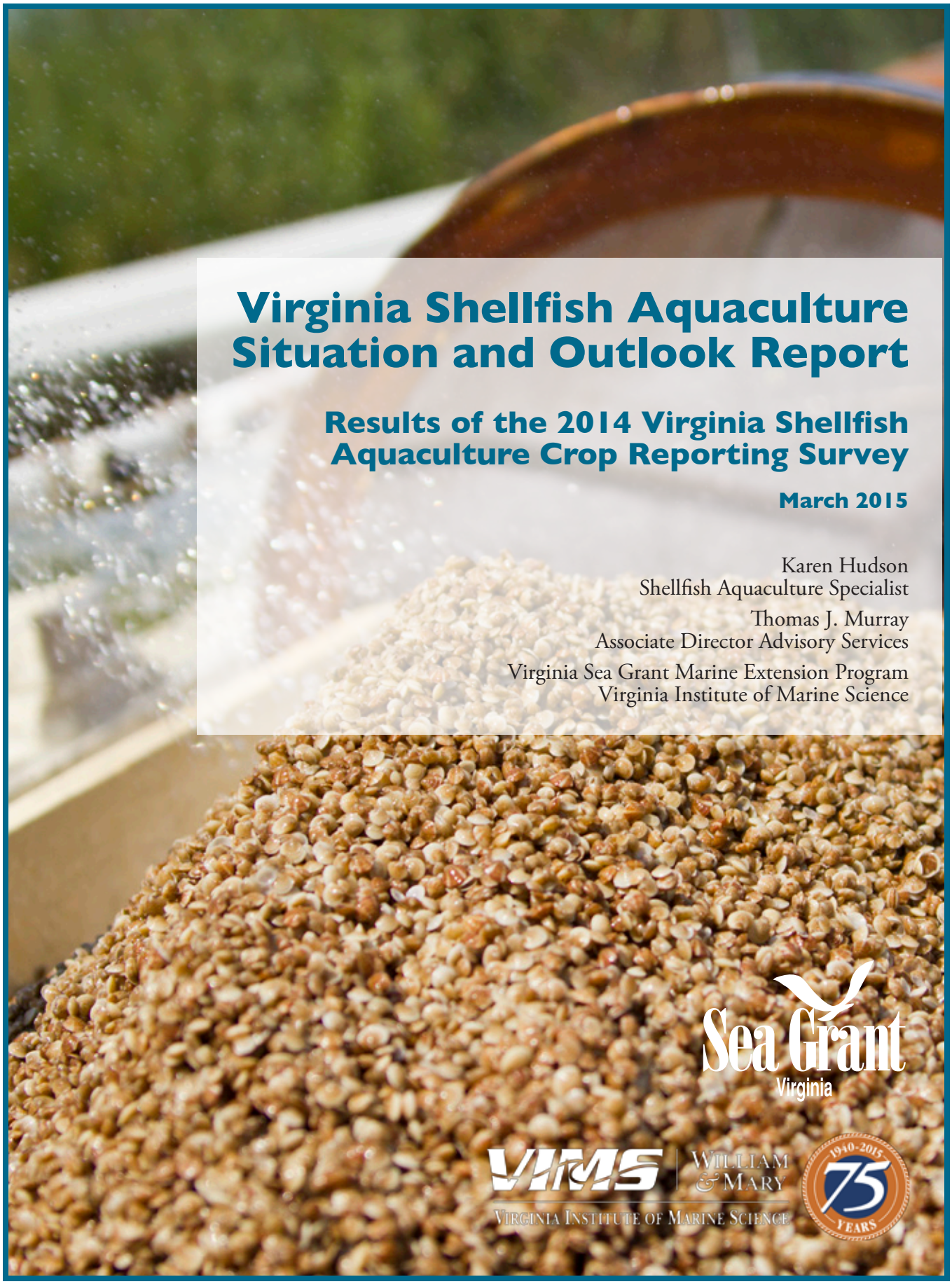

Virginia Shellfish Aquaculture Situation and Outlook Report

Results of the 2014 Virginia Shellfish Aquaculture Crop Reporting Survey

March 2015

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This page serves as the Executive Summary of the "Virginia Shellfish Aquaculture Outlook and Report Results from the 2014 Virginia Shellfish Crop Reporting Survey." March 2015. The complete report can be found online at: www.vims.edu/mas/aquaculture

VIMS Marine Resource Report No. 2015-3
VSG-15-01

$55.9M Farm Gate Value for VA Shellfish Aquaculture in 2014—An All-Time High

Virginia shellfish farmers sold $55.9 million in oysters and clams in 2014, an increase of 14% total revenue for clam growers and 33% for oyster growers, according to an annual survey of shellfish aquaculture in the state.

"It's all-around good news for the industry," says Karen Hudson, Virginia Institute of Marine Science extension affiliated with Virginia Sea Grant. Hudson co-authored the "2014 Virginia Shellfish Aquaculture Situation and Outlook Report."

At a Glance

$55.9M	Farm gate value in 2014
	$17.1M oysters
	$38.8M clams
100s	Directly employed
243M	All-time high in clam sales
86%	Oysters sold out of state
1st	U.S. clam production
	Leader in East Coast oyster production

For years Virginia has been the nationwide leader in growing hard clams, but in 2014 industry reached an all-time high of 243 million sold. Not to be out-done, sales of cultured oysters by Virginia growers has made the commonwealth a leader in East Coast production that year—39.8 million.

When it comes to explaining what's leading this increase in demand, Hudson suggests there could be any number of driving forces. However, she adds, "This report provides a snap-shot of how industry is doing, and everything I'm hearing from growers is that demand is up."

The "Virginia Shellfish Aquaculture Situation and Outlook Report" has been produced annually by Virginia Institute of Marine Science extension partners affiliated with Virginia Sea Grant since 2005. The survey and report provides annual assessments with which to gauge growth and inputs in Virginia's shellfish aquaculture industry. This report is based upon an industry survey completed during the first quarter of 2015.

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.[1] Each year, the survey instrument is evaluated and revised based upon field testing (Appendices 1 & 2). Seventy-two complete, useable surveys were returned via the Internet, mail, or fax, including responses from 16 clam growers, 62 intensive oyster growers, 13 extensive growers, 5 shellfish hatcheries, and 9 growers who cultured both molluscs. It is believed that the survey is representative of overall trends in 2014 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

Virginia Oyster (*Crassostrea virginica*) Aquaculture

The oyster industry continues to evolve from the traditional extensive planting of "shell on bottom," utilizing wild oyster seed, to the use of hatchery produced seed.[2] Methods of aquaculture have progressed into a more intensive or containerized form utilizing cages, racks, floats, and the like. In addition, there is an increasing contribution from extensive planting on bottom using shell struck with oyster eyed larvae produced from a hatchery.

Intensive Culture (cultchless method using single seed)

Figure 1 shows a reported 107.1 million single oysters planted, a slight increase from 2013, yet 30% below expectations from the previous survey. The outlook for 2015 suggests a 26% increase in oysters planted by Virginia growers.

Oyster Sales and Prices

In 2013, the crop reporting survey was expanded to include the question of whether the grower has a "cooperative" agreement with another oyster producer who would likely report the sales numbers. This was due to a reported increase in oyster cooperative arrangements in Virginia and was an effort to reduce the potential for double counting oyster sales. Seventeen of the 62 oyster responses to the survey indicated some sort of cooperative relationship to market, but most arrangements were similar to those with contractors, with no equity exchange such as providing

Fig. 1 Number of Single Oysters Planted (millions)

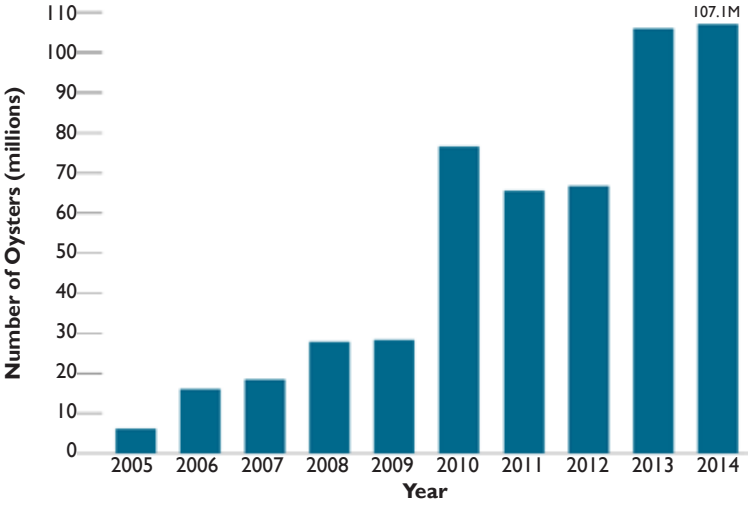
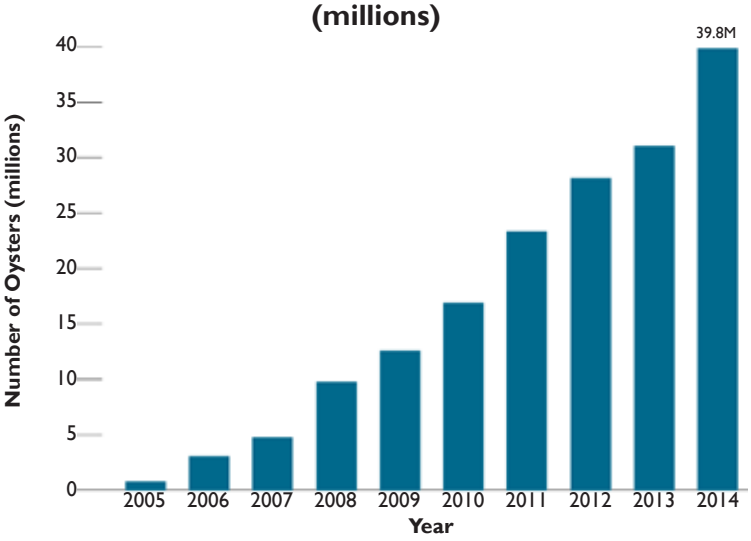


Fig. 2 Number of Aquacultured Market Oysters Sold (millions)



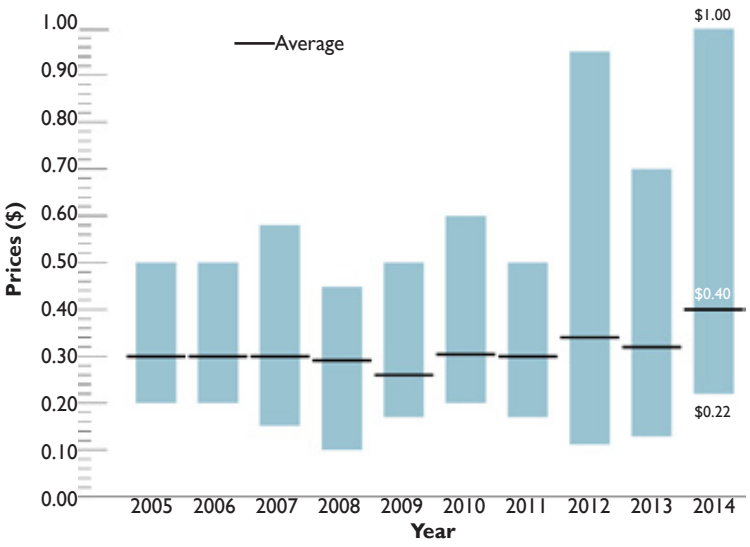
seed. Therefore, individual participation in the survey remains critical to capture the industry trends.

The 2014 crop reporting survey indicated the total number of market oysters sold by Virginia growers, subtracting the reported sales from those indicating involvement with a cooperative, was 39.8 million (Figure 2). This was an

1 Virginia Marine Resources Commission's Licensed Aquaculture Product Owners

2 Historically the most common oyster "culture" technique in Virginia was the transplanting of wild harvested seed to leased growing grounds. Prior to the onslaught of diseases, the grower paid little attention to the grounds between the time seed was planted and the time mature oysters were harvested, some 2 or 3 years later. Today this culture is still practiced however the results here do not include information on such oyster planting. 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.

Fig. 3 Prices Reported for Sale of Individual Oysters



increase of 28% from 2013; however, it is less than the 47 million cultured market oysters that growers had predicted from the previous survey year.[3] The forecast for 2015 from survey respondents is a 44% increase to nearly 57 million market oysters sold.

Combining the overall sales of single, market oysters with the weighted average price per oyster, it is estimated that the total 2014 revenue for oyster aquaculturists (not including spat on shell production) was $15.4 million, an increase of $4.3 million (or 39%) from 2013.

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 increase in the average price received for cultured oysters in 2013 and 2014, while the sales volume also has continued to expand.[4] Trends in the percentage of single oysters sold into wholesale markets remain fairly consistent at greater than 94% for the last six years. The percentage of single oysters sold out of state reached its highest level in 2014 at 86%. In previous years, the percentage of single oyster sold out of state was reported as between 56 and 77%.

Extensive Culture - Spat-on-Shell

Since 2008, the expansion of large-scale "remote setting" or "spat–on-shell' oyster planting in Virginia changed hatchery volume. Existing firms became active in purchasing not just cultchless seed, but large quantities of eyed larvae for spat-on-shell development. The spat-on-shell process has also been enhanced since its start in 2008. Improvements in the quality of eyed larvae coming out of the hatcheries and optimized methods have cut in half the number of eyed larvae required per bushel of shell.

Remote setting is a method of oyster cultivation in which oyster larvae and clean oyster shells are mixed in a controlled environment in large tanks on land rather than in open Chesapeake Bay waters. After the larvae attach or set on the oyster shells and metamorphose into seed or spat oysters, the resulting spat-on-shell is ready for almost immediate planting. The spat then grow naturally until they are ready for harvest roughly two years later. The primary advantage of spat-on-shell cultivation is that it requires less labor and fewer materials than single-oyster cultivation, thereby making it a more economically feasible option for producing large quantities of oysters. 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. For this reason, remote setting is not meant to take the place of single-oyster culture, which produces consistent, high-quality, half-shell oysters, but to complement it with a means of producing, on large scale, a local oyster for use by Virginia's oyster processors.

While large-scale spat-on-shell cultivation has been used in Virginia for the last several years, this report cannot currently be expanded to include realistic overall industry trends, because federal monies have subsidized a large portion of this development. It is uncertain what level of investment will continue in 2015, when the investment will be solely in private dollars, considered more relevant for forecasting purposes. What is clear, however, from the grower reports is that spat-on-shell is an important and likely expanding contributor to the overall economic

3 Several growers in the survey mentioned catastrophic loss of sub market oysters in the spring of 2014 which had been destined for market in 2014. Investigations into the cause are ongoing.

4 Smaller niche growers with sales less than 100,000 oysters reported average prices as high as $1.00 and in one case, nearly $2.00. During 2014 the median price was $0.36 per market oyster, an increase of $0.06 from 2013. The weighted average price across all growers was $0.386 per market oyster in 2014, an increase of $0.027 from 2013.

value of Virginia's shellfish aquaculture. It will be the subject of subsequent annual grower surveys.

The industry forecast continues to project expansion in the use of eyed larvae for spat-on-shell. This, however, depends on a consistent production of eyed larvae, which can be problematic due to poor water quality, as shown in Table 1 and Figure 4. Reports on the percentage of triploids used in spat-on-shell have continued to be at or near 100%. In 2014, growers reported using roughly one billion eyed larvae and the forecast is to double the amount of eyed larvae used in 2015.

Spat-on-Shell Sales and Prices

According to reports, the number of harvested bushels of spat-on-shell increased from roughly 2,000 in 2009 to almost 13,000 in 2012 and 2013. These numbers include a mix of plantings funded by private investment and subsidized support.[5] In 2014, growers reported harvesting 38,200 bushels of spat-on-shell. The average price was $44 per bushel of spat-on-shell, making the farm gate value $1.7 million in 2014. Expectations for 2015 are for an increase of 34% to 51,100 harvested bushels of spat-on-shell.

Oyster Hatcheries[6]

The continued growth in aquaculture of oysters in Virginia directly drives the hatchery forecast. Much of the oyster seed and eyed larvae produced is either planted by the hatchery owners themselves in their aquaculture operations or sold to other Virginia growers.[7] This vertically integrated system with eventual sales to many out-of-state consumers adds important economic development to local coastal communities.

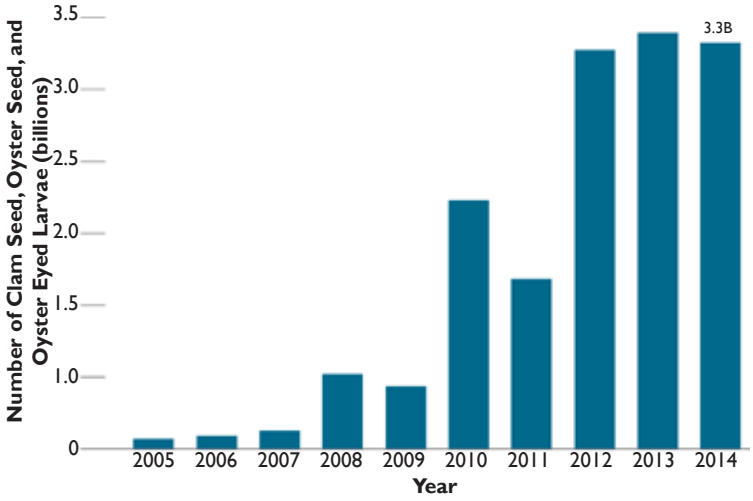
Oyster growers have adopted the use of improved strains of oyster seed and larvae over the years to optimize growth rates, disease resistance, and meat quality during warmer months. Triploid eyed larvae and seed were the source of the overwhelming majority of the oyster sales reported by hatcheries. In 2014, growers reported that triploids made up 91% of their plantings. In the last six years, the percentage of triploids has remained in the range of 80 to 95%. Industry also 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.

Oyster Hatchery Sales

Sales of oyster seed and eyed larvae by Virginia hatcheries realized an almost fourfold increase from 2008 to 2010, with the majority being eyed larvae (1.7 billion). This reflects the growth of the oyster industry, as seen in Figure 1, as well as the expansion of extensive culture. Sales of seed from hatcheries have increased over the years, and 2014 reports showed an increase of 55%, with 171 million single seed sold.

The continued potential for future expansion lies in the production of oyster eyed larvae for spat-on-shell aquaculture. Understanding water quality parameters that negatively impact consistent production and knowing how to mitigate around them remain key objectives of hatcheries. Water quality issues of unknown origin were reported by oyster hatcheries in 2009 and 2011 and show a clear impact on the overall produc-

Fig. 4 Total Hatchery Production (billions)



5 Based on the reports to date, it is unclear what percentage of funding is private investment. Spat-on shell numbers overall are likely underreported, given limited participation in the survey compared to known industry activity. This is enhanced by the unique composition of this sector of the industry which includes a subset of traditional watermen, not in sync with this ongoing survey effort.

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 Virginia shellfish hatcheries beginning with the 2011 survey.

7 In the last three years an increasing amount of seed production is being sold out-of-state, filling the gap in states seeing an expansion in oyster aquaculture with limited private hatchery capability of their own.

Table 1 Sale of Oyster Products by Hatcheries

Year	Seed Sold (M)	Eyed Larvae Sold (M)
2005	20	-
2006	26	-
2007	27	-
2008	28	499
2009	27	347
2010	56	1694
2011	69	605
2012	112	2000
2013	110	1486
2014	171	1442

Fig. 5 Virginia Oyster Farm Employment

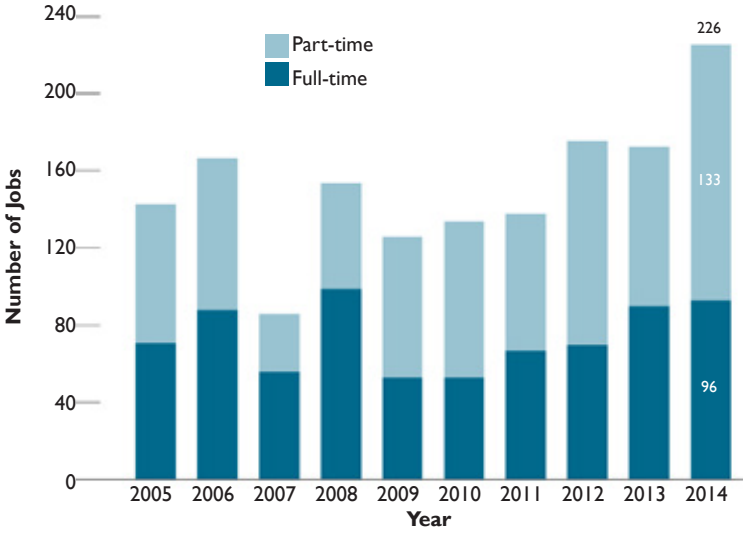
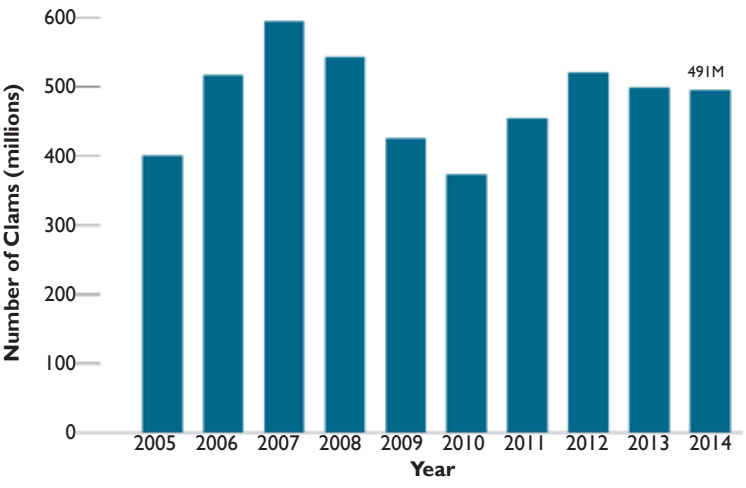


Fig. 6 Number of Hard Clams Planted (millions)



tion picture (clam and oyster products combined), as seen in Figure 4. Oyster production recovered after 2012, and although the reported sales in Table 1 show a slight decline in 2014, this represents more production going to the hatchery owner's private planting, which is not recorded in the sales numbers.

Employment

Finally, as shown in Figure 5, employment associated with oyster aquaculture, which has remained varied over recent years, shows an increase in the number of full time and part time employment in 2014. The difficulty of estimating the time and labor associated with relatively small-scale aquaculture conducted in conjunction with other business lines makes estimates of oyster culture labor problematic at this point in industry development. In view of this fact, the trends in these employment figures should be not overly interpreted. There is consistent expectation that with successful development of both spat-on-shell and cultchless oyster aquaculture, additional employment will be required to meet the greatly expanded planting and production needs.

Hard Clam (*Mercenaria mercenaria*) Aquaculture

Based upon previous economic assessments compiled by the authors, Virginia continues to lead the nation in the culture of hard clams.

As depicted in Figure 6, clam growers reported a slight decrease in seed plantings during 2014. The firms reporting indicated that during 2014 they planted roughly 491 million clams, a less than 1% decrease from 2013. The industry outlook for 2015 estimates an increase of approximately 13%, totaling 556 million clams.

Clam Sales and Prices

The 2014 crop reporting survey reflects an increase in the total number of Virginia market clams sold between 2012 and the end of 2014. During 2014, it is estimated that Virginia's total farm output reached an all-time high of 243 million "market" clams, as shown in Figure 7. Based on the overall sales and the weighted average price per market clam, it is estimated that total revenue for hard clam aquaculturists in 2014 was $38.8 million—an increase of 14%, or $4.8 million, from the prior year.

Figure 8 displays the survey findings regarding relative prices received for market clams. The

average price reported per market clam at the farm gate was $0.17 during 2014, $0.01 higher than in the previous four years. Trends in the percentage of market clams sold into wholesale markets had remained fairly consistent for the five years at greater than 97% but dropped to 94% in 2014. The percentage of market clams sold out of state has remained between 73 and 88% for the last five years and has increased to 91 and 93% in 2013 and 2014, respectively.

Clam Hatcheries

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.

Employment

Figure 9 demonstrates a decrease in the full time level of employment and a slight increase in part time employment. However, as noted above, the employment situation for all shellfish aquaculture is complicated by the diversity of the firms involved. The vast majority of the clam production is conducted by relatively large vertically integrated companies; these companies 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 (.9) full time equivalent (FTE) is needed to produce $100,000 of cultured shellfish output. Based upon this model, about 480 FTEs would be needed to produce the 2014 estimated output of $53.6 million, an increase of 20% over the 2013 estimate of 400 FTEs. Those figures do not represent the indirect and induced employment multipliers.

Fig. 7 Number of Hard Clams Sold (millions)

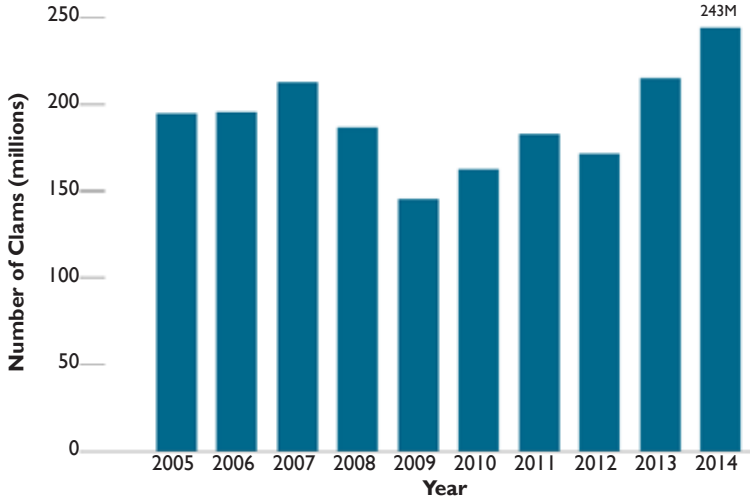


Fig. 8 Prices Reported for Sales of Individual Clams

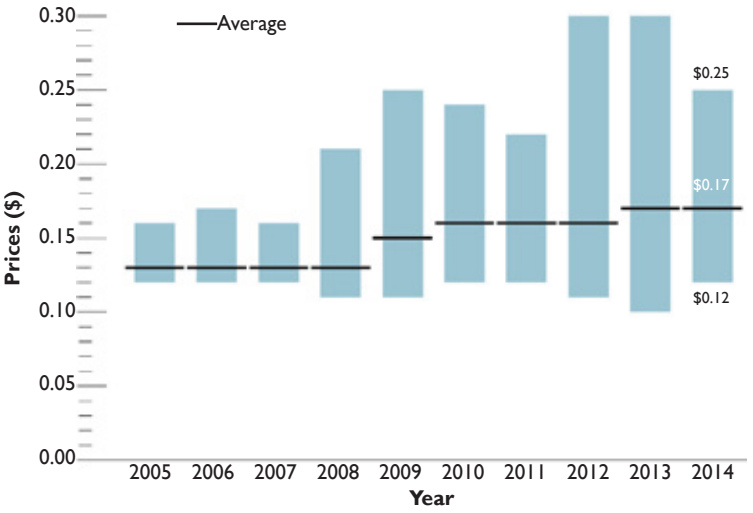
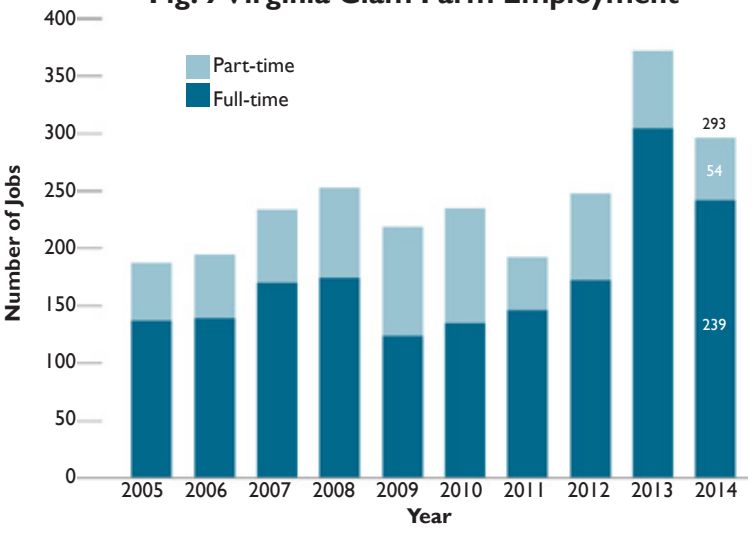


Fig. 9 Virginia Clam Farm Employment



Appendix 1: Grower Survey

Virginia Shellfish Grower Situation & Outlook Survey 2015

Welcome

Thank you for taking a few minutes to complete the following commercial aquaculture survey. This survey is meant to capture private ground activity that originates from a land-based hatchery. 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 the information provided, the better the characterization of the Virginia aquaculture industry.

Please complete the survey by February 16, 2015.

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

Thomas J. Murray
Marine Business Specialist
Phone 804-684-7190
Fax: 804-684-7161

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

You can also file online by accessing https://www.surveymonkey.com/s/shellfishsurvey2015

If filing online, please note your answers can be saved if you exit the survey before completion. You can then return at a later time to finish the survey.

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Sea Grant Virginia

Virginia Shellfish Grower Situation & Outlook Survey 2015

Commercial Clam Aquaculture

1. **Do you aquaculture clams?** Yes ○ No ○
2. **Do you have a clam hatchery?** Yes ○ No ○
3. **Do you "re-sell" seed?** Yes ○ No ○
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. **2014 Commercial Clam Aquaculture**

a) # Clams planted	
b) % Seed purchased	
c) Ave. price of seed purchased	
d) # Seed sold	
e) % seed sold out-of-state	
f) # Market (non-seed) sold	
i. % wholesale	
ii. % retail	
g) % Market sold out-of-state	
h) Ave. price per market clam	
i. Avg. price wholesale	
ii. Ave. price retail	
i) # Full-time help	
j) # Part-time help	

Virginia Shellfish Grower Situation & Outlook Survey 2015

Commercial Clam Aquaculture

7. 2015 *ESTIMATED* Commercial Clam Aquaculture

a) # Clams planted

b) % Seed purchased

c) Ave. price of seed purchased

d) # Seed sold

e) % seed sold out-of-state

f) # Market (non-seed) sold

   i. % wholesale

   ii. % retail

g) % Market sold out-of-state

h) Ave. price per market clam

   i. Avg. price wholesale

   ii. Ave. price retail

i) # Full-time help

j) # Part-time help

8. Comments or Explanatory Notes on 2014 and 2015 Clam Aquaculture:

Virginia Shellfish Grower Situation & Outlook Survey 2015

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 ○

Virginia Shellfish Grower Situation & Outlook Survey 2015

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.

11. 2014 Commercial Spat-on-Shell Oyster Aquaculture

a) # Eyed-larvae used

i. % Diploid

ii. % Triploid

iii. % purchased as private investment (not state-funded)

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. 2015 *ESTIMATED* Commercial Spat-on-Shell Oyster Aquaculture

a) # Eyed-larvae used

i. % Diploid

ii. % Triploid

iii. % purchased as private investment (not state-funded)

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 2014 & 2015 Commercial Spat-on-Shell Oyster Aquaculture:

Virginia Shellfish Grower Situation & Outlook Survey 2015

Commercial Oyster Aquaculture

14. Do you aquaculture cultchless (single) oysters? Yes ○ No ○

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

16. Do you sell market oysters to another producer who will likely be reporting your numbers? This includes "cooperative-type" arrangements with a larger producer. (We are interested in the first sale only to avoid double counting from multiple firms.)
Yes ○ No ○

Cultchless (single) Oyster Aquaculture

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

17. 2014 Commercial Single Oyster Aquaculture

a) # Oyster seed planted
   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
e) % Seed sold out-of-state
f) Avg. price of seed sold ($ per 1,000)
g) # Market (non- seed) oysters sold
   i. % wholesale
   ii. % retail
h) % Market oysters sold out-of-state
i) Avg. price per market oyster ($ per piece)
   i. Avg. price wholesale
   ii. Avg. price retail
j) # Full-time help
k) # Part-time help

Virginia Shellfish Grower Situation & Outlook Survey 2015

Commercial Cultchless (single) Oyster Aquaculture

18. 2015 *ESTIMATED* Commercial Single Oyster Aquaculture

a) # Oyster seed planted

   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

e) % Seed sold out-of-state

f) Avg. price of seed sold ($ per 1,000)

g) # Market (non- seed) oysters sold

   i. % wholesale

   ii. % retail

h) % Market oysters sold out-of-state

i) Avg. price per market oyster ($ per piece)

   i. Avg. price wholesale

   ii. Avg. price retail

j) # Full-time help

k) # Part-time help

19. Comments or Explanatory Notes on 2014 & 2015 Commercial Single Oyster Aquaculture:

Virginia Shellfish Grower Situation & Outlook Survey 2015

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*, please fill out the contact information below** Yes ○ No ○

22. Contact Information (Optional)

***At a minimum, please provide the zip code so the report can inform where production is occurring.**

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 2015

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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Sea Grant Virginia

Virginia Shellfish Hatchery Situation & Outlook Survey 2015

Shellfish Hatchery Production

1. 2014 Clam and Oyster Hatchery Production

a) # Clam seed produced

b) # Clam seed sold

c) % Clam seed sold out-of-state

d) # Oyster eyed larvae produced

e) # Oyster eyed larvae sold

i. % diploid

ii. % triploid

f) % Oyster eyed larvae sold out-of-state

g) Ave price per million oyster eyed larvae sold

i. diploid

ii. Triploid

h) # Single oyster seed produced

i) # Single oyster seed sold

i. % diploid

ii. % triploid

j) % Single oyster seed sold out-of-state

k) # Full-time help

l) # Part-time help

Virginia Shellfish Hatchery Situation & Outlook Survey 2015

2. 2015 *ESTIMATED* Clam and Oyster Hatchery Production

Please indicate any changes in production, sales and employment expected for 2015. If no changes are expected, please write "same".

3. Comments or Explanatory Notes on 2014 & 2015 Commercial Shellfish Hatchery:

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.

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