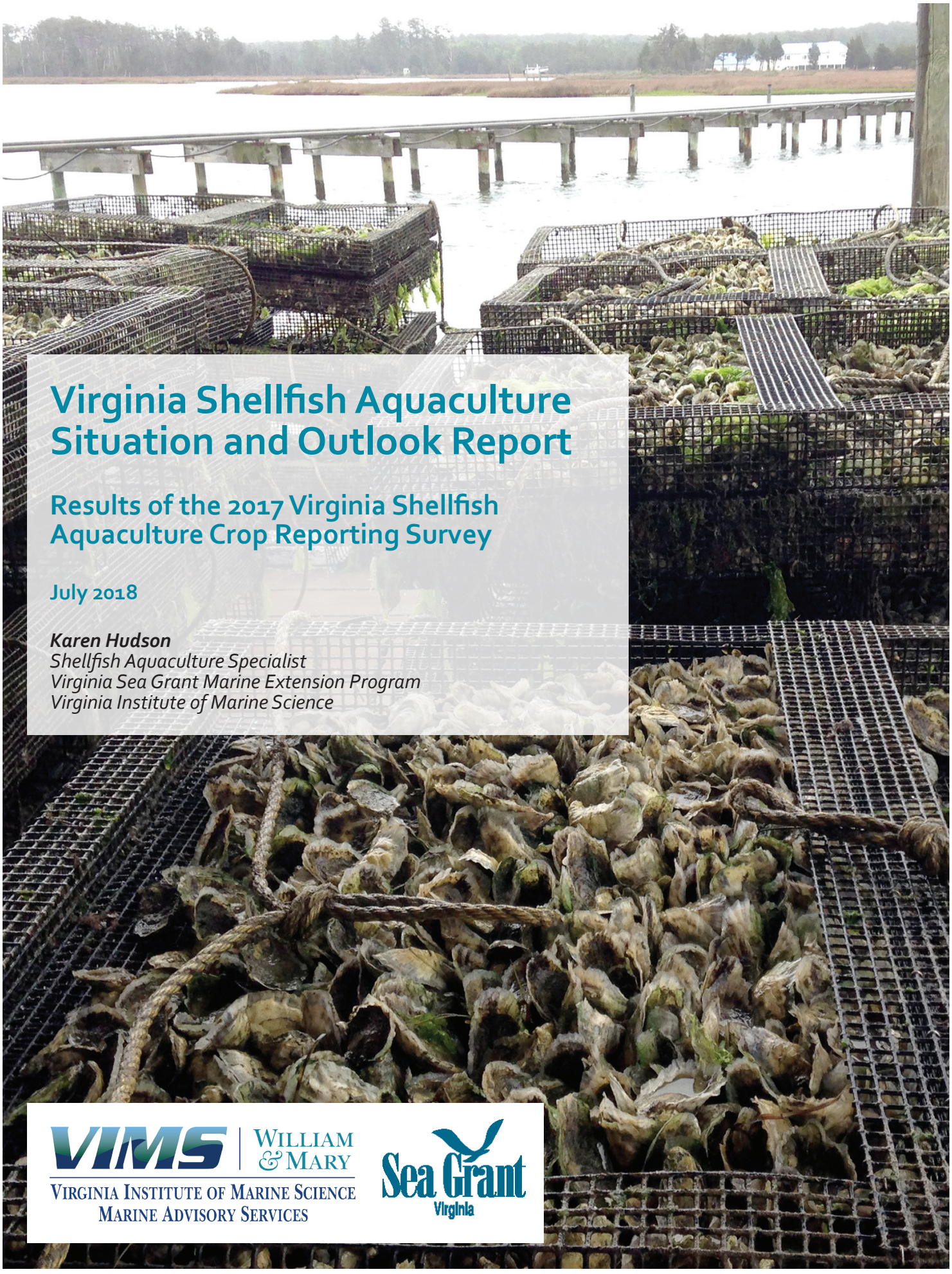

Virginia Shellfish Aquaculture Situation and Outlook Report

Results of the 2017 Virginia Shellfish Aquaculture Crop Reporting Survey

July 2018

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VIMS | William & Mary
Virginia Institute of Marine Science
Marine Advisory Services

Sea Grant Virginia

The complete report can be found online at www.vims.edu/map/aquaculture

VIMS Marine Resource Report No. 2018-9

Virginia Sea Grant VSG-18-3

Photos: ©Karen Hudson

Executive Summary

The shellfish aquaculture industry in Virginia continues to grow adding significant value to the Commonwealth's seafood marketplace. Today, watermen harvest both hard clams and oysters from the Commonwealth's public resources, albeit at rates diminished from historic levels. At the same time, Virginia's watermen-farmers are providing additional quantities of quality shellfish to consumers.

This survey, in its 12th year, is intended to continue annual assessments with which to gauge growth and inputs in Virginia's hatchery-based shellfish aquaculture industry[1]. This report is based upon an industry survey completed during the first quarter of 2018.

While these trends are widely acknowledged, there had been no consistent reporting of production and economic trends in Virginia's shellfish aquaculture industry until this annual survey was initiated in 2006. Periodic assessments are necessary to inform growers and related interests about the actual status and trends in the industry.

Highlights

- 2017 farm gate value for Virginia shellfish aquaculture was $53.4 million
  - $37.5 million Hard Clams
  - $15.9 million Oysters
- Prices and markets remain strong for Virginia shellfish products
- Virginia is 1st in the U.S. for hard clam production
- Virginia is 1st on the East Coast of the U.S. for Eastern oyster production
- Virginia shellfish aquaculture directly employs hundreds of Virginians
- Clams are the biggest contributor to Virginia's shellfish aquaculture economic value
- Oysters are the most rapidly developing sector of Virginia's shellfish aquaculture
- Virginia's shellfish production comes from a system of vertically integrated private hatcheries

[1] Historically, and still practiced today, is the oyster "culture" technique of transplanting wild harvested seed to leased growing grounds; however, the results here do not include information on such oyster planting.

Methodology

A mail and Internet-based survey was developed to collect information from Virginia clam and oyster growers known to be active in the industry[2]. Each year, the survey instrument is evaluated and revised based upon field testing (Appendices 1 & 2). A total of 57 complete, useable surveys were returned via the Internet, mail, or fax. These included responses from 14 clam growers, 47 intensive oyster growers, 5 extensive growers, 5 shellfish hatcheries, and 7 growers who cultured both molluscs. It is believed that the survey is representative of overall trends in 2017 and based on the majority of active commercial growers. For confidentiality reasons, the information collected is aggregated, and the total represents both the eastern and western shores of Virginia.

Summary of Findings

Oyster Aquaculture (Crassostrea virginica)

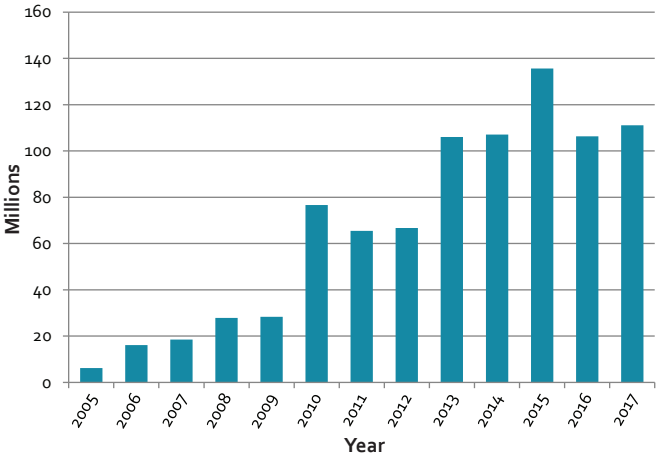
The results in this report reflect the use of aquaculture practices adopted as a result of increased oyster disease and predation which utilize only hatchery-produced seed and larvae. There are two methods of hatchery-based oyster aquaculture production in Virginia, intensive culture (containerized) and extensive culture (spat-on-shell). Both typically use genetically improved stocks and triploid, or "spawnless" oysters. Industry reports that the sterile triploid seed is more viable from a commercial standpoint, as the oysters grow faster and do not diminish in quality with seasonal spawning.

Intensive Culture (containerized)

Intensive culture methods use cultchless, or single seed, containerized for predator protection. Containerization varies but generally consists of off-bottom cages, racks and in some cases, floats. Intensive oyster culture requires more labor in gear and product maintenance and is generally considered more expensive. However, the end result is a consistent and high quality product that has the ability to obtain a higher price in the boxed and half shell markets.

Figure 1 shows a reported 111.1 million single oysters planted in 2017, a 5% increase from 2016 and 6% less than projected for 2017. Growers reported that triploids made up 87% of their plantings in 2017 which was similar to reports in 2016. The outlook for 2018 suggests a 2% increase in oysters planted by Virginia growers; to 113 million single oysters planted.

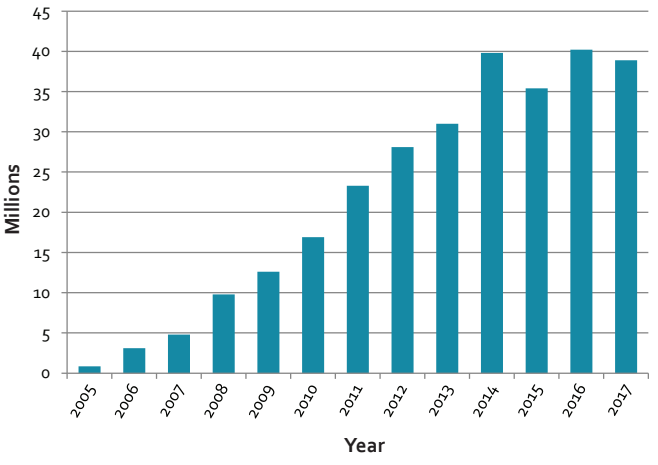
Figure 1. Number of Single Oysters Planted by Virginia Aquaculturists



Intensive Oyster Sales and Prices

Three of the 47 oyster survey responses indicated some sort of cooperative relationship to market but most arrangements were similar to those with contractors, with no equity exchange such as providing seed[3]. Therefore, individual participation in the survey remains critical to capture the industry trends. The 2017 results indicated the total number of market oysters sold by Virginia growers, subtracting the reported sales from those indicating involvement with a cooperative, was 38.9 million (Figure 2). This was a decrease of 3% from 2016 and 20% less than growers predicted from the previous survey. Survey respondents forecast an 8% increase for

Figure 2. Number of Market Oysters Sold by Virginia Growers (millions)



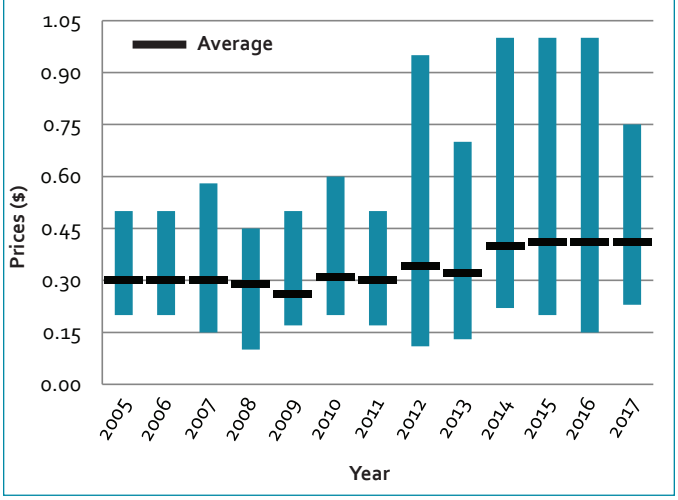
[2] Virginia Marine Resources Commission's Licensed Aquaculture Product Owners List.

[3] In 2013, the crop reporting survey was expanded to ask whether the grower has a "cooperative" agreement with a larger oyster producer who would likely report the sales numbers. This was due to reports of oyster cooperative arrangements and was an effort to reduce the potential for double counting oyster sales.

2018 sales which, if reached, would translate to nearly 42 million market oysters sold. A marketing concern reported from many growers in the past two survey years was heavy wild spat fall on the cultured product which excludes product from entering the higher-value boxed market.

For the purposes of this report, oyster prices are not broken down as to market segment (i.e. primary wholesale, secondary wholesale, retail, etc.). Figure 3 shows an average price of $0.41 per oyster in 2017, no change from the previous two years[4]. Trends in the percentage of single oysters sold into wholesale markets remain fairly consistent at greater than 90% for the last nine years. The percentage of single oysters sold out-of-state in 2017 was 63%. This export level has ranged from 56 % to 86% for the last eight years.

Figure 3. Oyster Prices Reported by Virginia Growers



Combining the overall sales of single, market oysters with the weighted average price of $0.374 per oyster, it is estimated that the total 2017 revenue for containerized oyster aquaculturists (not including spat-on-shell) was $14.5 million, a 12% decrease from 2016.

Extensive Culture - Spat-on-Shell

Extensive culture is also referred to as remote setting or spat-on-shell. The primary advantage of spat-on-shell cultivation is that it requires less labor and fewer materials than single oyster cultivation. Therefore, this method is a more economically feasible option for producing large quantities of local oysters for use by Virginia's oyster processors. Oyster eyed larvae purchased from the hatchery are transported to setting sites, struck on containerized oyster shells and ultimately planted directly on the bottom. Because spat-on-shell cultivation produces oysters grown in clusters (similar to wild-caught oysters), the primary product is predominantly oysters for shucking rather than single oysters for half-shell consumption.

The spat-on-shell process has been enhanced since its start in 2008. Improvements in the quality of eyed larvae coming out of the hatcheries and optimized remote setting methods have cut in half the number of eyed larvae required per bushel of shell. While large-scale spat-on-shell cultivation has been used in Virginia for the last several years, federal monies had subsidized a large portion of this development which impeded relevant forecasting[5]. These subsidies are gone, allowing for inclusion of industry trends. In 2017, growers reported planting 34,000 bushels, a 31% decrease from 2016. The industry forecast for 2018 is to increase by 15% to 39,100 bushels. The industry's expansion depends on a consistent production of large quantities of eyed larvae, which can be problematic due to poor water quality.

Extensive Culture - Sales and Prices

In 2017, growers reported harvesting 27,000 bushels of spat-on-shell, a 37% decrease from 2016. Expectations for 2018 are an increase of 61% to 43,600 harvested bushels of spat-on-shell. The average price per bushel was $52 making the 2017 farm gate value for spat-on-shell $1.4 million.

[4] Some smaller growers, with annual sales less than 150,000 oysters, market their product directly at the retail level and reported maximum prices in excess of $1.50 per oyster. During 2017 the median price was $0.40 per market oyster, same as the previous year. The weighted average price was $0.374 per market oyster in 2017, a decrease of $0.036 from 2016.

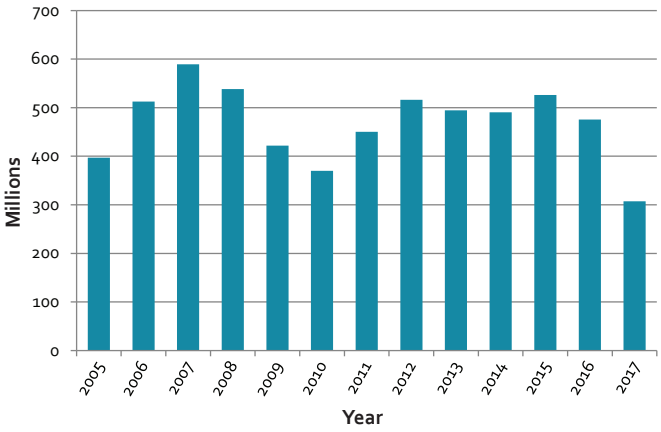
[5] According to prior grower survey reports, the number of harvested bushels of spat-on-shell has continually increased from roughly 2,000 in 2009 to almost 13,000 in 2012 and over 38,000 bushels in 2014. These numbers include a mix of plantings funded by private investment and subsidized support.

Hard Clam (Mercenaria mercenaria) Aquaculture

Clam aquaculture is a relatively mature aquaculture industry that has dominated over wild clam harvest in Virginia for more than a decade. Clams are not as low-salinity tolerant as oysters. Thus the majority of clam production comes from the higher salinity areas on the eastern shore including both bayside and seaside. Clams burrow into the sediment which makes the production methods much different than oyster culture. There is a standard method used for clam aquaculture in Virginia in which beds are planted in plots and covered with mesh net for predator protection. Planting to harvest is a two year process, longer than in oyster aquaculture.

Based on previous economic assessments compiled by VIMS Marine Advisory Program, Virginia continues to lead the nation in the production of cultured hard clams. As depicted in Figure 4, clam growers reported a 35% decrease in seed plantings during 2017 to a total of 307 million clams. The industry outlook for 2018 predicts an increase of 23%, to 377 million individual clams planted.

Figure 4. Number of Hard Clams Planted in Virginia (millions)



Clam Sales and Prices

The 2017 crop reporting survey reflects a 10% decrease in the number of market clams sold over the previous year to 176 million (Figure 5). Trends in the percentage of market clams sold into wholesale markets have remained in the range of 94% to 99% for the last eight years and were reported at 99% in 2017. During 2017, 88% of market clams were sold out-of-state. This export level has ranged from 85% to 93% for the last six years.

Figure 6 displays the survey findings regarding relative prices received for market clams. The average price reported per market clam at the farm gate was $0.20 during 2017, the same as the previous year. Based on the overall sales and the weighted average price of $0.213 per market clam, it is estimated that total revenue for hard clam aquaculturists in 2017 was $37.5 million, a decrease of 2% from the prior year.

Figure 5. Number of Hard Clams Sold in Virginia (millions)

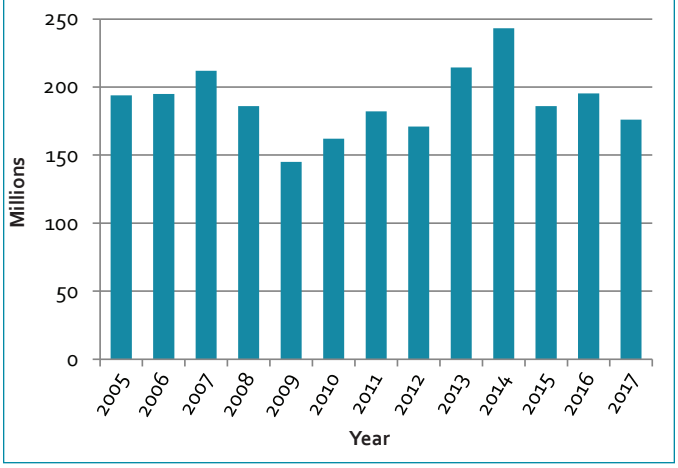
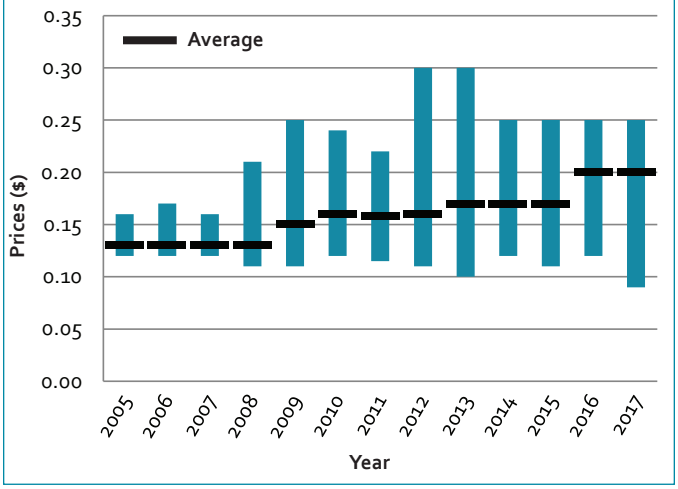


Figure 6. Clam Prices Reported by Virginia Growers



Shellfish Hatcheries[6]

The vast majority of Virginia's production comes from a vertically integrated system with about eight commercial shellfish hatcheries, of various scales, producing clam seed, oyster seed, and oyster eyed larvae. Products are either planted by the hatchery owners themselves in their aquaculture operations, or sold to other Virginia growers (Figure 7). The hatcheries are widely distributed throughout coastal Virginia, located on western and eastern shores, both bayside and seaside. Oyster production occurs on both shores; however, clam production occurs almost exclusively on the eastern shore due to the higher salinity requirement for this shellfish species.

Since 2008, the expansion of large-scale oyster spat–on-shell in Virginia has changed oyster production volume, as shown in Figure 8. Existing firms became active in purchasing not just cultchless oyster seed, but large quantities of oyster eyed larvae for spat-on-shell development. In 2017, oyster hatcheries reported sales of 255 million single seed and 2.7 billion eyed larvae[7]. These numbers represent a 3% and 7% decrease from 2016 sales, respectively. Triploid eyed larvae and seed sales are reported to be 89% and 97 %, respectively. The average price of eyed larvae has shown a continual increase over the past four years; increasing 9% to $ 356 per million in 2017.

Clam seed production and sales have remained stable for the last several years as well as the reported average price of clam seed. Industry sources indicate much of the hatchery capacity is dedicated to producing seed for the hatchery owner's own planting. Essentially, all of the seed produced is planted in Virginia. This vertically integrated system with eventual sales to many out-of-state consumers adds important economic development to local coastal communities.

Water quality remains a critical area for shellfish hatcheries. Water quality issues of unknown origin were reported by oyster hatcheries in 2009 and 2011 and show a clear impact on production as seen in Figures 7 and 8. Research is ongoing to understand the water quality parameters that negatively impact consistent production, with the goal of providing management tools for hatcheries to mitigate the issues.

Figure 7. Virginia Shellfish Hatchery Production (millions)
Includes clam seed, oyster seed, and oyster eyed larvae

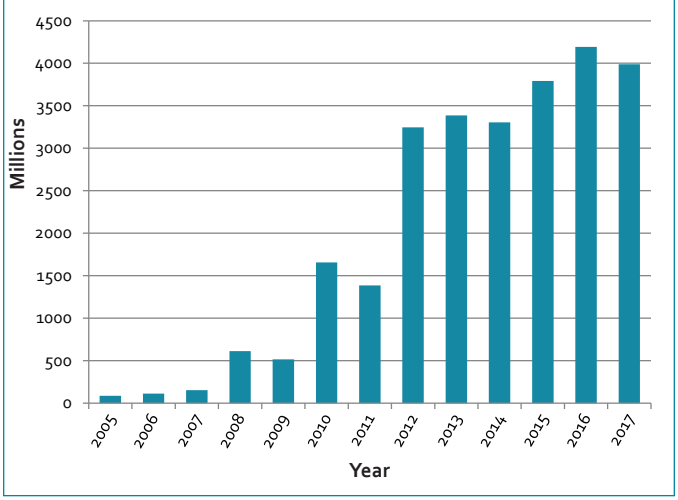
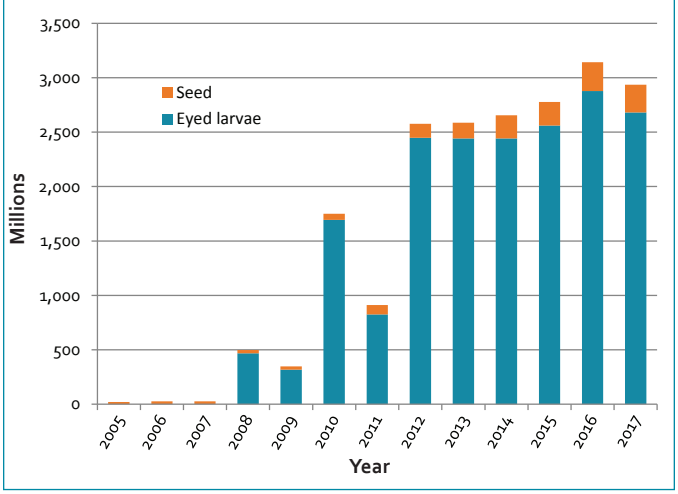


Figure 8. Oyster Hatchery Sales (millions)



[6] The expansion of oyster hatchery infrastructure in 2009 prompted the addition of hatchery-specific survey questions in 2010. Hatchery questions were then relocated to a standalone survey sent directly to the shellfish hatcheries beginning in 2011 (Appendix 2).

[7] Over the last four years, Virginia hatcheries have reported selling a percentage of their total seed and eyed larvae production out-of-state. These sales support development of oyster aquaculture in surrounding states with limited, or no private hatchery capability of their own.

Shellfish Aquaculture Employment

The employment situation for all shellfish aquaculture is complicated by the diversity of the firms involved. In view of this fact, the trends in these employment figures should not be overly interpreted (Figures 9 and 10). The difficulty of estimating the time and labor associated with relatively small-scale oyster aquaculture conducted in conjunction with other business lines makes estimates of oyster culture labor problematic at this point in industry development. The vast majority of the clam production is conducted by relatively large vertically integrated companies who often contract with self-employed grower cooperatives which, as with oysters, complicate the estimates of labor involved in this industry.

Given the ambiguity of reporting labor used for both oyster and clam culture noted above, it is useful as a benchmark to review the economic impact model developed for Virginia shellfish aquaculture for the 2012 growing year. The IMPLAN model used for that assessment estimates that just under one (0.9) full time equivalent (FTE) is needed to produce $100,000 of cultured shellfish output. Based upon this model, 481 FTEs would be needed to produce the 2017 estimated output of $53.4million. These figures do not represent the indirect and induced employment multipliers.

Figure 9. Virginia Oyster Farm Employment

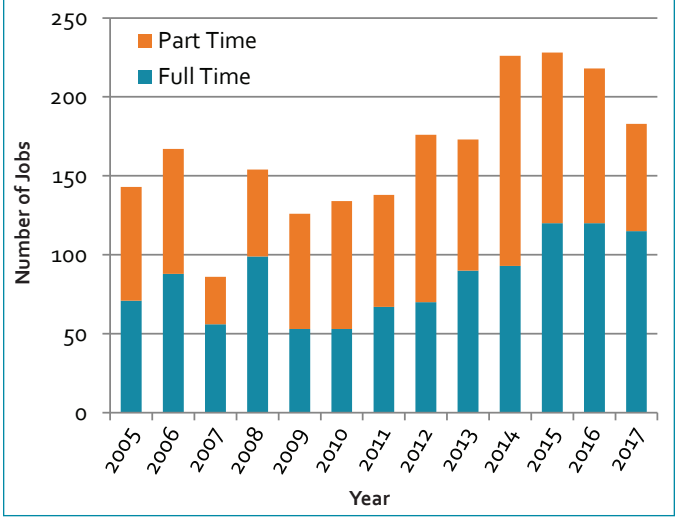
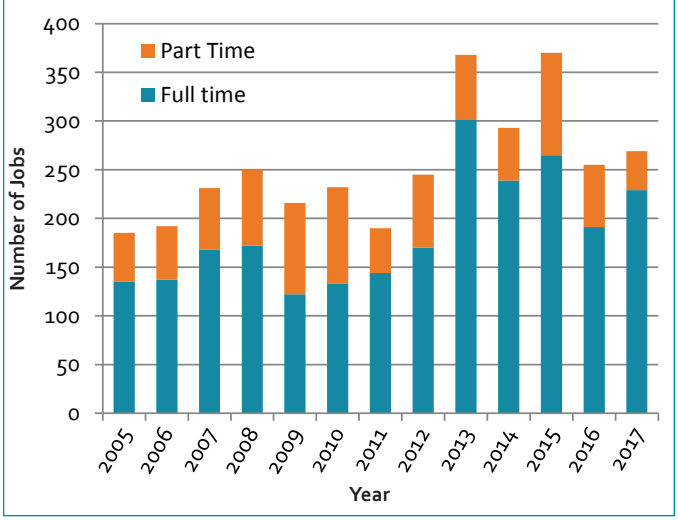


Figure 10. Virginia Clam Farm Employment



Appendix 1: Grower Survey

Virginia Shellfish Grower Situation & Outlook Survey 2018

Welcome

Thank you for taking a few minutes to complete the following commercial aquaculture survey. This survey is meant to capture trends in hatchery-based shellfish aquaculture activity on private ground. If you do not participate in hatchery-based culture, please disregard.

With your help, Virginia's past annual surveys have shown how useful timely information is for the shellfish aquaculture industry. Such information is vital to understanding the importance of Virginia's growing aquaculture business to the economy, and in turn the importance of clean water, reasonable land use and tax policies, access to financial capital and the like to shellfish growers.

All information provided will be held in the strictest of confidence and used only when combined with all of those providing information on their individual operations.

Not all questions may apply to your situation. Please answer all that do. The more accurate and complete the information provided, the better the characterization of the Virginia aquaculture industry.

Please complete the survey by February 5, 2018.

If you have any questions or would like to discuss, please contact:

Karen Hudson
Shellfish Aquaculture Specialist
Phone: 804-684-7742
Fax: 804-684-7161

You can also file online by accessing https://www.surveymonkey.com/r/growersurvey2018

If filing online, please note this year you must complete the survey before exiting – you are not able to save your answers and finish at another time.

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Virginia Shellfish Grower Situation & Outlook Survey 2018

Commercial Clam Aquaculture

1. **Do you aquaculture clams? (If NO, skip to #9)** Yes ○ No ○

2. **Do you have a clam hatchery?** Yes ○ No ○

3. **Do you "re-sell" seed?** Yes ○ No ○
Do you grow small seed to a larger size for resale to another grower(s)

4. **Do you have a "cooperative" agreement with a larger clam producer who will likely be reporting these numbers?** Yes ○ No ○

5. **Do you purchase hard clam crop insurance?** Yes ○ No ○

6. **2017 Commercial Clam Aquaculture**

a) # Clams planted

b) % Seed purchased

c) Ave. price of seed purchased

d) # Seed sold

i. % seed sold out-of-state

e) # Market (non-seed) sold

i. % wholesale

ii. % retail

iii. % market clams sold out-of-state

f) Ave. price per market clam

i. Avg. price wholesale

ii. Ave. price retail

g) # Full-time help

h) # Part-time help

Virginia Shellfish Grower Situation & Outlook Survey 2018

Commercial Clam Aquaculture

7. 2018 *ESTIMATED* Commercial Clam Aquaculture

a) # Clams planted

b) % Seed purchased

c) Ave. price of seed purchased

d) # Seed sold

i. % seed sold out-of-state

e) # Market (non-seed) sold

i. % wholesale

ii. % retail

iii. % market clams sold out-of-state

f) Ave. price per market clam

i. Avg. price wholesale

ii. Ave. price retail

g) # Full-time help

h) # Part-time help

8. Comments or Explanatory Notes on 2017 or 2018 Clam Aquaculture:

Virginia Shellfish Grower Situation & Outlook Survey 2018

Commercial Oyster Aquaculture

This section covers two methods of commercial oyster culture: spat-on-shell and single oysters. Each method has its own series of questions.

9. Do you aquaculture oysters? Yes ○ No ○

10. Do you aquaculture spat-on-shell oysters Yes ○ No ○

This includes setting, planting, and/or harvesting of spat-on-shell.
(If NO, skip to #14)

Note: Some of you may purchase eyed larvae for setting single seed. Do not include this activity in the spat-on-shell section. It should be included in the cultchless oyster section [provide the resulting seed planted and/or sold from your setting facility. In the comments section mention this was from the purchase of eyed larvae]

Virginia Shellfish Grower Situation & Outlook Survey 2018

Commercial Spat-on Shell Oyster Aquaculture

*Please report only oyster production which originated from an onshore hatchery.
This does NOT include "natural strike" product moved to private ground.
This does NOT include larvae purchased for setting single seed.

11. 2017 Commercial Spat-on-Shell Oyster Aquaculture

a) # Eyed-larvae used

   i. % Diploid

   ii. % Triploid

b) % Eyed-larvae purchased from out-of-state

c) # Bushels spat-on-shell planted

d) # Bushels "market-size" spat-on-shell harvested/sold

e) Ave. price received per bushel of "market-size" spat-on-shell

12. 2018 *ESTIMATED* Commercial Spat-on-Shell Oyster Aquaculture

a) # Eyed-larvae used

   i. % Diploid

   ii. % Triploid

b) % Eyed-larvae purchased from out-of-state

c) # Bushels spat-on-shell planted

d) # Bushels "market-size" spat-on-shell harvested/sold

e) Ave. price received per bushel of "market-size" spat-on-shell

13. Comments or Explanatory Notes on 2017 & 2018 Commercial Spat-on-Shell Oyster Aquaculture:

Virginia Shellfish Grower Situation & Outlook Survey 2018

Commercial Oyster Aquaculture

14. Do you aquaculture cultchless (single) oysters? Yes ○ No ○
(If NO, skip to #20)

15. Do you sell/re-sell oyster seed? Yes ○ No ○

Do you purchase larvae and set it for single seed and/or grow small seed to a larger size for resale to another grower(s)?

16. Do you have a "cooperative" agreement with a larger producer who will likely report your numbers of planted and sold? (This does NOT include sales to a wholesaler)
Are you a co-op? Yes ○ No ○

Cultchless (single) Oyster Aquaculture

*Please report only commercial oyster production which originated from an onshore hatchery.

If you purchased larvae and set your own seed, leave b) blank and note that in the comments (#19).

17. 2017 Commercial Single Oyster Aquaculture

a) # Oyster seed planted on your farm in 2017
   i. % diploid
   ii. % triploid

b) Avg. price of triploid seed purchased ($ per 1,000)

c) % Planted seed purchased from out-of-state

d) # Seed sold
   i. % seed sold out-of-state
   ii. Avg. price of seed sold ($ per 1,000)

e) # Market (non- seed) oysters sold
   i. % wholesale
   ii. % retail
   iii. % market oysters sold out-of-state

f) Avg. price per market oyster ($ per piece)
   i. Avg. price wholesale
   ii. Avg. price retail

g) # Full-time help

h) # Part-time help

Virginia Shellfish Grower Situation & Outlook Survey 2018

Commercial Cultchless (single) Oyster Aquaculture

18. 2018 ESTIMATED Commercial Single Oyster Aquaculture

a) # Oyster seed planted on your farm in 2018
   i. % diploid
   ii. % triploid

b) Avg. price of triploid seed purchased ($ per 1,000)

c) % Planted seed purchased from out-of-state

i) # Seed sold
   i. % seed sold out-of-state
   ii. Avg. price of seed sold ($ per 1,000)

d) # Market (non- seed) oysters sold
   i. % wholesale
   ii. % retail
   iii. % market oysters sold out-of-state

e) Avg. price per market oyster ($ per piece)
   i. Avg. price wholesale
   ii. Avg. price retail

f) # Full-time help

g) # Part-time help

19. Comments or Explanatory Notes on 2017 & 2018 Commercial Single Oyster Aquaculture:

Virginia Shellfish Grower Situation & Outlook Survey 2018

Thank You

20. Please provide any comments on the shellfish aquaculture industry situation.

21. Would you like to receive a copy of the overall report when completed?

***If yes*, you must fill out the contact information below** Yes ○ No ○

22. Contact Information (Optional but Preferred)

Name	
Company	
Address	
City, State, Zip	
Telephone	
Email	

Thank you for completing the Virginia Shellfish Grower Situation and Outlook Survey.

Appendix 2: Hatchery Survey

Virginia Shellfish Hatchery Situation & Outlook Survey 2018

Welcome

Thank you for taking a few minutes to complete the following commercial shellfish hatchery survey. With your help, Virginia's past annual surveys have shown how useful timely information is for the shellfish aquaculture industry. Such information is vital to understanding the importance of Virginia's growing aquaculture business to the economy, and in turn the importance of clean water, reasonable land use and tax policies, access to financial capital and the like to shellfish hatcheries and growers.

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Aquaculture Specialist
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You can also file online by accessing https://www.surveymonkey.com/r/hatchery2018

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Virginia Shellfish Hatchery Situation & Outlook Survey 2018

Shellfish Hatchery Production

1. 2017 Clam and Oyster Hatchery Production

a) # Clam seed produced

b) # Clam seed sold

i. % Clam seed sold out-of-state

c) # Oyster eyed larvae produced

d) # Oyster eyed larvae sold

i. % diploid

ii. % triploid

iii. % sold out-of-state

e) Ave price per million oyster eyed larvae sold

i. Ave. price diploid

ii. Ave. price triploid

f) # Single oyster seed produced

g) # Single oyster seed sold

i. % diploid

ii. % triploid

iii. % sold out-of-state

h) # Full-time help

i) # Part-time help

Virginia Shellfish Hatchery Situation & Outlook Survey 2018

2. 2018 *ESTIMATED* Clam and Oyster Hatchery Production

Please indicate any changes in production, sales and employment expected for 2018. If no changes are expected, please write "same".

3. Comments or Explanatory Notes on 2017 & 2018 Shellfish Hatchery Production:

4. Please provide any comments on the shellfish hatchery situation.

Thank You

5. Contact Information (Optional)

Name	
Address	
City, State, Zip	
Telephone	
Email	

Thank you for completing the Virginia Shellfish Hatchery Situation and Outlook Survey.

The complete report can be found online at www.vims.edu/map/aquaculture

VIMS Marine Resource Report No. 2018-9

VSG–18-3

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