A Social and Economic Analysis of Commercial Fisheries in North Carolina: Shellfish Growers 2022

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Contents

1 Introduction

The North Carolina the shellfish fishery is one of the oldest fisheries in the state and the oyster fishery was the first regulated fishery in North Carolina. Historically, fishers harvested shellfish off of public bottom where they could find them. In 1858 a law was established that incorporated a license that allowed for private shellfish cultivation of shellfish on otherwise public bottom. In its current regulatory form, the North Carolina Division of Marine Fisheries (”NCDMF”) administers the Shellfish Lease and Franchise Program for the purposes of shellfish cultivation, aquaculture, and mariculture within the state. The NCDMF provides for the private use of public trust waters to cultivate shellfish by allowing for bottoms and water columns to be leased.

The NCDMF conducted its first socioeconomic study on commercial shellfish growers in 2018 Stemle and Condon 2018). The industry was identified as having a $4.2 million economic output for the state economy of North Carolina. Since then, commercial shellfish growing has expanded further with 195 leaseholders which is an increase of 25% from the 156 leaseholders in the original survey (Figure 2. Both the number of leases and the acreage of leases in the last 10 years have increased each year (Figure 3 and Figure 4). Due to the recent growth in the shellfish growing industry size and value in North Carolina, and because the NCDMF Economic Program has a goal of surveying commercial fisheries on a five-year rotation, a new analysis was needed (Figure 5).

The NCDMF Fisheries Economics Program hosted a panel discussion at Aquaculture America 2023 to inform the survey development process. Panel participants were from North Carolina, Virginia, Florida, Maryland and Alabama. The panelists were asked to comment on the experiences in their respective states regarding barriers to the industry, state and federal resources available to lease holders, and industry development and growth. The panel discussion contributed to the development of the survey instrument and facilitated discussion between researchers, managers, and stakeholders from the East Coast. Panelists also weighed in on the impacts of COVID-19 on the shellfish aquaculture industry at the state and national levels. These conversations helped inform questions that were included in the survey instrument to receive feedback from the industry on perceived impacts and changes that resulted from COVID-19.

The survey also included questions about leaseholder perceptions of Shellfish Enterprise Areas (SEAs). There has been growing interest in fisheries management strategies like (SEAs) in North Carolina, specifically for Bogue Sound. A SEA is a ”designated area where state agencies have already verified site environmental and public trust [lease] suitability, as well as acquired necessary Federal permits” (Baillie et al. 2018, p. 55). The goal of these areas is to streamline a lengthy leasing process and reduce the cost of permitting, which can be a barrier to entry for potential applicants (Baillie et al. 2018). Questions focused on leaseholder perceptions of SEAs, shellfish siting tools, and the shellfish leasing process were included in this survey to provide additional insights on these topics for state fisheries managers.

2 Study Objectives

The primary objectives of this study were:

1. To understand the economic contributions, vulnerability, and business practices of shellfish aquaculture growers within the state.
2. To provide up-to-date information for resource managers on a growing industry in North Carolina.
3. To evaluate shellfish growers’ perceptions regarding current fisheries management practices, the importance of shellfish growing in their communities, and relevant issues currently facing the shellfish growing industry.
4. To help construct economic models used in NCDMF economic analyses.

3 Methodology

3.1 Recruitment and Participation

In 2023, a list of shellfish growers was compiled from the NCDMF license database. This list included every individual or business with an active bottom or water column lease in 2022. A bottom lease allows the lease holder to grow shellfish on or within 18 inches of the bottom. A water column lease allows the lessee to use gear that does not rest on the bottom or extends more than 18 inches above the bottom. In 2022, there were 448 leases with 2221.15 acres of leased bottom or water column.

A total of 195 leaseholders were identified in 2022. Survey packets were mailed to all leaseholders in the state in early May 2023. The mailing packet consisted of an invite letter detailing the goals of the study, a hard-copy of the survey, and a prepaid business reply envelope. Recipients also had the option to complete the survey online via a provided web link or quick response code to Survey Monkey. Approximately a month and half after the initial mailing, follow up calls were made with individuals who had not completed the survey. After removing leaseholders who no longer held a lease or operated their lease under an academic/research institution, the survey population was 188 active leaseholders. The survey received 40 responses with a response rate of 20%. Once incomplete surveys were removed, there were 34 valid survey responses, which resulted in a response rate of 18.10%.

3.2 Survey Instrument

This survey mirrored the 2018 survey with some minor modifications to allow for comparison of results over time. Prior to distribution, the survey was reviewed and approved by the NCDMF Biological Review Team. The survey consisted of 50 questions and took approximately 30 minutes to complete. The data collected in this study focused on several topic areas:

1. Lease characteristics and expenses;
2. Target species and gear;
3. Shellfish growing business characteristics and expenses;
4. Individual lease holder's demographics and reliance on shellfish growing;
5. Perceptions and opinions on shellfish growing and fisheries management.

Data from the online and mail-in surveys were recorded in a Microsoft Excel database and coded in Statistical Package for Social Scientists (SPSS). Frequency and univariate analyses were performed in Microsoft Excel and SPSS. Economic impact estimates were calculated by an Input-Output model using IMPLAN modeling software and the NCDMF economic impact model further described in Section 5.

4 Survey Results

4.1 Demographics

Demographic information for survey respondents can be viewed in Table 1. The majority of respondents were male (88.90%) and white/Caucasian (93.94%). Most were married (74.30%) and had attended or completed college (69.4%). The average number of people in the household was 2.53 people with a minimum of one person and a maximum of five people.

The average number of years in the industry was eight, which was a year less than the average last time this survey was conducted in 2018. Most respondents had two to four residents in a household. 30% of households reported incomes over $100,000. On average, respondents indicated that they get 35% of their income from commercial shellfish growing.

4.2 Vessels and Business Characteristics

Seventy-three percent of total respondents indicated that they own a primary vessel while only 30% had a second vessel for their commercial shellfishing operation. Both primary and secondary vessels had similar average length (20 feet), value ($16,000) and crew size (2 people) as described in Table 2. Most respondents indicated that they keep their vessels at their own home or at a slip where they do not pay rent (82%) as reported in Table 3.

Table 4 shows the responses of shellfish lease holders to a series of questions about their production to better understand their operations and sales. On average there were about 486 bushels and/or 395,000 seeds planted per growing operation. Most bushels were sold in state (69%). The respondents reported that they sold about 25% of their product directly to consumers, while 50% of the respondents stated that they sold exclusively to a dealer. If a shellfish grower has a dealers license they are able to legally sell their product directly to consumers. The price difference from selling their products on the wholesale market vs directly to consumers was about $10.

There was a diverse spread of responses of shellfish growers on their harvesting methods. Most respondents worked exclusively in oysters (82%) and used floating bags on their primary lease (25%). A combination of bottom and floating cages and tongs, rakes, or hand were the next common practices both with 22% of respondents reporting those methods. Floating cages and bottom cages were the least common operations making up 12% and 9% of respondents respectively (Table 5).

Technology has changed the landscape for many businesses across all industries. Shellfish aquaculture respondents reported that they use social media and websites as their primary marketing techniques. 52% of respondents said they use social media and 29% reported that they use websites in their marketing campaigns (Table 6.)

4.3 Expenses

Table 7 reports the average and median responses of business expenditure. Larger leases are associated with more expenses in most categories. This leads to large leases having much larger expenses than smaller leases and a large spread in expenses. We include the median values which more reasonably represent most shellfish aquaculture operations operations. As expected, labor, vessel and gear expenses, and fuel expenses (both truck and boat) make up most of annual expenses. Expense results will help the NCDMF in the development and fine tuning of the economic models used to estimate the economic contribution and health of the industry over time (Table 7).

4.4 Income

In questions asking about their income reported in Table 8, most operations reported that they made zero or lost money in 2022 (57%) with 34% saying they made some profit but under $15,000. Almost a third of the respondents reported that their household income was greater than $100,000. Most respondents reported that they were shellfish growing on a part time basis (61%) (Table 1). Many responses indicated low levels of income from their leases with the average percent of their income being 35%, but 77% of respondents indicated that they see themselves being shellfish growers in 10 years (Table 9).

4.5 Perceptions

Survey respondents were asked about the level of agreement they had with some statements about shellfish grower operations and how they are perceived in their respective communities (Table 10). They were asked to respond on a scale of 1 (I do not agree at all) to 10 (strongly agree). On average shellfish growers rated every statement over five that we presented them with with the highest being their perception of the importance of aquaculture historically and economically in their communities. Respondents also indicated that they believe their communities respect and value their industry.

In these questions respondents reported that they weakly agreed that they have to work harder to collect the same amount of shellfish that they have historically and that their health is negatively affected by their participation in the industry.

Respondents asked to report their concern on a scale of 1 (it's not important or doesn't affect my business) to 10 (it's extremely important or affects my business a great deal) on a variety of topics reported in Table 11. Topics that were of most concern were weather, uncertainty, development of the coast, rising costs, and regulations. Some of the topics that were reported as of the least concern were size limits, seafood scoring (i.e., the Monterey Bay Aquarium Seafood Watch scoring system), competition for space with commercial or recreational fishers and competition with riparian stakeholders.

4.6 User Group Conflicts

Participants were asked to report whether they had any conflicts with other user groups in the last year. The most reported responses were conflicts with recreational fishermen and with general boaters, followed closely by conflicts with state regulators. The least identified user group conflicts were with other shellfish growers, the charter fleet, and with federal regulators. Waterfront property owners was indicated as the fifth highest source of conflict by 18% of respondents. (Table 12).

4.7 COVID-19 Impacts

Like many industries, the COVID-19 pandemic was disruptive to the shellfish aquaculture industry. Respondents reported that the aspects of their industry that were the most impacted were fuel, materials, and labor. Shellfish sales were not perceived by respondents to be strongly impacted by COVID-19 (Table 13). This was supported through anecdotal accounts and discussion at the Aquaculture America 2023 panel that suggested shellfish lease holders were able to respond to market changes and alter their delivery processes to continue business during COVID-19.

4.8 Lease Approval Processes

To obtain a lease in North Carolina lease holders go through an application process which includes identifying a lease location, communicating with neighbors in the area, and speaking with NCDMF lease program staff before completing the application. Then applicants receive temporary lease signs from NCDMF to mark the proposed area. NCDMF Lease Program staff investigate the site and compile a report for the Director who ultimately decides if the application should be approved for public hearing. Once the packet is complete a public hearing is held in the county of the proposed lease. The public hearing gives the public the opportunity to publicly support or oppose a proposed lease. In the final step the Director will make the decision to approve or deny the lease application. Many applicants have expressed that the NCDMF Shellfish Lease Tool has been helpful to identify their potential lease. The lease tool can be found at: (https://www.deq.nc.gov/about/divisions/marine-fisheries/licenses-permits-and-leases/shellfish-lease-and-franchise). The NCDMF has continuously worked on ways to improve the lease process.

There has been support from the public to explore ways to streamline the leasing approval process. Sixty-six percent of survey respondents who responded about the lease approval process indicated that the process is slow or much too slow (Table 14). NCDMF has been exploring ways to simplify the lease approval process while following legal requirements and ensuring equitable designation of public resources. One proposed methodology to streamline the lease process is to approve large swaths of area that can be applied for by the public and are already approved for shellfish aquaculture by NCDMF. This could be implemented through the use of Shellfish Enterprise Areas. Bogue Sound was identified as a potential area of interest, and the survey instrument recieved feedback on the concept. Sixty-nine percent of respondents indicated they were indifferent to this management technique, and under 25% of respondents supported the development of Shellfish Enterprise Areas (Table 15).

5 Economic Impacts

As the shellfish aquaculture industry grows so does its economic contribution to the state. In 2013 the industry harvested 77,422 pounds of oysters off of leases in North Carolina, in ten years that number has grown by over ten-fold (Figure 1). Participation has increased by close to 75% (Figure 2). The industry has grown from 1% of total ex-vessel value in 2013 to 12% in 2022 supporting over 500 jobs and over 15 million dollars in added value impacts (Table 16). These estimates follow trends of similar studies on the east coast.

The economic contribution analysis was conducted using IMPLAN's Input Output software and data provided by the NCDMF Trip Ticket program and economic estimates from NOAA's Fisheries Economics of the United States report. NCDMF collects data on the harvesting sector of the commercial fishery but relies on NOAA's data collection to estimate other components of the commercial fishery such as seafood distribution, wholesale, retail markets, and restaurants. The analysis in this report is expected to be conservatively low because it does not include the interstate or intrastate movement of seafood products. This limitation is due to lack of data resulting from few reporting requirements to track seafood movement post ex-vessel sale. All economic contribution estimates represent contributions from the shellfish aquaculture industry to the state economy of North Carolina.

6 Discussion

The shellfish aquaculture industry is a significant economic driver in North Carolina creating over 15 million dollars in added value and employing both directly and indirectly over five hundred people. The industry is growing annually. In 2022, there was a drop in harvest and ex-vessel value compared to 2021, but 2022's ex-vessel value is still higher than any year before 2021. Participation, trips, lease acreage and number of leases have all increased each year since 2014. Not only has the industry grown, but the value of harvest in ex-vessel value has increased by lease (Figure 7) and by acre (Figure 8). Increased productivity by lease has remained stable, occilating between \$13,00 and \$9,000 per acre, since 2017. While productivity per lease has stabilized since 2017, productivity per acre has increased annually over the time series. Continued growth in economic contribution of the industry can be largely explained by the growth in the size of the industry and increased productivity efficiency of the industry.

Survey respondents indicated that they believe there is a future in shellfish aquaculture in North Carolina with over 75% of respondents reporting they will be shellfish growers in ten years. Shellfish growers perceives their industry as highly valued by their communities both culturally and economically, and they feel their communities support shellfish aquaculture. As the industry has grown, participants have increasingly interacted with other stakeholder groups. Survey respondents indicated that the groups they have had the most conflict with are recreational fishers, general boaters, and state regulators. This could indicate that there may be a need for more education with the public about shellfish leases, the process of lease approval, and lease identification.

The survey asked about marketing techniques that shellfish leaseholders are using to market their businesses and products. The most common strategies were social media and websites. The industry seems to be embracing technology to grow their businesses. This could indicate that the industry may be more reachable through online sources than other stakeholder groups. The respondents also indicated offering services like oyster roast experiences and farm tours to expand and market themselves. These other services may provide more value through recreational opportunities to the public than solely the ex-vessel value of the product itself. In future studies the authors recommend exploring these other services more and the impact they may have on the state's economy.

Through their survey responses the industry provided feedback that they are most concerned in the future about environmental uncertainty, coastal development, input costs like gasoline, and increased regulation. With survey participants claiming they are increasingly relying on their lease income, this could indicate that the industry is more vulnerable to industry shocks such as industry shocks as short and long term environmental changes as well as market fluctuations. Respondents listed gas and part/material prices as their most impacted expenses by COVID-19. This helps NCDMF identify industries that are vulnerable to market and environmental change and apply for funding or provide support to those industries when available.

The shellfish aquaculture industry is growing annually and becoming an increasingly significant industry to North Carolina's economy. The average number of years participants have held leases has gone down from 9 years in 2016 to 8 years in the most recent survey. Most survey participants are still reporting that their aquaculture income makes up less than half of their total income, but since the last survey, that percentage rose from 29% to 35%. This increase in the average percentage may indicate growers are transitioning to more full time reliance on their leases. Ninety-one percent of respondents reported less than $15,000 in commercial income. This could be an indication that the survey results are skewed towards part time shellfish growers.

The Fisheries Economics Program has had trouble recruiting participants for commercial and recreational surveys in recent years. To combat this the Program has incorporated the use of online survey participation options through both QR codes and website links. Regardless of the available participation mode, there has been a steady apathy to participate in NCDMF studies. NCDMF has been working diligently to regain trust through continuous outreach initiatives and emphasizing transparency. The response rate of 20% reflects that there is still work to be done by NCDMF to build public trust and encourage participation. NCDMF will continue to monitor and reassess the status and economic contribution of the industry. Surveys, like the one in this project, help the Fisheries Economics Program better estimate the contribution of the shellfish aquaculture industry to the state and ensure NCDMF has the most information possible when assessing the status of the industry and preparing for the future.

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8 Tables

Table 1: Demographic information of 2022 shellfish growers

Demographic Information					
	Observations	Valid Percent		Observations	Valid Percent
Gender			**Household Income**		
Male	32	88.90%	Less than $15,000	*	*
Female	4	11.10%	$15,000-$30,000	*	*
Sample	36		$30,001-$50,000	*	*
Missing	4		$50,001-$75,000	6	18.20%
Total	40		$75,001-$100,000	*	*
			Greater than $100,000	10	30.30%
Race			Prefer not to answer.	9	27.30%
White/Caucasian	31	93.94%	Sample	33	
Hispanic/Latino	*	*	Missing	7	
African American/Black	0	0.00%	Total	40	
Asian/Pacific Islander	0	0.00%			
Native American	*	*	**Number of People in Household**		
Sample	33		1	5	14.70%
Missing	7		2	14	41.20%
Total	40		3	8	23.50%
			4	6	17.60%
Marital Status			5	*	*
Never Married	6	17.10%	Sample	34	
Married	26	74.30%	Missing	6	
Divorced	*	*	Total	40	
Widowed	*	*			
Separated	*	*	**Grower Status**		
Sample	35		Full Time	14	38.90%
Missing	5		Part Time	22	61.10%
Total	40		Sample	36	
			Missing	4	
Education			Total	40	
Some High School	*	*			
High School/GED	9	25.00%	**Years Growing Shellfish**		
Some College	7	19.40%	Average	8	
Associates	*	*	Minimum	0	
Bachelors	11	30.60%	Maximum	53	
Graduate/PhD	5	13.90%			
Sample	36		**% Income from Growing Shellfish**		
Missing	4		Average	35.06%	
Total	40		Minimum	0.00%	
			Maximum	100.00%	

* indicates data are confidential because less than 3 people reported

Table 2: Characteristics of shellfish grower vessels

	Vessel Characteristics	
	Primary Vessel (n=29)	Secondary Vessel (n=12)
Average Length (feet)	19.98	20.58
Average Market Value	$16,385	$16,142
Average Years Owned	8	9.27
Average Crew Size	1.75	1.67
Most Frequent Operator Status	Owner-operator	Owner-operator

Table 3: Where respondents keep their vessels

Location	Frequency
My home	15
A slip not at my home, but I don't pay rent	11
A rented slip	3

* indicates less than 3 observations in category

Table 4: Average operational characteristics of shellfish growers n=32

Average Shellfish Operation	
Months from Seed to Harvest	15
Estimated Bushels Planted	486
Estimated Seeds Planted	394,924
Estimated Number of Market-Sized Bushels Sold	17,155
Percent of Bushels Sold in State	69%
Percent of Bushels Sold to Dealers	50%
Percent of Bushels Sold Direct	25%
Wholesale Bushel Price	$54.86
Direct Bushel Price	$65.88
Direct per Piece	$0.47

Table 5: Summary characteristics of shellfish growing business

Shellfish Growing Characteristics		
	Primary Lease (n=32)	
	Observations	Valid Percent
Gear		
Tongs, Rake, or Hand (Ground)	7	21.88%
Floating Bags	8	25.00%
Floating Cages	4	12.50%
Bottom Cages	3	9.38%
Both (Bottom and Floating Gear)	7	21.88%
Other: Nets, Mesh Covers, Suspended Longline	3	9.38%
	Primary Lease (n=34)	
	Observations	Valid Percent
Species		
Oysters	28	82.35%
Clams	2	5.88%
Both (Oysters and Clams)	4	11.76%
Average Lease Size (acres)	7.83	

* indicates less than 3 observations in category

Table 6: Respondent marketing practices n=32

Marketing technique	Frequency
Social media	18
Website	10
Oyster roast experience	6
Apparel	6
Farm tours	5
NC Oyster Trail	4

Table 7: Mean and median fishing expenses of shellfish grower respondents

Annual Expenses	Average	Median
Seed & Shellfish	$13,083	$3,625
Labor	$15,194	$610
Vessel Loan Payments	$1,144	$0
Vessel/Gear Repairs	$2,883	$1,000
Vessel Registration Fees	$396	$125
New Gear/Equipment	$20,797	$5,000
Insurance Boat/Crop	$1,048	$550
Docking Fees	$482	$0
License / Leaseholder Permit Fees	$519	$375
Truck/Transport Expenses	$2,151	$1,321
Boat Fuel Expenses	$1,570	$1,000
Other Professional Expenses	$1,201	$250

Table 8: Household and fishing income of shellfish grower respondents n=30

	Household Income	Commercial Income
$0 or lost money	-	17 (57%)
$1 to $5,000	-	5 (17%)
$5,001 to $15,000	-	5 (17%)
$15,000 to $30,000	*	0
$30,001 to $50,000	*	*
$50,001 to $75,000	5 (17%)	0
$75,001 to $100,000	*	*
Greater than $100,000	8 (27%)	0
Prefer not to answer	8 (27%)	*

* indicates less than 3 observations in category
- indicates category was not included

Table 9: Respondent confidence they will be a grower in 10 years n=35

	Agree
Will be a shellfish grower in 10 years (1=yes)	77%

Table 10: Perceptions of shellfish grower respondents on a scale of 1-10

Ranking	Issue	Rating
1	Shellfish growing/aquaculture has an important role in the history of my community	8
2	Shellfish growing/aquaculture is important economically in my community	7.8
3	Shellfish growers/aquaculturists are respected in my community	6.6
4	My community actively supports shellfish growing/aquaculture	6.2
5	I believe I will be able to make a living in shellfish growing/aquaculture in the future	6
6	I have to work harder now to collect the same amount of shellfish than I did a few years ago	5.7
7	My health is affected by my shellfish growing/aquaculture	5.4

Table 11: List of issues of concern of shellfish grower respondents on a scale of 1-10

Ranking	Issue	Rating
1	Weather	7.5
2	Coastal Development	7.1
3	Unknown Future	6.9
4	Fuel Prices	6.8
5	Proclamations	6.8
6	Start up Costs	6.7
7	State Regulations	6.4
8	Working Water front	6.2
9	Gear Restrictions	5.9
10	Environmental regulation	5.8
11	Federal Regulations	5.8
12	Seafood Prices	5.8
13	Seasonal Area Closure	5.4
14	Imported Seafood	5.4
15	Obtaining Repair Financing	5.4
16	Fecal Coliform Closures	5.3
17	Availability of Seed	5.3
18	License Cost	5.3
19	Overfishing	5.2
20	Record keeping	5.2
21	Labor Issues	4.8
22	Quotas	4.4
23	Off Limit Areas	4.3
24	Emergency Closures	4.2
25	Riparian Competition	3.7
26	Commercial Competition	3.3
27	Recreational Competition	3.2
28	Seafood Scoring	3
29	Size Limits	2.9

Table 12: Frequency of respondents indicating conflicts n=32

User Group	Percent	Frequency
With recreational fishermen	25%	8
With general boaters	25%	8
With state regulators	25%	8
With commercial fishermen	19%	6
With waterfront property owners	19%	6
With the for-hire/charter fleet	9%	3
With federal regulators	9%	3
With other shellfish growers		*

* indicates less than 3 observations in category

Table 13: Business expenses impacted by COVID ranked from 1-10

Ranking	Expense	Rating
1	Fuel prices	6.3
2	Availability of parts / materials	6.2
3	Labor costs	5.5
4	In-person sales	4.8
5	Shipping costs	4
6	Online sales	3.4

Table 14: Respondent perceived efficiency of NCDMF lease approval process

Lease process efficiency	Responses
Much too slow	11 (33%)
Somewhat slow	11 (33%)
Efficient	8 (24%)
Quick	*
Very Quick	*
Prefer not to answer	7

* indicates less than 3 observations in category

Table 15: Respondent support of the creation of Shellfish Enterprise Areas (SEAs) in and around Bogue Sound n=32

Level of Support	Responses
Strongly oppose	*
Oppose	*
Indifferent	22 (69%)
Support	7 (22%)
Strongly Support	*
Prefer not to answer	8

* indicates less than 3 observations in category

Table 16: Economic contribution of shellfish grown on leases in North Carolina in 2022. Reported in 2022 dollars.

Economic Contribution Estimates				
Pounds	Ex-vessel Value	Jobs	Income Impacts	Added Value
855,845	$4,113,059	529	$9,198,366	$15,530,644

9 Figures

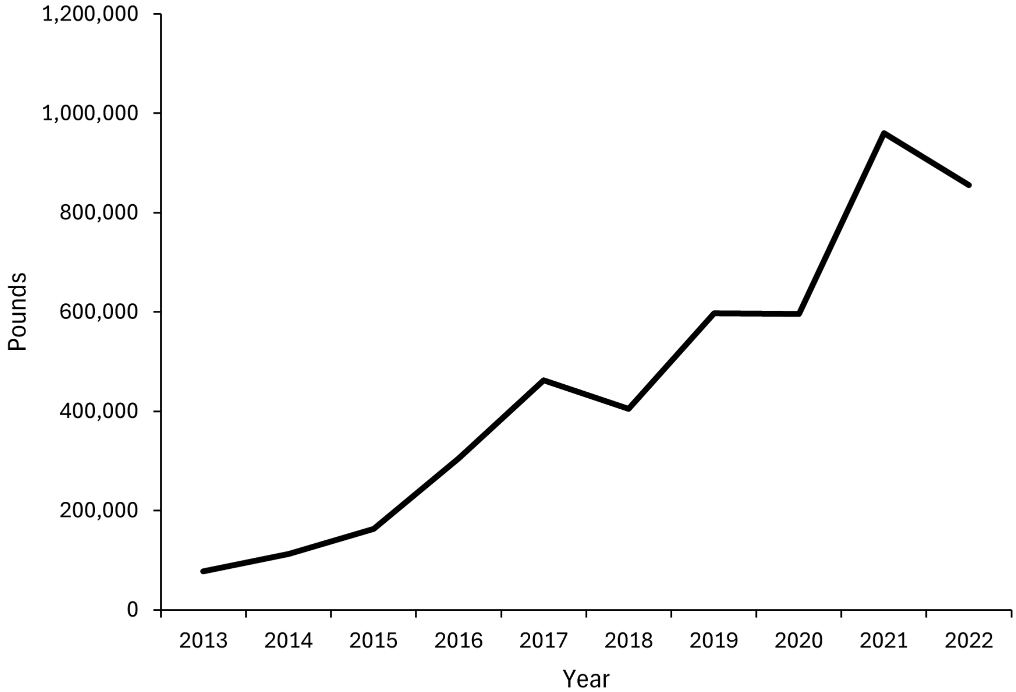

Figure 1: Landings in pounds on private oyster bottom from 2013 to 2022

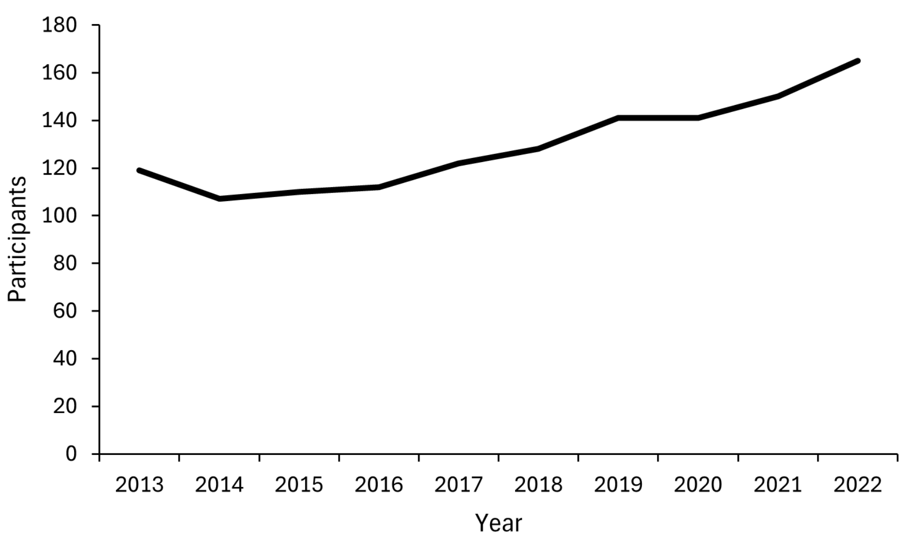

Figure 2: Participants on private oyster bottom from 2013 to 2022

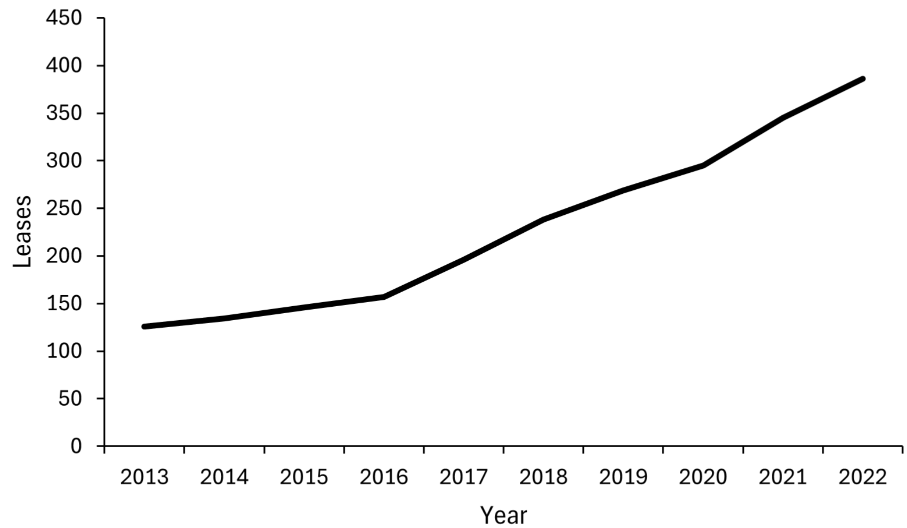

Figure 3: Leases of private oyster bottom from 2013 to 2022

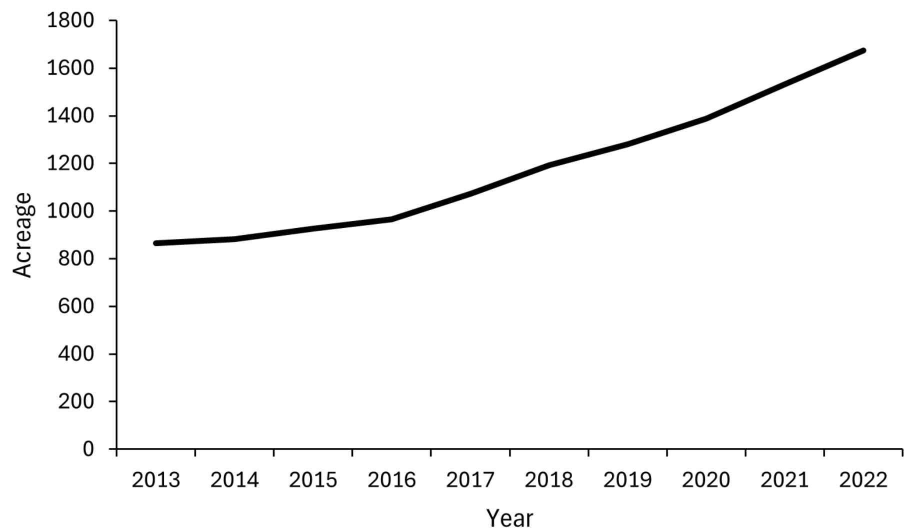

Figure 4: Acreage of private oyster bottom from 2013 to 2022

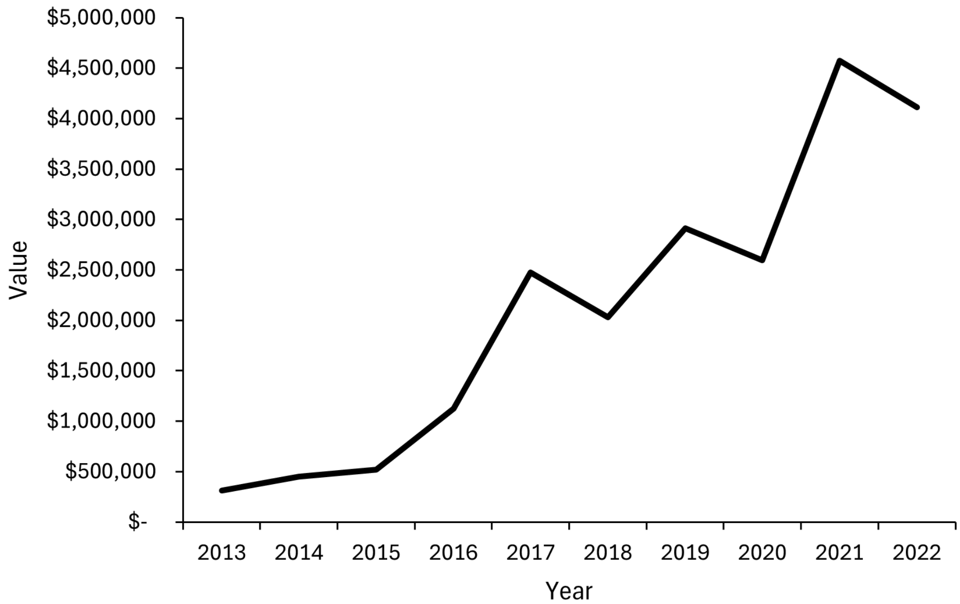

Figure 5: Ex-vessel value reported in 2022 dollars on private oyster bottom from 2013 to 2022

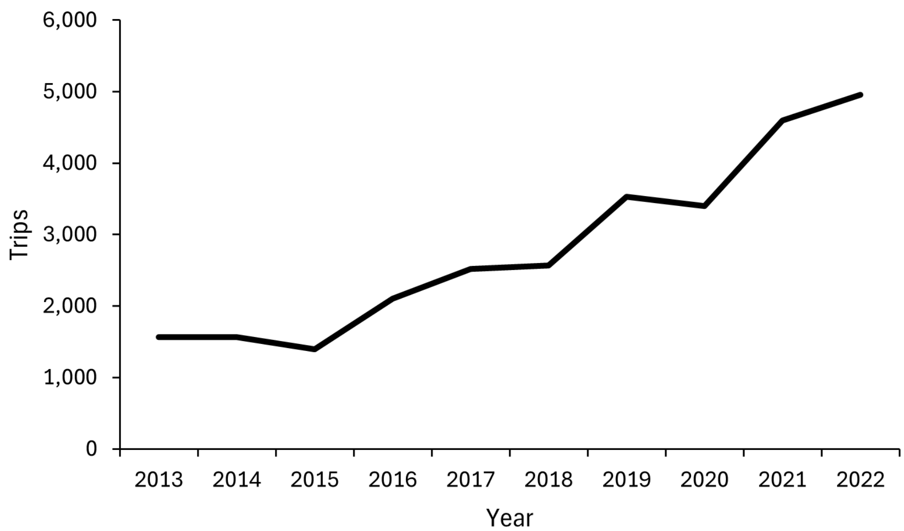

Figure 6: Trips on private oyster bottom from 2013 to 2022

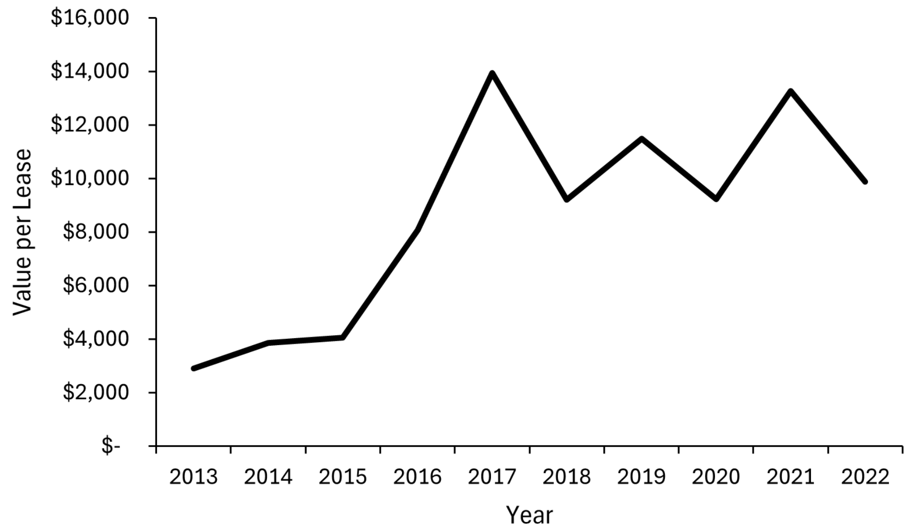

Figure 7: Ex-vessel value per shellfish lease reported in 2022 dollars on private oyster bottom from 2013 to 2022

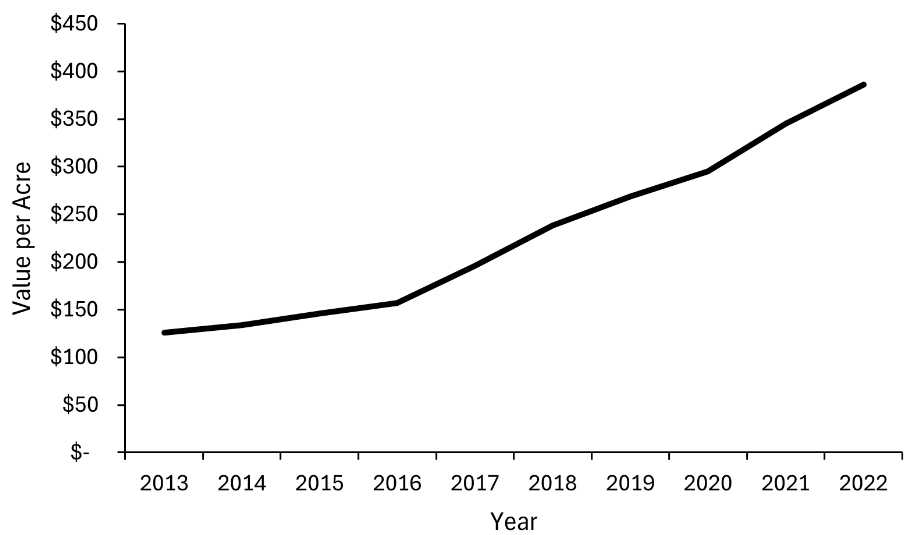

Figure 8: Ex-vessel value per shellfish acre reported in 2022 dollars on private oyster bottom from 2013 to 2022

A Appendices

A.1 Invite Letter

ROY COOPER
Governor

ELIZABETH S. BISER
Secretary

KATHY B. RAWLS
Director

Dear Shellfish Grower,

As a commercial shellfish grower, you know that the rules and regulations routinely enacted affect landings and, as a result, your business. These regulatory decisions are made based on the best fishery data available at the time. To improve the quality of this data, the North Carolina Division of Marine Fisheries (NC DMF) is conducting a socioeconomic survey of all shellfish lease holders within the state. The goal of this survey is to understand the economic contributions, vulnerability, and business practices of shellfish mariculture in North Carolina at the user, industry, and state level. Information collected may be used to estimate damages due to natural disaster or industry shocks. The NC DMF last conducted a socioeconomic profiling of its growers in 2015 and is now updating this data. That is where you come in!

You have been identified from the confidential records of the NC DMF shellfish program as a licensed North Carolina shellfish leaseholder in 2022. I understand that information about your business is sensitive. **This survey is strictly confidential, and your information is protected by NC General Statute 113-170.3(c).** Your answers will be combined with the answers of everyone who participates and will only be published in aggregate form. At no time will your name ever be linked to any of your individual answers in our reporting.

Enclosed is a hard-copy of the survey for you to fill out and return in a pre-paid envelope. Your time and responses are greatly appreciated. You also have the option of taking the survey online by using the URL listed below or by scanning the QR code with your mobile device.

Your personal ID number is: XXXX

https://www.surveymonkey.com/r/ShellfishNC

In the event that we don't receive a mail or online response from you, a staff member of the NC DMF Fisheries Economic Program may call you directly to complete the survey via telephone. This staff member will have more complete details about your participation. However, as the Fisheries Economics Program Manager, I will always be most happy to answer any questions or concerns you may have. My telephone number is (252) 269-9299. My email is jason.walsh@ncdenr.gov.

Sincerely,

Jason Walsh
Fisheries Economics Program Manager
NC Division of Marine Fisheries

State of North Carolina | Division of Marine Fisheries
3441 Arendell Street | P.O. Box 769 | Morehead City, North Carolina 28557
252-726-7021

A.2 Survey

ROY COOPER
Governor

ELIZABETH S. BISER
Secretary

KATHY B. RAWLS
Director

2023 Shellfish Leaseholder and Aquaculture Economic Survey

Thank you for taking this survey from the Fisheries Economics Program within the North Carolina Division of Marine Fisheries (NCDMF). Please estimate the numbers to the best of your ability. Round any dollar amount to the nearest whole dollar value. You can leave comments on the last page of this survey where you can also let us know if you would like to receive the results of this study.

Enter your participant ID number *(found on the front of your mailing packet):* _________

1. How many years have you been growing shellfish? _______________

2. How many years have you owned shellfish leases? _______________

3. Describe your 2022 shellfish leases/activities:

Size (Acres)	**Species**	**Gear Type**	**Months Grown** (e.g., Jan-Mar; Sept)	**Bottom or Water Column?**

4. Estimate the average time it takes you to grow from seed to harvest: ________ months

5. Estimated number of **BUSHELS** planted in 2022: _______________

6. Estimated number of **SEED** planted in 2022: _______________

7. Estimated number of "market-size" bushels harvested/sold in 2022: _______________

8. Percent of bushels sold in-state: ______________%

9. Percent of bushels sold to wholesale seafood dealers: ______________%

10. Percent of bushels sold directly (to consumer, stores, or restaurants): ______________%

11. Average wholesale price you received per bushel: $ ______________

12. Average direct market price you received for your oysters: per bushel $ _______________

per piece $ _______________

Shellfish/Aquaculture Participation

13. What is the ownership type that best describes your shellfish/aquaculture operation?
☐ Sole Owner / Sole Proprietorship ☐ Partnership ☐ Corporation ☐ LLC

14. Do you consider yourself to be a full-time shellfish grower? ☐ Yes ☐ No

15. What percentage of your total individual income do you earn from shellfish growing? ____%

16. What other kinds of work, if any, do you do to earn income other than shellfish sales?

____

17. **Please estimate your total annual expenditures for 2022**

Expense Category	**Amount ($)**
Seed & Shellfish (Payments for seed or shellfish for grow-out or resale)	$ _______________
Labor	$ _______________
Vessel Loan Payments	$ _______________
Vessel/Gear Repairs	$ _______________
Vessel Registration Fees	$ _______________
New Gear/Equipment	$ _______________
Insurance (Boat, Crop, Etc.)	$ _______________
Docking Fees	$ _______________
State Aquaculture License/Leaseholder Permit Fees	$ _______________
Truck/Transport Expenses	$ _______________
Boat Fuel Expenses	$ _______________
Other Professional Expenses/Fees	$ _______________

18. Are you aware of low interest loans available to shellfish growers by the NC Rural Center?

☐ Yes
☐ No, if no, please skip to Question 20.

19. Have you utilized low interest loans available to shellfish growers by the NC Rural Center?

- ☐ Yes, if yes, please estimate the value of the loan: $______________________
- ☐ No

20. Out of the following categories, please mark the amount of revenue you earned last year just from shellfish growing/aquaculture. Include only pre-tax profit, that is, **after you paid all expenses associated with your business**.

- ☐ $0 or lost money
- ☐ $1-$5,000
- ☐ $5,001-$15,000
- ☐ $15,001-$30,000
- ☐ $30,001-$50,000
- ☐ $50,001-$75,000
- ☐ $75,001-$100,000
- ☐ Greater than $100,000
- ☐ Prefer not to answer

21. Over the past three years, do you feel as though the profitability of your business has increased, decreased, or remained about the same?

☐ Increased ☐ Remained the Same ☐ Decreased

22. Please describe some basic information about the vessel(s) used in your shellfish operations.

Vessel	Years Owned	Market Value (including all gear)	Length (feet)	Crew Size (Captain included)	Operator Status*
Vessel #1					1 2 3
Vessel #2					1 2 3

****1. Owner-operator 2. Hired Captain 3. Other**

If Operator Status is **"Other"**, please describe: ______________________________________

23. Where do you keep the boat(s) you use most often for your shellfishing trips?

- ☐ At home
- ☐ At a rented slip
- ☐ At a slip not at my home, but I don't pay rent (e.g., at a fish house)
- ☐ Other place: ________________________________

Demographic Questions

24. What is your age? ________

25. What is your gender? ☐ Male ☐ Female

26. What would you consider your ethnic background?

☐ White/Caucasian ☐ Hispanic/Latino ☐ African-American/Black
☐ Asian/Pacific-Islander ☐ Native American ☐ Other: ______________

27. What is the highest level of education you have completed?

☐ Some High School ☐ High School/GED ☐ Some College
☐ Associates ☐ Bachelors ☐ Graduate/ PhD.

28. What is your marital status?

☐ Never Married ☐ Married ☐ Divorced ☐ Widowed ☐ Separated

29. How many people live in your household (including yourself)? __________________

30. What is the total income of everyone who lives in your household?

☐ Less than <$15,000 ☐ $50,001 to $75,000 ☐ Prefer not to answer.
☐ $15,000 to $30,000 ☐ $75,001 to $100,000
☐ $30,001 to $50,000 ☐ Greater than >$100,000

Opinions on Shellfish/Aquaculture Operations

31. Do you think that you will be shellfish grower/aquaculturist 10 years from now?
☐ Yes
☐ No, if no, why? ____

32. Using a **scale of 1 to 10**, with 1 being "do not agree at all" to 10 being "strongly agree", rate how much you agree or disagree with each of the following statements.

_____ I believe I will be able to make a living in shellfish growing/aquaculture in the future.
_____ My health is affected by my shellfish growing/aquaculture
_____ Shellfish growing/aquaculture is important economically in my community.
_____ Shellfish growing/aquaculture has an important role in the history of my community.
_____ Shellfish growers/aquaculturists are respected in my community.

_____ My community actively supports shellfish growing/aquaculture.

_____ I have to work harder now to collect the same amount of shellfish than I did a few years ago. (*If you think there is no difference, your answer should be 5.)

33. Approximately how many hours per month do you typically spend on record keeping for your business to meet federal and state requirements?

    a. Hours spent on **federally** mandated shellfish growing/aquaculture record keeping? _____
    b. Hours spent on **state** mandated shellfish growing/aquaculture record keeping? _____

34. Have you had any trouble finding a buyer to sell your shellfish to?

    ☐ Yes ☐ No

35. Do you have a commercial Fish Dealer License?

    ☐ Yes ☐ No

36. Do you have a business relationship with a specific seafood dealer or are you independent? *(Check all that apply to you).*

    ☐ I am a commercial seafood dealer and sell my own shellfish
    ☐ Independent (I sell to whomever I wish)
    ☐ Relationship with a specific commercial seafood dealer or dealers

37. How do you market/advertise your products? *(Check all that apply to you.)*

    ☐ Oyster roast experiences
    ☐ Farm tours
    ☐ Apparel
    ☐ Social media
    ☐ Website
    ☐ NC Oyster Trail
    ☐ Other: ____

38. Are you a member of any shellfishing or aquaculture organizations?

    ☐ Yes (NCSGA, NCAA, NCWU, etc.) ☐ No

39. In the last year, have you had any negative experiences with the following:

With commercial fishermen	☐ Yes	☐ No
With the for-hire/charter fleet	☐ Yes	☐ No
With recreational fishermen	☐ Yes	☐ No
With general boaters	☐ Yes	☐ No
With other shellfish growers	☐ Yes	☐ No
With federal regulators	☐ Yes	☐ No
With state regulators	☐ Yes	☐ No
With waterfront property owners	☐ Yes	☐ No

If yes to any part of Question 39, please explain why?

____

____

____

40. Rate how important the following are to your business on a **scale of 1 to 10**. 1 means "it's not important or doesn't affect my business" and 10 means "it's extremely important or it affects my business a great deal".

a.	Overfishing	a. _______
b.	Competition with commercial fishermen	b. _______
c.	Competition with recreational fishermen	c. _______
d.	Competition with riparian property owners	d. _______
e.	Environmental regulation	e. _______
f.	Keeping up with proclamations or changes in rules	f. _______
g.	Gear restrictions	g. _______
h.	Areas off limits to fishing	h. _______
i.	Seasonal or area closures	i. _______
j.	Fecal coliform closures	j. _______
k.	Emergency closures	k. _______
l.	Availability of seed	l. _______
m.	Size limits	m. _______
n.	Quotas	n. _______
o.	Federal regulations	o. _______
p.	State regulations	p. _______
q.	Seafood scoring (e.g., Monterey Bay Aquarium Seafood Watch)	q. _______
r.	Seafood prices	r. _______
s.	Imported seafood	s. _______

t. Startup costs t. _______
u. Obtaining financing for repair/replacement costs u. _______
v. Cost of licensing and taxes v. _______
w. Record keeping (trip tickets, tax purposes) w. _______
x. Crew or labor issues x. _______
y. Weather y. _______
z. Inability to predict the future for your business z. _______
aa. Fuel prices aa. _______
bb. Losing working waterfronts like docks, marinas, and fish houses bb. _______
cc. Development of the coast cc. _______

41. Rate how COVID affected the following business aspects on a **scale of 1-10.** 1 means "there's been no change or hasn't affected my business" and 10 means "it's changed a lot or has affected my business a great deal".

a. Fuel prices a. _______
b. Labor costs b. _______
c. Availability of parts / materials c. _______
d. In-person sales d. _______
e. Online sales e. _______
f. Shipping costs f. _______

42. Would you recommend becoming a shellfish grower to someone considering entering the industry? Use a **scale of 1 to 10 again.** This time the scale ranges from 1 meaning "not at all likely" to 10 meaning "extremely likely". _________

Opinions on Lease Application / Regulatory Process

43. Have you used the NCDMF Shellfish Siting Tool to aid with your site selection and lease application?

☐ Yes
☐ No

44. If yes to Question 43, rate the usefulness of the tool on a **scale of 1 to 10**, with 1 being "it's not useful or difficult to use" to 10 being "extremely useful or easy to use": __________

45. How would you describe the lease application and approval process in North Carolina?

- ☐ Much too slow
- ☐ Somewhat slow
- ☐ About right
- ☐ Somewhat fast
- ☐ Very fast

46. Have you experienced any lost opportunities for expansion or diversification due to regulations?

- ☐ Yes, if yes, please describe: ____

  ____

- ☐ No

47. Are there any regulations you would like to see changed?

- ☐ Yes, if yes, please describe: ____

  ____

- ☐ No

48. What is your opinion on the creation of Shellfish Enterprise Areas (SEAs) in and around Bogue Sound?

- ☐ Strongly oppose
- ☐ Oppose
- ☐ Not Sure
- ☐ Support
- ☐ Strongly support

Please list reasoning for opposition or support of SEAs:

____

____

49. Please provide an email address if you would like a copy of the results.

____

50. Any additional comments?

____

____

____

____

____

____

____

____

____

A.3 Aquaculture America 2023 Panel Discussion

Session Questions
1. What do you think are the most common barriers to entry for the shellfish aquaculture industry?

R- expensive to get into for some. Mostly hurdles to overcome... crop insurance.

M- Maryland permitting for aquaculture leases... only process applications from March-November. Backs up the permit process. Current administration is not very aquaculture friendly. Some applications have been delayed 5 years. Another hurdle... capital to start your farm. Inputs have tripled. A good business plan is essential.

P- Availability of seed. In Florida that is a major issue. Shellfish restoration projects is taking seed away. Conflicts with existing users when finding a new lease area. New people coming in who don't understand aquaculture / working waterfronts.

B- Virginia is a leader in clam aquaculture. Barriers to expansion... finding availability of leases. Leases aren't necessarily being used but they aren't available to be leased. NIMBY push back for many applications that are at the surface. SAV takes away areas that are available for leasing.

O- Broader conflicts as well. Recreational / Commercial fishing conflicts with growers. State put in a bill that put two moratoriums in the sound. Lease siting is an increasing challenge. Finding more seagrass and natural shellfish on site which denies or modifies the lease application. Some issues in the past with growers getting seed. Shellfish farming is steep learning curve.

2. What tools are available in your state to assist new / prospective growers with siting their farms?

R- ALAquaculture .com has information on permitting and siting tool . Mississippi doesn't have an online tool.

M- MD Aquaculture Siting Tool. Great place to show where not to put a lease. Shows SAV, existing leases, pound nets, outfalls. Just got funding to rank aquaculture sites... a tool that is free to use.

P- Alabama has a great website that walks you through the whole process.

B- VRMC has an online map. VIMS produced its own with public grounds and leasing conflicts. Anyone I know who is in the business still finds it a struggle.

M- Local knowledge for the folks who have been in the area is key in finding useable lease area.

O- NC has an ArcGIS tool. It's basically an exclusionary analysis. It shows all the areas that are terrible for a lease area. It even shows the areas where a lease was denied. UNCW has a siting tool as well. It has some environmental data as well. I've heard good feedback from folks using that tool. Eric Herbst at NC Sea Grant is a resource for applicants to speak with. Bryan at Cape Carteret Community College has a 3-hour class on siting.

M- Just because someone doesn't want a lease somewhere... doesn't mean it won't be approved.

3. How do you think growers are expanding their business / market share? In what ways do they need support?

M- Most state have a seafood marketing program. COVID has actually helped our farmers. I've got growers who have partnered with other growers with a subscription program for oysters. Website sales... ship with UPS or FEDEX. COVID hurt these guys but it did open up other avenues for sales.

P- We had farmers who got really creative with marketing and sales. They're also looking at new species like clams.

B- Newer, smaller businesses are more interested in support. Well established businesses are not interested in people getting support. Developing new markets

M- Lots of those value-added seafood products had a lot of sales during COVID. Try to understand why people buy seafood products.

B- I think there is an opportunity for shellfish aquaculture to sell affordable protein. Why don't we have a miller lite of oysters? Be at a price point where that would work. With the discussion of food, there is the potential that there will be consumers looking for a product that has less environmental impact and I think oysters could reach that point.

O- Growers are shifting to floating gear. People are shifting over to these more modern methods. NC Oyster Trail is an initiative that is ongoing. . . farm tours, restaurants. . . .we are also seeing individual growers being creative. . . .growers are delivering product from one end of the state

B- NC growers are selling the oyster roast experience now.

R- Catering and branding is another method. . . apparel.

M- If you're growing oysters in the water column or floating, they are selling to the half shell market. If you're growing on the bottom, they are selling them on the cluster market.

B- For folks with states with new growers, it's hard to not be attracted to the half shell market. But who is making more money? The half shell grower or the cluster grower? To be in the half shell market, it is a lot of work. Sometimes hand delivering oysters and doing all the social media limits your ability to expand.

B- Be careful with branding. There are real differences between oysters but if you get people in the industry who aren't doing anything to create the brand. . . that could cause the branding to collapse. . . it could be fraud.

- What tools does your state provide to help farmers with this stage of business?

4. What kinds of infrastructure are growers lacking in your state?

5. What kinds of business loans do growers have access to in your state? Are there public and private options?

O- Fixed and low interest loans for shellfish leases in NC by the Rural Center.

R- To start a farm, you need access to capital. We have folks who have leveraged their homes and commercial fishing operations to have capital to leverage these farms.

M- We have a shellfish loans program by MARBIDCO. Any loan you can take is between 5,000 and 500,000 dollars. On your first loan, if you've made all your payments they forgive 40% of your loan on the principal. We've had growers who have taken out 400-500k $ in loans. You can apply before you get your lease because the permitting process takes so long. We get applications from new people and people who want to expand. If you have an issue with making payments, they can work out a payment plan. . . .one person pays $25 a month. They can restructure your loan.

R- Those are wonderful programs unless you're established farmer. They perceive it as introducing competition.

B- I tried to get Alabama to do the MARBIDCO program but you do have the problem of it being perceived as unfair. But if you make it available to new and current growers maybe it is more fair... but capital is one of the hurdles to growers. I would not want to be the agency who is giving money to people to start farms. It's very difficult going to a bank and getting a small business loan. Having the capital upfront would help people not get trapped in those "smaller" farms

6. What kinds of access do growers have to crop insurance in your state?

O- NAP Insurance. It is capped at $300k. It doesn't cover multiple small loss events. It only covers single loss events. In NC, 30% mortality is considered the cost of doing business. But we are seeing larger scale mortality rates. In 2024, the FDA is going to offer more extensive crop insurance.

B- In VA, there is a lot of awareness on the federal insurance options but not a lot of usage.

P- We have NAP and ELAP that are available. There are also some COVID programs that are available.

M- While NAP is not the greatest, it's the best we've got. We still encourage people to get it in the hopes that you don't have to use it.

R- ELAP is a disaster relief program for hurricanes or high rainfall events like other crops. I started working with USDA... the goal is a whole farm insurance just like other crops.

B- The Whole Farm Revenue Program... why isn't that working? I know that you would have to report your sales to get federal support but that's what you've got to do.

M- It's not crop insurance... but there are some options available for business-related insurances.

7. Does your state facilitate educational opportunities for prospective / new growers such as on-farm mentorship with existing growers?

8. How has your state worked to streamline the permitting process?

Audience Questions:

1. Do any states have leniency to certain gear types in regard to SAV?

M- If there is SAV in Maryland, don't plan on putting a lease there.

R- Alabama / Mississippi it is a joint application with the USACE.

V- There has been talks about that. Not just gear type but practices. Ex. Walking the floating gear. VIMS is an advisory when doing this work but they haven't made any advise to the VA regulators.

2. How are you training growers?

M- MD has a demonstration farm to see how they work the farm.

R- Mississippi has a good training program. They have personnel who give a 5-day course, in-class and water training.

O- NC doesn't have state-funded training. Bryan Snider runs the shellfish course (8-weeks) in a community college. It covers all the topics one might need to get into the shellfish industry. We've seen the growers that go through that program are very successful and well-prepared. We recently had a rule change so that we may be able to provide

P- Sea Grant has a virtual platform training. Local community college in the Panhandle teaches courses.

B- New shellfish farmers are a risk to existing growers. So it is a benefit to have trainings. It's good to give a class but having a training program can create an influx of growers who saturate the industry.

LA is paying people to get into the shellfish industry.

3. Are you aware of any measures to discourage unused leases?

P- Lease holders are required to show how much input (seed) they invested in a year. There is a two-year window before lease is forfeited.

O- NC has similar requirements. Require growers show records once a year like Florida. As far as harvest goes, it is all calculated based on trip tickets. 3-year average production?

M- MD revised leasing laws in 2012. "Use-it or lose-it" leasing clause. They must submit monthly planting and harvest reports. We can track how harvests go throughout the year. We don't have a production requirement but you do have to report production.

P- One of the ways we've been able to encourage reporting and accurate reporting, all that information is public records exempt outside of insurance and federal requests.

R- In Alabama, you have to establish riparian rights. If you want to be in a park, they have a 100 k planting seed requirement, but it isn't enforced.

B- Bottom cages is very common in Virginia. With climate change, we want farmers to be flexible. There seems to be value in spreading your seed around but if you require a certain seed amount per acre, etc. . . .you may be constraining the farmer. Measure inputs. . . .I don't want to ask a grower how much they make. . . .and they don't want to share it. If you've grown shellfish, there is a very good reason why you didn't make production requirements. But not meeting inputs, there is no rational for that.

R- Production requirements limit the ability for small growers to be in the industry. Seed availability is a hindering factor.

O- 2019 in NC, new production requirements removed cultch as an eligible planting material so now growers have to plant seed. Different requirements for panting and harvest for all the different gear used. We have an "act of god" clause that allows a grower two years to make up production deficit.

4. What's the best way to facilitate information sharing to promote aquaculture in the community?

B- Our intent is to have a live feed on our oyster farm at VIMS as a public engagement tool. I want the most views.

O- In addition to training people, we are going to be focusing on best management practices and user-conflict issues. From lease applicants, that's going to be their biggest concern.