rutgers University (2012-2016)[9], and 2) harvest numbers reported by growers as required for the Commercial Shellfish Aquaculture Permit administered by the NJ Department of Environmental Protection (NJDEP, harvest reports for 2017-2020).

Total Production

According to the USDA NASS Census data, total aquaculture production in New Jersey peaked in the years following the last ADP Update in 2011 (Table 1). The highest reported sales for total aquaculture production within New Jersey was in 2013 with only 53 reporting farms. The number of reporting farms in the most recent Census report (2018) was similar to that of the 2013 Census, however, the 2018 reported sales were less than half the sales reported in 2013, when viewed in 2018 dollars.

New Jersey aquaculture growth, measured as increasing sales reported in the USDA NASS Census data, has eroded since the 2013 peak. To ensure confidentiality, the USDA NASS does not identify reporting farms, limiting analysis into why the industry is reporting reduced sales over the past two Census years (regardless of the number of reporting farms).

Table 1: Total aquaculture production reported from NJ farms over all Census years.[10-20]

Year	Farms	Sales (Census year dollars; $1,000)	Sales (2018 dollars; $1000)
1987	16	268	592
1992	33	331	592
1997	41	1,524	2,384
1998	28	5,787	8,915
2002	50	2,223	3,103
2005	87	3,714	4,775
2007	116	6,637	8,039
2012	94	12,396	13,557
2013	59	13,835	14,910
2017	107	8,876	9,093
2018	52	7,218	7,218

Mollusk Production

The highest sales value for farms reporting Mollusk production was in 2013. That same year, the lowest number of reporting farms was recorded since the first Census year (1998) (Table 2). In 2018, the number of reporting farms dropped again, to only 37 farms, with reported sales continuing to decline from the year prior.

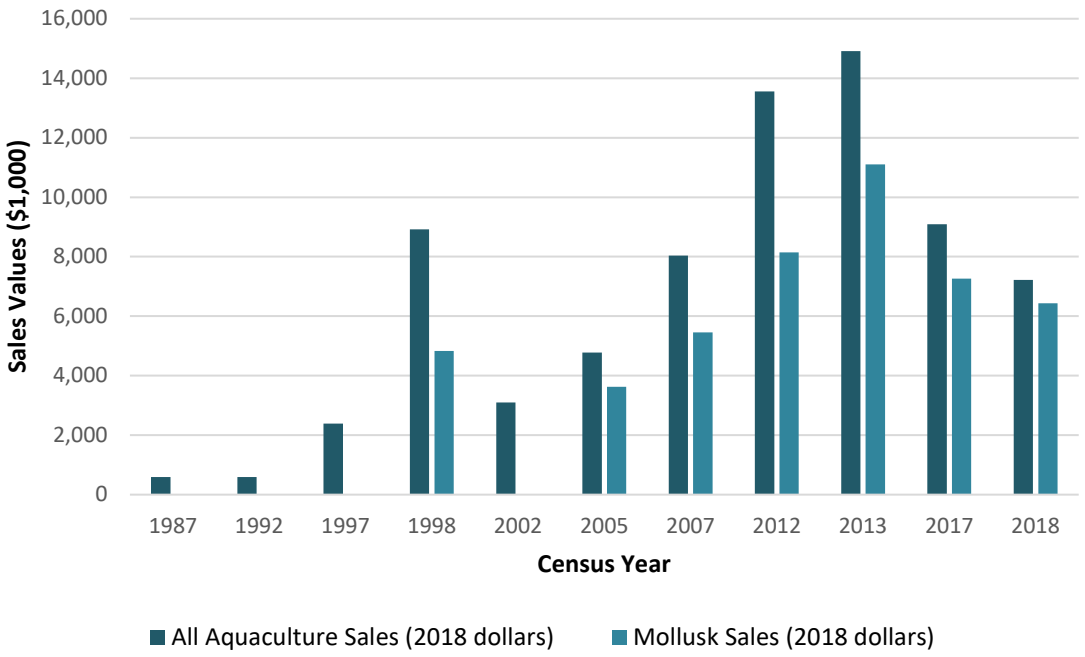

Figure 1: Total Aquaculture Sales Values and Mollusk Sales Values for New Jersey over all Census Years. Values reported in 2018 dollars. The years without data for mollusks are due to lack of data collection, not indicative of lack of industry.[10-20]

Table 2: Total mollusk production reported from NJ farms over all Census years.[13,15-20]

Year	Farms	Sales (Census year dollars; $1,000)	Sales (2018 dollars; $1,000)
1998	16	3,134	4,828
2005	67	2,820	3,626
2007	73	4,504	5,456
2012	59	7,446	8,143
2013	50	10,303	11,103
2017	69	7,086	7,259
2018	37	6,433	6,433

Mollusk production can be further refined to clam production (including all clams due to one year of surf clam production limiting hard clam data reporting) and oyster production. The number of farms reporting clam production fluctuated with no clear trend in the four years where data are assigned to species (Table 3). Sales over those four reporting years similarly have no trend, perhaps due to limited years of data. The 2018 reported sales total is the lowest of all four years (according to values in 2018 dollars) with the peak number of reporting farms and sales (in 2018 dollars) in 2005.

Table 3: Clam production reported from NJ farms in the Census of Aquaculture.[13,15,18,20]

Year	Farms	Sales (Census year dollars; $1,000)	Sales (2018 dollars; $1,000)
1998	14	1,574	2,425
2005	51	2,098	2,697
2013	39	2,334	2,515
2018	21	2,226	2,226

The number of farms reporting oyster sales had remained relatively constant in the 2005, 2013, and 2018 survey years (Table 4). Sales (in 2018 dollars), however, fluctuated drastically from $930,000 in 2005 to a peak of almost $8.6 million in 2013, and declined to $4.2 million in 2018. The data do not show if the same farms are reporting within each survey (and reporting lower sales from the same farms), or if there is turn-over in the industry that happens to retain the near constant number of reporting farms. The latter scenario of industry turn-over could result in lower sales if newer farms are at lower production levels in the 2018 survey.

Table 4: Oyster production reported from NJ farms in the Census of Aquaculture.[13,15,18,20]

Year	Farms	Sales (Census year dollars; $1,000)	Sales (2018 dollars; $1,000)
1998	2	(D)*	(D)*
2005	17	723	930
2013	19	7,969	8,588
2018	18	4,208	4,208

*(D) is reported in a Census, and data are withheld, to avoid disclosing individual farm sales.

Comparing the sales figures (in 2018 dollars) for clams and oysters reveals a transition that New Jersey industry members have noted— movement towards greater oyster production from newer industry entrants and an aging clam sector that is not being replaced with new farmers. The Census data shows evidence for this shift in species with decreasing values for clam production since the 2005 census, yet

oyster values peaked in the 2013 Census year. Producers of both species reported lower values for the 2018 Census (relative to their respective peak years), which may be due to other factors.

Data from the Rutgers University led NJ Shellfish Aquaculture Situation and Outlook Report (Table 5) shows a peak in reported harvest for hard clams and oysters for 2013, consistent with the data from the USDA. According to the five years of data, oyster harvest numbers were increasing yearly as the hard clam numbers fluctuated from year-to-year. Due to low survey responses from hard clam producers, the Rutgers study ceased in 2016, a year when only oyster production could be reported. Comparing the number of farms from the USDA and Rutgers studies, the Rutgers data are likely an underreporting of harvest for the study years.

Table 5: Summarized data from the New Jersey Shellfish Aquaculture Situation and Outlook Reports. All years are included (2012-2016).[21-25]

Year	Species	# Reporting Farms	Est. Value ($)	Number Harvested
2012	Oysters	11	760,920	1,492,000
	Hard Clams	7	660,000	4,000,000
	Total	**18**	**1,420,920**	**5,492,000**
2013	Oysters	8	860,431	1,573,000
	Hard Clams	9-10	1,522,796	9,238,600
	Total	**17-18**	**2,383,227**	**10,811,600**
2014	Oysters	7	981,151	1,627,669
	Hard Clams	7	586,500	2,950,000
	Total	**14**	**1,567,651**	**4,577,669**
2015	Oysters	10	1,121,947	1,782,000
	Hard Clams	11	1,517,960	7,776,500
	Total	**21**	**2,639,907**	**9,558,500**
2016	Oysters	19	1,370,060	2,029,500
	Hard Clams	not enough to report	N/A	N/A

2012: 11 oyster surveys returned, 12 growers known to be active in industry; 15 hard clam surveys returned, only 7 reported usable data.
2013: 12 oyster surveys returned, only 8 reported data; 16 hard clam surveys returned, 9 reported numbers harvested and 10 reported values.
2014: 10 oyster surveys returned, only 7 reported data.

Per the federal Food and Drug Administration (FDA), the State is required to collect harvest data from the previous year as part of the Commercial Shellfish Aquaculture Permit application process. The initial permitting year in New Jersey, 2017, did not require harvest data reporting but is included because the number of permits for that year can be a proxy for operating farms in 2017.

According to the production data from the permit applicants (Table 6), there is a continued decrease in shellfish aquaculture in New Jersey that was noted above with the USDA Census data. The data between these two sources cannot be combined given the differences in collection methods and data reported, but independently, they are showing the same decreasing production trend over the last decade.

Table 6: Yearly harvest data from 2017 to 2020 for eastern oysters (EO) and hard clams (HC), collected as part of the application process for an NJDEP permit.

Application Year (Number of Aquaculture Permits Issued)	Production Year	EO	HC	Total
2017 (73)	2016*	no data	no data	N/A
2018 (69)	2017	6,588,449	10,354,800	16,943,249
2019 (61)	2018	5,661,081	10,094,000	15,755,081
2020 (64)	2019	5,967,200	8,022,500	13,989,700
2021 (57)**	2020	4,090,785	5,255,795	9,346,580

*Required collection of prior year production numbers began in application year 2018 with 2017 harvest data.
**Applications for year 2021 may be received throughout the calendar year, potentially increasing the final 2020 production data.

Observationally, an increasing number of new farms are producing oysters, including larger scale operations within the deeper waters of the Delaware Bay. Based on all the data provided above, it is likely that one component of the overall production decrease for molluscan shellfish is a result of the transition noted above— hard clam growers are leaving the industry as it becomes more reliant on oyster production.

Weather Events
Several significant weather events since the last Plan Update in 2011 may have influenced aquaculture production. In the fall of 2012, Superstorm Sandy made landfall in New Jersey resulting in extensive damage to the shellfish industry. The Atlantic Coast growers experienced the greatest damage from the storm, resulting in over wash burial of clam farms, moved and destroyed oyster gear, vessels forced inland of waterways, and land-based operations completely razed. Since this event was in the fall of 2012, it would have been expected that the 2012 and 2013 reported farms and sales would be depressed in those years. The number of reporting clam farms is lower in the 2013 Census relative to the 2005; however, the number of farms decreases again in 2018, indicating that there may be additional factors influencing the industry decline. It is possible that the losses from Sandy in 2012 were the final push for some growers to leave the industry.

During the winter of 2017-2018, Delaware Bay growers faced winter ice formations along the Cape Shore region during an exceptionally cold winter. When the ice moved offshore, gear and oysters overwintering in the gear were carried away with the ice and subsequently lost. Those winter losses may have impacted the 2018 oyster production and data reporting.

Red Knot Listing
Previously a candidate for listing since 2006, the red knot (*Calidris canutus rufa*) was federally listed as a threatened species via rulemaking on December 11, 2014 with an effective date of January 12, 2015.[26] Once a species is listed, the consultation requirements under Section 7 of the Endangered Species Act (ESA) go into effect. [26]

The year following listing involved a lengthy consultation process to ensure the shellfish aquaculture industry along the Cape Shore region of Delaware Bay could continue operating while minimizing and

accounting for unavoidable adverse effects to red knots. The result of the yearlong process was inclusion of Conservation Measures— restrictions on activity and gear for intertidal and nearshore subtidal farms— into the U.S. Army Corps of Engineers permitting. The Conservation Measures were negotiated among the U.S. Fish and Wildlife Service (USFWS), the Army Corps, and the State, with input from growers, conservation groups, and outside experts. Based on the Conservation Measures, the USFWS issued a Programmatic Biological Opinion that continued aquaculture operations will not jeopardize the existence or recovery of the rufa red knot.[27] Additionally, the consultation process affords growers legal protection against unintentional violations of the ESA's prohibition on "take" of listed species, since any take that may occur is accounted for in the Programmatic Biological Opinion as long as the aquaculture activities are carried out in compliance with the Conservation Measures.[27]

Using the principles of adaptive management, the Conservation Measures undergo a yearly review by a committee comprised of growers, conservation groups, and researchers.[26,28] The Conservation Measures can be changed to allow greater flexibility to the growers or more restrictive and protective of the red knots. Since the original set of measures was designed to be conservative when dealing with uncertainty (giving the benefit of the doubt to protect the listed species), the measures to date have only been changed under this process to allow for greater operational flexibilities that do not impact the level of red knot protection. The yearly process has occurred since 2016.[28]

COVID-19

In 2020, all growers faced economic disruptions with COVID-19 precautionary measures, mainly the closure of food service establishments. More information on the direct impacts from coronavirus disease-related closures is included at the end of the Plan Update.

Grower Survey

To include industry involvement throughout this Plan Update, a survey at the beginning of the development process (2019) was used to capture growers' priorities. The survey was developed and administered by the Plan Update Committee with the goal of ensuring priority topic areas identified by the Committee were reflective of industry-wide priorities. Members of the industry were also actively engaged in the Plan Update process through their role as a member of the AAC (industry representatives), through inclusion on the Plan Update Committee, and as attendees at meetings to discuss the Plan Update.

Administered via the online platform Qualtrics, the survey requested that participants rank topic areas as one of the following: (1) Extremely Important, (2) Very Important, (3) Moderately Important, (4) Slightly Important, and (5) Not Important. The survey only addressed the molluscan shellfish aquaculture industry and was only sent, via email, to lease and permit holders as of April 4, 2019. It did not capture the interests of prospective growers or those who entered the industry after the initial survey date.

Results

The survey site was visited 64 times with 46 complete survey responses. Site visits could include those on the committee or AAC viewing the survey and are not indicative of non-responses. The number of completed surveys is higher than the total USDA Census reporting farms for 2018 (37 farms reported mollusk production). As of April 30, 2019, there were 49 Commercial Shellfish Aquaculture Permits issued, which is a fair metric of the active industry at the time of the survey. Approximately 94% of the shellfish

aquaculture industry active as of survey date completed the survey on industry priorities (roughly 75% of all growers permitted in 2019).

Overall, industry members responding to the survey indicated a common set of priorities. The most important items to survey respondents (ranked as (1) Extremely Important or (2) Very Important) are grouped below according to three broad categories.

Results Groupings:

1. Industry Inclusion in Regulatory Processes
    a. Fill Council vacancies*
    b. Promote Council engagement
    c. Review Council composition
    d. Representation on Tidelands Resource Council

2. Recognition of the Industry as Agriculture
    a. Extend agriculture programs
    b. Right to farm

3. Permitting
    a. Ease nursery permitting
    b. Streamline permitting

*Top priority of survey respondents is to fill Council vacancies. This may include the AAC as well as the Shellfisheries Council and Marine Fisheries Council.

In addition to the above groupings, there were topic areas that most respondents indicated were of (3) Moderate Importance or greater (scores of 1-3). These items are included here because they may relate to the top three groupings.

1. Additional items
    a. Document ecological benefit
    b. Document economic value
    c. Hatchery Development
    d. Research Needs

Of the four items listed as additional immediately above two are included in the 2021 Plan Update— the H*atchery Development* topic area is joined with the need for streamlined nursery permitting, while the *Research Needs* topic is included as a separate section. The ecologic and economic categories are not included due to resource limitations. If they are to be addressed by the AAC, that will be via another document.

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Recommendations

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MARKETING

Rationale: *Jersey Fresh* is a successful advertising, promotion, and quality standards program for New Jersey grown fruits and vegetables. Since the mid-1980s, the program has been widely recognized by consumers to signify quality, local produce. Funding to support the *Jersey Fresh* program is provided at the state and federal level, albeit at continuously diminishing levels.

Several additional marketing programs grew from the *Jersey Fresh* successes; the most notable for this document being *Jersey Seafood*. The promotional materials for *Jersey Seafood* focus on the high-quality fish and shellfish being harvested, grown, and landed in New Jersey. Significant effort early in the *Jersey Seafood* program helped bring additional recognition to New Jersey's wealth of fresh, healthy seafood, but there was never any widespread adoption of the program among industry members. ***The most significant issue for the discrepancy in program success is that the Jersey Fresh program is financially supported, while the Jersey Seafood program does not receive programmatic funding from any government sources***. Lacking support, the *Jersey Seafood* program was never as robust as it could have been, nor did the early efforts translate into long-term success.

Members of the shellfish aquaculture industry have pointed to the *Jersey Fresh* program as a better option for future marketing efforts due to the high level of recognition among consumers and to highlight aquaculture as a farming activity. Using the *Jersey Fresh* promotional materials would require state-level regulatory change to incorporate farmed fish and shellfish within the program. Unfortunately, that would only be a small step towards greater support for the aquaculture industry without funding to successfully implement the program.

Federal funding for the *Jersey Fresh* program is allocated via the specialty crop block grants from the U.S. Department of Agriculture (USDA). As long as farmed seafood is not an eligible commodity for specialty crop funding, changing the state-level marketing program will do little to advance efforts. Sustained, yearly funding is required for a successful marketing campaign.

Recommendation: Form marketing committee in the AAC to develop immediate and long-term marketing options for the industry. [Agency Action]

Acting Authority: NJ AAC

Recommendation: Regulatory amendment to include farmed fish and shellfish promotion under the Jersey Fresh program. [Regulatory Change]

Acting Authority: State Board of Agriculture; NJDA

Recommendation: Support efforts that move farmed seafood under the specialty crop program or create a separate funding source within the USDA for this commodity group. [Interagency Action]

Acting Authority: NJDA, NJ Farm Bureau, NJ Congressional Representatives

Recommendation: State legislature to appropriate and allocate funds to promote New Jersey farmed seafood over the next five years. [Legislative Action]

Acting Authority: NJ State Legislature

Recommendation: Aquaculture industry within NJ examine possible long-term funding solutions for marketing and promotion. [Interagency Action]

Acting Authority: Aquaculture Industry with support from State agencies, AAC

Agritourism

Rationale: In the simplest of terms, agritourism is tourism at a farm. It involves bringing customers to a working, commercial farm for an experience, event, or educational opportunity to provide a supplemental economic benefit to the farmer. Agritourism is a popular method for increasing farm sales in New Jersey. The shellfish aquaculture industry is increasingly looking at ways to add this revenue stream to their farming operations. Shellfish aquaculture, however, is unlike its terrestrial agriculture counterparts in that there are several obstacles to allowing visitors onto their farms. The shellfish aquaculture industry must balance greater oversight due to the farms location, species grown, and handling requirements at harvest, with the desire for guests to have in-person experiences of shellfish farming. Due to the nature of the industry, greater consideration must be afforded to this marketing avenue.

Recommendation: Develop guidance on shellfish aquaculture agritourism practices that complies with applicable regulations. [Interagency Action]

Acting Authority: AAC, Aquaculture Industry, State agencies

Strengthen Leadership and Representation

Rationale: Authority for the implementation and development of New Jersey's shellfish aquaculture rules, regulations, and policies is presently distributed across several agencies, departments, divisions and councils. To address this situation of wide-ranging leadership, New Jersey state agencies established of a Shellfish Aquaculture Workgroup (SAWG)— an informal workgroup of the agencies involved with New Jersey shellfish aquaculture. One of the goals was to foster a more uniform approach to industry development and oversight. The SAWG has made progress enhancing interagency communication; however, there are no mechanisms, at present, to require interdepartmental cooperation towards uniform goals for shellfish aquaculture. The current system (SAWG and other cooperative efforts) is the result of strong partnerships between current staff and Administrators.

Representation of the industry within the regulatory process is also a concern with the Councils that advise on or regulate aquaculture operating without the timely appointing of new members. This includes vacancies on the New Jersey Aquaculture Advisory Council (AAC), Shellfisheries Council (Atlantic Coast and Delaware Bay sections), Marine Fisheries Council, Fish and Game Council, and Tidelands Resource Council. The AAC, Shellfisheries Council, and Tidelands Resource Council currently have long-term vacancies and are not operating at full membership. Both the Atlantic Coast and Delaware Bay Sections of the Shellfish Council are lacking the full complement of five members, creating a challenge with respect to advancing a quorum and decision-making. Furthermore, the composition of the Tidelands Resource Council lacks representation from the aquaculture sector. It is critical that Councils function with full membership and that authorizing legislation outlining membership be reevaluated to ensure the perspective of stakeholders from the aquaculture community are represented.

Finally, with the growth of the shellfish farming sector in New Jersey and the present engagement of shellfish farmers on County Boards of Agriculture, there has been an increased appreciation of the value of, and challenges faced by, the sector among agricultural communities. Likewise, shellfish farmers have become more knowledgeable of their agricultural counterparts. It is favorable for land and sea farmers to continue to strengthen their relationship through valued partnerships and participation on County and State Agriculture Boards.

Recommendation: Continue to strengthen current efforts (e.g., SAWG) to recognize the NJDA Office of Aquaculture Coordination as the lead for industry development and coordination of regulatory interactions. [Interagency Action]

Acting Authority: NJDA, NJDEP, NJDOH

Recommendation: Fill vacancies on councils that oversee the shellfish aquaculture industry—Aquaculture Advisory Council, Delaware Bay and Atlantic Coast Shellfisheries Councils, and Tidelands Resource Council. [Executive & Legislative Action]

Acting Authority: Governor and Legislature (appointing entities)

Recommendation: Review composition of AAC given changes to member agencies and industry since first created via NJ Aquaculture Development Act. Process of evaluating representation should consider potential increase in industry seats on the Council. Changes require statutory amendments. [Interagency & Legislative Action]

Acting Authority: NJ AAC, Legislature

Recommendation: Develop an appropriate method to have shellfish aquaculture interests represented and considered by the Tidelands Resource Council. [Interagency Action]

Acting Authority: Tidelands Resource Council, AAC, State agency staff supporting Councils

Recommendation: Support the engagement of members of the shellfish aquaculture community on County and State Agriculture Boards. [Interagency Action]

Acting Authority: County Agriculture Boards, State Board of Agriculture, Shellfish Growers

Streamline Permitting

Rationale: Aquaculture rules, regulations, and policies in New Jersey are presently distributed across various agencies, departments, and divisions. The patchwork of rules regulating shellfish aquaculture has created a potential barrier to more efficient industry development due to a confusing permitting process that can be challenging for applicants to navigate. Modifying regulations to recognize the specific needs and special circumstances of aquaculture will ultimately support a sustainable and profitable industry.

Several important advancements to improve State permitting for shellfish aquaculture have been made since the 2011 Aquaculture Development Plan Update. First, the establishment of State Aquaculture Development Zones (ADZ) facilitated shellfish farming activity in Delaware Bay waters of New Jersey by providing pre-permitted leases for aquaculture operations. Farming within the inshore ADZ (ADZ-4) began in 2012, while one offshore ADZ lot was leased as of 2018. Expansion planning for ADZ-4 also began in 2018, however, at the time of this publication, issuance of new ADZ leases was halted due to a need for legal review of lease agreement language. In 2019, two growers were provided lease lots within ADZ-4 to move their farming operations out of leases north of the state growing area. This was due to red knot restrictions on lease use and not a result of formal lease expansion processes.

Second, a three-tier permitting system was developed within New Jersey Department of Environmental Protection (NJDEP) Division of Land Resource Protection (DLRP; formerly Division of Land Use Regulation) specific to the construction, placement, and maintenance of aquaculture gear on shellfish leases. The new permitting system, added in 2013, clarified the application process and created a General Permit to cover most aquaculture gear types, reducing the time and cost associated with obtaining a Waterfront Development permit. DLRP also assigned a staff expert to work with the aquaculture community to facilitate the application process.

Third, an interagency workgroup (Shellfish Aquaculture Work Group or SAWG) was created in 2014 and after a break in 2016-2017, has been meeting regularly since early 2018 to review issues and policies related to aquaculture. The SAWG has worked to clarify permits, streamline the permitting process, and coordinate review of permits. Based on the management efforts commenced in the SAWG, DLRP staff now routinely coordinate with U.S. Army Corps of Engineers staff on projects to expedite the permitting process.

Finally, the Tidelands Resource Council clarified their policy relating to shellfish aquaculture in 2017 after initially developing a policy in 2010. The 2017 policy includes fees for structure on a lease as well as a Floating Upweller System (FLUPSY) nursery installation. These aquaculture policies streamlined the process for shellfish aquaculture project review and approval.

In addition to the above items to improve the permitting process, another permit was added to the suite required of shellfish growers since the 2011 Plan Update. A Commercial Shellfish Aquaculture Permit within the NJDEP Bureau of Marine Water Monitoring (BMWM) was developed to comply with the National Shellfish Sanitation Program (NSSP) Model Ordinance. To satisfy immediate federal pressure for compliance, the permit was placed within a rule that was in queue for legal review in 2015 (adopted in 2016). Enaction of the permit further expanded the number of NJDEP agencies engaged in the process of permitting aquaculture. At the time, the New Jersey Department of Agriculture (NJDA) Aquatic Farmer License (AFL) was noted as serving the same role as the new permit; however, the need for farm

inspections and the NJDEP authority to regulate superseded the use of an already implemented authorization for shellfish aquaculture.

Recommendation: Consolidate state-level applications within a single common application using the Aquatic Farmer License application as a template. [Interagency Action]

Acting Authority: NJDA, NJDEP

Recommendation: Enact the same long-term renewal timeframes for DLRP permits and Tidelands Licenses, allowing growers to renew both items at the same time. [Regulatory Change; Agency Action]

Acting Authority: NJDEP DLRP [Regulatory] and Bureau of Tidelands Management [Agency]

Recommendation: Modify Tidelands Policy relating to shellfish aquaculture activities to make the upland owner notification and objection process consistent and consolidated with that of the DLRP General Permit 30 public notice. Rather than require shellfish growers acquire public permission, require the objecting public to act, making their objections known during the review process. [Agency Action]

Acting Authority: Tidelands Resource Council, NJDEP Bureau of Tidelands Management

Recommendation: Establish a clear and reasonable distance offshore from which landowner public trust rights extend for issuance of a Tidelands License. [Agency Action]

Acting Authority: Tidelands Resource Council, NJDEP Bureau of Tidelands Management

Recommendation: Release the annual State Vibrio Control Plan 90 days in advance of the action start date. [Interagency Action]

Acting Authority: NJDEP Bureau of Marine Water Monitoring and NJDOH

Recommendation: Allow shellfish growers operating in subtidal waters to harvest immediately before inshore transport, provided appropriate time-to-temperature regime employed (e.g., 4 hours). [Interagency Action]

Acting Authority: NJDEP Bureau of Marine Water Monitoring and NJDOH

Recommendation: Determine process for, and implications of, allowing shellfish growers to harvest 7 days per week (e.g., enforcement changes & funding). Legislative change required to allow harvest on Sunday. [Legislative, Agency, Interagency Action]

Acting Authority: Legislature, NJDEP, Shellfish Council, Aquaculture Industry

Support for Hatchery and Nursery Development

Rationale: One of the biggest bottlenecks to growth of the shellfish aquaculture industry is limited seed production. The New Jersey Aquaculture Innovation Center (NJAIC, Rutgers University) is presently the only hatchery in New Jersey that produces high volumes of oyster seed. A few private hatcheries in the state that initially focused on hard clam seed began producing oyster seed in the late 2010s after seeing the need for more in-state production. As the shellfish aquaculture industry shifted to greater production of oysters for the half-shell market, the demand for seed grew beyond the capacity of in-state hatcheries. For instance, the NJAIC receives yearly requests for seed that account for more than double the capacity of the facility. The limited in-state hatchery production has led the industry to source seed from other states.

Similar to oyster production, New Jersey's hard clam hatcheries are also operating at full capacity and cannot meet the demand for seed. According to the industry, the limitations on hard clam seed production are pervasive throughout the east coast. Given the importance of these two species to the New Jersey aquaculture industry, **support for in-state hatchery development is a priority area of state investment for aquaculture development**.

In addition to concerns over limited hatchery infrastructure, the constraints on nursery system installation have also restricted industry development. Many growers have expressed the preference to plant larger seed (8-10 mm) because it is less susceptible to mortality in the field. To achieve this, growers can purchase larger seed at a higher price (potentially adding thousands of dollars to seed orders) or grow seed in a nursery system until it reaches the grower's ideal planting size. In New Jersey, nursery capacity is limited, and private sector development of nurseries has not kept pace with demand. Nursery systems are relatively easy to operate and do not require the same level of technical expertise, equipment, and capital as hatcheries. However, those easy to operate systems require access to working waterfronts with suitable sea water. This is particularly challenging in a state as densely populated as New Jersey where waterfront land carries a premium cost.

Recognizing the need for more shellfish nursery capacity, the NJDEP Division of Land Resource Protection (DLRP; formerly Division of Land Use Regulation) created a permit-by-rule (PBR) for land-based systems in 2013. Any nursery system that follows the regulatory requirements is automatically permitted under the PBR. At the time, in-water nursery systems were not prominent within the State, and therefore not considered for expedited permitting (permitting is currently via an Individual Permit). Now that the industry is looking towards the lower cost in-water methods, concurrent permitting changes are warranted.

Recommendation: Develop a DLRP General Permit for in-water nursery activities. This needs to include consideration of nursery systems associated with areas outside of Commercial Shellfish Leases (e.g., boat slip, dock). [Regulatory Change]

Acting Authority: NJDEP DLRP

Recommendation: Provide financial incentives for nursery and hatchery development (e.g., low interest loans, grants, tax breaks, energy savings for hatchery and nursery operations). [Agency; Regulatory; Legislative Action]

Acting Authority: NJ Economic Development Authority, Department of Treasury, Division of Taxation

Recommendation: Streamline seed importation permit process, via (1) State participation in Regional Shellfish Seed Biosecurity Certification Program; and (2) extension of acceptance time limits for seed health evaluations from 30 to 45 days. This will retain the high degree of disease testing and review but allow for a more appropriate administrative timeframe. [Agency Action]

Acting Authority: NJDEP

Recommendation: Explore options, particularly those already supported by the NJ Coastal Management Program, to enhance and develop resilient working waterfronts that can provide land-based infrastructure for shellfish aquaculture. [Agency Action]

Acting Authority: NJDEP

Recommendation: Develop guidance on building hatchery & nursery facilities within specific planning areas of CAFRA, and size and location conditions that may apply (e.g., impervious surface percentages). Include path to streamline permitting of land-based hatchery & nursery facilities within a General Permit during future rule amendments. [Interagency Action; future Regulatory Change]

Acting Authority: NJDEP DLRP, AAC, Aquaculture Industry

Leasing

Rationale: There are approximately 2,500 acres of existing lease areas on the Atlantic Coast, and 33,000 acres of existing lease areas in the Delaware Bay. Of that total acreage, there are a significant number of inactive leases that are being held by leaseholders. Responsible use of public waters must consider the needs of the industry as well as those of other coastal users and natural resources. The Shellfisheries Council conducts an informal review of potential user conflicts prior to approving lease areas, serving as a steward for the public resource. To ensure space is available for industry development, the Shellfish Council periodically reviews lease allocation methods as well as possible options to ensure inactive leases in lower conflict areas are open for future industry use.

On September 7, 2017, new lease fees were put into effect that included 1) a $250 lease application fee for new leases and 2) a $100 annual lessee renewal fee (for each leaseholder entity). The increased fees were an attempt to deter new lease areas from being held by individuals not interested in performing culture activities, but rather "prospecting". This, in turn, allows for more new entrants serious about starting a shellfish aquaculture farm to obtain leases. Lease fee acreage renewal rates are set by the Shellfisheries Council and are $0.50 per acre for Delaware Bay and $2.00 per acre for the Atlantic Coast. Nominal rates such as these coupled with no requirement to use leases makes it easy for parties to acquire and hold leases in perpetuity. While the increases were an improvement, additional discussions are occurring with the Councils and industry members regarding lease fee structure, utilization, and methods of ensuring that leases are being reasonably used or reallocated to those who would use them (i.e., new entrants). The reallocation of inactive leases should help expand the aquaculture industry more efficiently and reduce the need to expand leases into new areas thereby avoiding additional siting issues and conflicts.

Recommendation: Request a Shellfisheries Councilmember or NJDEP, Bureau of Shellfisheries staff member provide a periodic update on leasing and lease utilization to the AAC. Further discussions on the topic may result in additional ideas for lease use promotion as well as identify potential conflicts (e.g., shellfish lease where finfish could be grown). [Interagency Action]

Acting Authority: Shellfisheries Council, AAC

Agricultural Benefits and Programs

Right to Farm

Rationale: Growth of the shellfish aquaculture industry (including new upland facilities and new lease areas) is likely to create an environment where the industry is more visible and increasingly interacting with neighbors. While the industry generally follows accepted practices (e.g., Best Management Practices[1]), there is always the chance a complaint may be lodged against a grower. In those circumstances, the industry requires right to farm protections when operating according to standard industry practices.

One concern regarding the applicability of current right to farm requirements to the shellfish aquaculture industry is the acreage to production value thresholds (five acres and $2,500; or, under five acres and $50,000[2]) that define a Commercial Farm. Leases issued along the Atlantic Coast are limited in size to two acres per lease, and a licensed grower can only obtain one lease at a time within an area where leases are developed. While some growers may have several lots in one area that amount to greater than five acres total, the system of lease issuance on the Atlantic Coast dictates that a shellfish farmer is initially binned into the less than five-acre category for right to farm. Acreage limitations would also apply to those growers working within ADZ-4 in the Delaware Bay where leases are capped at three acres.

Compounding the potential acreage to production threshold concern is the need for lease lots to be contiguous for the acreage to be considered as one unit (this is due to the right to farm requirements that a farm unit be "otherwise eligible" for Farmland Assessment[2], which requires parcels be contiguous for acreage calculations[3]). Based on the lease allocation methods along the Atlantic Coast, there is no guarantee that a grower or organization will have neighboring lease lots. Others may want to move into the area and obtain adjoining leases prior to the grower having the opportunity for expansion. Under the current right to farm conditions, if a grower has more than one lease lot, but none are contiguous, each lease must independently qualify. Some growers have multiple leases within an individual growing area; others have leases throughout several embayments to diversify growing areas and potentially develop different taste profiles to the shellfish. This common practice of leasing in different locations, as well as the lease allocation process, places the industry at a severe disadvantage with current right to farm requirements.

Furthermore, the shellfish aquaculture industry requires land-based facilities in addition to the in-water farms. Hatcheries and nurseries that produce and grow seed to a lease-ready size require access to high volumes of seawater. These facilities on land are within parcels smaller than five acres but are in areas of coastal development where neighbors may be more cognizant of the hatchery or nursery activities (e.g., areas where conflict may arise). In-water nursery systems are often no bigger than a boat slip, an area significantly smaller than five acres. Also on the upland is all certified dealer facilities. Commercial sales of shellfish must first be sold to a certified dealer, per national requirements.[4] Accordingly, it is possible that these critical components of shellfish farming could be left unprotected if the production value is below $50,000.

Vertically integrated farming operations, those with hatchery and/or nursery systems, in-water farms, and operate as a certified dealer could potentially have three or more distinct farming units according to the current right to farm requirements. Even if the operation could show production values adequate to be eligible regardless of acreage, the question is now where the value is applied when multiple, discrete

parcels may be necessary for the final sale. The further the right to farm program is investigated for its potential application to a typical shellfish aquaculture operation, the more it becomes evident that a new set of standards are needed for this sector of agriculture.

Finally, the Agricultural Management Practices (AMPs)[5] developed for aquaculture have not been amended since adoption in 2005. A subcommittee of the New Jersey Aquaculture Advisory Council (AAC) reviewed the AMPs in 2014 and 2015. At that time, it was decided to split the AMPs into two categories— one for bivalve shellfish and one for finfish and aquatic plants (essentially freshwater species). No further movement on the AMP document revisions occurred after 2015. The AMP documents should be reevaluated for today's shellfish aquaculture operations given the industry's evolution since original adoption.

Recommendation: Develop specific production value thresholds for shellfish farm operations under 5 acres. [Regulatory Change; Legislative Action]

Acting Authority: NJDA, SADC, Legislature

Recommendation: Determine how to incorporate the spatially distinct components of shellfish aquaculture— hatchery & nursery systems, leases, dealer facilities— into a right to farm program. [Regulatory Change; Legislative Action]

Acting Authority: NJDA, SADC, Legislature

Recommendation: Reevaluate the current aquaculture AMP document to determine what changes may be required to better suit the current industry. [Regulatory Change]

Acting Authority: NJDA, AAC, SADC

Farmland Assessment

Rationale: The Farmland Assessment Act stipulates that five acres or more of land actively devoted to an agricultural or horticultural use be assessed (local property tax) based on the productivity value.[3] The minimum acreage requirement— which is codified within the New Jersey Constitution— is larger than the area needed for the land-based portion of shellfish aquaculture. Shellfish hatcheries and nurseries are located within the coastal zone and are typically private property owned by the grower, taxed at the full municipal rates. Most hatcheries and nurseries use vertical systems that are not accounted for within terrestrial farming programs. To ensure aquaculture is afforded the same benefits as terrestrial farming, a new metric for assessing the value of the land-based portion of shellfish aquaculture systems is recommended. Commercial Shellfish Leases may be less than five acres, but they are not taxed (State-owned land) and therefore are not included in this tax abatement section.

Recommendation: Develop a differential tax program for aquaculture which mirrors programs provided for terrestrial agriculture (e.g., develop a "Coastal Conservation Program"). [Legislative Action]

Acting Authority: Legislature, NJDA, NJ Dept. of Treasury Division of Taxation

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Research

Active Research Programs— Optimize culture of oysters, hard clams and new candidate species for a broad range of coastal environments and changing environmental conditions

Rationale: Much of New Jersey's aquaculture industry focuses on the culture and grow-out of two primary shellfish species, oysters (*Crassostrea virginica*) and hard clams (*Mercenaria mercenaria*). These two species are a significant component of the state's coastal environment and economy, providing local, high-quality seafood that helps to attract tourists to the Jersey Shore. Disease-resistant stocks have been developed for the culture of eastern oysters within moderate-salinity estuaries. Superior stocks that survive and grow well in high-salinity water are needed to support oyster aquaculture in coastal bays.

Crop diversity, as means of adding resiliency to the bivalve aquaculture industry, is being explored for two native bivalve species— bay scallop (*Argopecten irradians*) and Atlantic surfclam (*Spisula solidissima*). These species have shown promise for culture within high-salinity environments, but they face challenges with winter and summer mortalities, respectively. Their vulnerabilities can be genetically improved by selecting for high survival. Selection for fast growth may also allow early harvest and reduce exposure to mortality-inducing conditions.

Rutgers University has received funding and begun conducting research on these items by investigating: (1) development of eastern oyster stocks that survive and grow well in high-salinity environments; (2) improved growth and survival of bay scallops; and (3) development of surfclams with fast growth and heat tolerance to enhance survival. The results of the project will be shared with New Jersey shellfish farmers as well as the regional shellfish growing community.

In addition to the state-specific work, a regional research program has recently been funded to investigate hard clam breeding, led by Stony Brook University. Historically, less academic research has focused on hard clam breeding relative to oysters. As with oysters, hard clams are subject to a variety of biological and environmental stressors including the well-studied Quahog Parasite Unknown (QPX) and the lesser known but increasingly apparent, transmissible neoplasia. Susceptibility of clams to QPX has been identified as a heritable trait thus offering the potential for selective breeding of disease-resistant stocks.

Research Needs

Rationale: Bivalve aquaculture development is hindered by on-farm natural occurrences such as disease, biofouling, and icing events. Targeted research developed with industry input to specifically address grower needs is critical to advance the shellfish aquaculture sector. Topics that growers and researchers have identified as priorities include:

- Biofouling control. Control of biofouling for all grow-out systems requires a significant labor investment. Effective means of biofouling control will improve product quality, reduce labor costs, and increase farm profitability.

- Vibrio spp. (1) the influence of local environmental conditions and (2) cooling methods. Continue research on Vibrio spp. within state waters to inform state policies and keep New Jersey's shellfish products among the safest to consume.

- Improve grow-out methods. Examine new gear technologies and materials as well as planting strategies in various environments.

- Winter Survival of Oysters. Many farms have experienced significant crop loss during severe winter conditions and events. Oyster lines developed for intertidal moderate-salinity locations could benefit from research on selection for winter hardiness.

- Wildlife Interactions. As more wildlife species are listed for state or federal protections, there is greater scrutiny over the actions of the industry. Research on specific interactions (or lack of interactions) between native wildlife species and farms can provide for focused policy and regulatory actions.

An emerging challenge for shellfish stocks and associated habitat is climate change. Shellfish habitat and population distributions are foreseeably altered in the future with coastal ecosystems already being reshaped by changing conditions. Forecasted scenarios of concern to shellfish aquaculture include: (1) sea level rise that is predicted to increase salinity in coastal bays and estuaries while limiting access to currently exposed areas (e.g., farms); (2) severe and more frequent precipitation events that are expected to lead to greater freshwater inputs; and (3) a northern shift of warmer waters which could lead to associated population shifts for species that cannot adapt to new environmental conditions. These ecosystem changes will also impact the distribution and prevalence of disease, particularly those that correlate to salinity (e.g., MSX) and temperature (e.g., Dermo), and those impacting human health (e.g., Vibrio). Production of phytoplankton, the key food source for shellfish, may be impacted as well. The examination of climate change and the potential consequent shifts in environmental conditions is essential to inform management of shellfish aquaculture and sustain the state's industry.

Recommendation: Conduct bi-annual research roundtable and needs assessment with the shellfish community to establish industry-based research priorities. [Interagency Action]

Acting Authority: New Jersey Sea Grant Consortium, University Researchers and Extension Agents, Aquaculture Community

Recommendation: Conduct research to address industry needs, including, but not limited to biofouling control, reduction of vibrio public health risks, understanding wildlife interactions, disease processes, and specialization of gear for challenging grow out conditions. [Interagency Action, Agency Action]

Acting Authority: Aquaculture Community, University Researchers and Extension Agents, New Jersey Sea Grant Consortium, New Jersey State Agencies

Recommendation: Expand the state research capacity and facilities to maintain a genetics and shellfish disease program tailored to N.J. coastal environmental conditions and shellfish grower needs. [Legislative Action]

Acting Authority: Legislature

Recommendation: Develop a research program to understand how environmental shifts in temperature, salinity, wind, oxygen, freshwater inputs, storm frequency, and the interactions between these parameters will alter shellfish habitat, distribution, diseases, and food sources. [Interagency Action]

Acting Authority: University investigators with external support from granting agencies

Aquaculture Spatial Planning

Rationale: Currently, New Jersey does not have a comprehensive spatial plan for shellfish aquaculture. This lack of transparent planning has led to persistent concerns about uncontrolled growth of the industry. Other coastal states have developed geospatial tools to identify suitable areas for shellfish aquaculture, providing a resource to inform coastal planning and policy.

At the time of this publication, research led by Rutgers University Investigators in partnership with NJDEP, Bureau of Shellfisheries was already underway to develop an interactive geospatial tool to weigh and analyze data about conditions affecting shellfish production to help identify areas that are of high, medium, or low suitability for shellfish aquaculture in New Jersey. The goal of the research is the development of a data-informed tool that can be used by state and federal agencies for aquaculture and coastal management policy and planning efforts. The tool only identifies areas that may be more or less favorable for aquaculture development based on the data incorporated. It is not a spatial plan nor a surrogate lease allocation process. Rather, it is a tool aimed at informing these later items, which are under the purview of the Shellfisheries Council and NJDEP.

Recommendation: Develop a comprehensive spatial plan for shellfish aquaculture in New Jersey, based on current aquaculture suitability research as well as decades of work by the Shellfisheries Council/NJDEP. [Interagency Action]

Acting Authority: Shellfish Councils, NJDEP, NJDA

Workforce Development and Beginning Farmer Training

Rationale: Most shellfish farmers are single operators, who come from diverse educational and experiential backgrounds. Some current growers started their business without first working on a shellfish farm. Training programs would benefit these beginning and novice shellfish farmers by providing fundamental information to plan, operate, and jump-start successful shellfish aquaculture businesses. Such training could also minimize business risks, encourage best management practices, and accelerate time to profitability, while ensuring established farmers are not negatively impacted by the actions of inexperienced farmers. At the time of this publication, however, there are no shellfish aquaculture training programs in New Jersey.

Likewise, as the industry continues to grow so has the need for a well-trained workforce. Shellfish farms are already experiencing a challenge with respect to recruiting workers. The need for a skilled aquaculture workforce is a resounding theme nationally. This was highlighted at the 2019 Northeast Aquaculture Conference and Exposition plenary session in which employment gaps were revealed as a significant impediment for the aquaculture industry from Canada to New Jersey. Economic stimulus and job creation are especially important in our coastal communities. Cape May, Cumberland, and Atlantic Counties had the highest unemployment rates in the State in 2018, at 8.4%, 6.5%, and 5.9%, respectively. Being focal counties for shellfish aquaculture development, shellfish aquaculture related job creation will offer significant uplift where most needed.

Recommendation: Establish professional development programs for the recruitment and training of aquaculture entrepreneurs, managers, and workers. The Continuing Education short courses administered by Rutgers University may be a good style to replicate. [Interagency Action]

Acting Authority: New Jersey Colleges and Universities, Cooperative Extension

Recommendation: Establish career development opportunities, courses, and training programs for students (high school and undergraduate) to be exposed to career paths and jobs (internships) in aquaculture. [Interagency Action]

Acting Authority: New Jersey Colleges and Universities, Cooperative Extension, NJDA Office of Food, Agriculture, and Natural Resources Education

Recommendation: Review existing agriculture training programs in New Jersey to determine how those could be adapted, or applied, to aquaculture. [Interagency Action]

Acting Authority: New Jersey Colleges and Universities, Cooperative Extension, NJDA Office of Food, Agriculture, and Natural Resources Education

Recommendation: Explore the option of a mentorship program where prospective growers can learn from those already in the industry. [Interagency Action]

Acting Authority: Aquaculture Industry, Cooperative Extension, NJ Sea Grant Consortium, NJDA Office of Food, Agriculture, and Natural Resources Education

New Opportunities

Macroalgae ("Seaweeds")
Rationale: Macroalgae culture is an emerging sector of aquaculture for the US. Along the east coast, several cold-water species are commercially cultured in Maine and Connecticut. In New Jersey, shellfish growers as well as non-affiliated interested parties have expressed a desire to begin farming native macroalgal species. Due to a lack of regulatory framework to allow experimental trials within New Jersey waters, no one has tried to grow these crops for commercial purposes. It is still unclear if native species of macroalgae can be successfully farmed within New Jersey waters, let alone grown at a commercial scale. To explore this potential (or lack thereof) further, the NJ Coastal Management Program has included researching this topic within an upcoming Coastal Zone Management Grant task. Additional study of this topic could advance understanding what is possible in New Jersey waters.

Recommendation: Develop a mechanism to enable pilot programs that advance aquaculture of native macroalgal candidate species in State waters. [Interagency Action; Regulatory Change]

Acting Authority: NJDA, NJDEP

Offshore Aquaculture, Federal Waters
Rationale: The federal government is increasingly looking at ways to support the nation's production of cultured seafood. Offshore waters, those beyond State jurisdiction, are being explored for potential culture sites. Given the interconnected nature of the seas, it is imperative that State interests are respected and protected from potential growth within Federal waters. The New Jersey Aquaculture Advisory Council (AAC) is a primary stakeholder for aquaculture and should be included in any future discussions.

Recommendation: The New Jersey Aquaculture Advisory Council should be considered a priority stakeholder for any discussions on aquaculture within the region's federal waters (e.g., waters off New Jersey and neighboring states). The AAC will keep up-to-date on national policy development for federal waters. [Interagency Action]

Acting Authority: AAC, NJ Marine Fisheries Council

The Aquaculture Industry and COVID-19 Pandemic

The 2021 Update to the New Jersey Aquaculture Development Plan (Plan) began in early 2019, at a time when commercial shellfish aquaculture was experiencing a wealth of positive attention and new grower interest. Regulators were working to improve permitting efficiencies and strengthen relations with the industry. Building on that momentum, a committee of state agency staff, industry representatives, and University extension experts was formed to thoroughly review progress, changes, and obstacles since the last Plan Update (2011). This consisted of an analysis of previous Updates and the original 1995 Plan; a review of aquaculture development plans produced by other states; and an assessment of the needs of the New Jersey shellfish aquaculture industry. Given the expansive process implemented for this ADP Update, the expectation was that a final product would not be complete until mid to late 2020.

The first working draft of this Plan Update was reviewed during the January 2020 quarterly meeting of the New Jersey Aquaculture Advisory Council. The result of that meeting was significant revision and improvement of the draft content, with the goal of reviewing a revised version at the April 2020 quarterly meeting. Between those meetings, however plans shifted with the documented arrival of the novel coronavirus (SARS-CoV-2; COVID-19) to New Jersey. In early March, the state essentially shuttered to limit the spread of the virus as health systems were strained handling the critically ill.

Specifically, for the aquaculture industry, Executive Order 104 issued by Governor Murphy on March 16, 2020, closed restaurants for indoor dining, only allowing take out or delivery orders.[1] With an estimated 70% of seafood consumed via food service establishments[2], that Executive Order and companion Orders in neighboring states and commonwealths immediately halted nearly all shellfish sales for New Jersey growers.

Initial Impacts

To understand the pandemic's impacts on the aquaculture industry, a nationwide survey of the immediate and year-long impacts from COVID-19 closures on the U.S. aquaculture industry was conducted by extension researchers at Virginia Tech and The Ohio State University.[3] The first quarterly report characterized the immediate impacts, with a survey administered from March 23, 2020, through April 10, 2020.[3]

According to the nationwide survey of aquaculture farms and businesses, Quarter 1 survey results for mollusk producers[3]:

- 97% of respondents were impacted by COVID-19,
- 98% experienced lost sales (as of Q1 survey) with 99% expecting lost sales in year 2020, and
- 48% could hold market ready product for 1-3 months before it would interfere with farm activity (crop & gear rotation).

Unfortunately, the responses to these quarterly surveys only capture a small portion of the industry. For instance, the Quarter 1 survey had responses from only 18% of the industry, when using the USDA 2018 Census of Aquaculture number of farms as a measure of total U.S. farms.[3] By the Quarter 4 survey, the responses were only around 4% (relative to the USDA 2018 data).[3] It is unknown if the decrease in survey responses was due to the closure of farms over the course of the year, nor is it known whether the same farms reported in each quarterly survey through the year.

In addition to the nationwide survey, a New Jersey only survey was conducted to measure immediate impacts to the commercial shellfish aquaculture industry. The survey was administered in late March 2020, and was developed by representatives from Rutgers University, the NJ Shellfish Council, and the NJ Aquaculture Association[4].

In the New Jersey survey of shellfish growers, the immediate impacts to industry included[4]:

- **92% of respondents recorded 100% lost sales,**
- All respondents had sales to restaurants; 69% with 100% sales to restaurants,
- Concerns with supply outpacing demand, and reducing the price received for products, and
- Concerns with changing market (few restaurants, limited capacity, lost summer markets, product outgrowing half-shell market).

In response to restaurant closures, shellfish distributors (many also growers) looked towards direct-to-consumer sales— online, dockside, retail sales. Several growers reported success with this newer market channel, but that still only accounted for a small percentage of typical spring and early summer sales. The Easter sales that some growers rely on to support their spring purchasing of gear and seed was never realized.

Long-term impacts & solutions

It was over a year before indoor dining reopened at full capacity in New Jersey (maintain distance between parties but otherwise no limits on number of patrons).[5,6] Over the late summer and fall of 2020, outdoor dining was the only real option for food establishments. Dealing with reduced seating options and still reliant on take-out sales for most of their revenue, restaurants focused on fast and convenient food options throughout 2020 and into 2021. Shellfish did not fit into many pandemic menus, especially shellfish produced for the half-shell market. This created a situation where stocks were growing beyond market size and retaining shellfish on a farm was going to cost more than growers would make in sales.

Two initiatives were developed to provide solutions to oyster growers dealing with lost income, oversized product, and no means of cycling stocks without more gear or sold oysters. The first effort was supported by a special NOAA Sea Grant COVID-19 Rapid Response Aquaculture Funding Opportunity.[7] Through this initiative, Rutgers University and partner organizations purchased 76,000 oversized, farm-raised oysters for the purpose of restoring habitats.[7] The oysters were transplanted onto targeted restoration sites in the Little Egg Harbor and Mullica River during the fall of 2020[7].

In late 2020, The Nature Conservancy (TNC) partnered with The Pew Charitable Trusts (PCT), in coordination with the U.S. National Oceanic and Atmospheric Administration (NOAA) and the U.S. Dept. of Agriculture, the oyster aquaculture industry, and state regulators, to launch SOAR: Supporting Oyster Aquaculture & Restoration.[8] SOAR is an initiative to help oyster farmers impacted by COVID-19 and the resulting market contraction by purchasing surplus oysters and placing them on nearby oyster reef research and restoration projects.[8] The initiative purchased oysters from shellfish growers in seven states (ME, NH, MA, NY, NJ, MD, WA) and established a Shellfish Growers Resiliency Grant Program.[8]

In New Jersey, the purchase program worked with 24 participating oyster growers (8 from the Delaware Bay, 16 from the Atlantic coast) in late 2020 and mid-2021 to purchase approx. 615,000 oysters (219,000 from Delaware Bay growers, 396,000 from Atlantic coast growers).[8] These oysters supported research and restoration efforts at 6 sites (2 in Delaware Bay, 3 in Barnegat and Great Bays, and 1 in Raritan Bay at NWS Earle).[8]

For the resiliency fund, SOAR is extending $1 million in funding via a nationwide Shellfish Growers Resiliency Fund (Fund).[8] The Fund is offering small awards (up to $20,000) targeted toward shellfish growers and large awards (up to $100,000) to address systemic issues facing the shellfish industry.[8] Small award recipients will be notified in July/August 2021 of their application status, with those projects expected to be complete in August 2022.[8] Large award recipients will be notified by the end of August 2021, with those projects expected to be complete in August 2023.[8]

Lessons

The pandemic highlighted the need for local food production and greater flexibility within regional distribution networks. It also emphasized the need to establish a better understanding of aquaculture being an agricultural activity (the farming of shellfish). For instance, local officials are quite open to allowing fruit and vegetable farmers to sell direct to the public via farmers markets and roadside stands. This sales avenue became much more favorable among shellfish growers due to prolonged restaurant closers. Many communities quickly recognized the need for shellfish dealers to transition from wholesale operations to local, retail sales, while still retaining all the health requirements of raw food sales.

By the late spring of 2021 with increased vaccination levels and reduced infection rates, much of the country opened for near normal activity. As travel resumed and vacation hotspots along the shore became fully booked, shellfish became a desirable commodity again. Anecdotally, some growers noted that they experienced overwhelming demand for their products as consumers returned.

Observations from national food retailers and analysts are showing that consumers are looking for high quality seafood. Demand for shellfish has fluctuated between a complete loss of sales during lockdowns to pent-up demand outpacing supply as tourists flock to oceanside towns during summer vacations. Specifically for shellfish growers, it is unclear if the high demand will be retained throughout the year, or if demand will continue to be cyclic with the seasons and potential future pandemic changes to buying preferences. To adapt to changing sales conditions, the partnerships fostered over the past year help to retain and strengthen the industry.

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