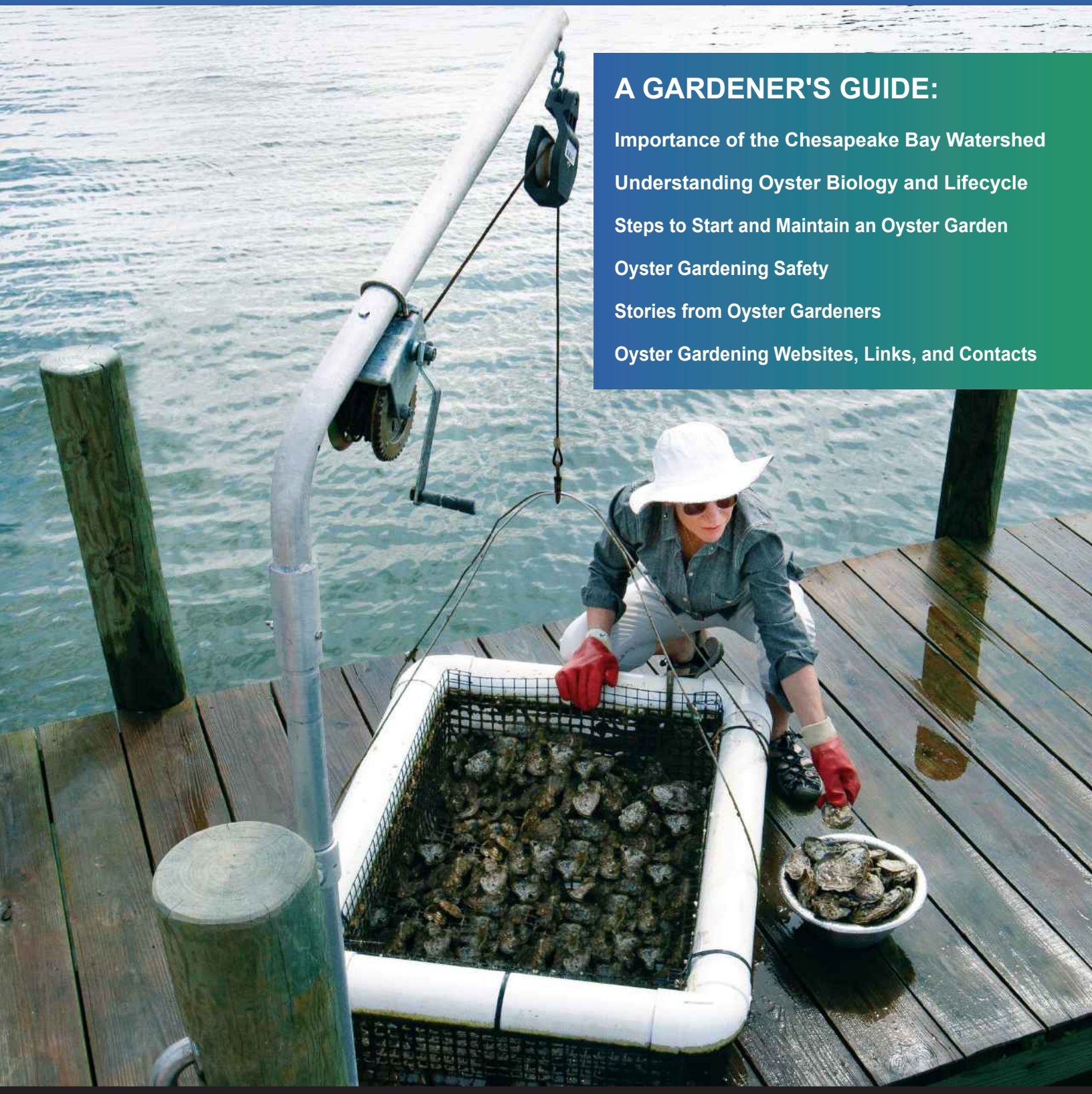
Virginia Oyster Gardening Guide

3rd Edition

2025



A GARDENER'S GUIDE:

- Importance of the Chesapeake Bay Watershed
- Understanding Oyster Biology and Lifecycle
- Steps to Start and Maintain an Oyster Garden
- Oyster Gardening Safety
- Stories from Oyster Gardeners
- Oyster Gardening Websites, Links, and Contacts

Growing Oysters for a Cleaner Bay.
Garden, and know you are making a difference!

Note from the Editor

The 1st and 2nd Edition of the Virginia Oyster Gardening Guide provided the base for this expanded edition. Authors of and contributors to these first editions are credited for much of the content in the 3rd edition. Authors and editors of this edition have used their personal experience with training, education, and information gleaned from colleagues and industry to prepare this content. Virginia State Agencies have reviewed and provided updates to key sections. Special thanks go to Adam Wood and Daniel Powell at Virginia Department of Health, staff at Virginia Marine Resources Commission, and Karen Hudson at Virginia Institute of Marine Science who reviewed this edition and authored specific sections. Other thanks for Tidewater Oyster Gardeners Association (TOGA) reviewers Carlton McFaden and Vic Spain, coordinator Russell Mait, photographer Kent Eanes, and graphic artist Erin Blunt. This guide could not have been prepared without the patient assistance of desktop publishing specialists April Bahen and Virginia Witmer at the Virginia Coastal Zone Management Program at the Virginia Department of Environmental Quality. No Artificial Intelligence (AI) tools were used in the preparation of this document.

Editor, Carl Zulick, TOGA

TOGA members building an oyster reef at Pittman Cove. Photo courtesy of TOGA.

Carl Zulick explains oyster anatomy to young visitors at the Deltaville Maritime Museum. Photo courtesy of Kent Eanes.

Cover: Andrea Levine with a bountiful harvest. Photo courtesy of Kent Eanes.

Virginia Oyster Gardening Guide
3rd Edition, 2025

Editors -

Carl Zulick, Editor, Master Oyster Gardener, TOGA Board Member
Russell Mait, Master Oyster Gardener, TOGA Board Member
Carlton McFaden, TOGA Board Member
Vic Spain, Master Oyster Gardener, TOGA Board Member

Contributors -

Adam Wood, Contributor, Virginia Department of Health (VDH)
Daniel Powell, Contributor, Virginia Department of Health (VDH)
Virginia Marine Resources Commission (VMRC)
Karen Hudson, Virginia Institute of Marine Sciences (VIMS)
Jessica Small, Virginia Institute of Marine Sciences (VIMS)
Ryan Carnegie, Virginia Institute of Marine Sciences (VIMS)
Mark W. Luckenbach, Virginia Institute of Marine Sciences (VIMS)
Ryan Carnegie, Virginia Institute of Marine Sciences (VIMS)
April Bahen, Desktop Publisher, Virginia Coastal Zone Management Program (VA CZM)
Virginia Witmer, Desktop Publisher, Virginia Coastal Zone Management Program (VA CZM)
Erin B Blunt, Graphic Designer, Illustrator
Kent Eanes, Photographer, Master Oyster Gardener, TOGA
Laurie Sloane, TOGA

References and Citations From -

Chesapeake Bay Commission (CBC)
Chesapeake Bay Foundation (CBF)
Chesapeake Bay Program
Maryland Department of Natural Resources
National Aeronautics and Space Administration (NASA)
Old Dominion University
The Oyster Alliance
US Department of Agriculture (USDA)
US Environmental Protection Agency (EPA)
US Geological Survey (USGS)
USDA National Agricultural Statistics Service
World Meteorological Society
Other Contributors as Cited Within

Virginia Oyster Gardening Guide
3rd Edition, 2025

This 3rd edition of the Virginia Oyster Gardening Guide was produced in 2025 by the Tidewater Oyster Gardeners Association (TOGA) and the Virginia Coastal Zone Management Program (VA CZM) at the Virginia Department of Environmental Quality (DEQ) in partnership with the Virginia Marine Resources Commission (VMRC), Virginia Institute of Marine Science (VIMS) and Virginia Department of Health (VDH).

Funding to print this edition was provided by TOGA (https://www.oystergardener.org) and made possible by a generous grant from the River Counties Community Foundation (RCCF), 834 Rappahannock Dr, White Stone, VA 22578, (https://www.rivercountiescf.org). Desktop publishing was completed by April Bahen and Virginia Witmer of the Virginia Coastal Zone Management Program at the Virginia Department of Environmental Quality.

The first edition of the guide was released in 2006 by the Virginia CZM Program, with support from the Virginia Oyster Reef Heritage Foundation and the NOAA Chesapeake Bay Office, based largely on a document written in 1999 by Mark Luckenbach, Francis O'Beirn and Jake Taylor of VIMS: "An Introduction to Culturing Oysters in Virginia."

The second edition of the guide was produced in 2013 by the CZM Program in partnership with the VRMC, VIMS, TOGA, VDH, Oyster Reef Keepers and the Chesapeake Bay Foundation (CBF).

This updated guide is available on the Virginia CZM Program website at https://www.deq.virginia.gov/our-programs/coastal-zone-management/coastal-conservation/habitat-restoration/oysters and the TOGA website at https://www.oystergardener.org.

Gardened oysters. Photo courtesy of TOGA.

IN THIS GUIDE:

Printing and publication of this guide has been made possible by the Tidewater Oyster Gardener's Association (TOGA), the Virginia Coastal Zone Management Program (VA CZM) at the Virginia Department of Environmental Quality (DEQ), and the River Counties Community Foundation (RCCF).

Welcome to Oyster Gardening!

We hope this oyster gardening guide will help you learn how to grow oysters while gaining an understanding of the value that oyster gardening brings to improving habitat, water quality, and the overall vitality of the Chesapeake Bay.

It's important to recognize that ***everyone*** living in the Chesapeake Bay watershed can make a difference! You don't need to be an oyster gardener or waterfront owner to help the Bay and its oysters. The quality of the Bay starts in or on every backyard, farm, road, city, parking lot, construction site, and business in the six-state watershed. All runoff ends up in the Bay, carrying whatever moves with air or water or is water-soluble. Water quality affects all life in the Bay, and oysters, as a keystone species, have a positive effect on all living things in the Bay. That's the reason this 3rd edition of the Virginia Oyster Gardening Guide has integrated discussions on the watershed, ecology, biology, and water quality while including how to create and maintain an oyster garden.

Whether you plan to eat the oysters from your garden, use them for reef restoration, or simply support oyster conservation efforts, growing oysters improves the Bay's health by filtering water, improving water clarity that helps Bay grasses grow, and creating habitat for many fish and animals.

Equipment, forms, technology, data, and addresses can change over time, so please check websites at TOGA, VDH, VIMS, VMRC, VA CZM, DEQ, CBF, or other sites listed in this guide for the most current information.

We hope that you will share your oyster gardening experiences with others and encourage them to take up this exciting hobby. Remember, even if you don't own waterfront property, your friends, neighbors, employers, schools, local parks, and businesses might. If they are willing to share their space, you could directly benefit as well as inspire more people to get hooked on oyster gardening.

Carl Zulick, Master Oyster Gardener and Editor

Photos left to right: oyster float, courtesy of TOGA; oyster seed, courtesy of TOGA; oysters on the half shell, courtesy of CBF.

Oyster Gardener -
A person involved in the non-commercial aquaculture of oysters. It's a popular activity whereby oysters are grown for restoration purposes, improving water quality in the Bay, and/or personal consumption in approved harvest areas.
www.vims.edu/research/units/centerspartners/map/shellfish-aquaculture/oyster_gardening/

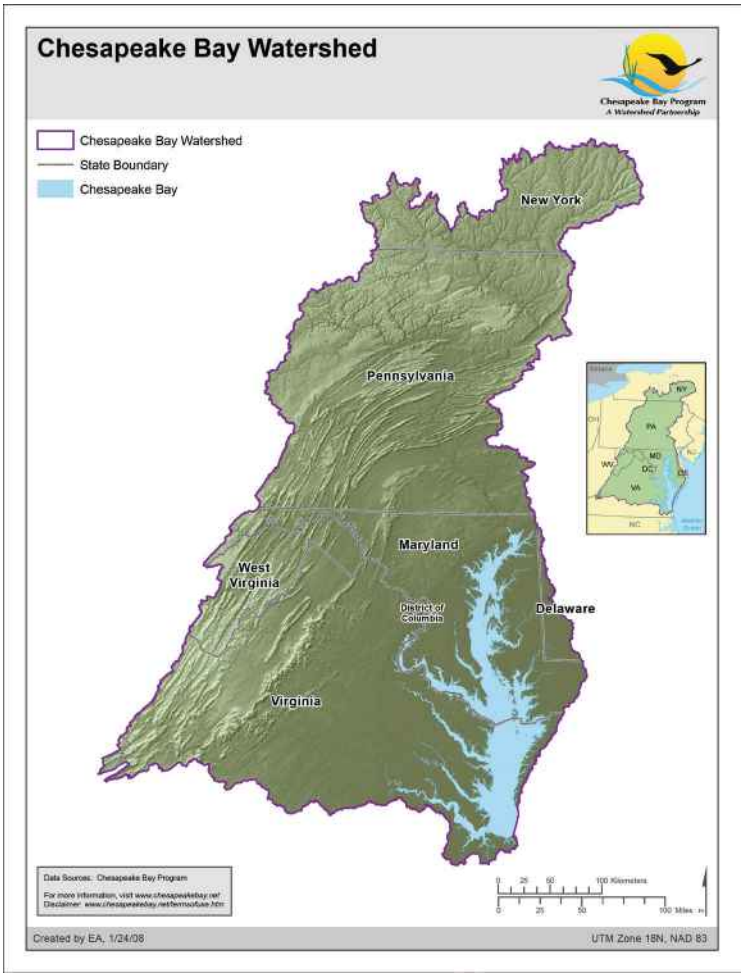
Oyster Enthusiast -
A person who has an active interest in oysters and/or supports oyster restoration to improve the health and productivity of Virginia waters but may not raise oysters.

Understanding the Bay is Important to Oyster Gardening

The Watershed – Headwaters of the Chesapeake Bay

The Chesapeake Bay watershed extends 524 miles long into six states and the District of Columbia. Three states make up 83 percent of the watershed- 35% in Pennsylvania, 34% in Virginia and 14% in Maryland. The remaining 17% of the watershed is in New York, Delaware, West Virginia, and the District of Columbia.

About 18 million people live in the 64,000 square-mile Chesapeake Bay watershed. The Bay generates over one trillion dollars for the economy and plays a major role in jobs in the mid-Atlantic region. Virginia's coastal population alone increased 41% from 3 million in 1986 to 4.9 million in 2023. According to the Chesapeake Bay Commission, the land-to-water ratio of the watershed is 14 to 1, the highest of any large, enclosed coastal water body in the world. Because so much land area drains into a much smaller area of the Bay, human activities in the watershed have an amplified effect on the health of the Bay. Population growth, increasing land development, and human activity place an ever-increasing burden on the health of the Bay and create regional challenges to control and manage any negative impacts.



Chesapeake Bay Watershed. Source: Chesapeake Bay Program

The Chesapeake Bay – A Brackish Water Estuary

The Bay is 200 miles long (north to south) and up to 30 miles wide (east to west). The deepest part of the Bay is 173 feet, but its average depth is only 21 feet, according to the Chesapeake Bay Commission (CBC). The CBC reports that more than 100,000 creeks, streams, and rivers in the watershed transport fresh water into the Bay. Among those, the seven largest rivers are the Susquehanna, Potomac, James, Rappahannock, York, Patuxent and Choptank. Groundwater and the rivers' freshwater mix with salt water from the Atlantic Ocean, creating more than 18 trillion gallons of brackish water.

The Bay is the second-largest estuary in the world. An estuary is a partly enclosed body of brackish water that opens to the sea. The amount of salt in the Bay's water is measured by the salinity level, which increases closer to the ocean and is highly diluted in the upper reaches of tidal rivers. The Chesapeake Bay estuary opens to the Atlantic Ocean in the south near Norfolk, VA. According to the CBC, the Bay estuary supports about 3,600 species of plants and animals, including 348 species of finfish, 173 species of shellfish and 2,700 species of plants that may require certain levels of salinity to thrive.

Many species of fish and animals rely on the Chesapeake Bay for food, resting areas during migration, winter habitat, and breeding grounds. Estuaries are highly balanced ecosystems that are sensitive to changes, and the Chesapeake Bay is no exception. Congress established the National Estuarine Research Reserve System to study and protect estuarine systems. Two areas within the Bay are part of the network of 30 reserve areas throughout the country. These areas are managed by NOAA and coastal states.

The Health of the Bay and its Complex Ecosystem

The Bay's ecology is closely connected to human activity. These activities can increase water runoff, promote soil erosion, and escalate siltation, all of which convey contaminants into the groundwater and surface waters that feed the Bay. Additionally, contaminants can be released into the air, which can be carried into the Bay.

Chesapeake Bay Watershed Activities, credit: TOGA, Design and Illustration by Erin Blunt.

Watershed activities and uses that can affect the Bay include landfills, logging, agricultural fertilizer and herbicide runoff, air pollution, mining, housing, urbanization, land development, malfunctioning septic systems, stormwater and street drains, wastewater effluent, pets, poultry farms, marinas, pesticides, cars, boats, pharmaceuticals, dams, clearing riparian vegetation, and wetland destruction.

It is estimated by the Chesapeake Bay Program (CBP) that up to 8.0 billion pounds of sediment enter the Bay from runoff and erosion every year. Runoff carrying contaminants and sediment from the land can smother shellfish and coat hard surfaces. Oyster spat cannot set when they are babies if no clean, hard surfaces are available.

Air and water pollution add 300 million pounds of nitrogen and 16.5 million pounds of phosphorus into the Bay. These nutrients cause macroalgae and microalgae blooms which increase chlorophyll concentrations, reduce water clarity, increase turbidity, and reduce sunlight to the bottom, all of which impair aquatic grasses that provide habitat for crabs, fish, and other aquatic life.

When the algae die, their decomposition consumes dissolved oxygen, which creates a condition known as anoxia (an absence of oxygen). Oxygen-depleted dead zones harm or kill less-mobile fish and immobile shellfish, including oysters. Dead zones in the Bay have been measured every year since 1985. Despite spikes in 2017 and 2021, the CBP's researchers accurately predicted lower rainfall in the spring of 2023 would result in lower amounts of nutrients being released from land sources, and, consequently, the Bay's dead zone would be reduced 33% below average. In fact, the Chesapeake Bay Foundation (CBF) reported that water monitoring data collected in 2023 by the Maryland Department of Natural Resources, Old Dominion University, and Virginia Institute of Marine Science (VIMS) produced the smallest dead zone area on record – only 0.52 cubic miles.

Warming waters have an impact on an ecosystem, bringing both predictable and unpredictable change. NASA and US Geological Survey satellites have collected years of data showing warming trends in the atmosphere, oceans, and land. The World Meteorological Society reports that the eight years from 2015 to 2022 are the warmest on record. NASA data show the earth's surface temperature has increased two degrees Fahrenheit since the late 1800s. Research by NASA and NOAA has linked extreme weather to change in climate. Increased air and water temperatures bring new species of plants, animals and insects into the Bay and its watershed, as evidenced by dolphin and manatee sightings, larger and more abundant shrimp populations, and widgeongrass replacing eelgrass as the dominant seagrass species in the Bay (VIMS, May 2023). These changes can affect oysters and their habitat.

Bay scallops on the submerged aquatic grass, eelgrass. Photo courtesy of VIMS.

Grass shrimp can live in shallow waters that have aquatic grasses or oyster reefs. Photo courtesy of NOAA.

Plans Protecting the Health of the Bay

Many Federal, State, and Local agencies are working with non-profits and others to protect the Bay. Efforts to reduce nutrient and sediment impact focus on land-based solutions such as riparian buffers and improved agricultural practices because most pollution comes off the land. Congress added specific protection for the Chesapeake Bay to the Clean Water Act in the late 1970s, commissioning a study to assess the Bay's critical loss of wildlife and aquatic life. The study concluded that nutrient pollution was the primary issue, and the CBP was initiated to address potential solutions. In 1987, the Program's Chesapeake Bay Agreement set restoration and pollution reduction goals for six states and the District of Columbia. The plan's milestones were set to be reached by 2025, and the U.S Environmental Protection Agency committed to enforcing those goals. The Chesapeake Clean Water Blueprint consolidated all state and federal plans to restore the water quality of the Bay and its tributaries.

Oysters are a keystone species of the Chesapeake Bay, and other aquatic life depends on them. Think how different the Bay would be without oysters!

Photo above: Oyster Reef. Photo courtesy of Oyster Recovery Partnership & NOAA Fisheries.

Photo above: TOGA President Emeritus Doug Schaefer demonstrates how oysters clean Bay water at the Urbanna Oyster Festival Education Day. Photo courtesy of Kent Eanes.

Photo above: In addition to helping to clear the water by filtering out algae and sediment, natural oyster reefs provide habitat to a wide variety of finfish and shellfish. Can you see the Oyster Toadfish hiding among the oysters? Photo courtesy of CBF.

In their 2022 State of the Chesapeake Bay Report, the Chesapeake Bay Foundation (CBF) reported "Since the Blueprint was established in 2010, states have put in place practices to achieve an estimated 42 percent of the nitrogen-pollution reductions and 64 percent of the phosphorus reductions that the Blueprint requires. Much of this progress is due to reducing pollution from wastewater treatment plants." The CBF 2022 assessment of the implementation of Blueprint's goals received a D+, which was unchanged from 2020 (https://www.cbf.org/about-the-bay/state-of-the-bay-report/index.html). But government alone cannot save the Bay. Homeowners, communities, industry, and farms can each undertake practices that contribute to reducing the amount of nutrients and pollutants entering the Bay. Protection starts in everyone's backyard.

The Importance of Oysters to the Bay and Our Communities

Virginia's native oyster, Crassostrea virginica, is a keystone species in the Bay's ecosystem. Other aquatic plants, fish, and animal species rely on oysters to create reef habitat, improve water quality and clarity, promote aquatic vegetation, and be a source of food. Oysters improve water quality by feeding on algae and plankton. A single oyster can filter up to fifty gallons of water per day under ideal conditions.

Along with consuming algae, oysters also remove excess nitrogen, phosphorus, silt, and other pollutants. Nitrogen, phosphorus, and nutrients are necessary for a healthy ecosystem. However, in high concentrations, they can promote algae blooms, which decrease oxygen levels in the Bay. Low oxygen levels cause "dead spots" where plants and bottom-dwelling animals cannot survive. With cleaner and clearer water, more sunlight passes through to the bottom, supporting underwater grasses that are critical as habitat for the Bay's populations of blue crabs, fish, and other animal species. As oysters grow on the surface of old shells, reefs are formed. These reefs stabilize and protect shorelines from erosion and create habitat for hundreds of species including fish, eels, crabs, worms, shrimp, and plant life.

Hampton City Schools student shows her oyster message: "I want clear waters in VA". Photo courtesy of Betsy McAllister.

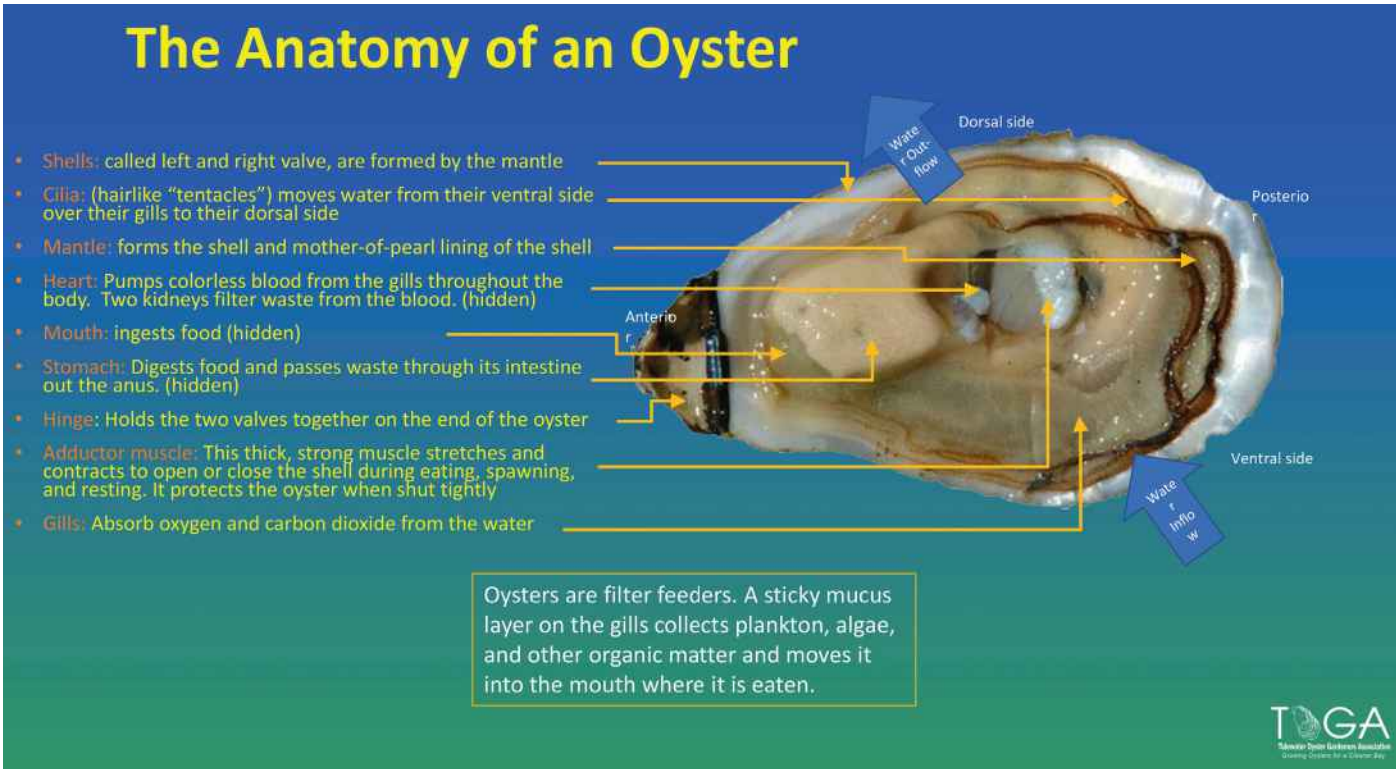
Oysters Contribute to Virginia's Economy and Culture

According to the 2018 USDA National Agricultural Statistics Service, the sale of Virginia wild and cultured oysters generated over $60 million of revenue in 2018. The USDA counted 143 oyster farms, which was up significantly from only 60 farms in 2013. The Virginia Marine Resources Commission (VMRC) estimated for the year 2023 that private aquaculture farms produced over 400,000 bushels of oysters while watermen harvested 300,000 bushels from public grounds. This was the largest harvest since 1988 and ranks Virginia as the largest oyster producer on the East Coast. The harvest supported both workers and businesses across multiple states as oysters made their way from docks to consumers' tables.

Oysters also provide value as a nutritional food source. According to the Healthline newsletter (https://www.healthline.com/nutrition/oysters), oysters contain protein, carbohydrates, fat, zinc, vitamin B12, copper, selenium, iron, manganese, phosphorus, vitamin E, riboflavin, and calcium, while also supplying valuable omega-3 fatty acids and antioxidants. Aside from their nutritional value, Chesapeake Bay oysters are recognized around the world as a highly sought-after delicacy.

Contrary to some beliefs, Virginia oysters are not a commercial source of pearls. Although it is possible for edible oysters from the family Ostreidae (such as Crassostrea virginica) to produce pearls, it is oysters from the family Pteriidae that produce the pearls used in jewelry.

Bay communities benefit from oyster festivals, community oyster roasts, shucking contests, and tourism. Oysters are an important part of Chesapeake Bay lifestyles, whether creating jobs for watermen and aquaculturists, being featured in local restaurant menus, protecting shorelines and aquatic habitat, improving water quality, or simply as a hobby for an oyster gardener.



Anatomy of an Oyster. TOGA Graphic courtesy of Carl Zulick.

Biology

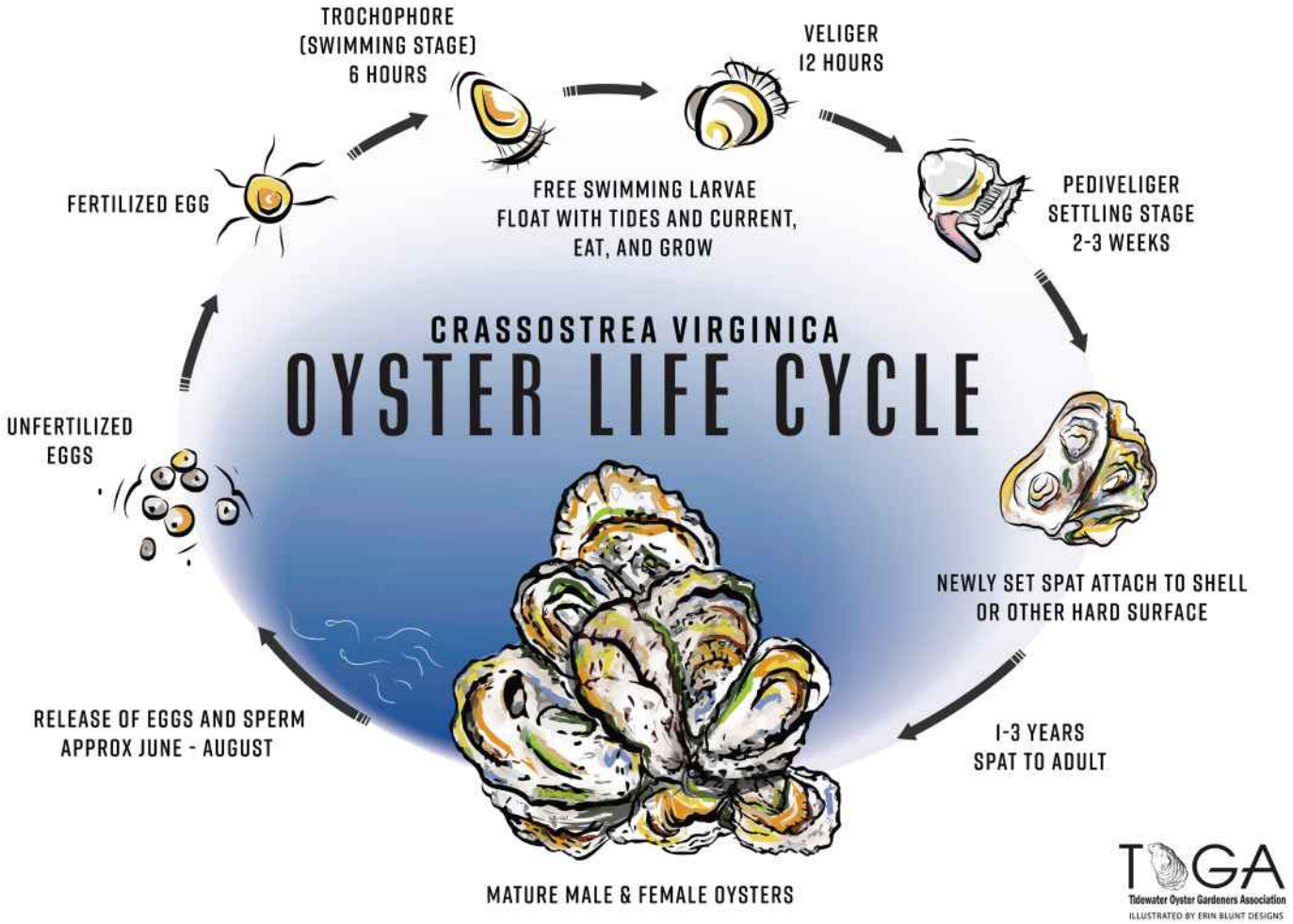
The native Eastern oyster, Crassostrea virginica, usually lives in water depths of between 3 and 25 feet and naturally forms three-dimensional reefs when it reproduces. An oyster orients itself with the flared edge of its shell tilted upward. The left valve is cupped, while the right valve is flat. The oyster uses its adductor muscle to open its shell to feed on plankton. It removes particulate algae and sediment from the water by beating the cilia on its gills and drawing water in at a rate of up to 2 gallons per hour. Food particles are caught in mucous strings on its gills and are then passed around the gills to the palps where some of the food is ingested. The remainder of the particles are released as "pseudo-feces", which effectively packages and removes sediment from the water column and places it on the bottom. When water temperatures fall during the winter, oysters stop filtering and seldom open their shells to feed, but they will lose very little weight during this time.

Oysters are scientifically classified as mollusks, a word from the Latin meaning soft.

Common name: Eastern oyster
Latin name: Crassostrea virginica
Kingdom: Animalia (animals)
Phylum: Mollusca (mollusks)
Class: Bivalvia (bivalves)
Order: Ostreoida (oysters and scallops)
Family: Ostreidae (true oysters)
Genus: Crassostrea
Species: Crassostrea virginica

Lifecycle

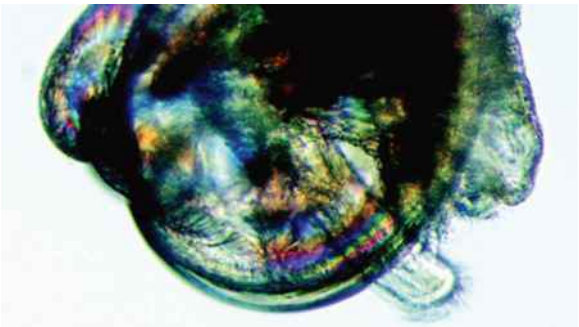
After a period in which oysters go through gametogenesis, a process where they convert much of their body mass into either eggs or sperm, an increase in water temperature triggers male oysters to release sperm and females to release eggs into the water. Millions of eggs and sperm will cloud the water. A single female oyster produces 10 to 100 million eggs each year where they are fertilized by sperm in the water column.



Oyster Life Cycle, TOGA Graphic courtesy of Erin Blunt.

Fertilized eggs develop and progress through a series of free-swimming larval stages over a period of 14 to 20 days, depending on water temperature. These stages are referred to as the trochophore, veliger and pediveliger. The trochophore larvae feed on very small algae as they move through the water column. Trochophore larvae quickly develop into more motile veliger larvae. Toward the end of the larval cycle, veligers develop a pigmented eye spot (then called eyed larvae) and a foot (thereafter called pediveligers). The larvae engage in a searching behavior until they find a suitable hard substrate on which to attach (set) and they transform into small oysters. Finding a clean substrate (cultch) such as clean oyster shell, granite, concrete, wood, PVC plastic, some metals, or other hard surface is essential to their survival.

Eyed pediveligers settle out of the water column when they are approximately .01 inch (0.3 millimeters) and may be stimulated to settle by the presence of adult oysters. The eyed larvae can move only very small distances in order to find a suitable spot to settle. Once settled, they attach and transform into small oysters called spat. Spat soon begin feeding on algae by filtering water through their gills and a special structure (labial palps) located just in front of the mouth.



Pediveliger. Pictomicrograph of eyed larvae with pseudopod extended. Photo courtesy of Michael Congrove, VIMS.

Oyster larvae can swim and drift in the tide or current. After 3 weeks, they develop a foot and attach themselves to wood, concrete, porcelain, rock, metal, or shell and remain immobile the rest of their lives.

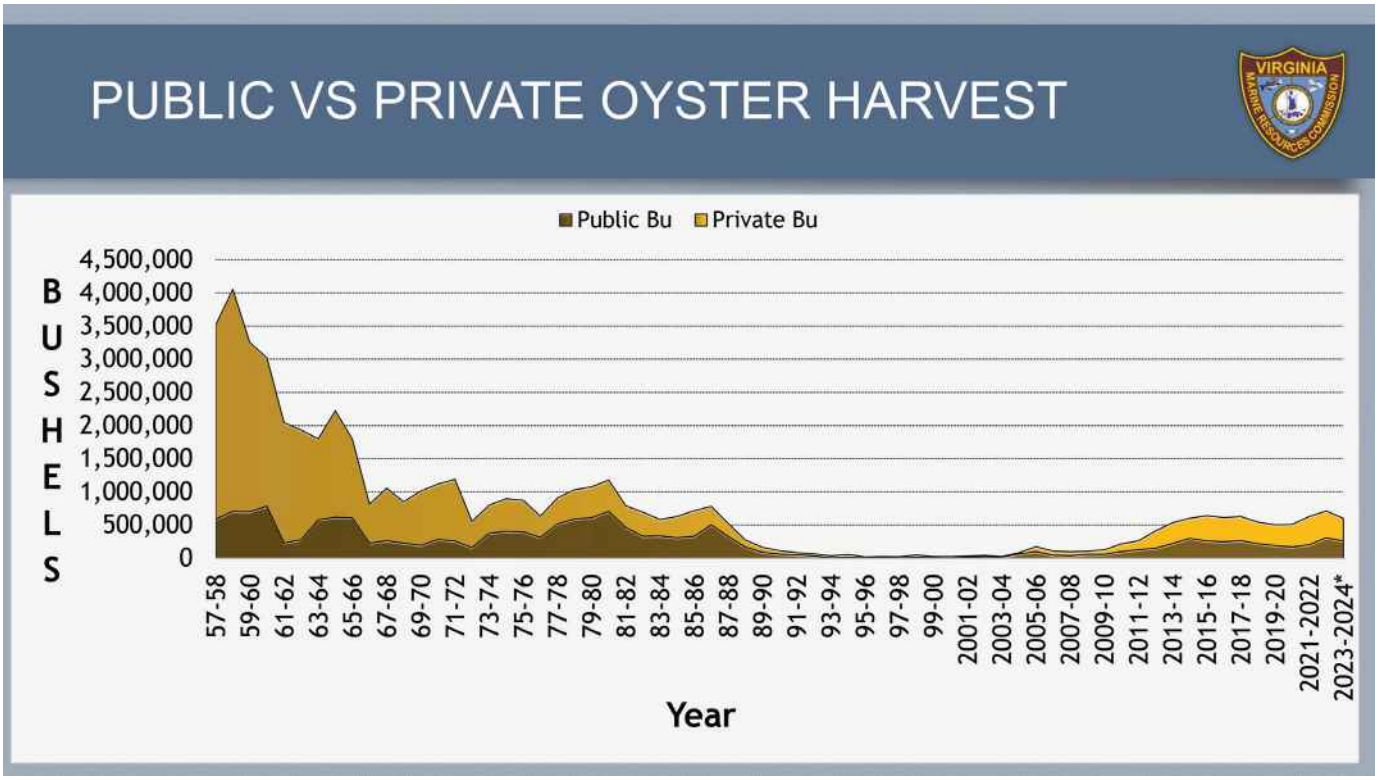
Oysters usually become sexually mature in one year. There is no way of telling male oysters from females by simply looking at them. While oysters have separate sexes, they may change sex one or more times during their lifespan. They are protandric, which means that they spawn as males during their first year, but, as they grow larger and develop more energy reserves over two to three years, they then spawn as females. According to NOAA, Eastern oysters can live up to 20 years. Oysters have shorter lifespans as compared to ancient oysters which were larger and lived 4 times longer (https://www.science.org/content/article/when-long-lived-oysters-roamed-earth). They usually live only four to six years before often succumbing to disease or predation, and this drives commercial operations to harvest at two or three years (or even earlier) into the oysters' lifecycle.

Successes in Restoration Efforts

Brief History of the Oyster Population

Large three-dimensional oyster reefs were once a prominent feature of the Chesapeake Bay. Captain John Smith reported in the early 1600s that a person could practically walk across the James River on the tops of the oyster reefs. Colonists used hand tongs to harvest oysters, but by the 1800's dredges were introduced and harvests grew significantly. With the introduction of skipjack boats, steam-powered dredges, refrigeration, and in 1869 the transcontinental railroad, the demand for oysters grew. During the Civil War, oyster reefs were still so large that they were a danger to navigation., The Chesapeake Bay Program reported that Virginia produced 1.5 million bushels of oysters per year in the 1850's, with approximately 20 million bushels being harvested by 1880. But overharvesting beginning in the mid-1800s lasted through the 1930's and caused a precipitous decline. After a slight recovery in the 1940s and 50s, oyster harvests drastically declined again in the mid-1950s, reaching their lowest points in the 1990s and early 2000s. This decline in oyster populations was due to over-harvesting, habitat loss, poor water quality, and two diseases, MSX and Dermo. As a result of these adverse man-made and natural pressures, only a small percentage of the oyster population now exists.

Beginning in the 1980's researchers and scientists improved the genetics of oyster stock and introduced non-reproducing triploid oysters that improved resistance and year-round marketability. Over the last decade, wild oyster populations also improved through natural selection, and the oyster aquaculture industry has grown. In 2023, the Virginia Marine Resources Commission (VRMC) extended the state's harvest season in certain locations after its survey found the wild oyster population was at its highest level in 35 years. The VMRC estimated a 2023 annual wild harvest of 300,000 bushels and an additional farm-raised harvest of 400,000 bushels-- the most since 1988.



Source: Shellfish Management Division, Virginia Marine Resources Commission (VMRC), 2023. Oysters produced by private aquaculture operations exceeded the amount harvested from public oyster grounds and were the highest on record since 1988.

The VA Oyster Replenishment Program administers four to ten million dollars annually and is the largest replenishment program in the United States (source: the VMRC Shellfish Management Division Evaluation 2/28/2023). In addition to the traditional public oyster harvest from open waters, private hatcheries and commercial aquaculture have spurred oyster production in Virginia. Working with nonprofits, business, and academia, Virginia and the Federal Government have invested in reef restoration in the Great Wicomico, Lafayette, Lower York, Lynnhaven, and Piankatank Rivers. Oyster Management Plans have helped keep public oyster grounds productive by using rotational harvests and other techniques. A three-year rotational harvest protocol allows the maximum amount of harvest before oysters succumb to disease and then allows each area time to "rest", which provides an undisturbed opportunity for the oysters to reproduce and replenish the harvest area. In addition to the public oyster grounds that can be commercially harvested, Virginia has established six oyster sanctuaries that are completely closed to harvest.

VMRC attributes the recovery of wild oysters to increasing resistance to disease, replenishment programs, and steps taken to improve water quality in the Bay. The cumulative impact of public and private hatcheries providing spat to thousands of homeowners who are growing oysters in their private oyster gardens and leased oyster grounds is also important. Oyster gardening has helped increase native oyster populations when diploid (fertile) oysters are grown and allowed to reproduce, spreading free-floating larvae with the tide and currents. Oyster gardeners can help increase the native oyster population by growing more oysters than they harvest, releasing extra stock, and by donating their excess reproductive oysters and shell to sanctuary reefs.

Many gardeners and aquaculturists choose to grow triploid (infertile) oysters, which do not reproduce. Sterile triploid oysters have a higher growth rate, better disease resistance, and higher quality meat during the summer months when compared to reproducing diploid oysters. While triploids may not renew native populations, through the efforts of hatcheries, they may reduce the harvest of wild oysters which helps protect reefs. Triploids also produce shell that can be used for augmenting natural or artificial reefs, and, like diploids, they filter water throughout their entire lives.

New challenges for oysters periodically arise, such as rise of disease, dead zones, and the influx of higher-than-normal freshwater into the Bay during years of heavy rainfall. For example, in 2018 and 2019, heavy rainfall reduced salinity levels causing oyster mortality in the upper reaches of many tributaries. Despite the recent resurgence in wild oyster populations in areas around state-managed reefs and private oyster gardens, state biologists remain vigilant to new diseases, predators, climate change, and the need to keep our Bay waters healthy.

Disease and Resistance

MSX and Dermo are not caused by viruses or bacteria, but rather by single-celled protozoans which are harmless to humans. Temperature and salinity regulate MSX and Dermo; therefore, oyster gardeners should be aware of how these conditions change throughout the year.

MSX can infect oysters from mid-May through October and result in mortalities from July through October. Oysters that survive may still harbor the parasite over the winter and succumb to the disease the following spring or early summer. The MSX parasite is inactive at temperatures <5°C (41°F). At 5-20°C (41-68°F), the parasite proliferates rapidly. Above 20°C (68°F), resistant oysters can overcome the parasite while susceptible oysters die. Salinity below 10 parts per thousand (ppt) results in expulsion of the parasite at temperatures above 20°C. Infection begins when salinity is at least 15 ppt. Above 20 ppt, high mortality from MSX can be expected. Over recent decades wild oysters have become increasingly resistant to MSX.

Photo of Oyster damaged by Dermo. Healthy oyster gut epithelium on the right side of the photo and a region damaged by Dermo on the left side of the photo. Photo courtesy of Ryan Carnegie, VIMS.

Dermo infections occur throughout the warm months, May through October, with maximum mortalities observed in September and October. Low numbers of parasites remain over the winter and proliferate once temperatures increase in late spring. Parasites are released from infected and dying oysters, so infected oysters should not be moved into uninfected areas. Infections intensify above 20°C (68°F), and the parasite rapidly multiplies and spreads above 25°C (77°F), killing oysters. Infections decline at temperatures below 15°C (59°F) and salinity below 9ppt. Dermo increases with higher salinity, and mortalities often occur in areas with salinities above 12-15 ppt. To battle Dermo, oysters are now being bred for faster growth, so that they can be harvested in their second year before they succumb to the disease.

Research and Breeding

Wild oysters are developing resistance to these diseases through natural selection. However, research and hatchery-based selective breeding programs have accelerated beneficial characteristics in oysters that grow faster, are disease-resistant, and live longer. These advances benefit commercial farmers, gardeners, and consumers who demand consistent size and shape, preferring medium, deep-cupped oysters with high quality meat and year-round availability.

Another genetic improvement that has been important to the development of oyster farming worldwide has been the technique called chromosome set manipulation. Triploids and tetraploids are examples of this technique. Triploids were developed in the 1980s by Stan Allen at the University of Maine, but true commercialization of triploids in oyster culture had to wait another decade. In 1994 at Rutgers University, Drs. Stan Allen and Ximing Guo developed oysters with four sets of chromosomes (hence tetraploid). Using sperm from the tetraploid male parent (containing two sets of chromosomes) and eggs from the diploid female parent (containing one set of chromosomes), triploids could be readily produced on a commercial scale. In 1997, Dr. Allen became the founding Director of the Aquaculture Genetics and Breeding Technology Center (ABC) at VIMS in Gloucester Point VA, where he and others continued selective breeding for diploids and tetraploids. Selectively bred triploid seed hit the market in about 2004. This innovation is now being used worldwide.

In the past, people were discouraged from eating oysters in the months not containing an “R”, namely May, June, July and August. This adage originated in the days when refrigeration was scarce. It was intended to reflect the less palatable condition oysters were in during the spawning months. Because triploids don’t reproduce, the old adage now only applies to diploids. During warmer summer waters, runoff and increased marina activity now drive seasonal closures by VDH in many Virginia creeks and bays from April 1 to October 31.

Dr. Stan Allen, at the Aquaculture Genetics and Breeding Technology Center (ABC), counts eggs to ensure equal genetic contribution of females to the formation of selectively-bred, disease-resistant, fast-growing oyster lines. Photo courtesy of VIMS ABC.

By having three sets of chromosomes, triploids are sterile (incapable of reproduction), giving them an advantage over diploids. Reproduction in diploid oysters is physiologically demanding; removing that requirement means triploids have more energy for growth and disease defenses. Growth rate is accelerated and resistance increases. From the consumer market perspective, a triploid oyster– being absent of gonads – is not watery or of inferior quality during and after summer spawning.

VIMS continues to advance its research and production, and, in 2022, opened the Acuff Center for Aquaculture, a 20,000 square-foot breeding and research facility. ABC is now under the direction of Dr. Jessica Small. ABC continues to develop strains more tolerant to MSX and Dermo for specific salinity levels. ABC currently has 5 diploid lines and 2 tetraploid lines available to commercial hatcheries. The current broodstock offerings can be viewed on the VIMS ABC website under "Industry Products" at: www.vims.edu/abc. When buying seed, ask commercial seed sellers which line(s) they offer and consider whether you want to purchase diploids or triploids.

Dr. Jessica Small, Working during Spawning Day in the Old ABC Hatchery at VIMS. Photo courtesy of VIMS.

Karen Hudson of the Virginia Institute of Marine Science teaching TOGA's Master Oyster Gardener class on campus in Gloucester Point. Photo courtesy of Kent Eanes.

Aerial View of Virginia Institute of Marine Science (VIMS) Campus, Gloucester Point VA- Photo courtesy of VIMS.

Selected oyster lines are field tested in a variety of locations including the York River, Coan River and Choptank River. Broodstock being grown for distribution to commercial hatcheries occurs in the Rappahannock River. Gear used by ABC includes subtidal cages, rack and bag, as well as adjustable long lines.

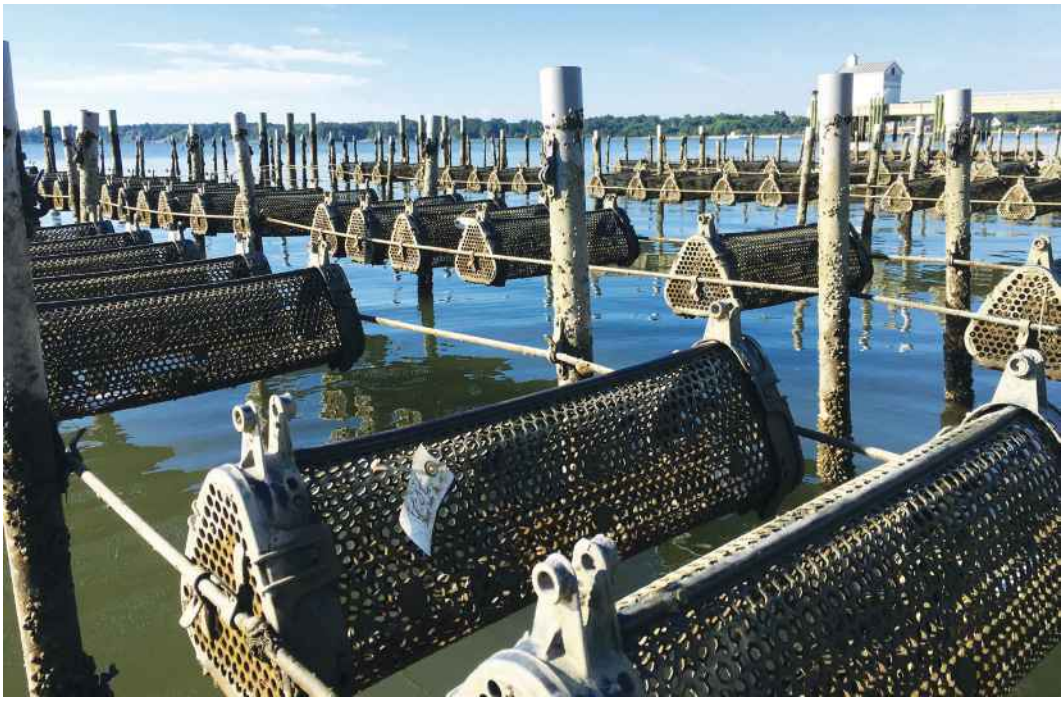


Photo: ABC Adjustable Long Line System of oyster cages for field testing oysters in the York River at VIMS. Photo courtesy of VIMS ABC.

Oyster Aquaculture Links

VIMS Shellfish Aquaculture Program -
https://www.vims.edu/research/units/programs/sap/

VIMS Aquaculture Genetics and Breeding Technology Center -
https://www.vims.edu/research/units/centerspartners/abc/

VIMS Shellfish Pathology Laboratory -
https://www.vims.edu/research/units/labgroups/molluscan_health/

VIMS Marine Advisory Program Aquaculture -
https;//www.vims.edu/research/units/centerspartners/map/shellfish-aquaculture

Aquaculture Program at VA Tech VA Seafood Agricultural Research Center -
https://www.arec.vaes.vt.edu/arec/virginia-seafood.html

Step One: Evaluate the Site

Will the Site Support and Oyster Garden?

Two important things to determine when identifying a potential oyster garden site are:

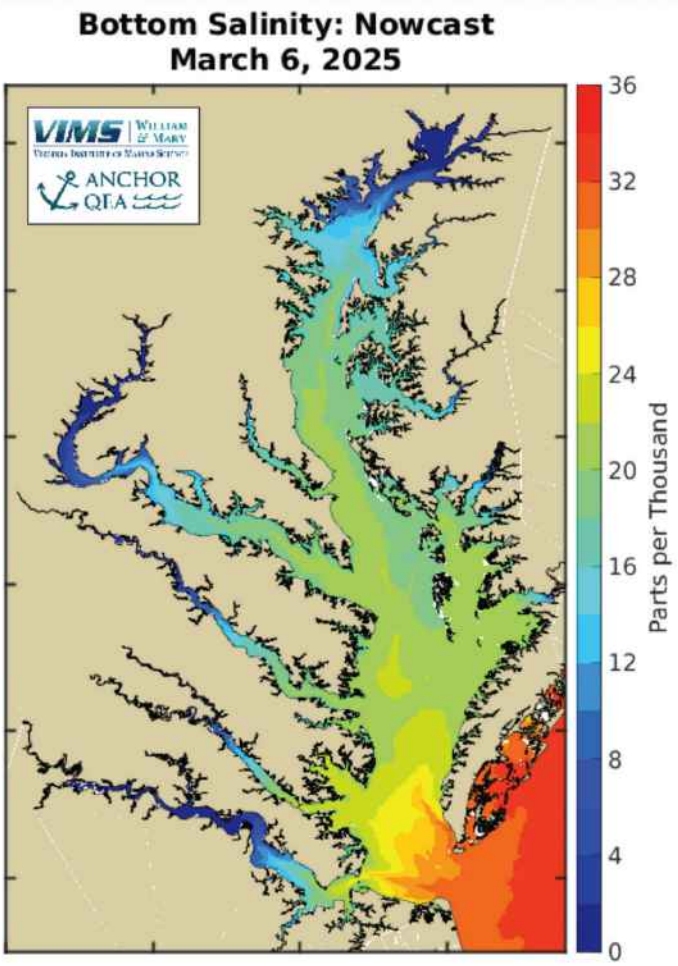
1. Will it support oyster growth?
2. Will it be safe to eat the oysters grown from the site?

An oyster garden needs to have 5 basic things:

- The correct water salinity range (which can decrease during prolonged rain events)
- A minimum water depth
- Adequate amounts of oxygen
- Adequate amounts of plankton (algae)
- Good water quality – (defined by the Virginia Department of Health's classification of waters, which includes possible permanent and seasonal condemnations)

Salinity

The salinity of the water will influence the growth rate of oysters and whether they may become exposed to oyster-specific diseases. Salinity is measured in grams of salt per liter of water or parts per thousand (ppt). According to VIMS, oysters require a salinity of about 8 ppt to grow, and oyster growth increases with increased salinity. They can survive lower salinity for short periods, but prolonged periods below 5 ppt can cause mortality. Water salinity can be tested using an inexpensive device known as a hydrometer. Hydrometers can be easily found online or at pet stores that sell saltwater fish. The graphic to the right from an interactive map shows the mean salinity of areas around the Bay on a certain date. Current and forecasted environmental conditions including salinity can be found on VIMS' Chesapeake Bay Environmental Forecast System (CBEFS) https://www.vims.edu/research/products/cbefs/. Prolonged heavy rain can significantly dilute salinity and can cause oyster losses in the upper reaches of the Bay's tributaries. Gardeners should expect significant stress on oysters during such periods of low salinity and avoid handling to reduce secondary impacts that could lead to oyster death.



Graphic right: Chesapeake Bay Environmental Forecast System Salinity Nowcast, shows real-time salinity online. Source VIMS, https://www.vims.edu/research/products/cbefs/.

Water Depth

The site must have a minimum water depth of 1.5 feet at the mean low tide. But it's all right to occasionally have low tide expose a cage for a few hours in suitable weather. Oysters can only filter water and grow when they are submerged, so they will grow faster if they are always under water. In the winter, when tides and winds may cause oysters to be exposed, they may freeze. Oysters can be frozen solid in the water and survive, but they can die if exposed to sub-freezing air temperatures. When there is a blowout tide, which is lower than a normal low tide combined with below freezing temperatures, it's best to move cages to deeper water so they are not exposed to freezing air. Oysters will survive when the Bay ices over if they are under water.

Dissolved Oxygen

Oysters need water with dissolved oxygen levels of at least 3.2 milligrams per liter, but 5.5 mg/l or more is best for survival and growth. Colder water can hold more oxygen than warmer water. That is why "anoxia events" (low oxygen situations) usually occur during the summer. Generally, Virginia's coastal waters have sufficient oxygen to support oysters grown close to the shore and off the bottom. A field kit can be purchased online to measure dissolved oxygen levels, but these are not needed in every oyster gardener's toolkit. VIMS Chesapeake Bay Environmental Forecast System has current dissolved oxygen conditions mapped online - https://www.vims.edu/research/products/cbefs/cbay/.

Plankton

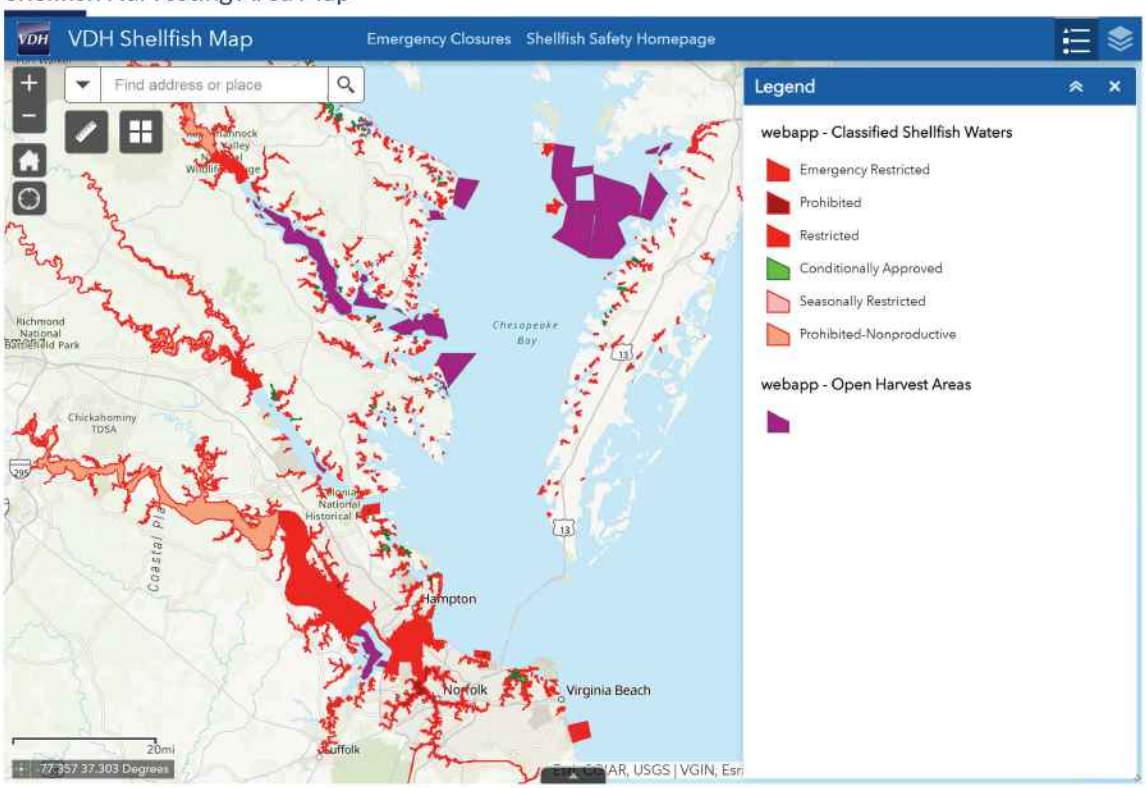
The quantity and quality of food available to oysters can vary considerably by location. Food quantity and quality are a function of how the water moves through the site as well as the abundance of phytoplankton in the water at different temperatures. Plankton will be more plentiful in the upper part of the water column since they rely on photosynthesis. Therefore, floating oyster containment devices may offer more food for oysters than deeply submerged cages. Different areas and depths of the Bay have varying levels of plankton availability. Sites with more food will produce bigger oysters and at a faster rate. Oysters will eat more plankton when temperatures are above 50 degrees Fahrenheit. They will close tight and stop ingesting water if disturbed, so it is best to secure cages, so they don't bump into a piling or other object due to wave action.

Water Quality - Will it be Safe to Eat Oysters Grown at the Site?

As oysters pump water through their gills and filter out microscopic food particles, they may also ingest bacteria and viruses. Oysters harvested for consumption must be taken from clean water – much cleaner than waters approved for swimming, crabbing, and fin-fishing. Not all gardeners choose to eat their oysters, but, if they do, they must determine whether the location is open for harvest by checking the VDH website (see next page). While proper cooking may kill disease-causing bacteria, proper cooking (baked at 450°F for 10 minutes or steamed for 4-9 minutes once opened according to foodsafety.gov) may render oysters unpalatable. Cooking will not make oysters safe from viruses or biotoxins. People with weakened immune systems should not eat oysters that are undercooked or raw.

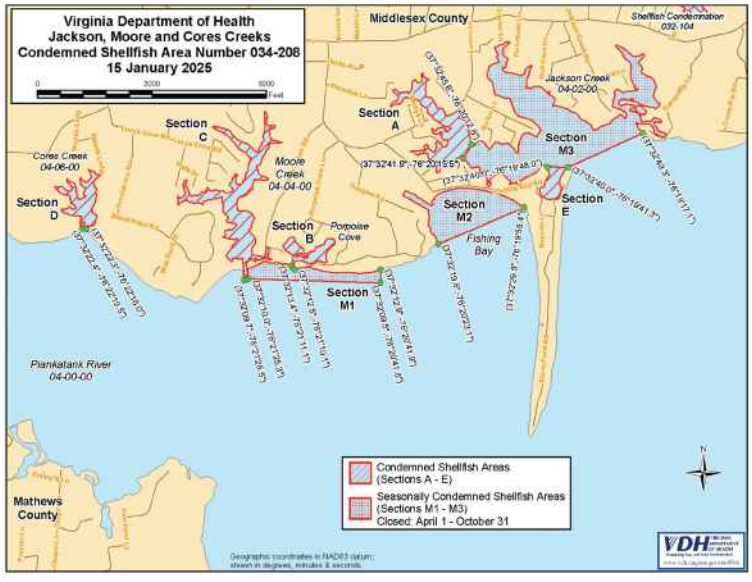
The Virginia Department of Health's (VDH) Division of Shellfish Safety and Waterborne Hazards (DSSWH) classifies which shellfish waters are safe for harvest. VDH/DSSWH collects and analyzes fecal coliform samples monthly at designated stations throughout shellfish growing waters in tidal rivers, the Chesapeake Bay, and the Seaside of Virginia's Eastern Shore. DSSWH analyzes an average of 20,000 seawater samples per year. VDH's shellfish safety website includes reports and maps of open, condemned, and restricted shellfish areas by county (see below). The maps are updated on the 15th of every month. Shellfish waters are broken into roughly 100 growing areas which are evaluated yearly. Areas close to a marina or with predictably seasonal variations may be seasonally closed during the warmer months. Likewise, areas predictably impacted by rain may be conditionally closed for 10 days after 1" of rain.

Shellfish Harvesting Area Map



Virginia Shellfish Harvesting Area Map (Example March 4, 2025).
The map above shows all areas in red that had a restriction at the time the website was queried. Purple polygons show open harvest areas. The map is updated frequently to show short term emergency closures. https://www.vdh.virginia.gov/environmental-health/environmental-health-services/shellfish-safety/shellfish-harvesting-area-map/

For more information about specific areas shown on the map above, refer to the large scale maps and reports listed by county on the VDH Shellfish Safety site under "Shellfish Closures" at https://www.vdh.virginia.gov/environmental-health/environmental-health-services/shellfish-safety/shellfish-closures/.



Map right: VDH Map example of Jackson, Moore and Cores Creeks Shellfish Area in Deltaville, VA. A Shellfish Closure Report (not shown) will accompany an area specific map on the VDH website.

Step Two: Choose a Containment System

Choosing the Best Device for the Gardener and the Site

A wide range of options exist for oyster gardening containment systems. These devices should provide sufficient room for the number of oysters being grown, maximize flow through the mesh, keep large and small predators out, and manage wave and current action. Remember that your no-cost oyster gardening permit requires that your gear be secured so that it does not impact navigation, the structures will not exceed 160 square feet in total area, and they will not impact existing stands of submerged aquatic vegetation.

Proven devices to contain oysters as they grow include the use of floats, tumblers, mesh bags, and fixed bottom racks or cages. No single method is right for everyone or guarantees success. However, if a cage or containment system isn't fixed to one spot, it's best to secure it so it doesn't bump a piling or other structure due to waves since oysters naturally close for protection and stop feeding when they are disturbed. Each grower must consider the characteristics of the growing site and his or her ability to handle the weight of the containers when full of oysters.

Selection of cage devices should consider a gardener's specific site and the need to provide:

1. Minimal flow obstruction
2. Ease of maintenance and handling
3. Adequate predator protection
4. Management of water energy (current and wave action)

Oyster Cage and Float Devices, Clockwise from Upper Left: Rough Rider, Tidal Tumbler, Bottom Cage, Flip Float, Mesh Bag with Tubes, Downunder, and Taylor Float. Photo courtesy of Kent Eanes.

Tidewater Oyster Gardeners Association (TOGA) offers its members the choice of several cage designs, each of which is described in this section. TOGA, a non-profit, sells devices at fundraising events twice a year. Their sale schedule can be viewed at www.oystergardener.org under the "Events" tab. Several different systems may be available from commercial vendors, hardware stores, or marine stores. A list of current suppliers is maintained at www.oystergardener.org/diy-resources. Directions for building the floats and descriptions of various types can be found at www.oystergardener.org/devices-and-designs. TOGA also holds workshops several times a year where gardeners can learn how to build their floats. The workshop events are listed at https://www.oystergardener.org/schedule and are announced in TOGA member newsletters.

Cost of Various Devices

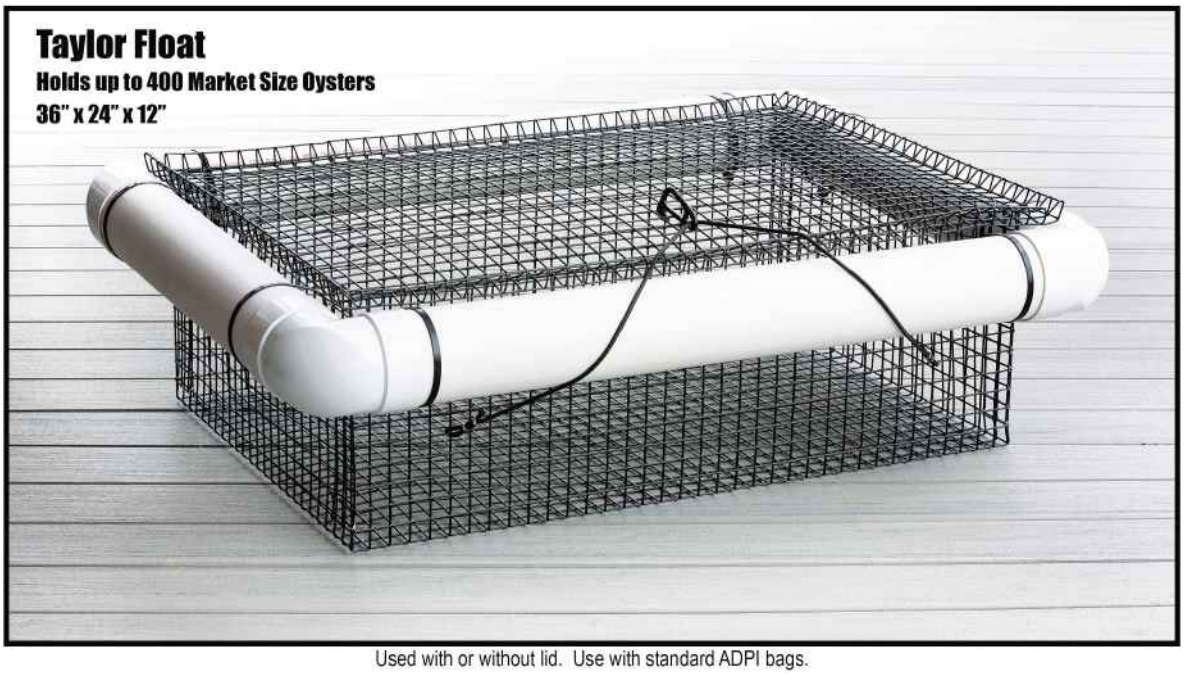
The containment system will be the most expensive part of a garden. Prefabricated Taylor Floats, which may come in various sizes, can cost $145-$200 or more. Floats, bottom cages, and hanging cages, all of which are smaller than the Taylor Float, start at $75 to $125. Growing oysters in hanging mesh bags may be the least expensive option at about $10. Tube floats can be purchased for about $16 a pair or made using PVC pipe or four 2-liter plastic soda bottles zip-tied to the bag.

When starting baby oysters in cages or floats, a mesh bag is used inside the wire cage to contain and protect the spat. Generally, gardeners get two or three mesh sizes at a cost of about $10 each. As spat grow, they need to be divided into additional bags to provide space and reduce competition for food. If they are too crowded by delayed separation, some mortality should be expected. The largest mesh that can keep the spat from falling through the bag should be used as it is easier to clean and allows more food-bearing water to reach the oysters. Promptly moving to a more appropriate size mesh will reduce mortality of crowded spat.

The materials for a home-built float or cage should only cost $50-$100. At home, hand tools such as a pig-ring tool, a wire cutter, a saw for cutting the PVC pipe, and a wire bender (or other method for bending the wire mesh) will be needed. TOGA conducts free instruction at float and cage building workshops where precut parts can be purchased, and attendees can use the organization's tools to build floats at a savings. TOGA's schedule for build-your-own-float workshops is at www.oystergardener.org/schedule. Or gardeners can save by building their own cages using simple TOGA plans found at https://www.oystergardener.org/_files/ugd/9d48db_a153c27e93554ca99fac4af48dd06673.pdf.

It may cost more to produce oysters in a garden during the first year when compared to buying them, but the equipment is reusable, and devices will last for many years. Gardeners will be adding filter feeders to Virginia's waters, creating habitat for other marine life, enjoying a rewarding hobby, and harvesting their own fresh oysters!

Taylor Floats



Taylor Float. Photo courtesy of Kent Eanes.

The Taylor float (named after its designer, Jake Taylor) is a floating containment system with a wire mesh basket that holds oysters about one foot under the surface of the water. The Taylor Float has a sturdy, open design that provides limited surface area for fouling and permits good water flow to the oysters. Designed with a flip top, a Taylor float can easily be opened to access oysters, remove invading crabs, or to clean it. Its disadvantages include its large size and the possible need for a hoist to lift a fully stocked (heavy) float, or if no hoist is available, it can be pulled onshore to manage it. A 2’ x 3’ Taylor float will hold about 500 adult oysters – about a bushel and a half. VMRC regulations limit the size of floating containers to 2' x 8' x 1'. A Taylor float can be tied under a dock or pier which keeps it out of the sun and helps slow the accumulation of algae on both the float and the oysters. Taylor floats can also be attached in tandem and anchored at each end, but, in this configuration, they must occasionally be hauled to a pier or shore or accessed by boat for maintenance and harvesting.

Taylor Floats Anchored Offshore. Photo courtesy of Carl Zulick.

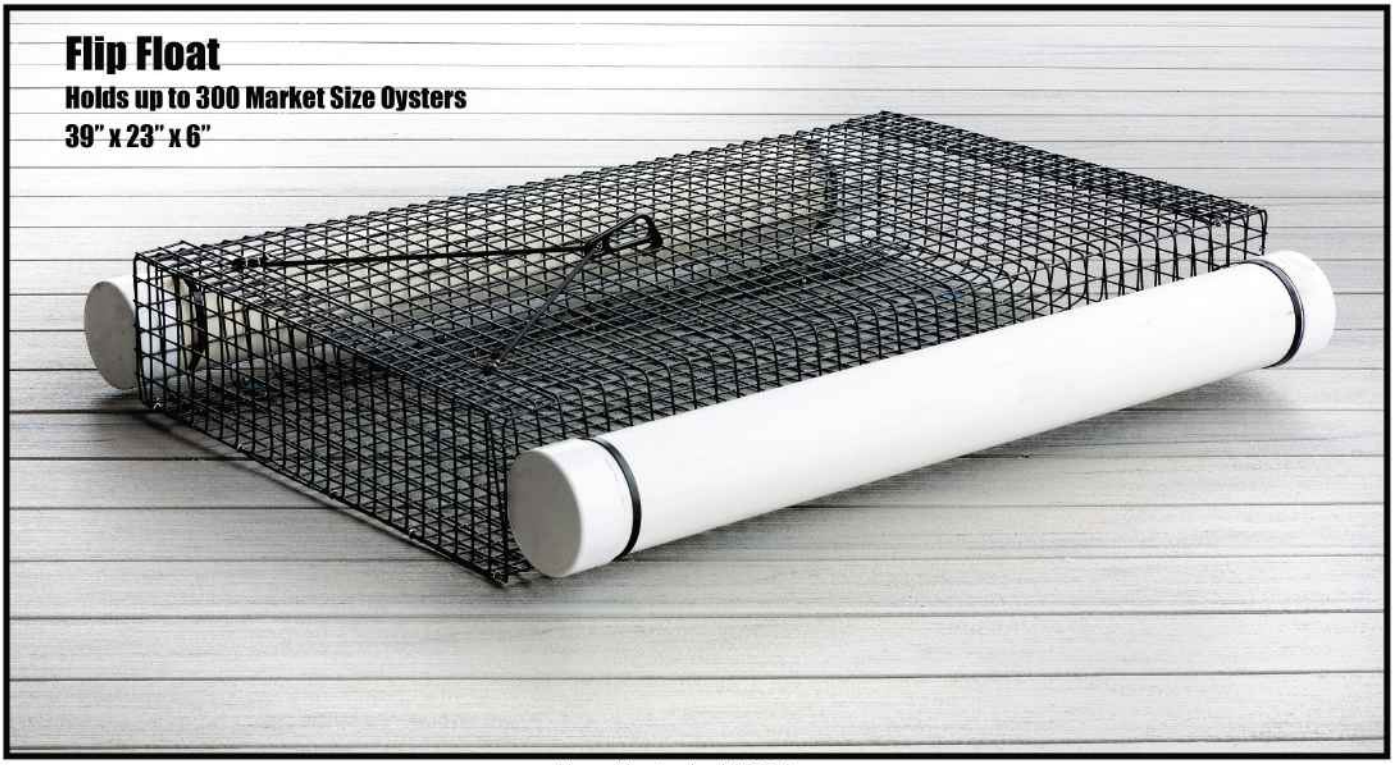
Taylor floats are with a 2’ x 3’ frame of four-inch PVC pipe and a one-inch by one-inch, mesh wire basket that is plastic-coated for marine purposes. Vinyl-coated, galvanized wire is best for reducing corrosion and extending the life of the float.

To raise spat in a Taylor float, a properly sized mesh bag (see Mesh Spat Bags and Spat Tubes below) should be used inside the float until the spat grow to over 1.5 inches in length and cannot fall through the wire mesh. Place 6-10 large oysters or shells under the spat bag to lift it off the bottom of the cage. This puts the bag out of reach from blue crabs that will hang onto the bottom of the float and reach inside the wire basket.

Oysters larger than 1.5 inches can be placed directly into the floats, but the float may need a lid to keep out predators. Lids can reduce predation by otters and other critters. However, seagulls, herons, ducks and geese roosting on top of the lids have been shown to increase the risk of Campylobacter infection. Bird spikes can be attached to the tops of lids to reduce roosting.

Taylor Float With Bird Spikes Attached to Top Will Reduce Roosting by Waterfowl and Wading Birds. Photo courtesy of Carl Zulick.

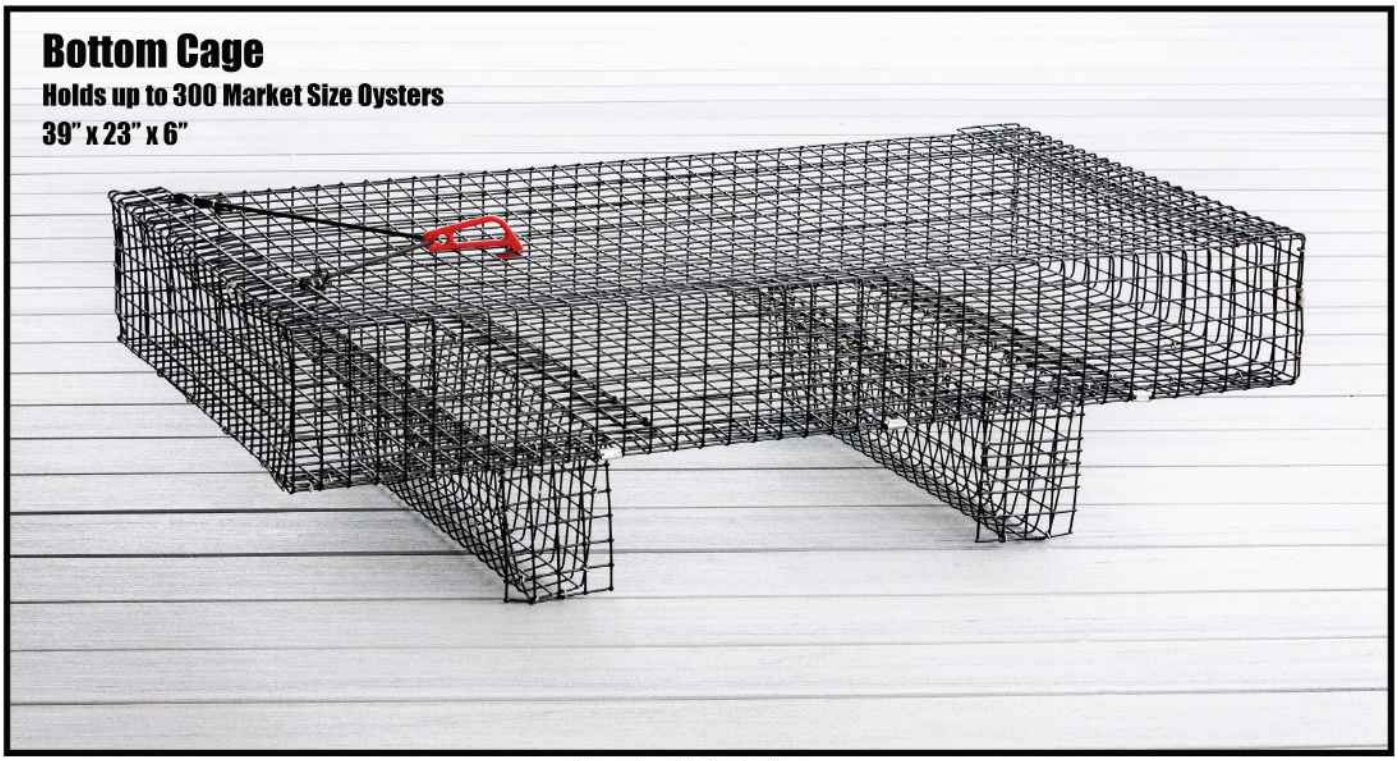
Flip Floats



The Flip Float is just one of the innovative designs oyster gardeners have devised to easily keep their oysters and cages clean. Photo courtesy of Kent Eanes.

Flip Floats are designed to be lighter than Taylor Floats while easier to clean and manage. The wire basket is 39" x 23" x 6" and holds up to 300 market-size oysters. A standard spat bag will fit inside. Because the cage is only 6 inches deep, the oysters should be spread out to be covered with water. The cage should not be more than 1/3 full of oysters. To flip it, use a boat hook or two lines on the sides to pull it over. Flip the cage every few weeks to allow the exposed side to dry in the sun, which will minimize fouling from algae and barnacles. When the silt load is heavy, occasionally shaking the cage or spraying it with a hose may also be required. One end of the cage has a lid for accessing the oysters. It can be hard to get crabs out of the far end without dumping the cage's contents. While it is preferred to release crabs back to the wild, it can be hard to herd them out of the end with the lid. A screwdriver can be used to spear the crabs through the wire if absolutely necessary. In freezing weather when the surface ices over, it may be helpful to temporarily sink the float. If the tubes are attached too tightly with zip ties, the cage will sit higher in the water. Slightly loosen the ties holding the tubes on the side to allow the basket to hang deeper, no matter which side is up.

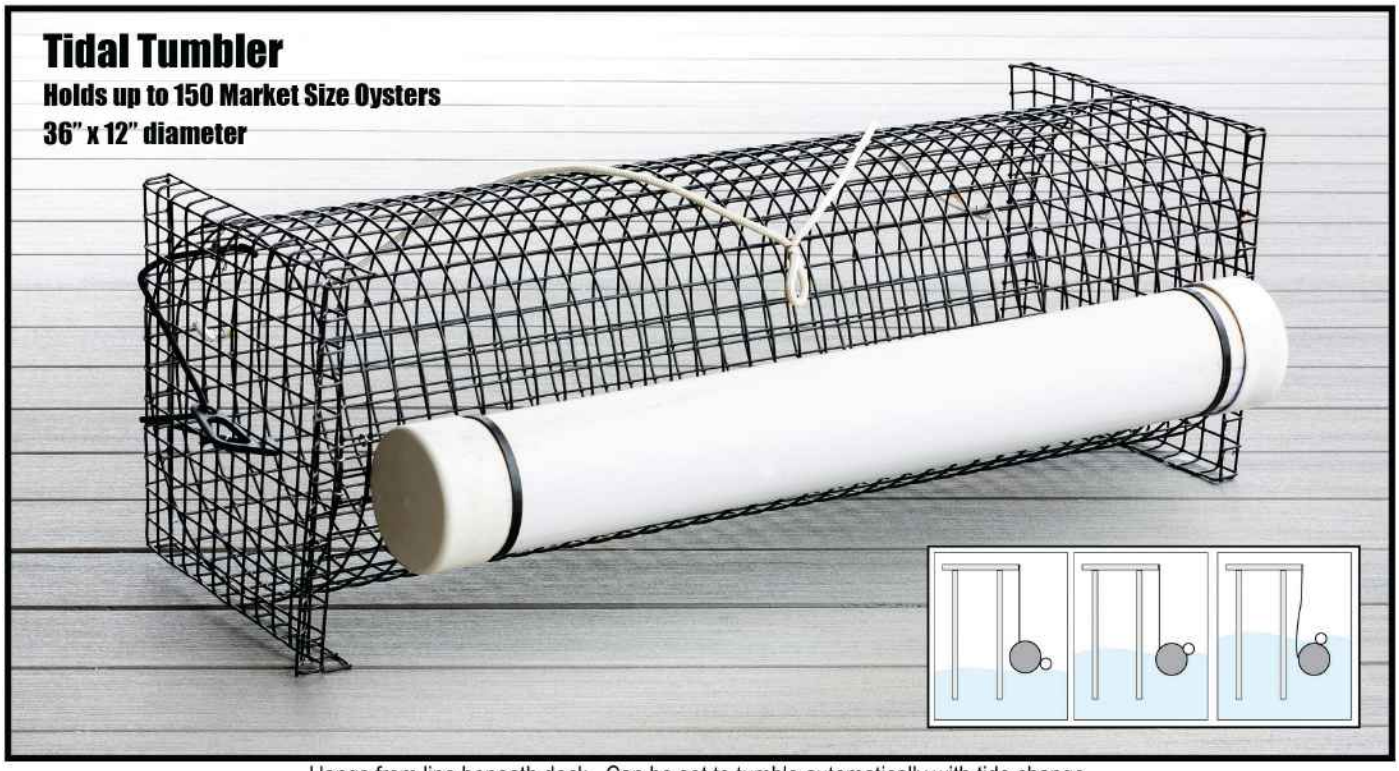
Bottom Cages



Bottom Cage. Photo courtesy of Kent Eanes.

Bottom racks or cages are useful in places where the bottom is hard and wave action or current is too great for surface floats. They may be preferred in shallow waters where aesthetics is a consideration and where it is desirable to have the oyster garden hidden from view. Bottom cages sit on feet that are 6 inches high and are usually sufficient to keep the containment section of the cage off the bottom. The cage must be fully enclosed to protect oysters from predators. VMRC regulations limit the size of bottom cages to 4' x 4' x 1' and shall not have legs higher than 1'. Full cages can be quite heavy, and this should be kept in mind when choosing them. Bottom cages can be more difficult than other types of cages to keep clean of silt, weeds, squirts, and crabs. Hauling them out of the water may be necessary to completely clean them. Because the cages open from one end, it can be hard to reach invading crabs. To remove crabs, open the lid and encourage them out by tipping the cage, or dump the oysters out into a concrete mixing tub or on a tarp where they can be easily returned to the cage after removing crabs. As a last resort, if you can't reach crabs at the end of the cage, you may need to spear them with a screwdriver or other implement.

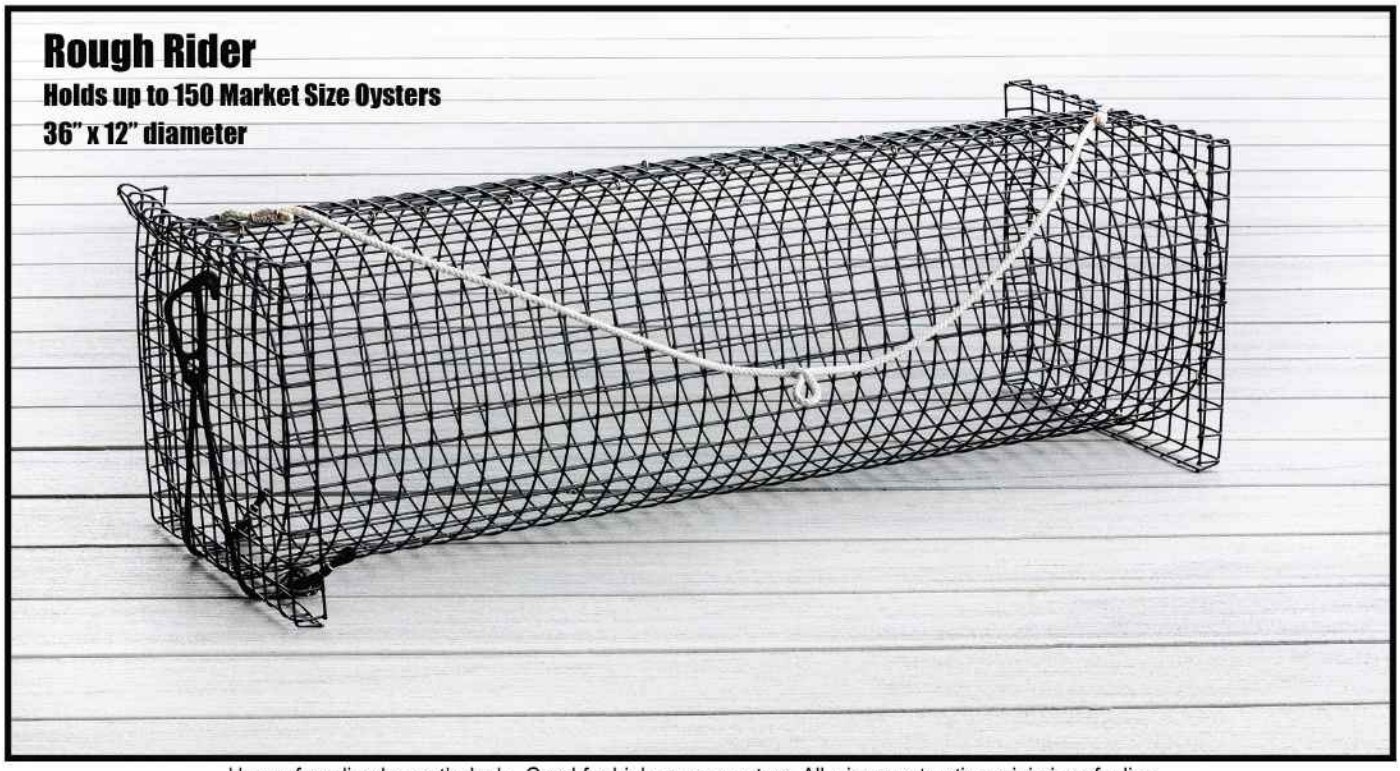
Tidal Tumblers



Tidal Tumbler. Photo courtesy of Kent Eanes.

A Tidal Tumbler has a sealed PVC pipe (float) attached to one side of the round cage. A Tidal Tumbler is suspended in the water by a rope attached to a pier so that it is partially out of the water at low tide (see diagram). As the tide goes in and out, the float causes the cage to roll up and down. The oysters inside will turn and "tumble" against one another, keeping them cleaner than floats of other designs. If a Tidal Tumbler is hung above the occasional low tide, allowing the oysters to dry for a short time, they stay even cleaner of silt and algae. Tumblers hold around 100-150 mature oysters. These cages are not as heavy to lift out of the water for cleaning and maintenance when compared to other cages previously described. Older Tumblers which had solid ends on the cages can be impacted by fast currents and wave action because of the float's design. Newer designs have replaced round bucket-lid ends used in the older Tumbers with square wire mesh ends (as shown above), allowing better water circulation and less tossing in rough water. The wire ends are also more durable and less prone to fouling.

Rough Riders



Rough Rider. Photo courtesy of Kent Eanes.

A Rough Rider is like a Tidal Tumbler except that it does not have a float. The Rough Rider is hung straight down from a pier or other structure. It is a better small-cage solution for an oyster garden in high energy waters (waves or current) because it has no solid surface area. Rough Riders can remain below the surface at all tide levels, or they can be hung high to periodically expose the cage at low tide, which will keep them cleaner. The cages are 36" long x 12" in diameter, and they will hold up to 150 market-size oysters. Their all-wire construction minimizes fouling. As with other cage designs that only open at one end, removing crabs from a Rough Rider can be difficult without dumping out the cage's oysters. Depending on the site, two lines may be desirable to prevent the cage from spinning with waves and shortening the hanger rope.

Mesh Oyster Bags

Mesh Bag with Commercial Floats. Photo courtesy of Carl Zulick.

A less-expensive oyster cage can be easily made at home with high-density, UV-resistant polyethylene marine plastic mesh bags, formerly called ADPI. The bags can be hung or kept afloat by four empty one-liter soda bottles, by two commercial plastic tubes, a PVC pipe tube, or by various rack systems. Some rack systems stack bags in a vertical rack situated on the bottom where bags slide into "shelves." Multiple floating bags can be lined up with a rope running through the middle of each bag and attached at each end to a piling or stake. Running a rope through the middle of the bags allows them to be flipped end to end every week or so, which helps to keep them clean. Fouling organisms tend to grow on the bottom side of this type of cage, so, when the bags are flipped, the fouled side becomes exposed to sun and air which will kill most of the fouling organisms. The bags can contain about 150 mature oysters.

Rack and Bag System in York River. Photo courtesy of VIMS, Dr. Jessica Small.

Gardeners in locations where the water may freeze in winter may not want to use a bag or rack system that exposes the oysters. When using floats on bags, one float can be removed from the mesh bag, or, if bottles are used, each bottle can be partially filled with water to keep the bag below the ice. If bags sink to the bottom, any oysters that become buried in mud may die. Bags can be purchased from commercial suppliers or made with 1/8", 3/16" and 5/8" mesh size openings. The bags can be closed with 4" cable ties, using a combination of ½" stainless steel hog rings and cable ties, or by sliding a piece of slit PVC pipe over the end and securing it with cable ties. However, it is recommended to "box" the ends of the bag to keep oysters from becoming lodged in the ends of the bag and growing into the mesh as shown in the photo under Mesh Spat Bags and Spat Tubes below.

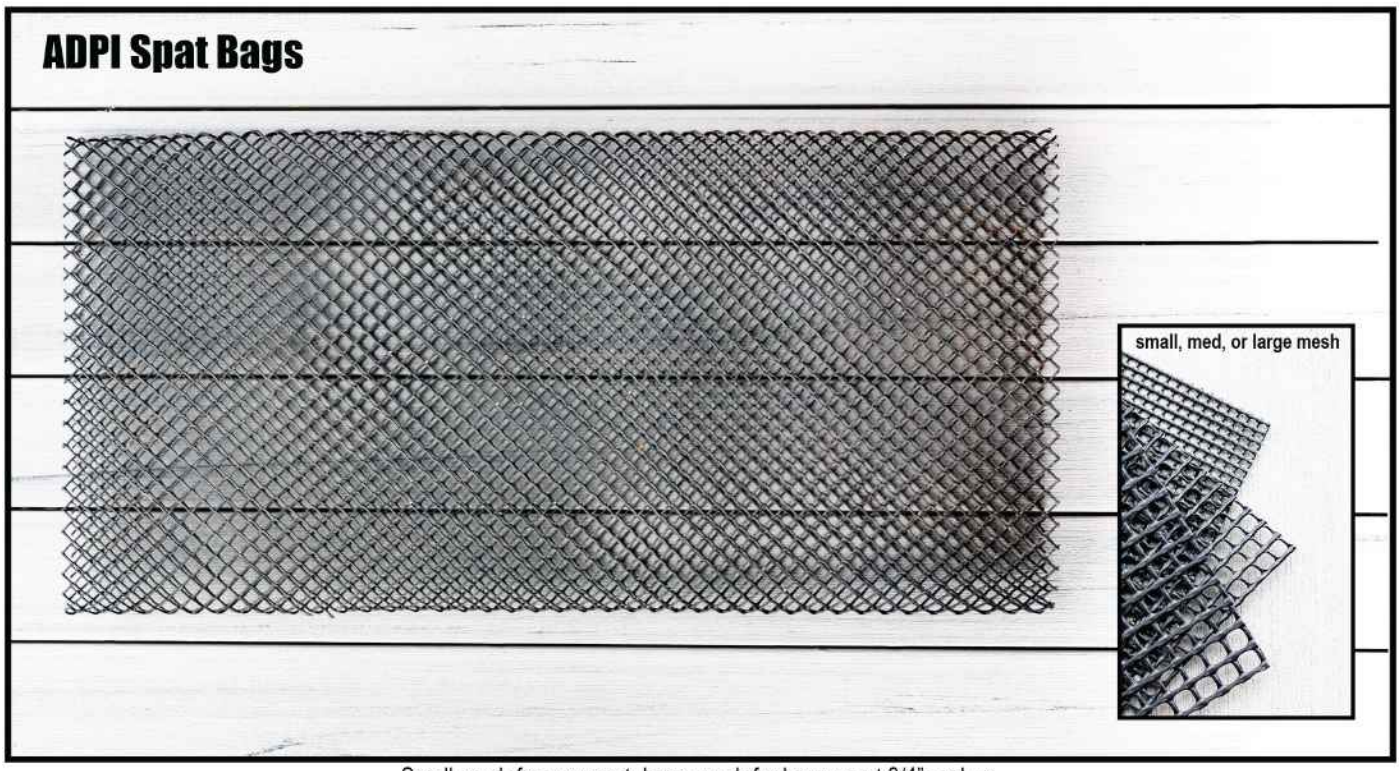
Wild Spat Cages

Wild Spat Cage. Containers holding clean shell will attract wild spat to set. Photo courtesy of Carl Zulick.

Natural set on clean shell. Photo courtesy of Carl Zulick.

It's easy and inexpensive to expand an oyster garden using a Wild Spat Cage. Scrap pieces of wire mesh or bags can be made into small containers of varying designs. Commercial mesh tubes are available in extended lengths and often used for shoreline protection, but they can be used as cages too. These devices should be ¾ filled with clean oyster shell and hung from a pier or placed near shore to stabilize the shoreline. Wild oyster larvae (called pediveligers at this stage) will find the shell and set on them between June and September. Avoid adding new shell outside of these months as the shells will collect algae and silt, and larvae won't set on them. While waiting for set, it is important to gently shake the cage periodically to clean the shells of silt or algae. Soon, the Wild Spat Cage will contain many wild baby oysters. The wild set can then be added to a cage or reef, which will develop as diploids and reproduce in the future.

Mesh Spat Bags and Spat Tubes



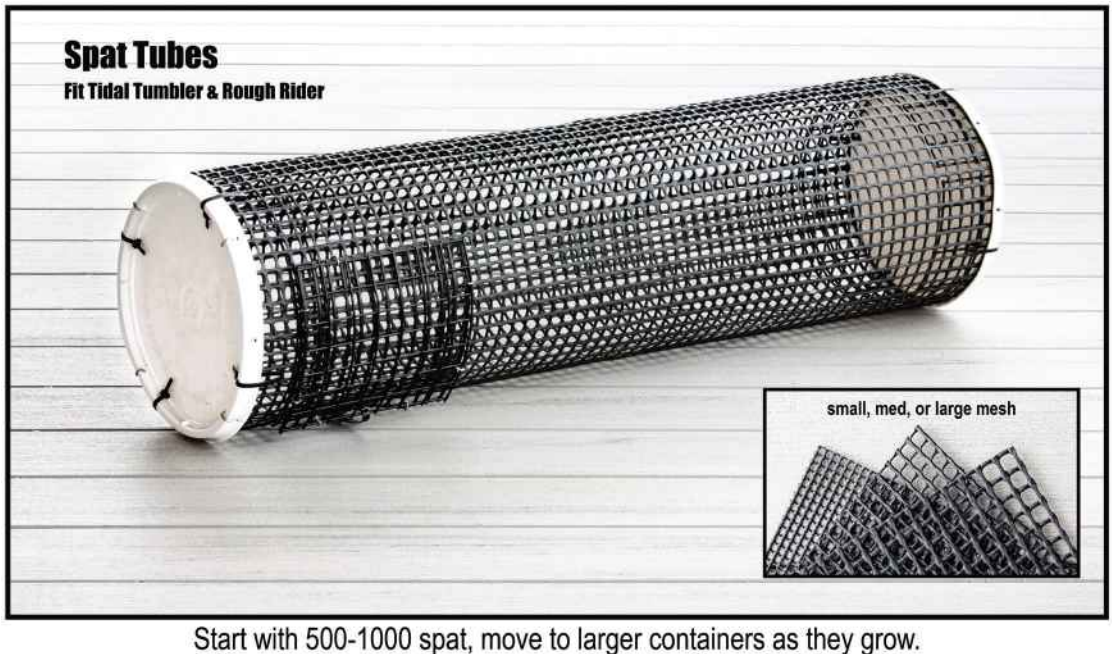
ADPI Spat Bags. Photo courtesy of Kent Eanes.

When starting spat, use UV-resistant, high-density polyethylene, black-plastic, square or diamond mesh bags of various mesh sizes, ranging from under ¼" to ⅞", to hold and protect spat from predators (especially blue crabs). Choose a size that does not allow any spat to fall through the mesh. As they grow, move them to the next larger size to make it easier to clean and improve water flow which brings more plankton for spat to eat. When the oysters grow to over 1 ½" and can't fall through the wire mesh of a cage, they can be released from the bag into the cage. If starting with spat larger than 1 ½", a bag is not needed in the cage. The bags should be laid flat in the float and held off the bottom with a few large oysters or other objects placed under the bag. This will keep them out of reach of blue crabs that like to hang on the bottom of cages. A rectangular bag can accommodate several thousand small spat, but the spat should be separated into additional bags or cages as they grow and become crowded. It is recommended to box the ends of the rectangular bags as shown in the photo above, securing the ends with zip ties. This method keeps spat from getting stuck in the ends of the bag and allows them to wash around in the bag so that they don't grow into the plastic mesh. The bag should be turned over every few weeks as the bottom will foul, but, when flipped over, it will clean itself from exposure to the sun. If algae and silt clog the mesh, the bag should be brushed and sprayed with a hose to remove fouling. Do not use a high-pressure power washer on spat. High-density polyethylene bags can be purchased at a TOGA sale or from vendors offering aquaculture supplies.

Mesh Spat Bags and Spat Tubes

Mesh Bag with "Boxed" Ends that Fits Inside a Taylor Float. Photo courtesy of Carl Zulick.

> ***Warning!*** Never put the thin, flimsy mesh bags that spat are sold in directly in the water, even for a short time, as crabs will quickly find it and tear it open to release or eat the spat.



Spat Tubes. Photo courtesy of Kent Eanes.

TOGA-made spat tubes are used to hold spat inside a Rough Rider or Tidal Tumbler. The tube's cylindrical design allows the spat to drift around inside the float without growing together or into the plastic mesh. A hinged door allow access to stock the tube and remove any blue crabs that get inside.

These cylindrical spat tubes are necessary when spat are less than 1 ½" in size and can pass through a cage's wire mesh. Small or medium mesh tubes are available from TOGA. Tubes can fit 1000 small spat, but, as the spat grow, they should be separated into additional tubes or cages.

Oyster Cage Lift

Oyster floats and cages can get very heavy when the oysters are mature. Many gardeners have adapted truck cranes (available at tool/hardware stores) to lift cages onto their piers. The lifts crank manually, pivot 360 degrees, and usually have a hydraulic jack to raise the arm. Place two straps under the cage to safely lift it out of the water using the hoist. Some gardeners have manufactured a modified "double L-shaped" metal support that goes under the cage to be used instead of straps. When attaching a lift to a pier, it should be connected to a piling or the deck over a strong joist. Install 2x8s that are at least 36" long under the decking to reinforce the base, so that the lift doesn't pull away under a heavy load. Small cranes, boat lifts, and even jet-ski lifts may also be used for lifting oyster cages out of the water. When a lift isn't available, pull the float or cage onto the shore, access it by boat, or use a boat or jet ski lift.

Left: Oyster Cage Lift. Gardeners have installed truck lifts on their piers for lifting heavy cages to maintain and harvest their oysters. Photo courtesy of Carl Zulick.

Wire Bender

Many gardeners enjoy making their cages. A wire bender makes it fast and easy to bend angles as a cage is built. The photo shows a bender constructed of wood, deck screws and three hinges. Screws are evenly spaced on the lower hinge and grab the wire (see photo). The upper hinged board is routed above each screw, so it does not contact the screw as the wire is bent. The wire can be bent to any desired angle depending on the degree of closure with the hinged board. Low-cost benders can be acquired through TOGA.

Right: Students From the Hampton City Schools Use a TOGA Oyster Cage Wire Bender to Make an End Cap for a Rough Rider Cage. Photo courtesy of Kent Eanes.

Step Three: Get a Permit

Getting a permit from the Virginia Marine Resources Commission (VMRC) for oyster gardening is **required** for all oyster gardeners. It is a simple and free process and is for the protection and benefit of the oyster gardener as well as the public. Having a permit registers gardens as aquaculture sites. A big safety benefit of a permit is that permittees will be opted-in to receive notification from the State when there are changes in any harvest restrictions or closures of their growing area.

The necessary permit is called a ***Virginia General Permit #3*** (VGP3). To qualify for approval, gardeners must adhere to the relevant VMRC procedures and regulations. To find the full regulation governing VGP3s please see the following link: https://law.lis.virginia.gov/admincode/title4/agency20/chapter336/

A summary of the requirements is outlined below:

- The oysters must be grown in protective structures.
- The proposed structures must be within the riparian area of the applicants own private waterfront property.
- The proposed structures must be secured either to an existing structure such as a pier or a dock, or otherwise secured to the bottom of the riparian area in an approved manner.
- The structures may not exceed 160 square feet in total area.
- The structures may not impede navigation of the water body area.
- The structures may not disturb existing submerged aquatic vegetation (SAV) growths.
- The oysters grown may not be sold.
- The permittee must remain up to date and compliant with all Virginia Department of Health (VDH) regulations regarding consumption of oysters grown in various water body areas.

Permits help make it possible to get a better estimate of how many cultured oysters are in Virginia waters and what positive effect they may be having on water quality. The State will consider all permitted gardens when reviewing applications for other activities nearby.

By applying for a permit (see next page), gardeners ensure that their oyster garden does not interfere with the public's right to navigate or the growth of SAV. If SAV is present near the shoreline, it could be shaded by floats on the surface or damaged by cages placed on the bottom.

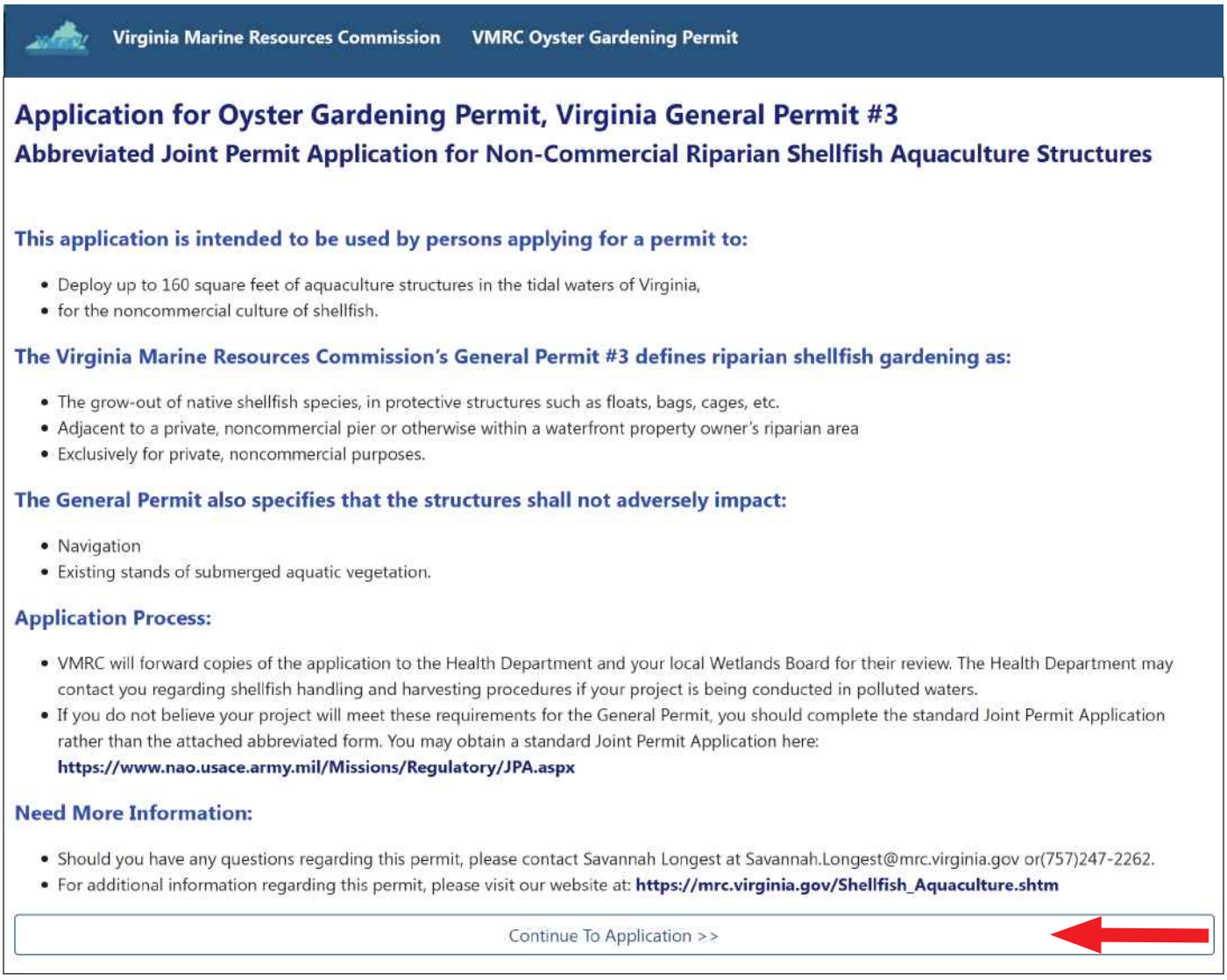
Because regulations, procedures, and agency contact information are periodically updated, always check for the latest permit at this site: https://mrc.virginia.gov/Shellfish/VGP3-Oyster-Gardening-Permit.pdf.

If the proposed gardening project will cover more than 160 square feet, impact navigation or SAV beds, or if a gardener wishes to raise oysters for sale, please check Virginia's laws, regulations, and requirements for marine shellfish aquaculture activities at www.mrc.virginia.gov/regulations/.

To go directly to the VGP3 application, go to this link: https://webapps.mrc.virginia.gov/public/habitat/gp3/ or scan the QR code:

On the next seven pages, is an example of a correctly completed VGP3 application.

When you navigate to https://webapps.mrc.virginia.gov/public/habitat/gp3/, you will see the screen below. Read the page and when you are ready to continue to the application, click “Continue to Application.”



Virginia Marine Resources Commission VMRC Oyster Gardening Permit

Application for Oyster Gardening Permit, Virginia General Permit #3

Abbreviated Joint Permit Application for Non-Commercial Riparian Shellfish Aquaculture Structures

This application is intended to be used by persons applying for a permit to:

- Deploy up to 160 square feet of aquaculture structures in the tidal waters of Virginia,
- for the noncommercial culture of shellfish.

The Virginia Marine Resources Commission’s General Permit #3 defines riparian shellfish gardening as:

- The grow-out of native shellfish species, in protective structures such as floats, bags, cages, etc.
- Adjacent to a private, noncommercial pier or otherwise within a waterfront property owner’s riparian area
- Exclusively for private, noncommercial purposes.

The General Permit also specifies that the structures shall not adversely impact:

- Navigation
- Existing stands of submerged aquatic vegetation.

Application Process:

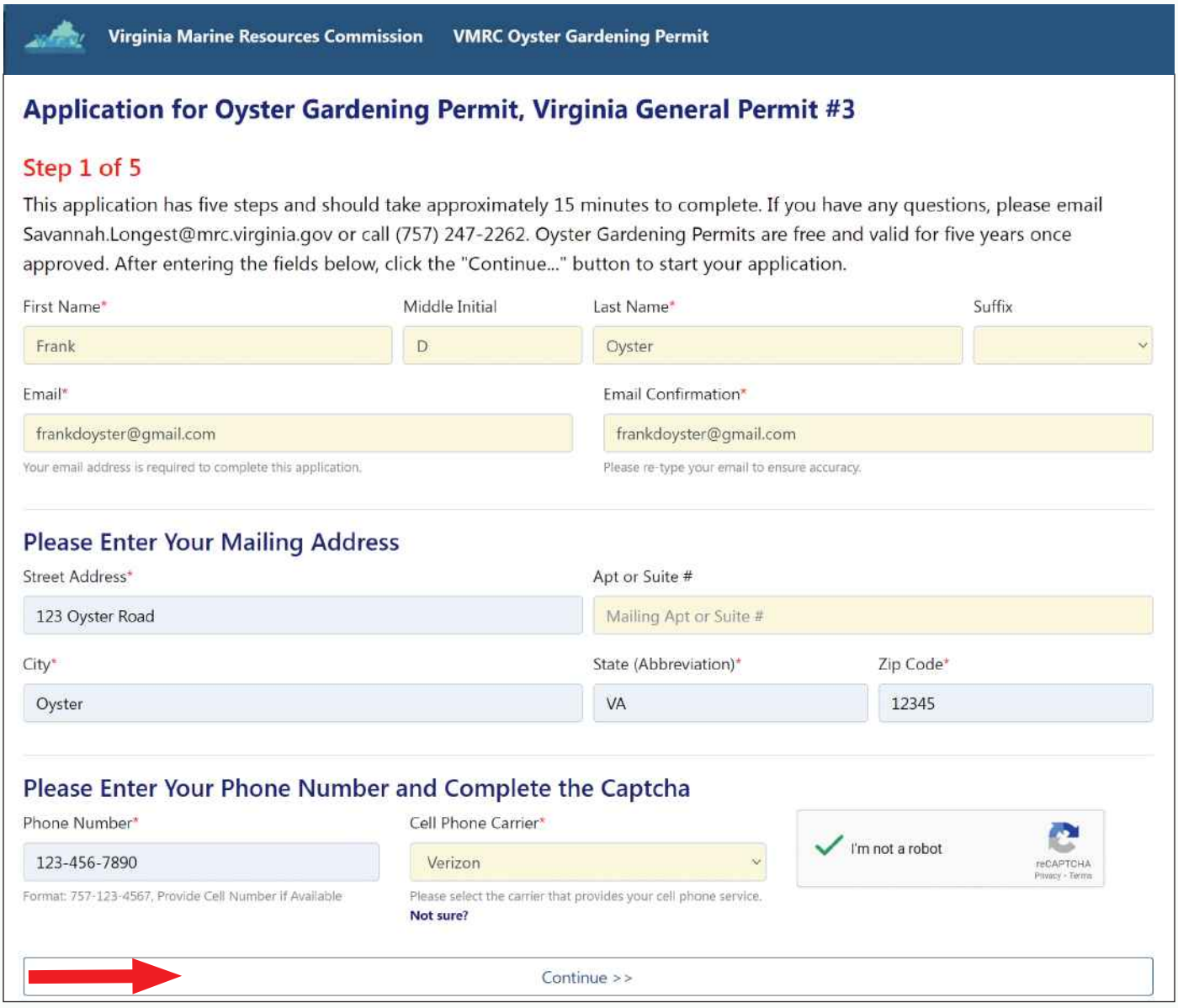
- VMRC will forward copies of the application to the Health Department and your local Wetlands Board for their review. The Health Department may contact you regarding shellfish handling and harvesting procedures if your project is being conducted in polluted waters.
- If you do not believe your project will meet these requirements for the General Permit, you should complete the standard Joint Permit Application rather than the attached abbreviated form. You may obtain a standard Joint Permit Application here: **https://www.nao.usace.army.mil/Missions/Regulatory/JPA.aspx**

Need More Information:

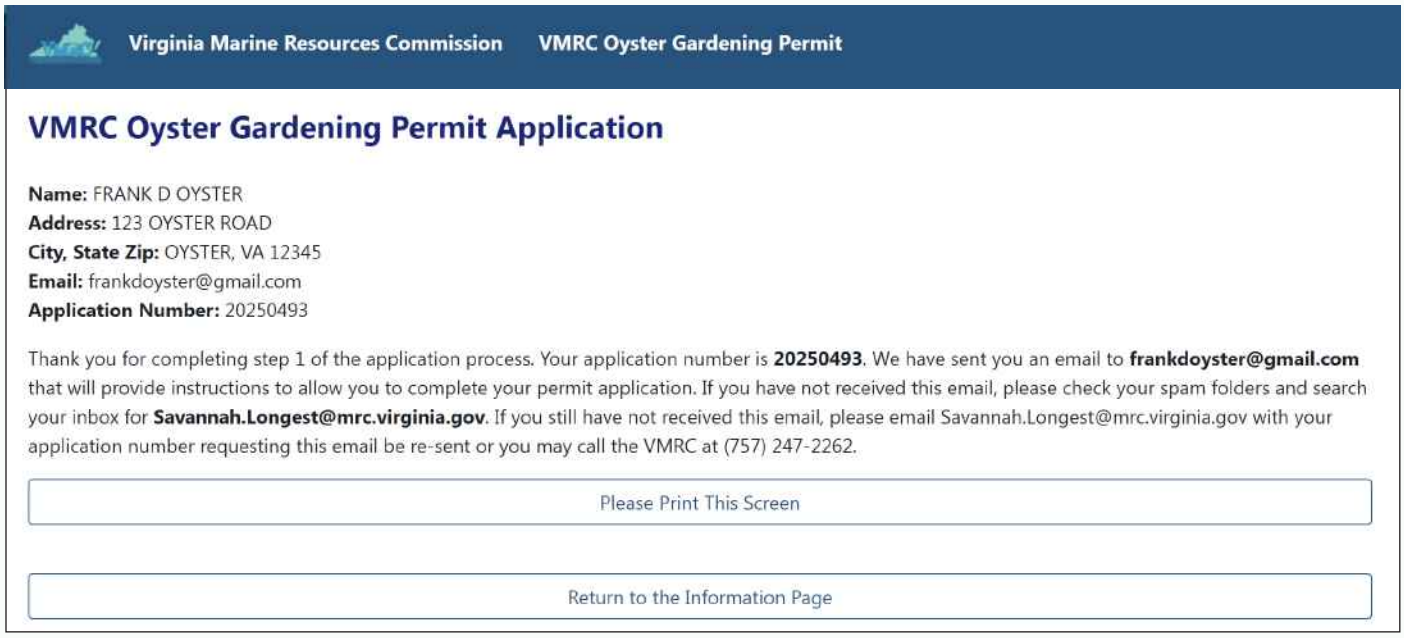
- Should you have any questions regarding this permit, please contact Savannah Longest at Savannah.Longest@mrc.virginia.gov or(757)247-2262.
- For additional information regarding this permit, please visit our website at: **https://mrc.virginia.gov/Shellfish_Aquaculture.shtm**

Continue To Application >>

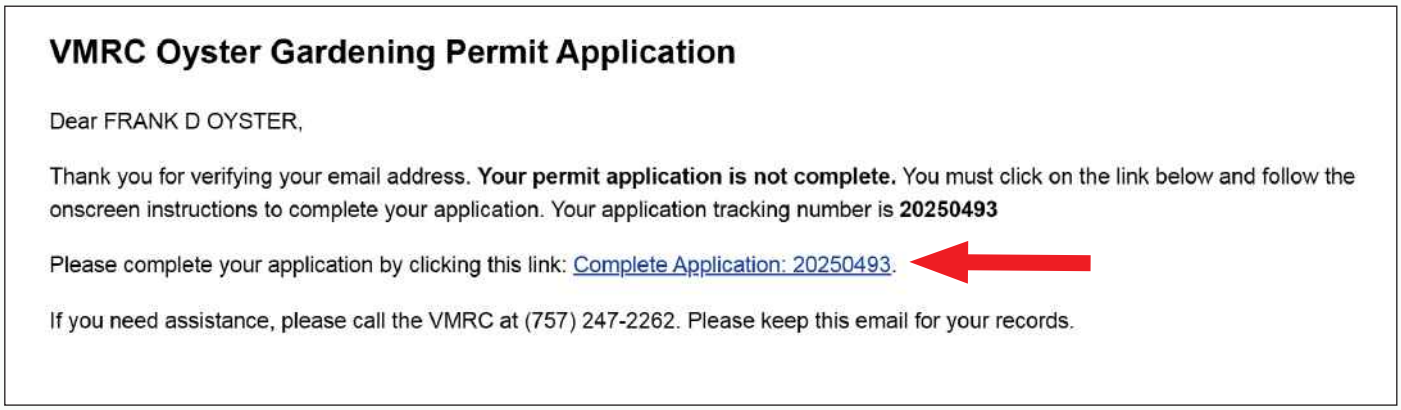
Once you click continue, complete the screen (shown below) which gathers your ***contact information***. This is where you will enter your contact information including mobile number and carrier. This enables the VDH to add you to the water quality alerts system.



Once you complete Step 1 with your ***contact Information***, you will see the screen below:

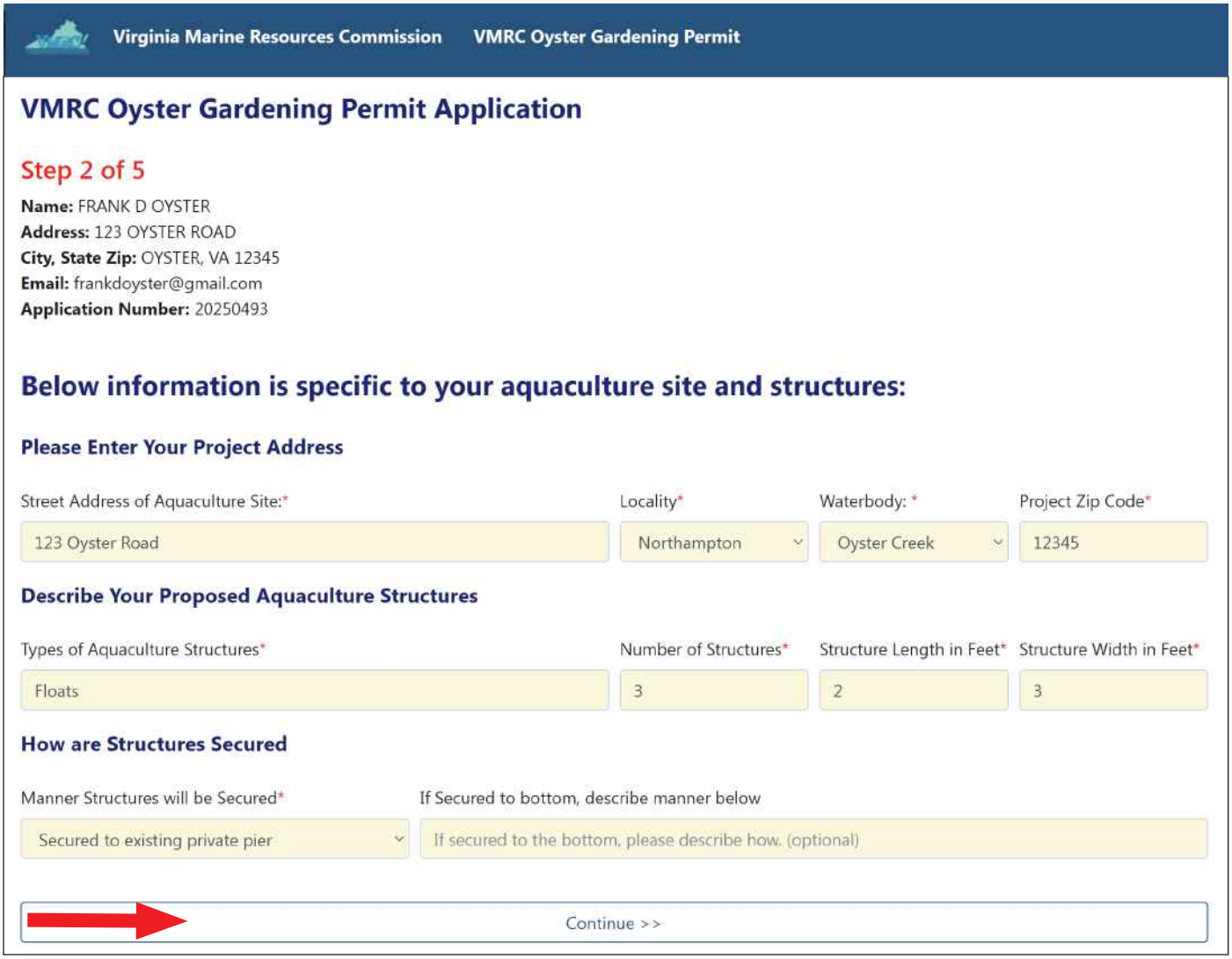


You will then need to navigate to your email and open an email from VMRC that will look like the one below:



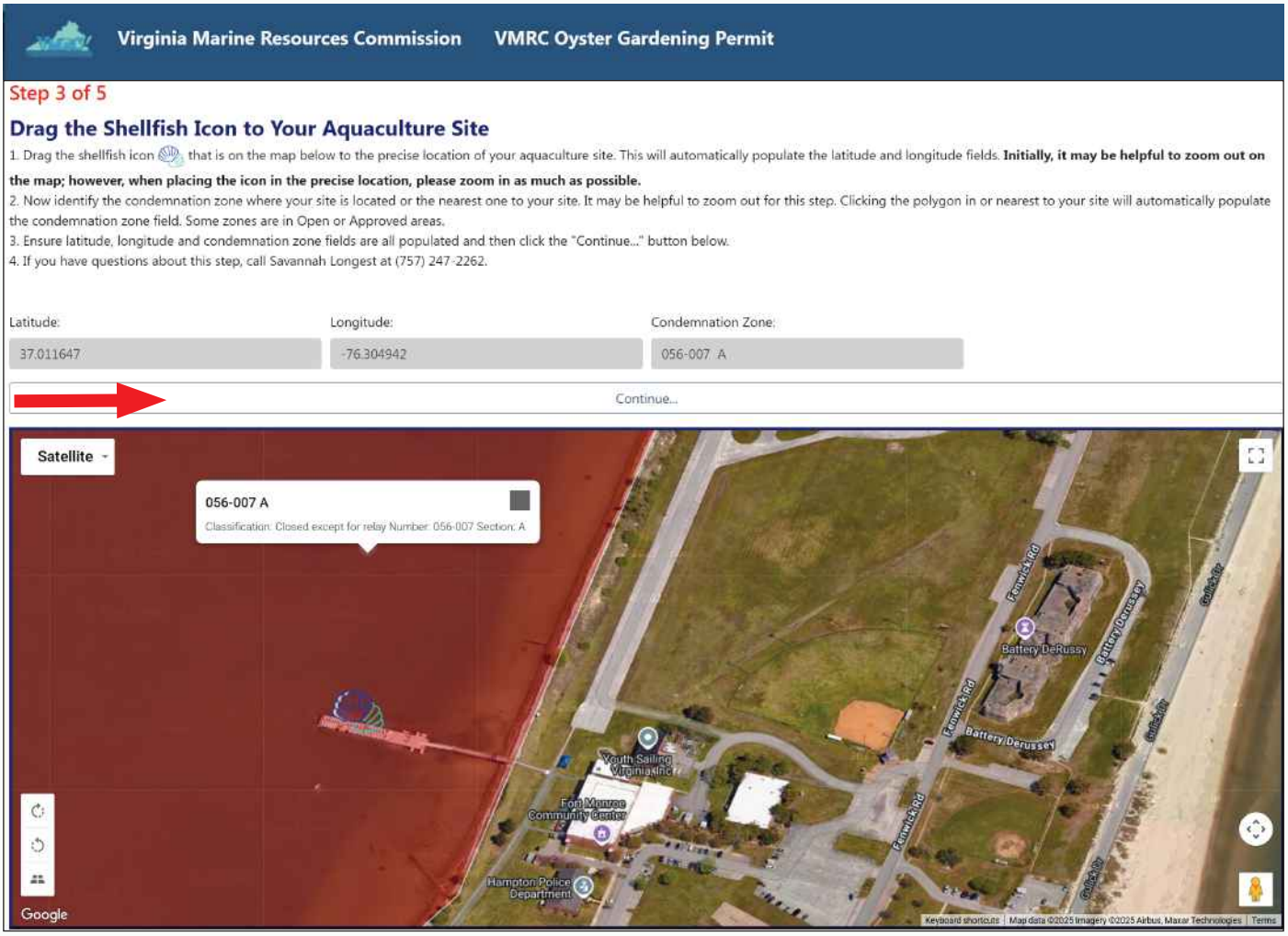
In the opened email, click on the hyperlink indicated by the red arrow above. This will allow you to complete your application.

When you click the hyperlink, you will be taken to step 2 and the screen shown below to enter your ***project site information*** including the address at which your garden project will take place, information about what types and how many structures you wish to install, the dimensions of the structures, and the manner in which the structures will be installed. *All fields marked with an asterisk are required.*



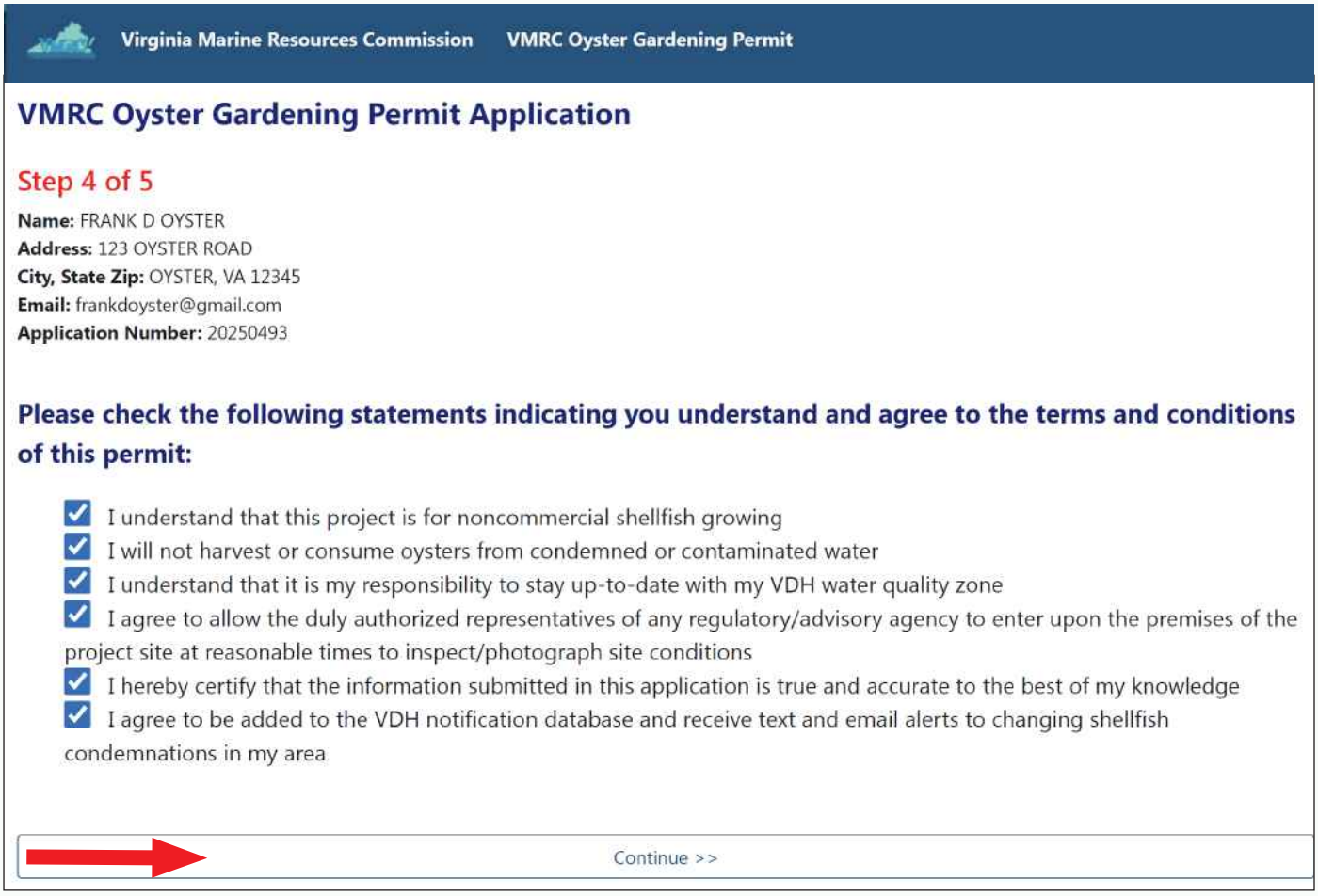
After you complete the step 2 screen, click “Continue” to be taken to step 3.

The screen for step 3 includes an auto- generated map image showing the project address entered on the previous screen. Click on the shell icon and drag it to your pier or exact location where your structures will be installed. **The coordinates will populate automatically.** When you have the shell icon in the *precise location* of your structures, get the VDH Condemnation Zone by clicking on the red area of the map. The **condemnation zone will populate automatically.**



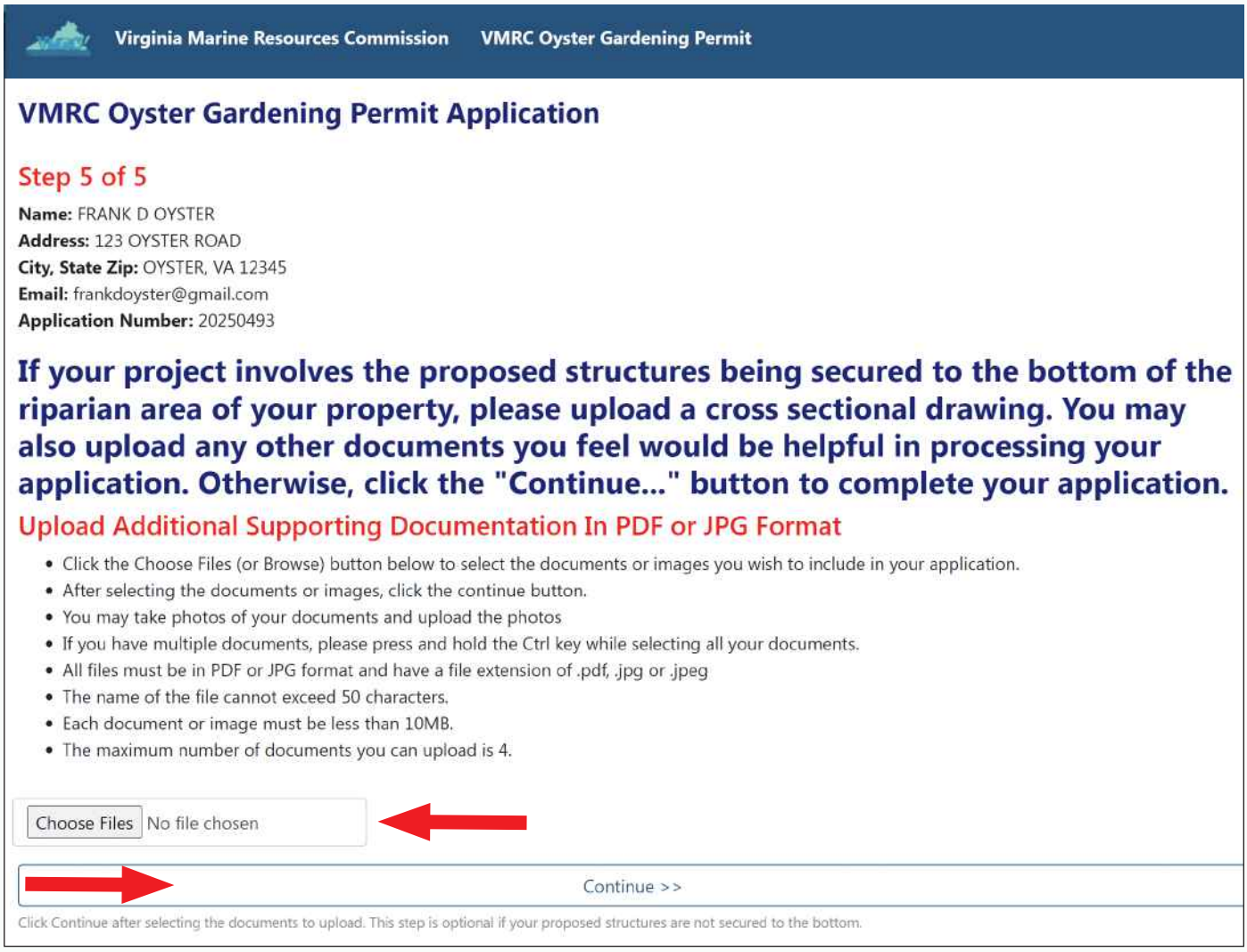
When both fields are completed, click “Continue” to go to Step 4.

The step 4 screen will show various acknowledgements to read and check.



Once you have read and understood the statements, click “Continue” to move to step 5 of the permit application.

The last step is only ***required if you are securing structures to the bottom of your riparian area.*** If you are securing structures to the bottom you will need to submit a *cross-sectional drawing*. If you are securing the structures to an existing structure such as a pier or a dock it is not necessary to enter further documentation, however you are able to upload anything additional you feel is relevant. Once the 5 steps are complete, click “Continue” and you will receive a confirmation that your application was successfully submitted.



The application will then be sent to VMRC and processed. Once it is processed you will receive notice via email.

Step Four: Purchase Hardware, Tools, and Supplies

Hardware and Tools that Simplify Oyster Gardening

- **Gloves made of puncture-resistant steel mesh or Kevlar** to protect hands when shucking and handling oysters and cages with barnacles. These are essential!
- **Stiff cleaning brushes** to scrub oysters
- **Long-handled brush** to clean mesh spat bags, cages, and floats
- **Shucking knife** to open oysters. Many styles are available.
- **Concrete mixing tub** to hold oysters when sorting oysters or cleaning floats
- **Crab pot rope or UV-resistant marine rope** to tie up floats
- **Pier/boat dock cleats** to tie floats to and easily adjust the length of rope
- **Scrapers** to remove barnacles from PVC pipe
- **Water source and hose** to spray spat bags and cages for cleaning
- **Salinity meter** to periodically test the salinity level of the water
- **Float label** with phone number and name to identify floats if they break away
- **Pig ring pliers and stainless-steel pig rings** to repair cages and attach ropes
- **Boat hook** to shake or flip cages
- **Power washer** (helpful but optional) to clean empty cages (Reminder: do NOT use a power washer directly on your spat or oysters!)
- **16-inch tongs** to remove blue crabs from cages
- **Bird spikes** to keep waterfowl and other birds off floating cages

Oyster Seed

Oyster seed, or spat, is available from several vendors along the Chesapeake. Try to buy spat as close as possible to where it will be planted. Research shows the best success is from seed that is raised in similar salinity and water to where it will grow. Vendors for oyster seed can change frequently, and buying from a dependable Chesapeake Bay seller will assure that Virginia's oyster seed import regulations will be met to protect the biosecurity of our local waters. It is imperative that we safeguard Virginia oysters from diseases that could be introduced from outside the state.

Tidewater Oyster Gardeners' Association (TOGA) maintains a current list of local spat suppliers on the web at www.oystergardener.org/spat-center. TOGA's site also provides contact information for local Master Oyster Gardeners (MOGs) who can advise on sources for oyster seed and best practices for oyster gardening in general.

Spat usually comes from vendors in thin mesh bags. Never put spat bags in the water as crabs will quickly rip the bag open and eat the spat. Photo courtesy of Carl Zulick.

Triploid of Diploid Spat?

Gardeners must decide whether to buy diploids (that reproduce) or triploids (that are sterile). Many vendors carry both. According to a fact sheet issued by VIMS and Virginia Sea Grant in July 2020, “ploidy is the number of sets of chromosomes in a cell. Diploids have 2 sets (1 from Mom, 1 from Dad); triploids have 3 sets rendering them “spawnless”".

Spawning oysters are more watery, less palatable, and therefore less saleable during the summer months of June to September. All wild oysters are diploids. Hatcheries can culture diploids that are selectively bred for disease resistance and desirable traits, which generally can make them stronger than wild diploid oysters.

Triploid oysters are sterile and usually grow faster than diploids because they do not expend any energy for reproduction. Triploids are fatter and firmer for the entire year when compared to a weakened, reproducing diploid oyster. Most commercial growers raise triploids as they are marketable year-round.

Many gardeners raise both triploid and diploid oysters – choosing triploids for eating and choosing diploids when their primary interest is benefiting the health of the Bay through oyster repopulation. Either way, diploids and triploids filter water during their lives and produce shell that can be returned to the Bay to support wild spat set.

Considerations When Buying and Raising Spat

Left Photo: Mesh spat bag with 1,000 spat. Photo courtesy of Carl Zulick. Right Photo: Larger spat benefit from larger mesh that allows better flow and is easier to clean Photo courtesy of Jay Nash.

The size of spat will vary with the time of year. The size also depends on whether the seeds were held over the winter or are from the current year’s crop. Sizes of spat for gardeners usually range from ¼” to over 1”, although hatcheries may have smaller ones. 1000 spat of ¼” size should fit into a single, small mesh bag that is approximately the size of a softball. 1000 larger spat will fill close to a gallon.

Place the bag in a small cooler on top of an ice pack covered by newspaper or a towel. Never place the spat directly on ice because they will freeze. Place a wet towel on top of the bag to keep the spat damp. Never put them in water while in a container without aeration because they will use up the oxygen and suffocate. Do not leave the cooler in the hot sun. Properly stored spat from your purchase will be fine for several hours, but, if they are under 1 ¼", try to get them into a mesh spat bag within a cage as soon as possible. NEVER hang the thin-mesh onion bag from the original purchase in the water, as blue crabs will tear it open, spill the bag and eat the spat. A blue crab or two can decimate spat and eat young oysters quickly. Spat grow quickly in the right conditions. When introducing spat into a fine mesh bag, gardeners must keep the mesh clean to assure optimal water flow is reaching the oysters. It is important to separate spat into additional bags as they get larger. Otherwise, the spat will get too crowded, they will compete for food, and their growth could be stunted. Gardeners may need up to three mesh spat bags in different graduated sizes if starting with small spat. Start oysters in the largest mesh size that will keep the spat from falling through the holes in the bag and eventually move them into the next larger mesh bags as they grow. As spat reach 1", a bag should not have more than 250 young oysters in it. Only a few spat should be lost to mortality under good conditions, which means that you can expect to harvest roughly as many mature oysters as the amount of spat that you initially purchased. Examine cages every week or two to clean the spat bag, flip it, and remove crabs.

A bag of 1000 oyster spat of varying sizes. Photo courtesy of TOGA.

What Will My Garden Cost?

Gardeners could spend anywhere from $100 to $250 the first year to start a garden with a single cage. It all depends on the size of seed, the containment system acquired, and how many oysters a gardener wants to grow. Gardeners can start with a small investment by using inexpensive mesh bags with soda bottle floats and buying small spat. Another option is for gardeners to manufacture their own cages using TOGA's designs (https://www.oystergardener.org/_files/ugd/9d48db_a153c27e93554ca99fac4af48dd06673.pdf) or attend a TOGA cage/float building workshop to build their own device with expert assistance from Master Oyster Gardeners. With a larger investment, gardeners can buy several floats and/or cages, get various sizes of mesh spat bags, and purchase large spat (which cost more than smaller sizes). Each approach has its merits depending on the gardener's situation, interest, and energy. Cages and bags will last for years. After cages and tools are acquired, the cost of raising 1000 oysters will be under $100 a year with the primary expense being the purchase of new spat.

In 2024, bags of 250 or 1000 spat were selling in a range from $25 to $70, depending on the vendor, quantity, and spat size. The larger the spat, the more expensive they will be. For current spat prices, contact any of the hatcheries or vendors on the list at https://www.oystergardener.org/spat-center.

Floats and cages will sell for $75 to $250 depending on the model and vendor. For the most recent information and prices for TOGA floats, go to www.oystergardener.org/spring-float-sale or check other vendors on the web. Other tools are optional and may add up to $125 to the investment.

When considering the cost of growing oysters and how many to grow, remember that even if there is no plan to consume the oysters, each of them will be filtering up to 50 gallons of water a day in optimal conditions. The value of water filtration to the Bay's health and water quality is considerable. Even if the oysters are eaten, they will likely each have filtered at least 10,000 gallons of water prior to harvest.

Step Five: Setting Up Cage Devices

Most people find it easy and enjoyable to set up and maintain an oyster garden. Cages set just below or floating on the surface of the water increase the quantity and quality of the food available to the oyster. Raising the oysters as little as 6" above the bottom is enough to reduce suspended sediments which they must filter, and it will improve their growth rate. While people find it convenient to tie cages to their dock, on wide rivers the energy of the water current and waves in storms will be a major factor in what cage design is most effective and how the cage should be secured. Any type of cage benefits from the shade under a pier, which will inhibit algae growth. If cages bump into the pier or pilings with wave action, it will cause the oysters to close and stop feeding, slowing their growth. Allowing cages to bump a piling during storms can also damage the cage regardless of design. Decisions on where and how to locate cages will have to be site-specific and will depend on water depth, salinity, temperature, food availability, weather, orientation of the shore, predators, and presence of disease.

Waterfowl can be an issue as they like to sit on floating devices and will often leave excrement both on the cage and inside of it. According to the Center for Disease Control, duck and goose droppings can contain infectious germs such as E. coli, Salmonella, Campylobacter, or Cryptosporidium. If ducks, wading birds, and geese frequent a site, submerged cages are a good choice. If birds are an issue, consider affixing bird deterrent spikes to the perimeter of the float using a strong waterproof adhesive or zip ties.

Organizations like VIMS, Chesapeake Bay Foundation, and TOGA can assist for free if advice is needed.

Mark Mikuta displaying some of his oysters on the Rappahannock River. Photo courtesy of Sherry Mikuta.

Bags and Bottom Cage Setup

Placement of oysters in bottom cages or in hanging bags in the intertidal zone (above water at lowest tides and underwater at high tide) can have advantages, including easy access at low tide while wearing waders or a swimsuit as well as the ability to drag cages onto shore without lifting them. Allowing an oyster cage to be exposed to sun and air for an hour or two in moderate weather can reduce algae, sea squirts, and burrowing worms (polydora) that cause the shells to be brittle. However, placing cages in water that is too shallow can keep oysters out of the water, which reduces the feeding time and growth rate for oysters. Reduce oysters' exposure to extreme conditions by moving cages to deeper water during very hot temperatures or during blow-out tides in freezing weather. While oysters can tolerate 1" – 2" of surface freezes, they will likely perish if exposed to freezing air.

Bottom cages are often used in locations with a lot of wave action that can damage or break away surface floats. These cages often get heavy, so locating them off the side of a pier near a lift can be helpful. It will be hard to monitor and remove blue crabs and fouling on cages that stay on the bottom. Bottom cages will build up algae and debris from the current and do need to be cleaned periodically. Make sure the legs on bottom cages lift them 6-12 inches above the muddy silt layer of the bottom.

Rough Rider, Basket, and Tidal Tumbler Cage Setup

Rough Riders, baskets, and Tidal Tumbler cages work best when they hang with two or more lines from cleats or between the pilings on a pier. It is important that the cages do not bang against the pier with wave action as it can damage the cage. With heavy waves, a single line holding a cage will become twisted as cages spin in the currents. This twisting shortens the rope, which raises the cage and may stress the rope to its breaking point. These styles of hanging cages are lighter than the larger cages and can usually be raised by one person without a lift.

Gardeners should use strong UV-resistant rope such as crab pot line to secure their cages and floats. Ropes should be inspected before major storms for abrasion and for weakness caused by sun exposure. Best practice is to replace the ropes after several years of use. Taylor Floats should be held by at least two lines which are tied to the basket or to the PVC pipe to reduce wear at each connection point. It is not uncommon for gardeners to lose their floats during storms when their gardens are in high velocity areas that have big waves or a fast current. For this reason, keeping an engraved tag or writing the owner's name, address, and phone number on the pipe is advised.

Adjusting a Tidal Tumbler at the Deltaville Maritime Museum. Photo courtesy of Carl Zulick.

The unique design of a Tidal Tumbler, as discussed in the Containment System section, makes setup harder than other floats. Tumblers must be attached to a cleat or beam on a pier, and it may take some time to appropriately adjust the height to match the water level. The Tumbler should float with the basket fully in the water at high tide and the bottom of the basket just touching the water at low tide, so that the top of the cage and the oysters are exposed to air (see photo insert in Step 2, Tidal Tumblers section). It is best to locate the cages in the shade as very hot sunny days can harm the oysters if the tide stays low for more than about an hour. It is fine for cages to be out of the water for an hour or two on moderate days if the temperature is not significantly below freezing. For this reason, most gardeners adjust their Tumblers in the winter to have the baskets fully submerged most of the time. A Tidal Tumbler is not the best choice for high energy water, as the float tube can catch waves, and current action will twist and toss the cage around, possibly resulting in damage.

Flip Float Setup

A Flip Float is best hung between two pilings on a pier with two lines that can be used to keep it from bumping the pilings during wave action and to turn (flip) it over when algae or debris builds up on the top. A boat hook can be used to help turn over the float. Flip Floats are more vulnerable than other devices in high energy water, and they are not recommended for gardens that experience heavy currents. They can tip in the waves, which results in the bunching of the oysters at one side of the float. Remember, oysters grow best when spread evenly in any float. Because Flip Floats open on only one end, it can be difficult to reach all the way in to remove invading crabs. Therefore, dumping out the oysters is often required. If ducks and geese are often present, Flip Floats may not be the best choice as waterfowl like to sit on them. Pigeon deterrent spikes would be required on both sides of a flip float, but the spikes on the underside of the float would catch floating debris and weaken the marine adhesive.

Taylor Float Setup

Taylor Floats should be secured with one or two lines to keep them in place but with enough slack to accommodate tidal and storm surge flow. Many gardeners like to position their floats under their piers, as this helps reduce fouling and keeps them out of the way of watercraft and swimmers. Taylor Floats should be placed where wave action is low, and, as with other cages, lines should be positioned to reduce bumping into the pilings of the pier. Taylor floats get very heavy and will require two people or a lift device to pull them up when full of mature oysters. If a pier isn't available, Taylor Floats can be placed with one or two anchors in open water that is outside navigation zones. The size of the anchors depends on the potential water energy during storms. A low cost, effective anchor can be made by attaching ropes to stainless steel eye bolts that have been embedded in concrete-filled 5-gallon buckets. Multiple Taylor Floats can be lined up in series (if the water isn't too active) with an anchor on each end. Wading or using a boat may be required when maintaining anchored floats.

Jeff Donahue and Ellie Boyd with their Taylor float. Photo courtesy of Laura McKay.

How Often Do I Have to Work on the Oyster Cages?

Many gardeners inspect their oyster cages weekly, but some only check monthly during the summer and less frequently in winter. Since oysters are filter feeders, restricted water flow reduces the phytoplankton and algae foods available for consumption. Cages and bags will need to be cleaned often if the water is green, shallow, or has a lot of current or drifting debris. If using fine mesh bags with small spat, the bags should be cleaned at least bi-weekly as fine mesh can quickly clog. Larger mesh won't need to be cleaned as often. At least once a year, check the lines securing the cages to ensure they have not deteriorated or twisted. At this time, also confirm that the cage still has a readable ID in case it is lost. To optimize the growth and survival of the oysters, check them every few weeks or months to keep crabs out, limit overcrowding, and improve water flow by cleaning bags and cages. It's a good idea to check on oysters regularly, but many gardeners don't try to optimize growth, they simply want to raise oysters for the good of the Bay, eat a few, and let nature run its course.

George Miller working with oysters from his oyster garden on Nanci Reeves' dock. The Millers work cooperatively with the Reeves on their oyster gardens. Photo courtesy of Maryethel Miller.

How to Maintain Floats, Cages, and Bags

Fouling caused by floating or suspended weeds and debris, algae, mussels, sea grapes, barnacles, sponges, and other small organisms on floats, bags and oysters can be removed by washing them with water (fresh or salt) and by scraping and/or scrubbing the devices with a broom or stiff brush. Oysters should never be sprayed directly with a high-pressure washer. The high pressure could damage adult oysters and would likely destroy young, fragile spat. A regular hose will work fine.

Allowing floats and bags to air dry on land for a day or less can kill many fouling organisms. Fouling can weigh down floating devices and can cause them to sink. Sea squirts and sponges should not be returned to the water as they will continue to grow and spread. While it is good practice to pull floats out of the water to clean them, gardeners will find scores of shrimp, small fish, and other life that fall through the bottom and can be saved by washing them back into the water with a bucket of Bay water or a quick spray from a hose.

Fouled oyster cage. This fouled float has filamentous algae, sea squirts and barnacles on it that can be removed by spraying water and/or using a brush or scraper. Pulling cages out of the water and letting them dry can help keep cages clean of parasites and fouling organisms such as polydora worms, sea squirts and algae. Mature oysters can usually tolerate being out of the water for several hours or a day, but it is not advised on a very hot, sunny day or with young spat. Photo courtesy of Carl Zulick.

When spat bags lay horizontally in a cage, the bottom side will usually be cleaner than the top side (which is exposed to more light and debris). Flipping bags over can help control fouling and improve water flow to the oysters.

Oysters should be spread evenly and not stacked more than two or three deep, which provides space for all the oysters to feed and grow. Large oysters should be moved to separate containment systems so that any remaining smaller oysters will have less competition for food.

Examine cages and remove any blue crabs during the spring and summer. If cages are not checked often, they are likely to have a few small blue crabs that quickly grow after eating oysters. Small crabs easily enter a cage through the wire mesh, and, when they grow, they can't get back out. Crabs won't be an issue in the winter. If any crabs are left in cages in the fall, they will likely die over the winter as the water cools and they are unable to move to deep water.

Above: Sea squirts on oysters. Photo courtesy of Carl Zulick.

Right: Wear gloves and relevant protective clothing while handling oysters and cages to prevent cuts, waterborne illness, or infections. Be extra careful when shucking. Cleanse ANY scrape or cut with hydrogen peroxide, Clorox, or Bactine right away. This will protect against Vibrio and other infections. Photo courtesy of Carl Zulick.

Dead oysters should be removed from the cage. Dry the shells for at least a couple weeks or months to assure any diseases are gone before returning them to the water. In the summer between June and September, when oysters are spawning, clean shells should be put back in the water where they will provide habitat for small fish such as blennies, shrimp, skilletfish, and gobies. Wild spat will also attach to the shells' hard surface. To encourage the wild set of oysters, fill a wire cage, crate, or create a reef with the shell either in shallow water or hanging from a pier. Shake the shells weekly to keep them clean of silt. Wild set starts out looking like a tiny white spot and gets larger by the month.

Floats and cages should be identified with the owner's name, address, and phone number. A waterproof sharpie marker can be used to write on the PVC pipe, but the marker ink doesn't last for more than a few months so rewrite it occasionally. A longer lasting alternative is an engraved plastic or aluminum pet tag that stores may engrave onsite or can be ordered online. It may be best to take stocked floats out of the water and temporarily store them in a safe, cool place in advance of more intense, direct-hit storms such as hurricanes, tropical storms, and nor'easters. If a severe storm is coming and you have floating devices, be sure lines are secure and the cage can be identified if lost.

Alternative Treatments for Biofouling

Most biofouling is best removed through washing and air drying as described in the previous section. However, a brine dip is an alternative treatment that may be considered in the case of pests such as flatworms that can kill oysters or Polydora (also called Mud Blister Worms) which burrow into the shell making them brittle and crumbly for shucking. These and other marine worms can be reduced using a salt-brine dip. A brine dip should be used only with oysters greater than ½". Smaller oysters will die from the procedure. Oysters should be left out of the water for about one hour before dipping to ensure they are closed. A brine solution is made by dissolving 25 pounds of salt in 10 gallons of estuarine water (plastic trash cans or cement mixing tubs work well). Oysters should be left in their mesh bags during the process. Dip and agitate the bags for five minutes. The bags should be left out of the water for another hour or two, then rinsed thoroughly before being placed back into the water. The amount of time that oysters should be left out of the water will depend upon their size and the weather conditions. Reduce the time if cleaning small oysters on a very hot day.

An easy alternative to the brine dip is to simply raise the bags above the low water mark for several hours so that they are exposed to the sun at low tide on a day below 90 degrees Fahrenheit. This method will not harm the oysters, but it should kill the marine worms along with reducing barnacles and sea squirts. Any basket-type cage (such as a Tidal Tumber or Rough Rider) that hangs from a pier and is exposed to air and sun at low tide will also help keep cages and oysters cleaner. Regardless of the tides, periodically pulling the cages and exposing them to sun and air on a pier or bank will help eliminate these intruders. When pulling a cage, try to return any valued marine life that falls though the bottom of the cage back into the water.

This fouled float has filamentous algae, sea grapes, and barnacles on it that can be removed with freshwater, a brush, and scraper, or by allowing the float to air dry and then brushing/scraping them off. Photo courtesy of Brian Wood.

Moving Oyster Cages

There are times that gardeners may want to move their cages, such as when painting a pier or cleaning the hull of a boat on a lift. Paints or cleaners can harm the oysters. It's okay to temporarily move permitted cages a short distance to clean water and subsequently return them a short time later to their original location. Commercial oystermen are permitted to relay their oysters to different locations for various reasons but only with VMRC approval.

For more information on managing oysters during periods of seasonal closures or if the oysters are threatened by low salinity after major rains, see https://www.mrc.virginia.gov/shellfish/index.shtm or contact VMRC Shellfish Management for current expert advice.

Chapter 5 - Oyster Harvesting: Eat, Donate, or Leave Them

Below are some considerations to guide a gardener's choices between eating gardened oysters, donating them to a sanctuary reef, holding them in cages, or simply releasing them to public or private waters. No matter the final decision, every gardener can be proud of their accomplishment in raising oysters and providing a "cleaning" service to Virginia's coastal waters as well as a "housing" service to other small marine creatures, which need places to feed, hide, and live.

When to Harvest

Unlike for commercial oystermen on public waters, there are no restrictions on when oysters grown by oyster gardeners may be harvested. But diploid oysters generally spawn June to September and during this period they will be watery and lack taste. This is not an issue with triploids since they don't spawn.

> The old adage of only eating oysters in months having an R in the name is actually because wild diploids aren't as palatable when spawning and more bacteria grows in hot weather. This was coined before triploids became available, and before refrigeration was widely available. Triploids do not spawn and are palatable all year-round, which is why commercial oyster farmers usually grow triploids. However, there is truth to the fact that bacteria levels in the water are higher during warmer summer months. Commercial farmers have more control of bacteria, and their oysters are inspected by the health department. Use caution if consuming oysters from warm water between April 15 and October 15—ESPECIALLY if anyone in your party has a compromised immune system. See www.vdh.virginia.gov/content/uploads/sites/20/2016/05/oystersvibrio-1.pdf for more information on health concerns related to Vibrio. According to the CDC, "Most Vibrio cases (from eating raw or undercooked oysters) occur between May through October when water temperatures are warmer".

Gardeners should always check whether there are any closures due to contamination or a major rain event before harvesting their oysters. In Virginia, the Department of Health (VDH) Division of Shellfish Safety and Waterborne Hazards regularly samples water for the presence of bacteria or viruses to determine the risk of exposure. The VDH website has a map of the Bay and its tributaries to show any current restrictions at www.vdh.virginia.gov/environmental-health/environmental-health-services/shellfish-safety/.

If there is a major rain event, wait at least 10 days before harvesting. Runoff from upstream increases the possibility for contamination even when an area is in the approved status. Bacterial and viral contamination can come from many sources. Animal feces are a common source of contamination, as well as chemicals such as herbicides and pesticides.

Chill Oysters Immediately After Harvest

After collecting oysters for harvest, chill them ***immediately*** to prevent the rapid growth of bacteria. Always keep oysters below 50° F. Oysters must be kept cold until they are consumed. It's always best to eat oysters as soon as possible, but oysters will keep safely up to a week if they are covered with a damp cloth and refrigerated.

Photo: Oysters on the half shell. Photo courtesy of Chesapeake Bay Foundation.

Harvesting Oysters of Different Sizes

Virginia regulations limiting harvest size for wild stocks do not pertain to cultured oysters, so gardeners can harvest at any size.

Many gardeners buy spat every year and keep each purchase in a separate cage. It's recommended that gardeners track the date they stocked the spat and the type of spat, especially when growing diploids and triploids at the same site. This practice allows gardeners to have oysters of various ages and sizes for different uses and makes sure that oysters are available to eat in the summer if their water is unrestricted. While diploids and triploids taste the same, triploids grow faster, tend to have thin shells, and hold a high meat content, so they should be easy to open, flavorful, and filling.

Small oysters under 2 ½" are popular for appetizers and eating raw on the half shell. They tend to be mildly sweet and tender. Small oysters may be better for people new to oysters as they are easily consumed in a single bite. Medium-sized oysters from 2 ½" – 3 ½" will be firmer and are preferred for frying, barbeque, steaming, as well as making stuffing, soup, or chowder. Large oysters over 3 ½" are meatier with a more scallop-like adductor muscle that can be tougher. These larger oysters are likely to have a richer "oyster flavor", but, due to their size, they are not popular for eating raw. Larger oysters are generally harder to shuck. Large oysters are often used for grilling, smoking, baking, barbeque, and chowder, as they will shrink when cooked.

There are countless cookbooks dedicated exclusively to oysters, and even more recipes can be found on the internet.

Volunteers with the Chesapeake Bay Foundation spread a crop of oysters on a protected reef in Virginia Beach's Lynnhaven River. Photo courtesy of Chesapeake Bay Foundation.

Donating Gardened Oysters or Leaving Them to Benefit the Ecosystem

Many gardeners like to grow more oysters than they plan to consume. They donate surplus diploid and triploid oysters and shell to organizations such as the Chesapeake Bay Foundation that stock sanctuary reefs. On a sanctuary reef, oysters cannot be harvested and are left to serve as brood stock and habitat for other marine creatures. Surplus oysters as well as clean, empty shells can be placed on a hard, sandy bottom or an existing oyster reef. When large enough, these reefs reduce wave action and can create a "living shoreline" where plants and animals can thrive. A living shoreline is of far greater ecological benefit than a bulkhead or rip rap, and under low-to-moderate wave energy conditions, can provide the same protection from erosion.

Chapter 6 - Safety

Safety should be a major consideration for oyster gardeners, but it is easily manageable with education and awareness. The Virginia Department of Health, Division of Shellfish Safety and Waterborne Hazards works to protect public health related to the consumption of molluscan shellfish—mainly clams and oysters. All gardeners should become familiar with the Division's comprehensive website on shellfish safety at www.vdh.virginia.gov/shellfish.

Food Safety and Health Considerations

There are health concerns related to oysters and the Bay. Eating oysters is inherently risky since they are one of the only animals that are eaten raw with their digestive tracts intact. Bacteria, toxins, or other contaminants present in the water where they grow can be concentrated in their tissues. When the oysters are eaten raw, so are the contaminants.

Gardeners may be thinking, "*I love eating oysters and clams. How can I protect myself*?". Before eating molluscan shellfish, check to make sure that they came from approved waters. Eating shellfish from approved sources greatly reduces the risk of getting sick, however, people with weakened immune systems or underlying health issues should be cautious when eating raw shellfish due to the risk of *Vibrio vulnificus* (discussed later).

Oysters and clams can come into contact with naturally occurring bacteria, bacteria from human sources, viruses, algal biotoxins, and runoff following rain events in the waters where they grow. This list is by no means exhaustive but contains the most common sources of contamination that can affect molluscan shellfish. Due to their nature of being filter feeders, contaminants in the water are concentrated in the animal's tissues.

A best practice for safe consumption is to chill oysters immediately upon harvest and keep them chilled until they are consumed. Just as you don't leave milk sitting out on the counter unrefrigerated, you don't want the natural bacteria inside of the oysters to grow and multiply at room temperature. Bacteria can be destroyed by cooking, but other contaminants like heavy metals, viruses, biotoxins or fuel, cannot be destroyed by cooking.

Oysters filter their food from large volumes of water not only concentrating algal food in their gut, but also concentrating bacteria, viruses, biotoxins and other contaminants present in the water. Oysters are actively pumping and feeding when the water is over 50° F. As the water cools down, pumping rates also slow down. This causes them to grow slower and purge less, allowing contaminants to be retained in their systems for prolonged periods of time. This is especially problematic in the cooler months of November through April, during rainfall events, and after sewage spills.

Fried oysters with caper sauce made with oysters from Jeff and Marianne Donahue's oyster garden. Photo courtesy of Laura McKay.

Rainfall

Even if oysters are in approved waters, it is safest to wait about 10 days after heavy rain for the water to clear before harvesting. Just think about everything washing from the land into the water—you may scoop the poop, but does your neighbor? In the heaviest or most prolonged rains, VDH or VIMS may send a consumption alert to the email address used when registering an oyster garden. Delaying harvest will provide the oysters with time to pass most bacterial contaminants through their digestive tract.

Water Sampling and Condemnations

VDH collects water samples from roughly 2,500 sample locations across Virginia and samples those stations 6 to 10 times per year. That adds up to an average of 20,000 bacteria indicator samples each year. The bacteria indicator is called fecal coliform. Fecal coliform will not cause you illness, but instead indicates the potential presence of human sewage. There are several different pathogens in human sewage that have been known to cause shellfish related illness outbreak. (The outbreak of Salmonella Typhi in the 1920's that killed 150 people who consumed raw oysters is the deadliest foodborne disease outbreak in US history.)

The data from these routine water samples, combined with sanitary surveys, create shellfish condemnation areas. VDH updates these condemnations once per year. Four main condemnation types are as follows:

- Condemned with no relay: These areas are considered prohibited, and no shellfish can be harvested for any reason.
- Condemned with relay: These areas are considered restricted, and shellfish can be harvested only by relaying to approved waters for a minimum time period and by VMRC permit.
- Conditionally Condemned: These areas are considered approved or restricted depending on a specific condition. The three main conditions are: seasonal marina activity, rainfall, or the time of year.
- Emergency Condemnations: These are discrete events that trigger immediate closure of growing waters. These are usually caused by a sewer failure or large-scale flooding event.
- No Condemnation, unrestricted/approved areas: indicated on the map by areas without color.

Please visit www.vdh.virginia.gov/shellfish to find the VDH shellfish map or use the VMRC mobile application to see current condemnations and approved waters. Note that areas without color are considered approved.

Scan the QR code for either the VDH shellfish map or VMRC mobile application.

VDH Shellfish Map QR code.

VMRC Mobile Application QR code.

Vibrio Bacteria

When temperatures rise in the summertime, so do bacteria levels in the water—most notably naturally occurring bacteria, such as Vibrio parahaemolyticus (Vp) that cause gastrointestinal illness, and Vibrio vulnificus (Vv) that are flesh-eating bacteria. Because oysters and clams pump and filter water, Vibrio bacteria is more likely to be taken up by and adhere to oysters too. Risks of Vibrio in molluscan shellfish are greater beginning in May through October. However, if the air or water is above 50° F, the risk is elevated, even in the cooler months.

Shellfish concentrate these bacteria from the water, and the bacteria that have accumulated can rapidly multiply if the shellfish are not quickly cooled after harvest and kept cold until eaten. Therefore, it is important that shellfish be placed in refrigeration or iced as quickly as possible. Icing oysters will not harm the oysters, in fact, using plenty of ice makes them safer to eat. Properly cooking shellfish reduces this risk further.

Vibrio parahaemolyticus (Vp) is commonly found in the marine environment around the same time that Sea Nettles (Chrysaora quinquecirrha) begin to show up or when the air and water are becoming warm. Vp illnesses generally cause bloody diarrhea, stomach cramps, fever, nausea, and/or vomiting, which usually are fairly mild and last less than a week.

Vibrio vulnificus (Vv), often referred to as *flesh eating bacteria*, is a naturally occurring pathogen commonly found in marine waters. Symptoms include fever, diarrhea, abdominal cramps, nausea, and vomiting. Onset of septicemia is characterized by fever and chills, occasionally accompanied by vomiting, diarrhea, abdominal pain, and/or pain in the extremities. Death occurs in about 35% of patients who contract septicemia -- a life-threatening infection that occurs in the bloodstream and spreads throughout the body. People with underlying health issues, compromised immune system, or those who have high serum iron levels (usually due to liver disease) are at much higher risk.

Vibriosis-caused Vv can be from raw molluscan shellfish or from contact with contaminated water. Doctors and medical offices around the Chesapeake Bay are familiar with Vibrio infections and know how to treat them. However, visitors who enjoy the Bay and then return to other parts of the country often find that their local medical personnel are unfamiliar with Vibrio and other waterborne bacteria. Education is important, as people have lost limbs or died without treatment.

For more information on Vibrio, visit the following CDC and VDH websites at:

- www.cdc.gov/vibrio/about/index.html or www.cdc.gov/vibrio/hcp/clinical-overview/index.html
- www.emergency.cdc.gov/han/2023/han00497.asp
- www.vdh.virginia.gov/waterborne-hazards-control/recreational-water-illnesses/vibrio/

Kevlar or chain mesh gloves work well to protect hands from cuts during shucking and handling cages, submerged ropes, and sorting oysters. Photo courtesy of Carl Zulick.

Never go into the Bay water with a known open cut or scrape during the warmer months when the bacteria multiply more quickly. Even cooler water contains Vibrio bacteria. Infections must be treated with strong antibiotics. Keep medication in your oyster gardening toolbox to treat at your worksite. Always use gloves when shucking oysters or handling cages or their contents. If injured while working, immediately cleanse the wound with Bactine, Peroxide, or diluted Clorox and then stay out of the water. Seek immediate treatment if there is any sign of infection - DO NOT WAIT!

Vibrio can enter open wounds and scrapes causing life-threatening infections. Photo courtesy of Millville Medical Center, NJ Facebook Post.

Bacteria

Several other types of bacteria are present in shellfish waters that can cause illnesses, such as the vibrio species V. cholera and V. fluvialis, Campylobacter, Klebsiella, Shigella, Salmonella, and E coli. These are often associated with raw sewage, so the best way to mitigate the risks of these bacteria is to only eat shellfish from waters that are approved. See previous section about the maps available to gardeners and the public.

Viruses

Several types of viruses may be present in shellfish waters but the most common viral illness from shellfish consumption is from Norovirus. Symptoms usually start within 1 or 2 days of eating the contaminated food but may start in as few as 12 hours. Vomiting that's explosive is often the first symptom, along with watery diarrhea that isn't bloody, and abdominal cramps. Headache, mild fever, and muscle aches also may occur. Most people get better in a day or two, although it takes others a little longer. Although technically Norovirus can be cooked out of shellfish, the temperature and duration to render shellfish safe would make the food unpalatable, therefore, cooking is not seen as a suitable control option for viruses. These are often associated with raw sewage, so the best way to mitigate the risks is to only eat shellfish from approved waters. See previous section about the closure maps available to you.

Harmful Algal Bloom (HAB) Biotoxins

Phytoplankton are microscopic algae that are common members of freshwater and marine habitats. They represent the major source of food and oxygen for many of the organisms present in lakes, rivers, estuaries, and oceans. Among the several thousand species of phytoplankton that exist worldwide, approximately 70 to 80 of these are known toxin producers. These toxins are potentially harmful to humans through direct ingestion, inhalation of aerosolized toxins, or through consuming fish or shellfish that have accumulated toxins from their environment and/or food sources. Toxins produced by phytoplankton can also be potentially harmful to birds, fish, and other inhabitants of aquatic habitats.

VDH has a robust screening and monitoring system in place for HABs. Currently, the two main HAB forming species of concern are Dinophysis and Pseudo-nitzschia. VDH has not found biotoxins present in shellfish waters that exceed the national standard.

Algae and duckweed blooms occur as water warms in the Northern Neck. Photo courtesy of Kent Eanes.

Harmless Neighbors...

Clam Worm

This harmless polychaete worm (Nereis succinea) is often seen crawling on top of cultured oysters. It is 1 - 3 cm (1/2 - 1 inch) in length and looks like a centipede.

Grass Shrimp

This shrimp (Paleomonetes pugio and P. vulgaris) is one of the most common organisms associated with oyster floats and does not pose a threat to oysters. They are primarily detritivores and feed on decaying animal or plant material.

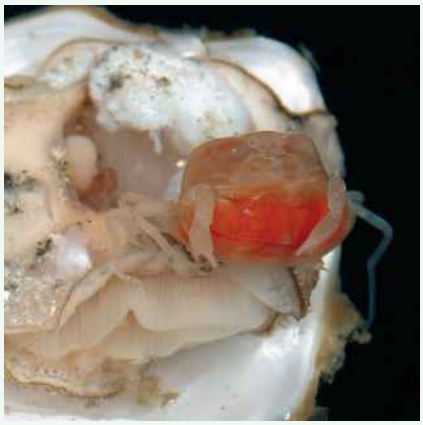
Periwinkle Snails

This snail (Littorina littorea) climbs up and down salt marsh grasses, where it feeds on small fouling organisms. Adding a dozen or so periwinkles to your oyster garden will help keep it clean.

Blennies, Gobies and Skillet Fish

Small fish, like blennies, gobies and skilletfish, love to visit oyster gardens where they can hide from their predators. Blennies nest in empty oyster shell.

Pea Crabs



These tiny crabs (Zaops ostreum) live inside the oyster, feeding on algae, but they generally cause little harm to the oyster.

Hermit Crabs

Small, 1-2 cm (about 1/2 - 1 inch), hermit crabs (genus Pagurus) are no threat to oysters and can help keep your garden clean of fouling organisms that obstruct water flow.

Mud Crab

Several species of mud crabs (Panopeous and related genera) are very common to the oyster garden. This small crab may feed on your small oysters but is also in search of other prey such as Hermit crabs and Periwinkle snails.

Photo credits: Clam Worm & Pea Crab by Southeastern Regional Taxonomic Center/South Carolina Department of Natural Resources; Grass Shrimp by NOAA; Hermit Crabs and Striped Blennie by Tim George, Virginia Aquarium and Marine Science Center; Periwinkle Snail by Virginia Witmer; Mud Crab by K. Hill, Smithsonian Marine Station at Fort Pierce, FL.

Harmless Neighbors...

Various Worms

Many species of red worms will appear when working with and shucking oysters. They are hard to identify without expert examination. While unsightly and maybe disturbing to some consumers, they are harmless to humans and the oysters themselves. They are simply using the oyster shells as habitat.

Lined Seahorse

Lined Seahorses prefer submerged grasses but can be found in oyster cages where they are protected by the structure and can hide among the shells while they gather food from the current. This specimen was found by a TOGA gardener in a cage on the lower Rappahannock River.

Competitors...

Barnacles

These hard-shelled crustaceans attach in large numbers and can compete with oysters for space and food. Barnacles can be eliminated by air exposure if identified early enough, but large individuals must be physically removed with a scraper. Careful! Barnacles are very sharp. When lifting, carrying or dragging cages, be careful not to get cut. If you get cut or scraped, treat the wound immediately with antiseptic to avoid possible infection.

Mussels

Mussels (blue mussel, Mytilus edulis; ribbed mussel, Guekensia demissa; scorched mussel, Brachiodontes spp.) may settle in oyster gardens. They do not pose a threat unless they are abundant as they compete with oysters for food. Remove them when small by scraping or twisting, but be careful to not get cut as they are sharp.

Sea Squirts

Sea Squirts (Molgula manhattensis) are tunicates, and may grow on oyster shells and floats in water with higher salinity. To get rid of them, control with a brine dip, gentle plucking, scraping, or aerial exposure for 1-2 hours. It's best to dry them on land. If they are put back into the water they will likely survive and reproduce.

Sponges

There are a variety of sponges that can foul oyster shells, mesh bags, and floats. The type of sponge will depend on the salinity and other environmental site conditions. Generally, their presence can result in a reduced flow of water to the oysters, and the sponges should be removed. Sponges can be removed with spraying and brushing or exposure to full sun.

Photo credits: Varioius Worm photos by Carl Zulick; Lined Seahorse by Mike Ballato; Barnacles & Mussels by Tim George, Virginia Aquarium and Marine Science Center; Sea Squirt by Melissa Frey, Royal BC Museum, Canada; Sponge by Carl Zulick; Blue Crab by Virginia Tidewater Oyster Gardeners Association; Asian Shore Crab from a cage on the Rappahannock River in 2024 by Carl Zulick; Boring Sponge, Mud Blister Worm and Flatworm by Virginia Institute of Marine Science; Oyster Drill Snail by The Chesapeake Bay Program.

Predators...

Blue Crab

(Callinectes sapidus) Blue crabs are voracious oyster predators and the most serious threat to oysters. They will enter the bags in early to late summer while they are very small and will grow up eating some young oysters. Regularly inspect floats and bags and remove any crabs.

Asian Shore Crab

According to the USDA, the Asian shore crab (Hemigrapsus sanguineus) is an invasive species likely introduced in ship bilge water from Asia. It ranges in the US from Maine to the Carolinas. Larger than a mud crab at up to 2 inches, this crab competes with native crustaceans and preys on other native species including mollusks, so might be a threat to spat.

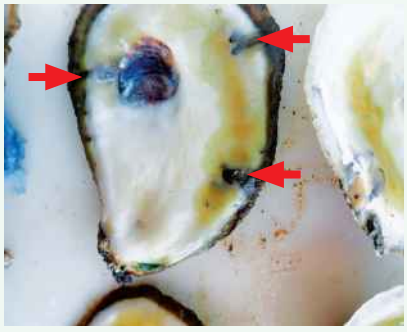
Flatworms

(Stylocus ellipticus) are flat, pale green, yellowish-brown, or salmon-colored worms, usually one inch or less, that slide between the valves of oysters and eat the meat when the oysters are small in late spring or early summer. The preferred treatment for flatworm is a brine dip.

Boring Sponge

(Cliona celata) are filter feeders that burrow into, and weaken shell (watch for series of holes with light yellow sponge tissue visible), usually affects 3–4-year-old oysters in high (18+ppt) salinity. The sponge can generally be ignored, but severe infestation can make oysters unsightly and (rarely) cause mortality. A brine dip can control the sponge.

Polydora-Mud Blister Worm



(Polydora websteri) Polydora worms are small, less than an inch in size, and burrow into the oyster shell where they make their home. Red worms may be mistaken for Polydora. The oyster host attempts to wall them off by laying down new shell, producing blisters on the inside shell surface or inside the adductor muscle. Polydora are rarely seen, as they stay in tunnels inside the shell and blisters. Infection rarely causes death and oysters are edible, but if the blisters are broken during shucking, thin flakes of shell and mud may be deposited on the meat. They also weaken the shell making it more difficult to shuck without breaking or crumbling, especially with triploids which have thinner shells. Polydora can be managed with routine air drying in moderate sun and possibly with brine dips.

Oyster Drill Snail

Oyster drills are snails, about ½" – 1" in size. They kill oysters by drilling through the shell and eating the meat. Oyster drills live in high salinity areas and are not a problem for most gardeners. They may be controlled by heavy brine dips, but only if the oysters are large enough to survive this treatment.

Photo above left: Mud blister worm (Polydora). Red arrows show worm burrows and mud seen through the thin layer of new shell growth. Polydora infestation weakens the shell. The larger, circular dark area is the adductor muscle scar, not a blister.

Lynn A. Nash, PhD, New Gardener

I'm one of TOGA's new gardeners—I picked up my float on May 27th, the spat on June 3rd and hoped and prayed that I did it right when I got them in their mesh bags and into the water. I'm happy to report that both the diploids (2nd photo) and triploids (3rd photo) are doing great. I'm amazed at how much they've grown here in Deltaville. I got my permit from the State, and I'm looking to share my oysters with my neighbors. I would never have been able to do it without TOGA's help.

Photos left to right: 1: Here goes! First time gardener Lynn Nash gets "the kids" ready for their first swim in a flip float. 2: Diploid spat quickly outgrew a fine mesh bag. 3: 10 weeks later, the "triploid kids" have tripled in size. Who knew they would grow so fast? Photos courtesy of Jay Nash.

Vic (TOGA Board Member) - NASA Engineer With a New Mission

One of the things I enjoy is creating contraptions, not only oyster cages, but the tools we use to build them. The demand for TOGA floats and various containment devices (especially for spat) at TOGA's Spring and Fall Float Sales has skyrocketed, doubling in two years. Anything we can do to produce devices faster, cheaper and easier really helps. And the dedicated volunteer float builders who come to TOGA Float Building Workshops help even more. Seems we can never build enough, but that's good for oysters and good for the Bay!

Photos left to right: 1. Spring 2023 Float Sale at Deltaville Maritime Museum. Drone photo courtesy of Kent Eanes. 2. High speed wire cutter saves time and labor when we are building hundreds of cages. Photo courtesy of Judy Spain.

Photos left to right: 1. High speed wire cutter, wire bender, new types of spat containers and a Tidal Tumbler. Photo courtesy of Vic Spain. 2. Vic (in orange) proudly working with Hampton City Schools teachers, ready to deploy cages and spat bags he helped their schools with. Photo submitted by oyster champion Betsy McAllister, standing far right.

John B. Reeves, Rockingham and Mathews, VA.

BEWARE of Vibrio infections- wading in Creek or handling gear

At my family house in Mathews County VA, I have tried various floating oyster bags since 2003 to help protect about 120' of exposed shoreline. After receiving a VMRC permit, my experiment now uses a strong rope, held about 25' into the creek by strong bamboo poles and a series of 17 floating bags tied on rope (bags with 80 or so native oysters or just oyster/mussel shells which collect wild spat).

In July of 2021, some floats needed repair and the tide was low. I quickly put on work shoes and waded through the 3-4" deep mud to the floats. That evening, I felt some pain in my right ankle and saw there was a small cut. So, I did the first aid cream and band-aid. At bedtime, the wound looked worse. The next morning, I was hurting and got packed up to drive home to Harrisonburg. When I got home my wife quickly directed me to the ER. Since I have a blood disorder, the ER Doctor started IV antibiotics and admitted me.

The infection soon sent red streaks up my leg, and my blood doctor visited daily and ordered a mix of IV antibiotics. Thankfully, my doctor grew up in Maryland and suspected a type of Vibrio. Surprisingly, the lab did not identify the type of infection. After six uneasy days of IV antibiotics, I got discharged with lots of oral antibiotics and instructions.

Since that close call when I could have lost my leg or worse, I have always used good wading boots, water-proof gloves and keep peroxide or Clorox close to immediately treat any cut or scrape in the water.

(Editor's note: TOGA has 12 highly experienced Board Members who have raised oysters for years and are very aware of the threat of vibrio, yet 2 of those members have contracted it. Be careful, especially when the water is warm. Don't wait to see a doctor and get treated.)

Photo: Shoreline Grass thrives with protection that floating bags provide. Photo courtesy of John Reeves.

Kathy Hoffmann, Mundy Pt., VA. - Wilkens Creek off the Yeocomico River

I've been gardening since 1999. I have discovered that you really don't need to clean oysters until you are ready to harvest them. Cleaning floats is incredibly easy: Transfer oysters from fouled and barnacle-laden floats to a clean float. Wait for the dirty floats to dry out and barnacles to die. Use a stiff brush and plastic scraper on the wire and easily pop off the barnacles from the PVC pipe with a scraper or small putty knife.

Photos: Float retrieval pulleys and barnacle encrusted floats, ready to clean. Photos courtesy of Kathy Hoffmann.

Chef Vic Chapman MOG Class of 2022 - I Love Oyster Gardening!

Introduced to the Northern Neck in 2020 as a COVID run-away from the crazed neighbors in Old Town Alexandria, we found ourselves saying “yes“ to waterfront land and decided to move. Our weekend getaway became a compound, and we received a housewarming gift of spat, bucket, gloves, and a cage all handsomely wrapped with literature from TOGA. I was intrigued and in awe that I could grow an oyster. As a chef, give me lettuce, radishes, tomatoes, basil…but an oyster? Wow!

After a little research and a VMRC permit, I started my adventure. Two cages became four and four have now become nine. It’s amazing what happens when you leave the diploids and triploids on their own and how they grow and change over time. Year after year and house guest after house guest, we are all excited to see what the new season will bring.

I may be more neurotic than most growers. I fancy deep cleaning eating oysters grown in good water quality. I have learned to keep them under the dock for less light and therefore less algae growth and to shake often to keep out unwanted visitors/critters. It’s what keeps me visiting them often.

The fact that we can help clean the Bay and tributary rivers through man-made oyster reefs and affordable individual cages on private property is amazing. Why not help? We all benefit; it’s a win-win… I may have to add another cage!

Deborah Mantlo, Bayport, VA.

Boy Scout Troop 521 Eagle Scouts built cages in 2018, and Mom continues to use them to grow oysters in Bayport on the Rappahannock River. Oyster gardens make great school science, ecology, or scout projects.

Photo right: Deborah uses a jet ski lift to raise a well-stocked, heavy Taylor Float. Photo courtesy of Deborah Mantlo.

Photos on previous page and left: Vic, sporting fancy protective gloves and gear, managing her oysters near White Stone VA. Photos courtesy of Jack Chapman.

Hampton City Schools Wins 2023 Governor's Environmental Excellence Award

With the help of TOGA and other community partners, Hampton City Schools has established a flourishing oyster restoration program where 21 teachers from 13 schools raised oysters with students in 2022-2023. Since 2015, when the division's oyster restoration efforts began, teachers and students have placed more than 120,000 oysters on sanctuary reefs in the Hampton and Back Rivers. Oyster restoration is the vehicle used to teach Virginia Science Standards of Learning concepts such as data collection, water quality, sampling techniques, anatomy and physiology, animal adaptations, food chains and webs, animal classification, and measurement. Students in the Maritime Academy at Hampton High School worked with TOGA members Vic Spain and Brian Ingram to construct oyster floats for TOGA's spring sale, as well as spat cages for HCS teachers who want to join in the efforts. According to Betsy McAllister who coordinates the program for the school division, "In a very real way, Hampton City School teachers are engaging students as citizen scientists and helping them to understand that, individually and collectively, they can have a positive impact on the Hampton Community, the Chesapeake Bay, and beyond."

The program was awarded a Governor's Environmental Excellence Award in the spring of 2023. (Editor's note: Middlesex County VA Schools have integrated TOGA's free Oyster 101 curriculum into their Environmental Education Plans.)

TOGA Board Members Vic Spain and Brian Ingram proudly display the 2023 Governor's Environmental Excellence Award for the oyster project given to Hampton City Schools. Photo submitted by Betsy McAllister.

Hampton City Schools Wins 2023 Governor's Environmental Excellence Award

Photos clockwise from top: 1: A Hampton City Schools student measures spat to record growth. 2: Students enthusiastically spell out T-O-G-A while showing a truckload of cages they made. 3 and 4: Students at Hampton City Schools learn how to make an oyster cage. Photos submitted by Betsy McAllister.

Dave Coakley, White Stone, VA. - Aw Shucks!

Well, I have had some wins and some losses. I was introduced to the Oyster Garden World by Captain Tom at the Irvington Farmers Market @ 12 years ago. That first harvest via “flip float” may have been my most successful and fun! No clue what I was doing.

One year when I got behind schedule, I failed to move the little critters from a Stage “1” bag in time and lots of them grew (fused) together. Oyster Stew became a popular menu item at our home! Last year I put a sturdy 3” deep plastic soup container into the Phase 1 bag and it worked like a charm, taking the “squeeze” pressure out of the early bag picture.

5 or 6 years ago a thief cut through the top of my Taylor Float and robbed the Bay of potential future spat, so that was a loss on several levels. 24/7 video was an easy and effective solution to that, so “no worries” ever since!

All in all, Oyster Gardening is terrific fun…and delicious eating. Nothing beats enjoying our family dock on the Rappahannock and shucking a few right out of the River at sunset. Next crop will try riding in a Tidal Tumbler!

Tom Quigley - Oyster Calling

I derive a lot of pleasure in talking to people who are interested in, but have little knowledge about oysters, their life cycle, origins and habitat. So, when I reveal that I am an oyster gardener, it prompts many questions and suppositions that I enjoy explaining. Sometimes, I answer with a factual, complete reply and, depending on the circumstances and the nature of the inquirer, I may wander (leap) into light-hearted prevarication.

For example, I am often asked how I grow oysters or how I collect them. Most of these types of questions are open to any imaginable reply. I remember my father who expressed wonder that city kids (he was farm-raised) had no idea that milk came from cows. Rather they thought markets produced milk by some unknown process. So, I sometimes become creative in my reply. To the question, "How do you collect oysters?”, I reply that I wait until low tide then wade through the mud and dig them out by hand, being careful not to be pinched by an aggressive 2 or 3-year-old bivalve. My favorite reply is that I "call" them to me. I lay on my stomach on the dock at high tide, reach into the water and clap my hands. Sound travels well through water, so the oysters then hydraulically propel themselves upward to my waiting hands - again being cautious not to be pinched. You see, I raise triploid oysters (unable to reproduce themselves) and they are bred to be docile and unaware of the consequences of my grasping them as they come to me. One caveat to consider is that oyster-calling takes practice and you must train them to respond. Most people who are unfamiliar with oysters won't know if I am even close to telling the truth. Some are immediately skeptical.

If there is time, I finally explain that I raise triploid oysters in a floating wire cage. Commercial growers often cage them on the bay's floor but growing them in a floating cage is how I do it. It keeps them from wandering away. It is all in fun. In the end I explain the history of bay oysters and how beneficial oysters are to the bay's health and that raising them as an oyster gardener is an interesting pastime which produces a delightful morsel for oyster lovers. I must end this treatise now and go train my oysters to respond!

Editor’s Note: New oyster gardeners now have the opportunity to learn all they need to know about starting an oyster garden from TOGA’s class “Basic Oyster Gardening 101”.

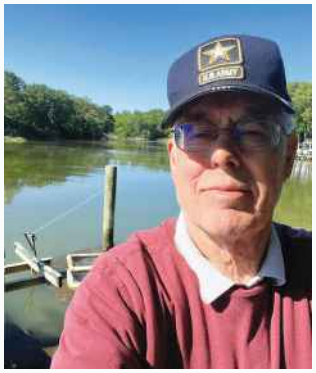


Photo: Tom Quigley and his oyster floats. Photo courtesy of Tom Quigley.

Photo above: Wild Spat Cage. Photo courtesy of Carl Zulick. Photo right: Roasted oysters on the BBQ. Photo courtesy of Carl Zulick.

Kent Eanes - Oyster Gardener Profile

Oyster Gardener Profile
Kent Eanes

I have zero doubt, if you ask ten different oyster gardeners for a list of their techniques, you're going to get ten different lists. Yes, the basics will be the same, oysters, containment device, in minimum 8ppt salinity water, but the peripheral items will be different. I say this because I don't want anyone to think that my list is "the" list that you have to follow or else. There is no "or else." To quote a gardening peer, "there is no wrong way to grow oysters" (within reason).

Garden Location
Mill Creek, Northumberland VA

Years Gardening
Fifteen

First Device
Taylor

Current Devices
4 Taylors 1 Tidal Tumbler

Oyster Types Grown
Diploids & Triploids

Spat Vendors
OysterMama 804-725-8557
Capt Tom's 804-580-5021

Reason for Gardening
Food, environment, pleasure

Shell Discard
Mill Creek (June)

Master Oyster Gardener
Since 2017

Mentors
Jackie Partin
Vic Spain

Advice to New Gardeners
Start slow. I've seen new enthusiastic gardeners go crazy and buy 5 devices and 4000 spat to start their garden. There's nothing wrong with easing into an oyster garden.

Questions:
Kent@kenteanes.com

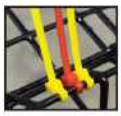
1 Even just half filled with oysters, Taylor floats can get very heavy, so we've opted for this schedule 80 aluminum davit. Money well spent! They can be found on Ebay with brackets. At the Ebay search type in "Premium 2 Piece Crab Shrimp Lobster Pot Puller Davit Kit". There are many different crank types at Harbor Freight. We did switch out the cable with a stainless steel one after a few seasons.

2 Having a single hanging point makes cleaning cages and floats an easy task. We just position ourselves in one spot and spin the device around. We use a good stiff scraper to clean the PVC floats. We do this once a year, including the use of a power washer on the float and cage but not the oysters. To clean the oysters we use a good stiff brush but only do so when harvesting/eating (or doing a little showing off).

3 Two stainless steel cables are permanently connected to our Taylor floats. The cable loops are long enough to ease to each side to be able to open the cage lid. The cables are woven through the bottom of the cage. Copper crimps are used to make the loops. Willing to email more detailed photos.

4 We attach stainless steel pet tags to our cages for contact information in the event a cage breaks free. These don't get as fouled as other methods and if they do get fouled they wipe clean with ease. (Amazon GoTags)

5 Small color zip-ties attached to a cage help us track results stored on my phone. For example, yellow-red-yellow: 3/4 inch spat May 2020 Vendor: Oyster Mama, Type: Triploid, 1 year size 3.5inch. If we transfer a batch of oysters to a different device, we will transfer the zip ties. This is a total oyster-geek item.



6 All manner of critters call oyster cages home, from mud crabs to minnows. If you're working with a cage on your dock, these critters end up in-between the boards and are nearly impossible to free. Placing your lifted cage onto a tarp eliminates this issue.

7 Not only is a floating dock the best way to access the water with kayaks and paddle-boards, but floating docks are also ideal for maintaining oyster cages and harvesting oysters. If we're just going to harvest, we won't use the davit. Instead, we untie the cage from the dock and, with a boat hook, drag/float the cage down to the floating dock.

8 I use our TOGA tidal tumbler & spat tube as the "nursery". New spat start in this device and remain there for a few months during the growing season, until they are large enough to transfer to a Taylor (no spat bag), large enough not to fall through the cage or have the oyster hinge get stuck in the cage.

9 We've heard too many stories of lost cages from storms so we don't mess around with line diameter. We use UV weather-resistant lines in the 1/2 - 5/8 inch range.

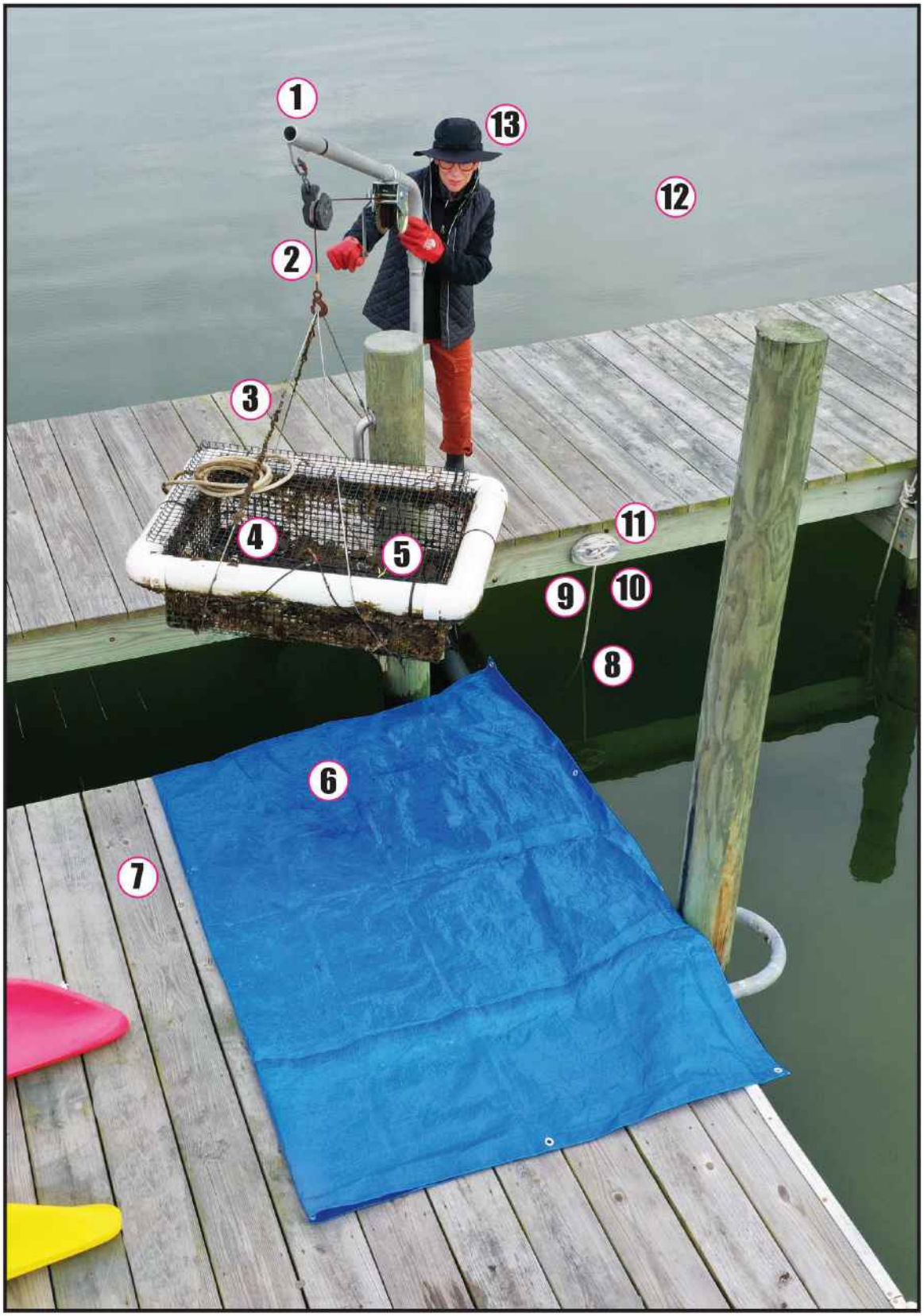
10 We buy spat in the 1/2 - 3/4 inch size range and have even bought over-wintered 1 inch spat. First, larger spat has a reduced mortality rate. Second, larger spat does not require the extra fine mesh spat bags which are more prone to fouling in the growing months with algae, so more maintenance is required to keep the fine mesh clean. Fouled spat bags = less water flow. Less water flow = less food for the oysters. Less food for the oysters = reduced growth. We return our discarded shells back to the creek early June. And we will also release live oysters back to the creek as well. Last year, I returned about 75 gallons of live oysters back to the creek for environmental reasons.

11 We use large cleats to attach our devices to the dock. They make it easy to adjust line lengths for tide changes, storms etc.

12 Salinity levels in Mill Creek are very good for oyster growth. Normally in the 18-20 ppt range (parts per thousand).

13 Getting your significant other to embrace the oyster garden...priceless! Working smart, there's actually not much maintenance involved in an oyster garden, but to be able to cut the workoad in half is so worth having a partner.

Kent Eanes - Oyster Gardener Profile



Appendix - Oyster Gardening Websites and Contacts

Aquaculture Information

Virginia Marine Resource Commission (VMRC) Shellfish Management Division:
www.mrc.virginia.gov/Shellfish/index.shtm

Shellfish Growers of Virginia Association:
757-238-2003
www.vashellfish.org/

Extension Support
Virginia Institute of Marine Science (VIMS)
Sea Grant Advisory Services
Karen Hudson, (804) 684-7742, khudson@vims.edu
www.vims.edu/bayinfo/habs/researchers/hudson_kl.php

Chesapeake Bay Watershed

Chesapeake Bay Program - www.chesapeakebay.net/discover/watershed

Chesapeake Bay Foundation - www.cbf.org/about-the-bay/bay-facts.html

National Park Service - www.nps.gov/locations/chesapeakebaywatershed/index.htm

Virginia Department of Forestry - dof.virginia.gov/water-quality-protection/learn-about-water-quality-protection/chesapeake-bay-watershed-and-virginia/

Eating Oysters

Virginia Marine Products Board - www.virginiaseafood.org/recipes/ (Great Recipes!)

Shucking from the Lip- Deb Prat Video -
www.facebook.com/BayDirectVA/videos/how-to-shuck-a-virginia-oyster/126685572736754/

Shucking from the Hinge - www.youtube.com/watch?v=awOFU95fRSQ

How open oysters without a knife - www.youtube.com/watch?v=bXKeVUNg8v8

Virginia Oyster Trail - virginiaoystertrail.com/

VIMS - Is it Safe to Eat My Oysters - www.vims.edu/research/units/centerspartners/map/shellfish-aquaculture/_docs/2022_is-it-safe-to-eat-my-oysters.pdf

Oyster Anatomy and Physiology

Chesapeake Bay Program - www.chesapeakebay.net/discover/field-guide/entry/eastern-oyster

Virginia Institute of Marine Science - www.vims.edu/public/msd/news/oysters-how-much-do-we-know.php

TL Morris Seafood - www.tlmorrisseafood.net/oyster-anatomy/

Maryland Sea Grant and NOAA - www.mdseagrant.org/interactive_lessons/oysters/labs/internal_anatomy_lab.html#

Oyster Disease Information and Research

VIMS Oyster Disease Monitoring - www.vims.edu/research/units/labgroups/molluscan_health/index.php

Disease Resistant Oyster Research - VIMS Aquaculture Genetics and Breeding Technology Center - www.vims.edu/research/units/centerspartners/abc/index.php

Oyster Gardening

Virginia Marine Resources Commission - Shellfish Farming and Gardening - www.mrc.virginia.gov/Shellfish_Aquaculture.shtm

Chesapeake Bay Foundation - www.cbf.org/how-we-save-the-bay/programs-initiatives/virginia/oyster-restoration/oyster-gardening/

Maryland Sea Grant - www.mdsg.umd.edu/topics/oyster-gardening/oyster-gardening

Tidewater Oyster Gardens Association (TOGA) - www.oystergardener.org/

Virginia Institute of Marine Sciences - www.vims.edu/research/units/centerspartners/map/shellfish-aquaculture/oyster_gardening/index.php

Oyster History

TOGA - www.oystergardener.org/oysterhistory

University of Maryland Center for Environmental Science - www.umces.edu/oysters/history

Virginia.org - www.virginia.org/blog/post/virginia-oyster-history/

Oyster Reef Ecosystems

NOAA - Oyster Reef Communities in the Chesapeake Bay - www.fisheries.noaa.gov/national/habitat-conservation/oyster-reef-habitat#:~:text=Oyster%20reefs%20create%20important%20habitat,%2C%20invertebrates%2C%20and%20other%20shellfish

NOAA - www.fisheries.noaa.gov/feature-story/oyster-reefs-provide-habitat-and-filter-water-findings-show

NOAA - www.fisheries.noaa.gov/infographic/infographic-value-oyster-habitat

Nature.com - www.nature.com/articles/s41598-022-11688-6

Oyster Restoration

The Nature Conservancy - https://www.nature.org/en-us/about-us/where-we-work/priority-landscapes/chesapeake-bay/

NOAA Chesapeake Bay Office - www.fisheries.noaa.gov/topic/chesapeake-bay/oyster-restoration

Chesapeake Bay Program - https://www.chesapeakebay.net/news/blog/restoring-oyster-reefs-in-the-chesapeake-bay-takes-four-steps

Chesapeake Bay Foundation - www.cbf.org/how-we-save-the-bay/programs-initiatives/virginia/oyster-restoration/virginia-mobile-oyster.html

Oyster Recovery Partnership - www.oysterrecovery.org/?gclid=EAIaIQobChMIiMynr9jlgwMVV2BHAR16EwqbEAAYASAAEgLtg_D_BwE

US Army Corps of Engineers - Norfolk District - www.nao.usace.army.mil/About/Projects/Oyster-Restoration/

VCU Rice Rivers Center - www.ricerivers.vcu.edu/research-and-restoration/virginia-oyster-shell-recycling-program/why-recycle-oyster-shell/

Virginia Coastal Zone Management Program - https://www.deq.virginia.gov/our-programs/coastal-zone-management/coastal-conservation/habitat-restoration/oysters

Virginia Institute of Marine Science (VIMS) Molluscan Ecology – www.vims.edu/research/units/labgroups/molluscan_ecology/

VIMS Oyster Monitoring Program - www.vims.edu/research/units/labgroups/molluscan_ecology/archive/norm/index.php

Permits

Virginia Marine Resources Commission (VMRC) Shellfish Farming & Gardening -
380 Fenwick Rd, Building 96
Fort Monroe, VA 23651
757-247-2200
webapps.mrc.virginia.gov/public/habitat/gp3/

TOGA Link to VA permit - www.oystergardener.org/agencies-permits

Teacher Resources

Virginia Institute of Marine Science - Advisory Services - www.vims.edu/research/units/centerspartners/map/education/

MD Sea Grant Oyster Anatomy Laboratory - www.mdsg.umd.edu/lesson-plans/eastern-oyster-education

NOAA - www.fisheries.noaa.gov/infographic/infographic-value-oyster-habitat

TOGA School Resource - www.oystergardener.org/about-oysters and www.oystergardener.org/oyster-gardening-101

Virginia Aquaculture

Virginia Aquaculture Association - www.facebook.com/VirginiaAquaculture/

East Coast Shellfish Growers Association - www.ecsga.org

Water Quality and Shellfish Safety

Virginia Department of Health, Shellfish Safety, Closures and Condemnations -
www.vdh.virginia.gov/environmental-health/environmental-health-services/shellfish-safety/

Virginia Department of Environmental Quality -
www.deq.virginia.gov/our-programs/water/water-quality

TOGA - www.oystergardener.org/safety-sanitation

VIMS - Is it safe to Eat My Oysters - www.vims.edu/research/units/centerspartners/map/shellfish-aquaculture/_docs/2022_is-it-safe-to-eat-my-oysters.pdf

Notes:

Photo Back Cover: TOGA Members Vic and Nick plant shell at an oyster reef. Photo courtesy of Kent Eanes.

Oyster Gardening Basics Quick Guide

Tidewater Oyster Gardeners Association

*Did you know??? One oyster filter up to **50 gallons of water a day** under ideal conditions.*

Help restore the Chesapeake Bay! ***You*** can make a difference with an Oyster Garden - a type of Aquaculture.

Grow them for fun, for delicious food (eat them cooked if raw isn't your thing) AND help save the Bay.

The basics are EASY. Have waterfront on the Bay/River/Creek, or know someone who does? You can be an Oyster Gardener.

To have an Oyster Garden:

1. Ensure your water is at least 1.5 feet deep at low tide and brackish (part salt and fresh: min of 5-7 parts per thousand, ideal at 14-30). Most of the Bay and its estuaries are.
2. Go online to submit a FREE **VMRC Oyster Gardening Permit** at webapps.mrc.virginia.gov/public/habitat/gp3/.
3. Find the **VA Dept of Health current classification of your water.** (approved or condemned for eating shellfish). https://www.vdh.virginia.gov/environmental-health/environmental-health-services/shellfish-safety/conditional-shellfish-harvesting-status/.
4. Buy a **mesh bag** (smaller holes for babies) and a **float** (see TOGA website for resources).
5. Purchase your **baby oysters, called SPAT.**
6. Place spat in a mesh bag, and the bag in the cage. (When oysters are over 1.5 inches long, release them from the mesh bag into the cage.

Oyster Care and Cage Maintenance: Cages, floats, and bags need to be kept clean enough for water to flow through. In warmer months (Apr-Nov): ideally shake, tumble or wash oysters and cages every month or more. Remove small blue crabs from the cage. Periodicallys, air dry the cages and oysters for a few hours to kill off parasites and clean the cages. In winter months, check ropes and owner labels are intact and secure. Oysters survive in cold water, but don't let them freeze while exposed to the air.

7. Watch them grow and periodically maintain the cage.

TOGA (Tidewater Oyster Gardeners Association) can help with all your questions! Join the non-profit and save on supplies at one of TOGA's Float and Spat Sales (spring and fall). Visit OysterGardener.org to learn more, donate, find supplies, and more!

Virginia Coastal Zone
MANAGEMENT PROGRAM

VMRC
Virginia Marine Resources Commission

River Counties Community Foundation

National Oceanic and Atmospheric Administration
NOAA
U.S. Department of Commerce

VIMS | William & Mary
Virginia Institute of Marine Science

VDH Virginia Department of Health
Protecting You and Your Environment

www.OysterGardener.org