STATE OF THE OYSTER: 2017 Progress Report

on the OYSTER RESTORATION AND PROTECTION PLAN FOR NORTH CAROLINA

Prepared by the North Carolina Coastal Federation
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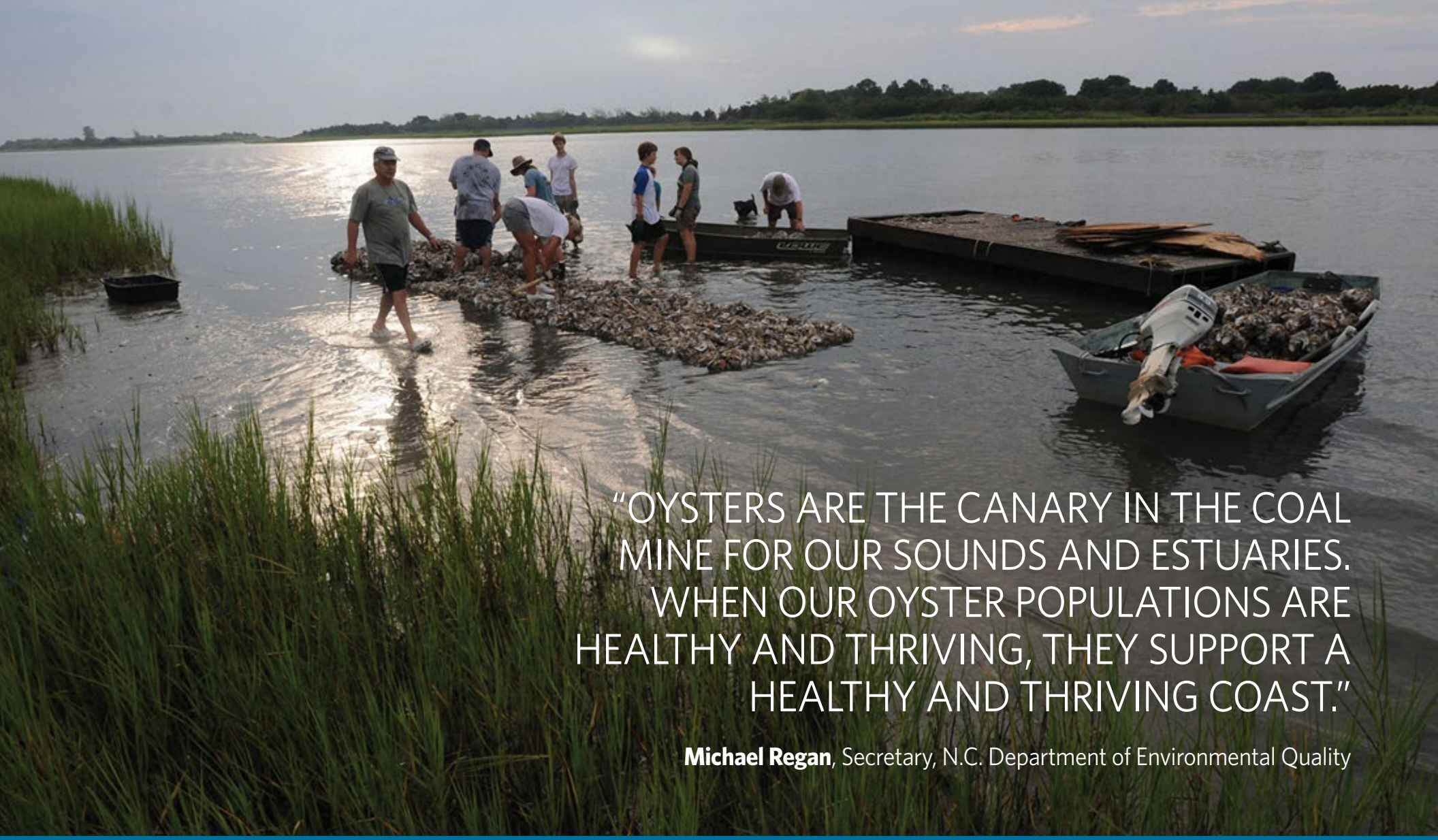

"OYSTERS ARE THE CANARY IN THE COAL MINE FOR OUR SOUNDS AND ESTUARIES. WHEN OUR OYSTER POPULATIONS ARE HEALTHY AND THRIVING, THEY SUPPORT A HEALTHY AND THRIVING COAST."

Michael Regan, Secretary, N.C. Department of Environmental Quality

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EXECUTIVE SUMMARY

The *Oyster Restoration and Protection Plan for North Carolina: A Blueprint for Action 2015-2020* (Blueprint) includes seven major goals and dozens of corresponding actions to reverse the decline of oyster populations in North Carolina through oyster restoration, sustainable wild harvest and shellfish mariculture. This annual *State of the Oyster Report* tracks progress made in 2017 to achieve these goals.

Significant progress was made in 2017. These improvements include:

1. The General Assembly appropriated significant funds to advance oyster restoration. These funds allowed the state to leverage more than $1 million in federal funds. As a result, 55 acres of harvestable shellfish management areas and 15 acres of oyster sanctuary were built.
2. State lawmakers supported more staff for the Division of Marine Fisheries to administer the shellfish mariculture lease program. The number of applications for leases more than doubled in 2017, and this expanded staff was necessary to keep up with the increased demand for lease evaluations.
3. The North Carolina Coastal Federation hosted a summit where it unveiled an economic development strategy that recognizes the importance of and opportunity that shellfish restoration and mariculture can provide to the state, especially in rural coastal economies. Restoration and farming operations are creating private sector jobs in North Carolina.
4. Research conducted by North Carolina State University will help guide future restoration efforts by improving our understanding of the habitat benefits oysters provide to other fisheries. Additional research by the National Estuarine Research Reserve System and University of North Carolina Wilmington is exploring the benefits and impacts of farming and will help guide future farm siting efforts.
5. The state is developing a Strategic Shellfish Mariculture Plan. This planning effort has brought numerous partners to the table, including fishermen, shellfish growers, community organizations, private foundations, academic institutions, state and federal agencies and private businesses.
6. North Carolina Sea Grant and Carteret Community College are leading the way in developing outreach, education and demonstration opportunities to learn about oyster growing in the state.
7. The state, The Nature Conservancy and North Carolina State University are collaborating to explore a better way to determine the health and status of wild oyster populations.
8. Water quality changes in the state continue to be tracked with efforts underway in strategic watersheds to improve water quality. The Shellfish Sanitation Section of the Division of Marine Fisheries continues to devise better methods for recording and tracking temporary shellfish closures that are occurring with increased frequency in coastal waters.

Restoring and protecting oysters is a win-win-win opportunity, and these efforts continue to receive substantial support from Governor Roy Cooper and the North Carolina General Assembly. The combined work of a diverse group of collaborators to restore, grow, protect and harvest oysters creates opportunities and results that are greater than the sum of their parts. This past year's efforts are summarized in this report. Please visit ncoysters.org for more information or contact the North Carolina Coastal Federation if you have questions or require more details on this work.

"I'm pleased with the investment the General Assembly has made in restoring and growing more oysters in N.C. during my tenure. I look forward to seeing these investments pay off in years to come."

Bill Cook, N.C. State Senator, District 1

Background and Purpose

The State of the Oyster: 2017 Progress Report tracks progress made in carrying out the *Oyster Restoration and Protection Plan: A Blueprint for Action 2015-2020* (Blueprint). The progress outlined here builds on the accomplishments of many, including the 1995 Blue Ribbon Advisory Council on Oysters, the 1997 Fisheries Reform Act and the first editions of the *Blueprint*, originally drafted in 2003 and now in its third edition.

The *Blueprint* aims to achieve the following goals by 2020:

1. Link restoration of oysters and water quality with an economic development strategy for North Carolina;
2. Establish at least 500 acres of new oyster sanctuaries;
3. Plant cultch to provide for ample sustainable wild oyster harvest;
4. Build the oyster mariculture industry to meet or exceed wild harvest;
5. Sustainably manage oyster harvest on public bottom;
6. Protect and improve water quality in priority shellfish growing areas; and
7. Document oyster population status and trends resulting from the successful implementation of the *Blueprint*.

IMPORTANCE OF OYSTERS

Oysters are vital to North Carolina's coastal ecology and economy. They filter water, provide food for humans and are important fish habitat. These environmental functions, in turn, support jobs and provide economic opportunities for coastal communities.

OYSTERS IN TROUBLE

Worldwide, oyster populations are at record lows. Despite some recovery in recent years in North Carolina, it is estimated that oysters are at about 15-20 percent of historic harvest levels. Oyster harvest is currently considered the best measure of the oyster population.

Harvest Over the Years (in bushels and USD ex-vessel value)

- 1889.....800,000 bu.
- 1960.....200,000 bu.
- 1994.....35,000 bu.
- 2004.....70,000 bu.....$1,551,870
- 2014.....137,000 bu.....$4,544,236
- 2016.....123,000 bu.....$4,045,444
- 2017.....158,000 bu.....$5,571,391[1]

CAUSE OF THE DECLINE

Oysters are listed as a "species of concern" by the Division of Marine Fisheries. The *Blueprint* identifies the primary reasons for the decline in oyster populations and harvest levels as:

- Overharvest without returning enough substrate to the water
- Habitat loss
- Natural disasters
- Low recruitment
- Shellfish diseases and predators
- Water quality degradation

1 North Carolina Department of Environmental Quality. Division of Marine Fisheries. 2017. North Carolina License and Statistics Section 2017 Annual Report., Preliminary 2017 data was received through email from Alan Bianchi, Marine Biologist Supervisor, Division of Marine Fisheries, May 2018.

GOAL 1: Link restoration of oysters and water quality to an economic development strategy for North Carolina.

"Our guys were able to build oyster reefs when our other more traditional marine business had dried up. We were thankful for the jobs created by the initiative to build oyster reefs, similar to other infrastructure projects for the coast."

Simon Rich, Stevens Towing, Contractor of Swan Island Oyster Sanctuary

The *Blueprint* includes a five-year strategy for incorporating coastal restoration as part of a formal state economic development plan. The following progress was made in 2017 to link the restoration of oysters and water quality to an economic development strategy:

2017 LEGISLATIVE ACTION

Mariculture Plan Development

In 2017, the General Assembly charged the North Carolina Policy Collaboratory with developing a mariculture plan for North Carolina. A team of state and regional experts were convened to craft elements of the plan. The plan, still in draft form, outlines ways to grow shellfish mariculture to a $100 million industry (currently a $2 million industry) in 10 years. It acknowledges that this growing industry's success depends on reliably clean coastal waters.

A team of state and regional experts are considering the following factors in developing this plan:

- How best to spend financial resources to counter declining oyster populations and habitat;
- The use of nonnative oyster species to accomplish oyster restoration;
- Means of combating oyster disease and managing harvesting practices to balance the needs of the industry and promote long-term viability and health of oyster habitat substrate;
- Economic aquaculture methods to improve oyster stock and populations;
- Long-term, dedicated options for funding sources and water quality improvements;
- Means to increase oyster production for both population growth and harvest;
- Options that expand the use of private hatchery capacity in the state;
- Options for promoting the use of cultch planting to enhance and increase oyster habitat and population;
- Other resources that might be leveraged to enhance reform efforts.

To learn more about the Mariculture Plan or to get involved, please contact Dr. Chris Voss at c.m.voss.unc@gmail.com, or Dr. Charles Peterson at cpeters@ad.unc.edu.[1]

1 Information received from collaboratory.unc.edu/current-projects/legislative-studies/.

OTHER ACTIONS

Unveiling an Economic Development Strategy at the Sound Economic Development Summit

In 2017, the North Carolina Coastal Federation unveiled a plan to incorporate habitat restoration as an economic development strategy at the Sound Economic Development Summit held in Raleigh. This economic development strategy and summit highlighted the environmental and economic benefits of oyster restoration and mariculture to North Carolina.

Oyster Restoration Once Again Proves to be an Economic Builder

In 2017, 15 acres of the Swan Island Oyster Sanctuary were built. This unique public-private partnership leveraged state appropriations and matched them with a National Oceanic and Atmospheric Administration's (NOAA) Community-based Restoration Program grant, allowing local contractors, suppliers and other workers to be employed and build new oyster reefs.

THROUGH THIS PROJECT

$2.775 million	**56 people**	**15 acres**
INVESTED	EMPLOYED	OF REEF CREATED

NORTH CAROLINA 2017
Sound Economic Development Summit
Creating a Rising Economic Tide for the NC Coast

CONCLUSIONS OF THE SOUND ECONOMIC DEVELOPMENT SUMMIT

The two-day Sound Economic Development Summit brought together appointed and elected officials, business leaders, scientists, academics, economic developers, tourism leaders and shellfish growers. With keynote speeches by North Carolina Department of Environmental Quality Secretary Michael Regan and Senator Bill Cook, and participation by other key economic development leaders, the summit concluded that:

1) North Carolina has a team of passionate and dedicated stakeholders committed to advancing oyster restoration and mariculture in the state;

2) comprehensive support of restoration and mariculture are important to advance these economic development efforts;

3) regional economic development strategies in the state are critical — oysters provide a unique opportunity for the coastal economy;

4) oyster mariculture is an economic driver and North Carolina has all the necessary assets to be a national industry leader.

5) industry growth can balance opportunity with public trust and environmental goals.

"Economic development in our coastal areas often depends on tourism and entrepreneurship. The exciting progress in North Carolina's oyster farming initiatives is a great opportunity to leverage these two pillars of coastal economic development and job-creation."

Chris Chung, Economic Development Partnership of North Carolina

GOAL 2: Establish at least 500 acres of new oyster sanctuaries.

The Division of Marine Fisheries strategically locates oyster sanctuaries in estuarine waters to ensure there are sufficient natural juvenile oysters (spat) to populate nearby harvestable oyster reefs. The *Blueprint* outlines a goal to properly site oyster sanctuaries to create a self-sustaining network of reefs and to minimize user conflicts in coastal waters. The following progress was made in 2017 toward establishing 500 acres of oyster sanctuary in the state:

2017 LEGISLATIVE ACTION

The General Assembly appropriated $1.4 million to the Division of Marine Fisheries to continue building oyster sanctuaries as part of the Senator Jean Preston Oyster Sanctuary Network in Pamlico Sound for FY 17/18.[1]

OTHER ACTIONS

Swan Island Oyster Sanctuary

The Division of Marine Fisheries partnered with the North Carolina Coastal Federation to build 15 acres of oyster sanctuary. Funding from a NOAA Community-based Restoration Program grant and state appropriations helped make this project a reality. Through this partnership, North Carolina contractors and suppliers were hired to build the reef.

IN PROGRESS

Swan Island Oyster Sanctuary Future Work

The Division of Marine Fisheries and the North Carolina Coastal Federation plan to continue their sanctuary building partnership in 2018. The North Carolina Coastal Federation received a second year of funding from NOAA's Community-based Restoration Program, providing $1.088 million to match $1.1 million in state appropriations to continue building the Swan Island Oyster Sanctuary.[2] Sites for future work are being identified and surveyed.

Figure 1: *North Carolina's oyster sanctuary network. Map courtesy North Carolina Division of Marine Fisheries.*

205 ACRES **Restored**

500 ACRES **Goal**

PROGRESS **41%** **complete**

The Division of Marine Fisheries, with guidance and support from state universities, is exploring the use of alternative materials for oyster reef building.

Working to Facilitate Restoration

Oyster restoration can be a long and involved process with delays caused by permitting and funding uncertainty. In 2017, *Blueprint* partner agencies initiated work to streamline this process. Action steps achieved to-date and future steps include:

- Working toward the federal adoption of Nationwide Army Corps of Engineers Permit 54 for the construction of living shoreline projects. This nationwide permit would allow for a streamlined review of shoreline stabilization projects that involve building oyster reefs and protecting coastal marsh;
- The Nature Conservancy held conversations with the Division of Coastal Management to explore options to more explicitly include restoration on Coastal Management Area Act (CAMA) major permit applications- currently CAMA major permits are more focused on providing permission for new development activities to take place as opposed to restoration work;
- The North Carolina Coastal Federation has requested that oyster restoration be part of the Division of Marine Fisheries' legal mandate.

1, 2 Data received from Joint Conference Committee Reports found www.ncleg.net/fiscalresearch/budget_legislation.html

3 Data received through email from North Carolina Division of Marine Fisheries, The Royal Order of the Honorary St. James Oyster, The Nature Conservancy, Penderwatch, North Carolina Coastal Federation, Spring 2018.

OYSTER PATCH AND FRINGING REEFS

Additional oyster habitat restoration in the form of patch reefs and living shorelines are smaller scale restoration efforts carried out by nonprofits, universities, municipalities and waterfront property owners. In 2017, 1.5 acres of these reefs were built.[4]

"The Aquarium at Pine Knoll Shores is excited to serve as a demonstration and research site for a living shoreline project that will use several oyster restoration techniques to protect our shoreline. We aim to show our visitors the value of using natural materials to slow shoreline erosion while creating important habitat."

Carol Price, North Carolina Aquariums

THE 50 MILLION OYSTER INITIATIVE

Recent monitoring of oyster sanctuaries showed that for every acre of oyster sanctuary created, over 1 million oysters are restored to our coastal waters. The North Carolina Coastal Federation has recently launched an initiative to help the Division of Marine Fisheries restore at least 50 acres of oyster reef, coastwide, in three years, thereby restoring 50 million oysters by 2020. Those 50 million oysters will filter an estimated 2.5 billion gallons of water daily — providing cleaner water, better habitat and a stronger coastal economy. In 2017, 16.5 acres of reef were established toward this goal.

FiftyMillion Oyster Initiative

GOAL 3: Plant cultch to provide for ample sustainable wild oyster harvest.

Cultch planting throughout the state creates public shellfish management areas that are open to harvest once oysters reach legal size (>3 inches). The Division of Marine Fisheries annually deposits hundreds of thousands of bushels of oyster shell, marine limestone and/or clam shell — collectively called "cultch" — to create these beds that are open to recreational and commercial harvest. The *Blueprint* calls for continuing cultch planting efforts, implementing adaptive management when needed and building reefs with state and private partnerships whenever possible. The following progress was made in 2017 to plant cultch to provide for ample wild oyster harvest:

2017 LEGISLATIVE ACTION

In 2017, the legislature approved $1.1 million in recurring funds for the cultch planting program to be used in both 2017-2018 and 2018-2019.[1]

OTHER ACTIONS

In 2017 (with FY 16/17 funding), the Division of Marine Fisheries planted 333,313 bushels of shell and marl on 55 acres of cultch reefs statewide.[2]

The Division of Marine Fisheries assessed their cultch planting efforts and decided to consolidate materials into fewer, larger cultch planting sites located near their land-based stockpile locations to reduce transit time and improve the cost-effectiveness of the program.[3]

IN PROGRESS

Ongoing research conducted by North Carolina State University Center for Marine Science and Technology is investigating the role of cultch reefs as essential fish habitat. The research is monitoring fish use and the diversity of fish that use the restored reefs. Researchers are monitoring six state reefs for fish biodiversity and composition as well as oyster density. Research is expected to be completed by October 2018.[4]

In 2018, the Division of Marine Fisheries anticipates planting about 400,000 bushels of marl and shell at various locations throughout the state to create at least 40 acres of harvestable reef.

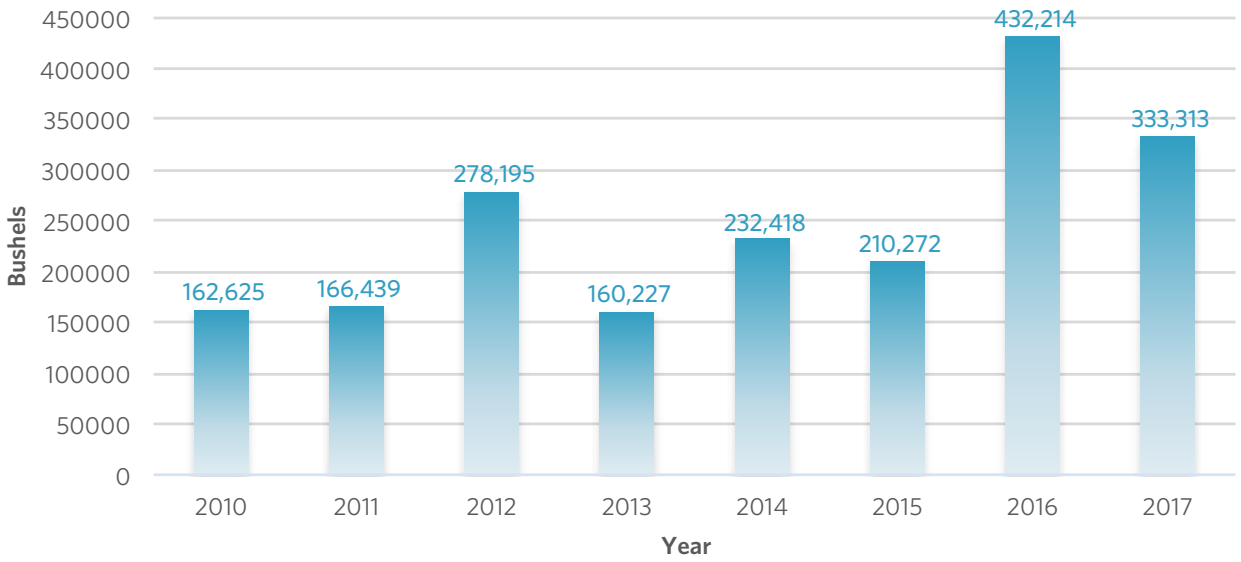


Figure 2: *The Division of Marine Fisheries deploys cultch material annually in designated cultch planting sites. In 2017 and with FY 16/17 funding, the Division planted 333,313 bushels of cultch.*[5]

CULTCH PLANTING PROGRAM

The Division of Marine Fisheries annually plants hundreds of thousands of bushels of cultch in shellfish waters from the Shallotte River to Pamlico Sound. Cultch is colonized by oyster larvae. This "spat" attaches and grows to harvest size (3 inches) in 18-36 months. Cultch sites are open to public harvest once the oysters grow to legal size.

The Division of Marine Fisheries is permitted to plant up to 100 acres of cultch annually. It aims to plant as much acreage as possible each year, but the program depends on reliable material and adequate funding.

1 Data received from Joint Conference Committee Reports found www.ncleg.net/fiscalresearch/budget_legislation/budget_legislation.html

2 Data received through email from Jason Peters, Enhancement Program Supervisor, North Carolina Division of Marine Fisheries, Spring 2018.

3,5 Data received through email from Jason Peters, Enhancement Program Supervisor, North Carolina Division of Marine Fisheries, Spring 2018.

4 Data received through email from Dr. David Eggleston, Director, Center for Marine Sciences and Technology, North Carolina State University, Spring 2018.

GOAL 4: Build the oyster mariculture industry to meet or exceed wild harvest levels.

This goal was achieved in 2017. The value of farm-raised oysters now exceeds wild harvest levels in the state. A new goal is to grow the industry to about $33 million in landings by 2030. This will make shellfishing farming worth approximately $100 million to the coastal economy of N.C. Progress made in 2017 includes:

2017 LEGISLATIVE ACTION

Mariculture Plan Development

During the 2017 legislative session, the General Assembly directed the University of North Carolina Policy Collaboratory to a mariculture plan for North Carolina, which is due to the legislature by December 2018. For more details about the Mariculture Plan development see page 4 of this report.[1]

University of North Carolina Shellfish Research Hatchery at the University of North Carolina Wilmington

The legislature continues to fund $500,000 to support the research program at the Shellfish Research Hatchery (SRH) hosted by the University of North Carolina Wilmington. The SRH has used these funds to expand and strengthen its selective breeding program with the goal of developing and increasing production of lines of oysters that will perform well (fast growth, high survival) in North Carolina waters.

The SRH boasted 15 successful spawns in 2017, equaling a 65 percent increase in oyster seed production from the previous year. Over four million oyster seed and larvae were either sold or provided to N.C. growers and researchers. A commercial hatchery and Carteret Community College's hatchery were among the recipients of the bred oysters. These oysters will be grown and studied to further improve the selective breeding program. At UNCW, the university's demonstration lease is growing oysters which will be selected for the 2018 and 2019 breeding season. To date, the SRH selected lines are showing increases in the yield of market-sized oysters at 18 months, indicating an increase in growth rate relative to previous generations.[2]

"Our millions of acres of coastal waters create unique varieties of locally grown oysters. These offer visitors a one of a kind culinary experience and create new and expanded tourism opportunities for the state."

Wit Tuttell, Visit NC

Additional Division of Marine Fisheries Positions

In FY 17/18, the General Assembly added two technician positions to the Division of Marine Fisheries staff. These positions have increased efficiency in processing new lease applications in 2017 and are funded in part by the Coastal and Recreational Fishing License (CRFL) program.

OTHER ACTIONS

Expedite and Streamline the Leasing Process

Lease siting was modified in 2017 to streamline the application process. New applications obtain more information upfront and get review from more agencies to ensure there aren't issues on the back end of the process. Site investigations for new leases have become more efficient by using better GPS and AGOLs (Arc GIS Online) to pre-evaluate sites before going in the field. The two additional lease staff, mentioned above, contributed to increased efficiency in 2017.[3]

North Carolina Sea Grant Updates

North Carolina Sea Grant held two shellfish farming workshops — one in Wanchese and one in Morehead City — to provide information to prospective growers. Sea Grant also initiated a North Carolina Shellfish Mariculture Industry Survey to be used in an annual report.[4]

IN PROGRESS

Researchers from the North Carolina National Estuary Research Reserve and the University of North Carolina Wilmington are examining the potential environmental changes (benefits or impacts) associated with oyster mariculture. Research is intended to facilitate discussion among end users and is expected to be completed by the end of 2018.[5]

North Carolina Sea Grant has applied for grant funding to create oyster demonstration lease sites along the coast. The proposed projects will provide communications information, farm planning and management tools, business planning models and other educational opportunities to prospective shellfish growers. In preparing for the demonstration sites, lease permits have been submitted in Morehead City and Wanchese with approval anticipated in spring 2018.

North Carolina Sea Grant is leading or partnering on several research projects including, Expansion and Diversification of the Shellfish Mariculture Industry, Economic Development of the NC Oyster Farming Industry, Identification of Consumer Value Points and Development of Shellfish Marketing Strategies, Development of Curricula for Marine Aquaculture Introduction Towards Workforce Development, Evaluation of Oyster Farming/Habitat Interactions, Correlating Human Health and Oyster Consumption and Development of Oyster Reef Siting Protocols to Optimize Restoration Efforts.

Note: Since publication, DMF has revised the 2017 farm gate oyster mariculture value to $2.40M.

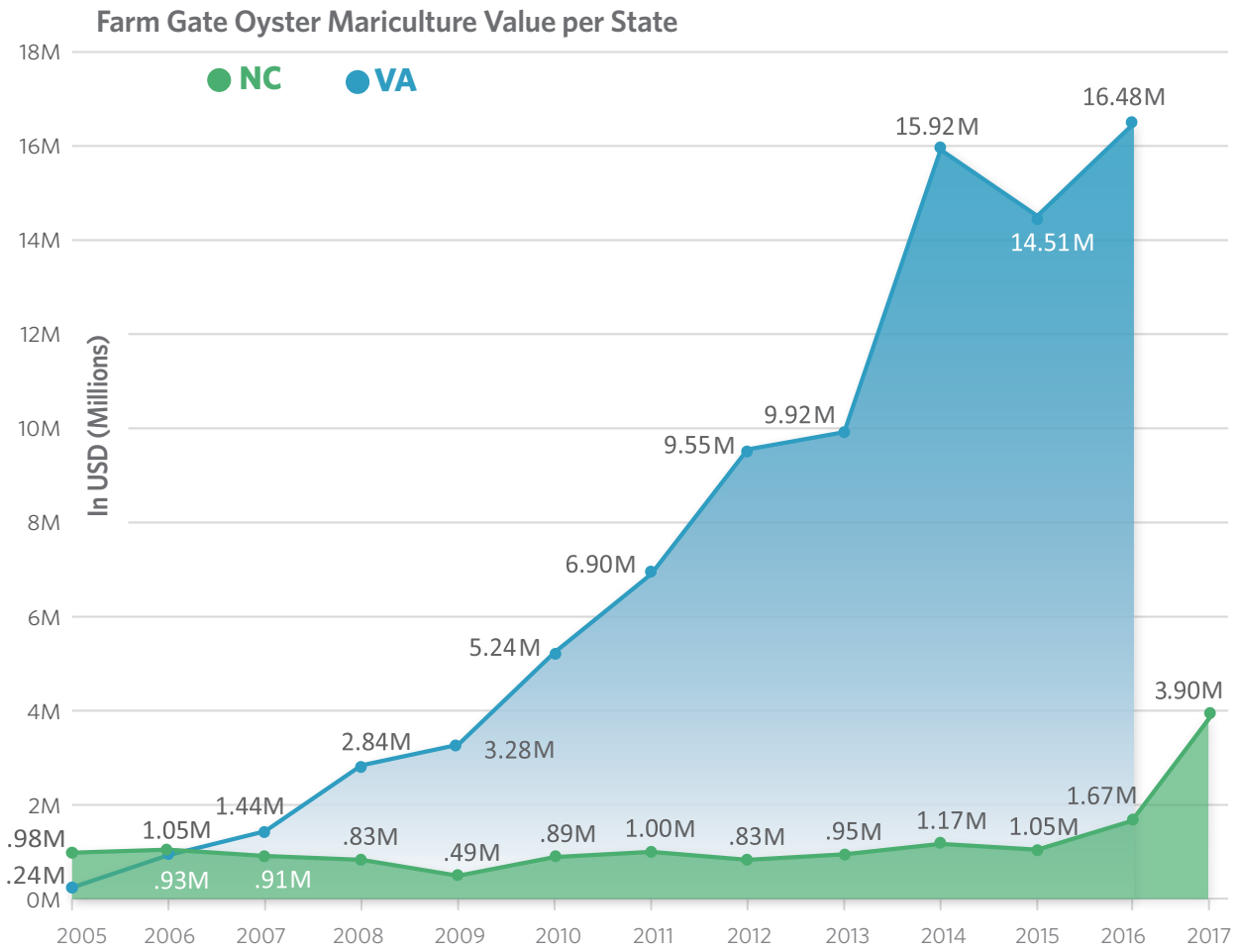


Figure 3: Comparative growth of oyster mariculture in Virginia and North Carolina since 2005. In 2016, the Division of Marine Fisheries used a new quantification method to ensure data accuracy. All North Carolina data were updated according to the new method.[6]

1 Information received from collaboratory.unc.edu/current-projects/legislative-studies/.

2 Data received through email from Ami Wilbur, Director, University of North Carolina Wilmington Shellfish Hatchery, Spring 2018.

3 Information received through email with Division of Marine Fisheries staff, Spring 2018.

4 Information received through email with Dr. Chuck Weirich, Marine Aquaculture Specialist, North Carolina Sea Grant, Spring 2018.

5 Information received through email with Dr. Brandon Puckett, Research Coordinator, North Carolina Coastal Reserve and National Estuarine Research Reserve, North Carolina Division of Coastal Management, Spring 2018.

6 Preliminary North Carolina data was provided by Alan Bianchi, Environmental Program Supervisor, North Carolina Division of Marine Fisheries, Spring 2018. Virginia data obtained from Murray and Hudson, Virginia Shellfish Aquaculture Situation and Outlook Report (s), 2011-2017. All farm gate values were calculated by multiplying average yearly price per oyster by the total number estimated to be sold.

7 Data received through email from Michael Graven, Lease Program Coordinator, North Carolina Division of Marine Fisheries, Spring 2018.

INCREASED INTEREST IN OYSTER MARICULTURE

In 2017, 72 lease applications were submitted with 52 leases granted. This shows a more than two-fold increase in interest in shellfish farming compared to the past six years when an average of 28 lease applications were submitted per year. As of April 2018, the Division of Marine Fisheries had received 50 shellfish lease applications. In comparison, 11 applications were submitted for the entire year of 2015.[7]

GOAL 5: Sustainably manage oyster harvest on public bottom.

Wild harvest of oysters is vital to our coastal economy and heritage. Efforts to refine strategies through the state's Fisheries Management Plan (FMP) process and secure adequate resources will help to ensure that wild harvest can continue in a sustainable manner. The following progress was made in 2017 to sustainably manage oyster harvest on public bottom:

2017 LEGISLATIVE ACTION

Continued recurring funding to the Division of Marine Fisheries to staff and implement its fisheries management program.

OTHER ACTIONS

Amendment Four of the Division of Marine Fisheries' Oyster Fisheries Management Plan (FMP) was adopted in 2017, and resulting rule changes came into effect during the 2017/2018 oyster harvest season. A few long-term goals of Amendment Four of the Oyster FMP are currently being pursued by the Division of Marine Fisheries' legislative liaison. Pertaining to harvest off of public bottom, these include eliminating oyster harvest as an allowable fishing activity under a Shellfish License — this would require all people commercially harvesting oysters to hold Standard or Retired Standard Commercial Fishing License with a shellfish endorsement.

For more information, contact Tina Moore at the Division of Marine Fisheries at tina.moore@ncdenr.gov.[1]

IN PROGRESS

The Nature Conservancy, North Carolina State University Center for Marine Science and Technology, and the Division of Marine Fisheries have initiated research to better assess North Carolina's oyster populations. This collaborative project will (1) design needed population survey methods for oysters; (2) quantify oyster population abundance and mortality, both naturally and due to harvest pressure, at a pilot location in Pamlico Sound; and (3) map changes in the aerial extent of intertidal oysters south of Back Sound. This research will also provide recommendations to the Division of Marine Fisheries on how to best implement the survey and integrate the resultant information into a stock assessment model to revolutionize the state's Fisheries Management Plan.[2]

Figure 4: *Comparison of oyster landings off of public bottom areas by harvest method since 2000. Bushels calculated using the standard conversion rate of lbs. meat/ 5.29 = bushels.*[3]

1 Information received through email with Tina Moore, Biologist Supervisor, North Carolina Division of Marine Fisheries, Spring 2018.

2 Data received through email with Dr. Brian Boutin, Program Director, The Nature Conservancy Albemarle Pamlico Sounds, Spring 2018.

3 Data received through email from Alan Bianchi, Environmental Program Supervisor, North Carolina Division of Marine Fisheries, Spring 2018.

GOAL 6: Protect and improve water quality in priority shellfish growing areas.

Coastal waters must be clean enough to allow oysters to be safely harvested and eaten. Land drainage carries stormwater runoff and transports high levels of bacteria and other pollutants into coastal waters, threatening public health. Shellfish beds are often closed to fishing after moderate to severe rains. For example, potential shellfish growing areas of the Newport River were closed to shellfish harvest on average for 25 percent of the year due to stormwater runoff, and many of its tributary tidal creeks were permanently closed to harvest. In 2017, Shellfish Sanitation reported a total of 760,209 acres, or 34 percent of all shellfish growing areas, closed to harvest due to poor water quality or lack of funding for monitoring.[1]

Preparing watershed restoration plans to identify the most cost-effective measures to protect and improve water quality, restoring wetlands located in the headwaters of growing areas, retrofitting existing land uses with stormwater reduction measures and using low-impact development practices in new developments are tools that help restore and protect water quality management efforts. The following efforts were implemented in 2017 to protect and improve water quality in priority shellfish growing areas:

2017 LEGISLATIVE ACTION

Appropriations to Protect Water Quality

- The General Assembly increased appropriations to the Clean Water Management Trust Fund (CWMTF) to support grants that address water pollution issues. The revised net appropriation for CWMFT grants was $18.3 million for FY 17/18.
- The General Assembly appropriated $150,000 non-recurring funding for the FerryMon program in FY 17/18. This provided funding to the UNC Institute of Marine Sciences to continue the North Carolina ferry-based water quality monitoring program along the state ferry routes in the sounds.
- The General Assembly continued funding to the North Carolina Department of Environmental Quality for water quality monitoring, assessment and regulation.[2]

OTHER ACTIONS

Watershed Restoration Plans in Coastal Counties

Watershed restoration plans are put in place by municipalities or other interested groups to protect and preserve water quality using land-based management strategies. Once a watershed restoration plan is written, actions identified in the plan can be submitted to the U.S. Environmental Protection Agency or other grant agencies for implementation. In 2017, watershed plans for the Bradley and Hewletts Creeks Watershed, the Mattamuskeet Drainage Association and the towns of

Tracking Water Quality Trends in the State

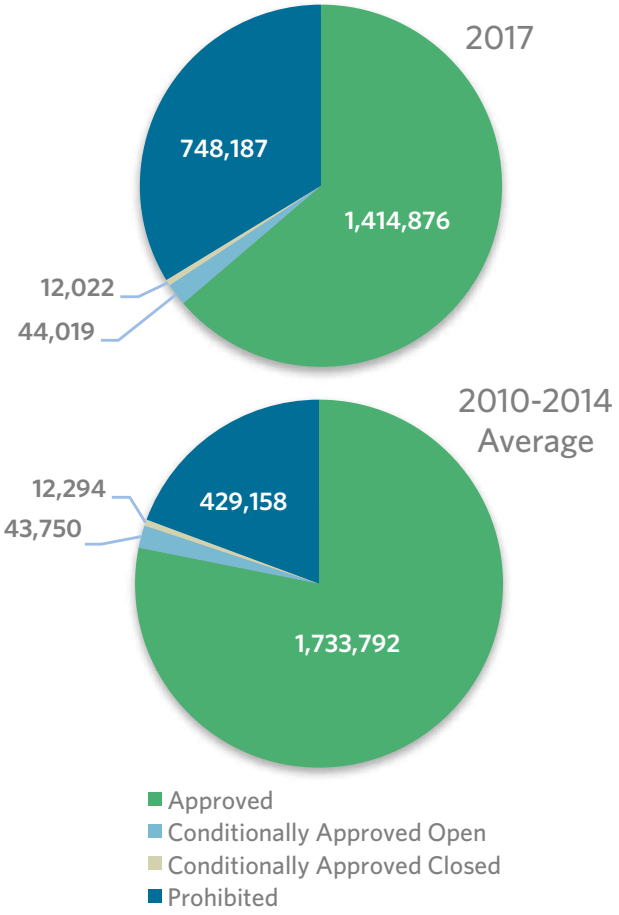


Figure 5: *The Shellfish Sanitation and Recreational Water Quality Section of the Division of Marine Fisheries monitors the health of the state's waters for public safety. In 2015, the northern water quality testing lab was administratively closed, effectively closing 314,710 acres of Albemarle Sound, of which 54,503 acres are viable shellfishing waters.*[3]

Swansboro and Beaufort continued to be implemented.

The Division of Marine Fisheries and the Division of Energy, Mineral and Land Resources revisited the state Stormwater Design Manual to ensure consistency with the 2016 stormwater rules. The design manual was finalized in April 2017. Also in 2017, the Division of Marine Fisheries and the Division of Energy Mineral and Land Resources worked with the engineers from WithersRavenel to update supplemental forms required to submit stormwater plans for state permit review.

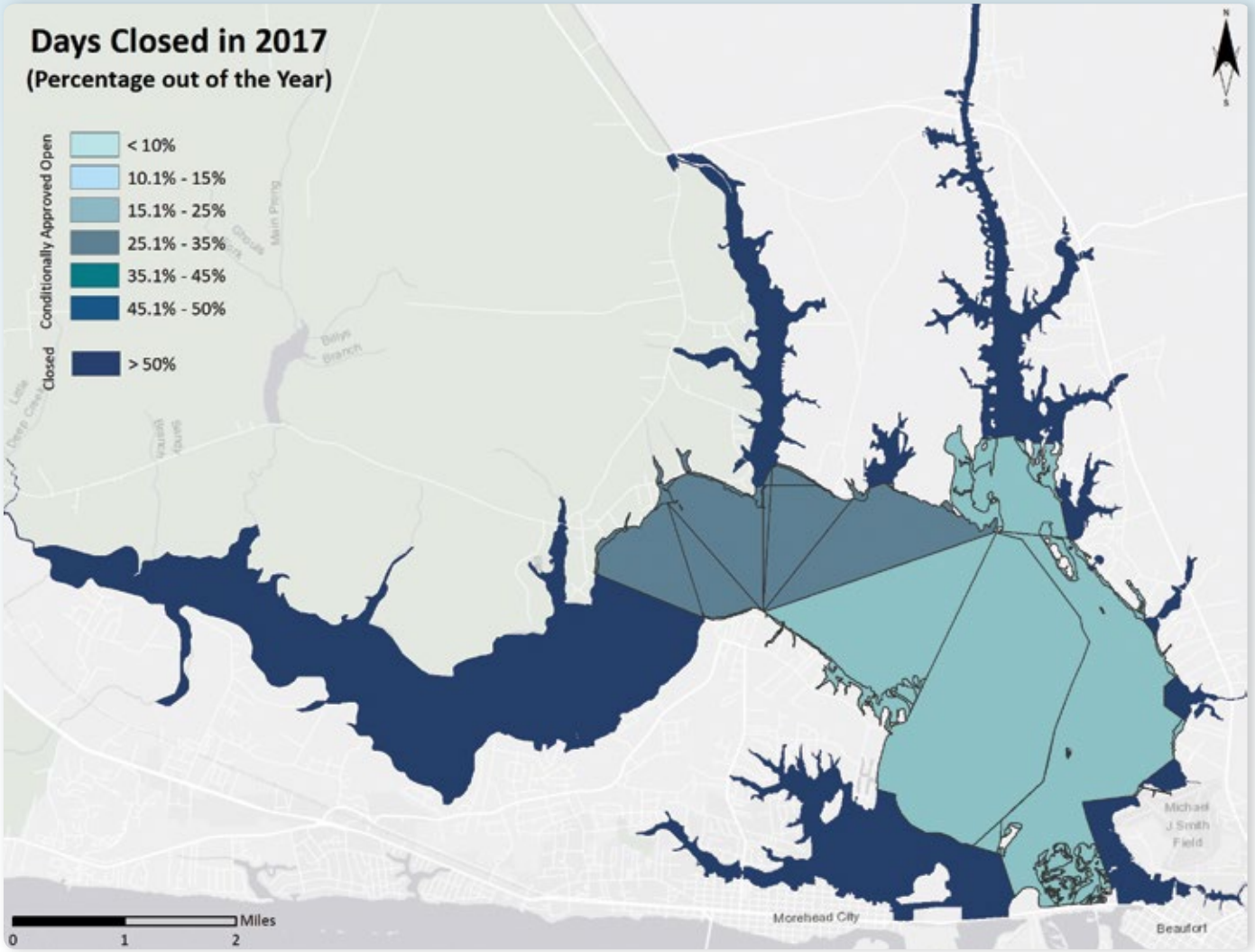
IN PROGRESS

The Division of Marine Fisheries is looking to reopen a laboratory on the northeastern coast for water quality monitoring. Due to lack of funding in 2015, the lab shut down, effectively closing viable shellfishing waters. Reopening the lab would enable about 50,000 acres to reopen for shellfish activities, and the state would be better equipped to respond to water testing needs after rainfall events in the northeastern part of the state.

Watershed management plans are being developed for the Lower Cape Fear River, Stump Sound, Lake Mattamuskeet and the towns of Pine Knoll Shores, Nags Head and Emerald Isle.

The Division of Marine Fisheries' Shellfish Sanitation Program and the North Carolina Coastal Federation are developing a new way to map water quality trends in shellfish waters. See Map of Newport River.

Newport River Growing Area



The Effect of Stormwater Runoff on "Open" Conditional Waters

The Division of Marine Fisheries' Shellfish Sanitation and Recreational Water Quality Section closely monitors Conditionally Approved Open shellfishing waters for stormwater inputs and bacteria concentrations. Although these areas are typically open to shellfish harvest, they are highly susceptible to temporary closures after rainfall events transport high levels of bacteria and other pollutants into the waters. As an example, portions of the Newport River Growing Area were temporarily closed to harvest for about a quarter of 2017. These temporary closures are separate from the prohibited waters shown in Figure 5.[4]

1 Data received through email with Andrew Haines, Environmental Program Supervisor II, Shellfish Sanitation Section, North Carolina Division of Marine Fisheries, Spring 2018.

2 Data received from Joint Conference Committee Reports found www.ncleg.net/fiscalresearch/budget_legislation/budget_legislation.html

3 Data received through email with Andrew Haines, Environmental Program Supervisor II, Shellfish Sanitation and Recreational Water Quality Section, N.C, Spring 2018.

4 Newport River maps were made with 2017 North Carolina Division of Marine Fisheries, Shellfish Sanitation and Recreational Water Quality Section data in Spring 2018. Maps were created by the North Carolina Coastal Federation in partnership with Shannon Jenkins and Andy Haines, North Carolina Division of Marine Fisheries, Shellfish Sanitation and Recreational Water Quality Section.

GOAL 7: Document oyster population status and trends resulting from successful implementation of the *Blueprint*.

The *Blueprint* lays out seven overarching goals for successful oyster restoration and protection in North Carolina. *The State of the Oyster: 2017 Progress Report* is aimed at providing a way to track progress made in carrying out the *Blueprint*. For more immediate news and updates go to **ncoysters.org** and sign up to receive the "On the Half Shell" quarterly email newsletter.

2017 LEGISLATIVE ACTION

The General Assembly appropriated $253,794 non-recurring funding to develop a satellite aquarium facility whose exhibit will be focused on the North Carolina shellfish and aquaculture industry.[1]

OTHER ACTIONS

North Carolina researchers were very productive in 2017. North Carolina oyster research keeps the Oyster Steering Committee informed with the best science. Research conducted in 2017 by *Blueprint* partner agencies includes:

- Investigating the ecological role of oyster cultch reefs;
- Exploring the benefits of shellfish mariculture;
- Surveying shellfish growers for industry statistics;
- Better quantifying the native oyster population;
- Exploring different substrates for oyster restoration activities;
- The occurrence and distribution of *Vibrio* spp.;
- Environmental and epigenetic effects on *Vibrio* spp.;
- The dynamics of boring sponge on oyster reefs;
- Micro-plastics in oysters;
- Developing a bacteria test for oysters to protect public health and to help growers know their product is safe;
- Determining how different oyster growing methods impact *Vibrio* spp. occurrence.

IN PROGRESS

The Oyster Steering Committee continues to track the progress toward implementing the *Blueprint* and refining recommendations and guidance for its successful implementation.

1 Data received from Joint Conference Committee Reports found www.ncleg.net/fiscalresearch/budget_legislation/budget_legislation.html

KEY NEXT STEPS

A solid investment in oyster mariculture and restoration of natural oyster reefs safeguarded by enhanced restoration measures to protect water quality and habitat provide the potential for tremendous economic, social and environmental returns for coastal communities in North Carolina. The North Carolina coast is poised with all the assets and public interest to become the "Napa Valley" of oysters.

IN THE YEARS AHEAD, THE FOLLOWING ARE KEY PRIORITIES:

Finalize a strategic plan for the North Carolina shellfish mariculture industry.

Develop North Carolina specific broodstock through university research and foster the development of private hatcheries to provide a suitable amount of seed for a growing mariculture industry.

Invest in water quality and habitat restoration.

Develop public-private partnerships whenever possible to build out oyster reefs and expand the state's capacity to restore oysters.

Keep our waters clean and productive for the growing oyster industry by promoting effective stormwater management and low-impact development.

Provide adequate funding to implement watershed restoration plans and the monitoring of shellfish waters.

Develop enforceable measures to safeguard both public and private reefs from illegal poaching.

Continue to produce sound science from the state's universities and community colleges in collaboration with stakeholders from all aspects of the industry to refine and expand oyster restoration and mariculture.

Develop capacity within the state to ensure shellfish health is adequately researched and understood.

Properly site shellfish mariculture and restoration activities so that they minimize user conflicts, maintain the public trust uses of the sound, restore important habitats and grow the shellfish mariculture industries.

Educate and develop a highly skilled workforce, through practical education and training, that will support competitive and sustainable commercial shellfish production.

It is an exciting time for oysters in North Carolina. Over the next two years, a solid investment in this industry and measures to safeguard water quality will advance the goals of the *Blueprint*.

RECOGNITON AND CONTRIBUTIONS

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