

Virginia Department of Health
Shellfish Growing Area Assessment Activities Report
October 4, 2016

Todd Egerton PhD: Marine Scientist Supervisor
Adam Wood MS: Marine Scientist
Evan Yeargan: Marine Scientist

Executive Summary

The 2015 General Assembly appropriated \$225,000 in new funding for three positions in the Virginia Department of Health's (VDH) Division of Shellfish Sanitation (DSS) intended to allow VDH to assess sources of bacterial contamination in shellfish waters and to develop data in support of conditional management plans to allow for the safe harvest of shellfish from Virginia's shellfish growing areas. The 2016 Appropriations Act (Item 298) directs VDH to report on the agency's activities pursuant to the 2015 appropriation.

Virginia's coastal zone has approximately 84,000 acres of waters with bacteriological impairments to the extent they are closed to the direct harvest of shellfish. While some of these areas have persistently elevated bacteria levels, many are subject to episodic pollution events with periods of low bacteria levels. Shellfish closures (and the lifting of closures) are the result of assessments conducted by the Virginia Department of Health pursuant to criteria set by the National Shellfish Sanitation Program (NSSP). The Commonwealth is required to comply with NSSP criteria in order for its shellfish industry to sell products in interstate commerce.

The two primary shellfish growing area management approaches outlined in the NSSP are "Adverse Pollution Condition" based on the worst case conditions observed, and "Systematic Random" management which is based on randomly collected data over all environmental conditions. These two approaches are thoroughly documented by the NSSP, and state shellfish programs may utilize either method without additional studies to support its efficacy for providing public health protection. VDH utilizes the Systematic Random management method for all 105 VDH designated shellfish management areas.

The NSSP recognizes a third management option called "Conditional" management which is based on predictable pollution conditions. Water quality in a given area can be influenced by a number of factors including rainfall, tide stage, winds, seasons, etc. Since these effects are very site-specific, the use of conditional management strategies requires growing-area specific research to assess impacts associated with environmental or seasonal influences on water quality. The data generated then must show the level of predictability associated with the condition or conditions selected, and a management plan must be developed that implements controls to adequately address the identified risks and provide the necessary public health protection. Conditional management requires significantly more active oversight by state regulatory programs, but it provides opportunities for shellfish industry utilization of growing areas that are otherwise closed to harvest year-round.

To date 116 acres in Westmoreland County have been placed under conditional management allowing shellfish harvesting during seven months of the year; 782 acres in the Nansemond River have been placed under conditional management based on rainfall. This report details the activities of the Marine Science branch of DSS since its inception in 2015 through September 30, 2016.

Introduction

The marine science branch of DSS was established in 2015 and fully staffed in February 2016. Since its inception, DSS has made several significant strides in its goal of addressing water quality impairments in shellfish growing waters. These include:

- Development and implementation of a seasonal conditional management plan in Westmoreland County allowing for shellfish harvest in an additional 116 acres during seven months of the year.
- Monitoring and assessment of pollution sources and rainfall data within the Nansemond River and the development of a precipitation based conditional management plan for the growing area allowing for an additional 782 acres of shellfish harvest in waters previously closed year-round.
- Enhancing the algal biotoxins monitoring and management plan for Virginia including increasing laboratory capacity of the field offices in White Stone, Norfolk and Accomac for phytoplankton identification and toxin measurement in response to increased regional algal bloom concerns.
- Technical assistance and support of augmented field and laboratory protocols, including additional sampling and analytical methods, data management and statistical analyses.
- Continued outreach and collaboration both within VDH and additional stakeholders including industry partners, state and local agencies, academic institutes and non-profit organizations.

Conditional Area Assessment and Management in Growing Area 6: Westmoreland County, VA

In its first full week of operation, the marine science branch met with a representative of the shellfish industry in Westmoreland County to discuss water quality concerns in Gardner Creek and their implications to the industry. Additional meetings with watermen, municipal utilities, Department of Environmental Quality (DEQ), Virginia Marine Resources Commissioner (VMRC), state government, and other stakeholders were conducted to gather information and develop a monitoring and management plan for the growing area. Marine scientists conducted additional seawater sampling within Gardner, Jackson, and Bonum creeks to identify potential point and non-point source contamination and enhance the existing dataset of water quality parameters measured previously by DSS. These investigations included coordinated pollution source assessments with the Coles Point Wastewater Treatment Plant and with local watermen. Bacteriological data from effluent, surface runoff, and within the growing area itself were collected and analyzed to identify sources



Figure 1: Marine scientists Evan Yeargan and Adam Wood collecting water samples in the Gardner Creek watershed for pollution assessment in Westmoreland County, VA.

of microbiological contamination to shellfish waters. Marine science staff also devoted a significant amount of time to statistical analyses of all existing data to develop a conditional management plan based on the criteria of the National Shellfish Sanitation Program (NSSP). After identifying predictable cycles in bacteriological data within the growing area, a seasonal



Figure 2: Newly classified conditionally approved shellfish growing areas (green) in Gardner, Jackson, and Bonum Creeks.

District (HRSD), and a regional non-profit organization to collect data and coordinate sampling efforts. Extensive additional seawater sampling was conducted in the Nansemond River, extending the collections beyond the established growing area stations into smaller tributaries to identify sources of contamination. Source tracking efforts to detect locations of fecal bacteria into the waterway included sampling by marine science staff as well as coordination with other partners. Collaboration with the Division of Shellfish Sanitation, Suffolk Department of Public Works, the Nansemond River Preservation Alliance, and local watermen has led to an enhanced monitoring protocol capable of characterizing fecal indicator bacteria over the extent of

conditional management plan was written and instituted on July 21, 2016 for Growing Area 6. This is the first conditional management plan of its type within the state, and results in 116 acres of growing area reclassified from *Restricted* to *Conditionally Approved*, allowing for continued protection of public health and increased economic productivity within the region. Similar work is underway to investigate conditional management in additional watersheds, with planned implementation in further growing areas within the next 6-12 months.

Pollution Source Assessment and Conditional Area Management in Growing Area 63: Suffolk, VA

Over 3000 acres within the Nansemond River are classified as *Restricted* for shellfish harvest due to fecal coliform exceedances. The condemnation line has moved up and downstream across approximately 1.5 river miles over the last 10 years as a result of annual evaluations of changing bacteriological conditions at the stations in the growing area. The marine science branch met with local watermen, DEQ, the City of Suffolk, Hampton Roads Sanitation



Figure 3: DSS marine science automated water sampler deployed in the Western Branch of the Nansemond River to investigate bacterial contamination and transport in the shellfish growing area.

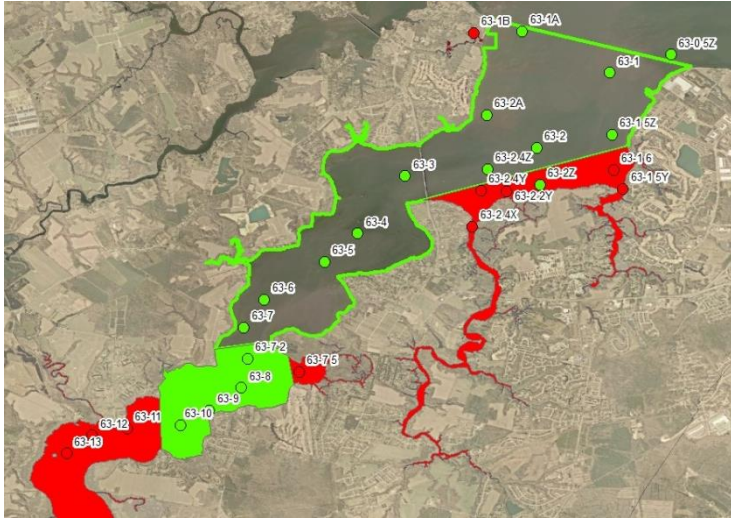


Figure 4: Proposed rainfall based conditionally approved growing area in the Nansemond River.

the estuary. Sampling was conducted to better describe dry-weather and wet-weather conditions in the river to support the development of a rainfall based conditional management plan. Statistical analyses identified a rainfall threshold capable of being protective of bacterial contamination in the growing area following NSSP criteria. Based on these data, a precipitation-based conditional management plan was developed resulting in 782 acres of *Restricted* growing area to be re-classified as *Conditionally Approved*. Implementation of this plan in September 2016 provided leaseholders the opportunity to harvest shellfish in this area in the absence of increased

rainfall events. Continued work on bacterial source tracking in the watershed focuses on identifying the sources of this contamination with the goal of improving water quality in the Nansemond, which would allow for even greater safe harvest of shellfish in the future.

Marine Biotoxin Control

An increasing number of potentially harmful algal species represent significant human health concerns to shellfish safety throughout the world, including within Virginia waters. In recent years, harmful algal blooms on the seaside of the Eastern Shore, Chesapeake Bay, and Virginia tidal tributaries have occurred that have the potential for producing biotoxins. As required by the NSSP, the Division of Shellfish Sanitation has adopted a marine biotoxin contingency plan. Over the last six months, the marine science branch has worked to update and enhance this plan to better protect the shellfish industry and public health from the increased threat of shellfish poisoning posed by regional algal species. This has included the addition of laboratory equipment (plankton microscopes, algal toxin plate readers) and training to Shellfish Sanitation staff in the White Stone, Norfolk, and Accomac field offices. The marine science branch has worked with lab staff on the microscopic analyses of seawater samples to identify harmful algal species as well as conducted inter and intra-laboratory training on the analyses of algal toxins in water and shellfish tissue. A training workshop organized by the marine science branch was conducted for DSS laboratory staff and covered techniques and equipment necessary to measure the toxins responsible for algal



Figure 5: DSS Accomac laboratory specialist Ryan Snead taking part in biotoxin training workshop held at the Norfolk Field office

shellfish poisoning. New field and laboratory protocols have been implemented by DSS as a result and are currently being used as part of routine seawater monitoring. An updated biotoxin contingency plan has been developed, with the marine science branch of DSS also taking a leadership role within the Virginia Harmful Algal Bloom Taskforce. The marine science branch has met with Virginia shellfish growers, VMRC, VIMS and other industry representatives to discuss the concerns that marine biotoxins pose in the region, which has led to greater communication regarding bloom events and increased monitoring, including additional sampling on the seaside of the Eastern Shore in Northampton and Accomac counties. DSS continues to work on both routine monitoring and event-based response to algal blooms in developing a predictive understanding of harmful algal events to inform the shellfish industry and management decisions regarding human health.



Figure 6: Marine science supervisor Todd Egerton analyzing water samples from a *Pseudo-nitzschia* bloom in Pocomoke Sound.

Technical Services and Growing Area Characterization

In addition to the projects focused on specific growing areas, the marine science branch has also worked on establishing additional techniques and protocols necessary for DSS to better address water quality impairments throughout Virginia's growing areas. Field protocols and equipment have been expanded to allow for sub-surface sampling to investigate vertical migration of harmful algal bloom species and bacterial contaminants in stratified waters. Sediment sampling

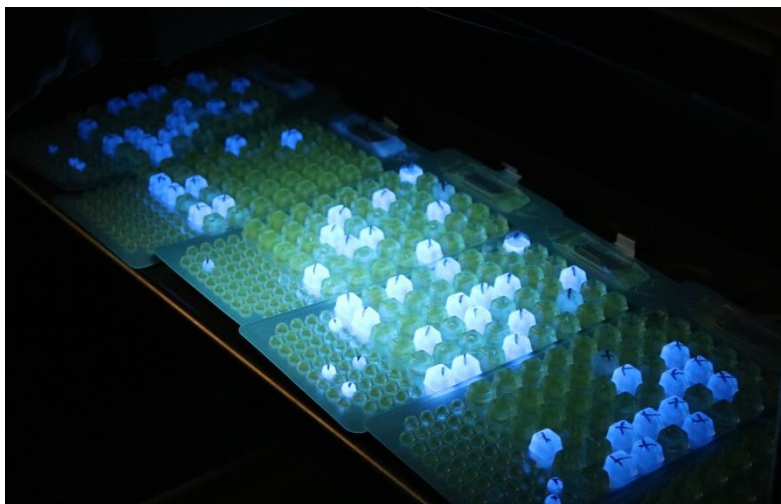


Figure 7: Enterococcus, an additional fecal indicator bacteria, quantification trays examined under ultraviolet light to process water samples from the Nansemond River.

enterococcus, another fecal indicator bacteria found in brackish and marine waters. This tool

has been optimized to target dinoflagellate cyst beds associated with potential impacts to shellfish health. Automated samplers have been added to the tools used by DSS allowing for time series data to be gathered in investigations of bacterial source tracking. Development of GPS drifter studies and hydrographic measurements are underway to track and model the transport of pollutants in shellfish areas. Enhancements have also been developed by the marine science branch to laboratory techniques and capacity. DSS is now capable of analyzing water samples for

allows for the rapid quantification of microbiological water quality from a large number of samples, and supports source tracking and time series studies. These data have allowed for growing areas to be characterized at a much higher degree than previously possible, including a greater understanding of temporal variability and spatial distributions of bacterial impairments. To date this method, new to DSS, has been implemented in investigations in the Northern Neck and Hampton Roads area, with additional plans for use in contaminated waters of the Eastern Shore and elsewhere in the state. In addition to analytical tools, the marine science branch has also been involved in increasing the statistical analyses of DSS data. Marine science staff has worked toward developing data analysis tools to support the expanding projects of DSS. These approaches have been utilized for the formation of the conditional management plans, and can be adapted to experimental designs and growing areas throughout Virginia.

Outreach and Interagency Collaboration

The marine science branch works in partnership, not just with the rest of the Division of Shellfish Sanitation, but with several other collaborators. Investigations of water quality impairments have begun by meeting with local stakeholders, including the shellfish industry, state and local agencies, non-profit organizations and other interested parties. These meetings have led to both a better understanding of the specific concerns of impairments within in the watershed, as well as productive partnerships to address these impairments. Ongoing collaborations with HRSD involve the analyses of pathogens within Virginia waters. This project which will take place over the next three years will provide vital data to DSS' understanding of bacterial and viral pathogens and their relationship with fecal indicators in our tidal tributaries and better inform management of shellfish growing areas. Additional collaborations include presentations to and ongoing communication with the Virginia Shellfish Growers Association. Marine science staff has worked with hatcheries and other industry partners in regards to harmful algal blooms and their potential impacts both to human health and shellfish aquaculture. DSS has made presentations and led meetings in conjunction with the Nansemond River Preservation Alliance and the City of Suffolk Department of Public Utilities and coordinates sampling efforts in the region between the multiple agencies. DSS marine scientists also work with VDH's Division of Environmental Epidemiology to monitor potential waterborne hazards in shellfish growing areas and inform management decisions and related public health advisories. The marine science branch of DSS maintains close links with research institutions including Old Dominion University and the Virginia Institute of Marine Science (VIMS).

Ongoing and Anticipated Projects

While the marine science branch of DSS has made several accomplishments within its first few months, it is still very much in the development stage. Continued progress in setting up field and laboratory protocols is ongoing, with a major goal of establishing a microbial source tracking program within DSS. Marine scientists and other DSS laboratory staff are working to adapt existing molecular tools for use in identifying the source of bacterial contamination (human, canine, avian, etc.) with coordination with established source tracking labs including HRSD, VIMS, and the University of North Carolina. These data will allow for targeted studies of growing areas to determine the relative contribution of specific vectors, and influence

*Virginia Department of Health, Office of Environmental Health Services
Shellfish Growing Area Assessment Activities Report*

management and remediation strategies. Additional planned projects include rainfall surface runoff studies and their influence on bacterial and viral densities both in growing area seawater and within shellfish tissue. These time series evaluations will measure both uptake of contaminants as well as purging rates and support conditional area and emergency closure management. Seawater sampling is already underway, with oyster deployment anticipated within the next two months. Pollution source assessment will be ongoing, and will focus on growing areas with impaired water quality throughout the state. Where possible, conditional management will be investigated as a strategy for growing area evaluations. Marine scientists also continue to work as part of DSS and the rest of VDH to make findings and data available to the public. Work is ongoing to ensure that technical reports, management plans and evaluations, along with data summaries and visualizations are accessible to interested parties. These projects and others promise to result in a much greater understanding of the safety and management of the economically, ecologically, and culturally important shellfish resources within Virginia.