

An Overview of the History of Oysters in the Chesapeake Bay

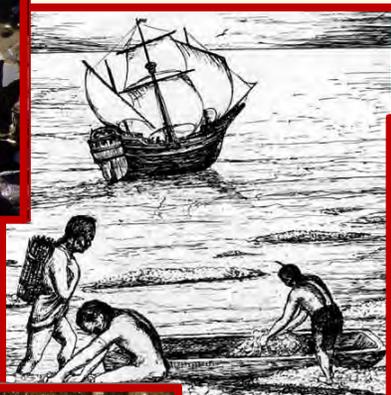
- 2023 Update -

by Vic Spain, Master Oyster Gardener



The reefs

The Natives



The wars



The oyster



"And the tragedy of the commons for the Chesapeake Bay was that men believed that the resources were available to all to exploit because the resources of the bay were inexhaustible."
 John R. Wennersten

The collapse



The packing houses



The boats

Aquaculture



Editor's Note: The original printing of this document was in 2017 and included pages 1 through 16. Pages 17 through 23 provide updated information available after 2017.

An Overview of the History of Oysters in the Chesapeake Bay

by Vic Spain, Master Oyster Gardener, 2017

Introduction

The Chesapeake Bay is a unique and beautiful estuary, once a pristine and bountiful home to Native Americans as well as the European settlers of the seventeenth century. The oyster reefs were so prevalent that they were navigational hazards to the early explorers but also helped the colonists avoid starvation.

Because of relatively low population densities and lack of transport in the early days, harvesting of the bivalves that filtered and cleansed the Bay had little effect on the environment. Over-harvesting and destruction of the oyster habitat seemed to have been first noted in the mid-1800s.

The end of the Civil War resulted in a huge labor force from ex- soldiers, freed slaves and immigrants, all desperate to make a living. Combined with completion of the transcontinental railway in 1869 and improved shipping, Maryland and Virginia experienced an oyster boom from which they are still trying to recover. But the difficult and tenuous recovery has in fact started.

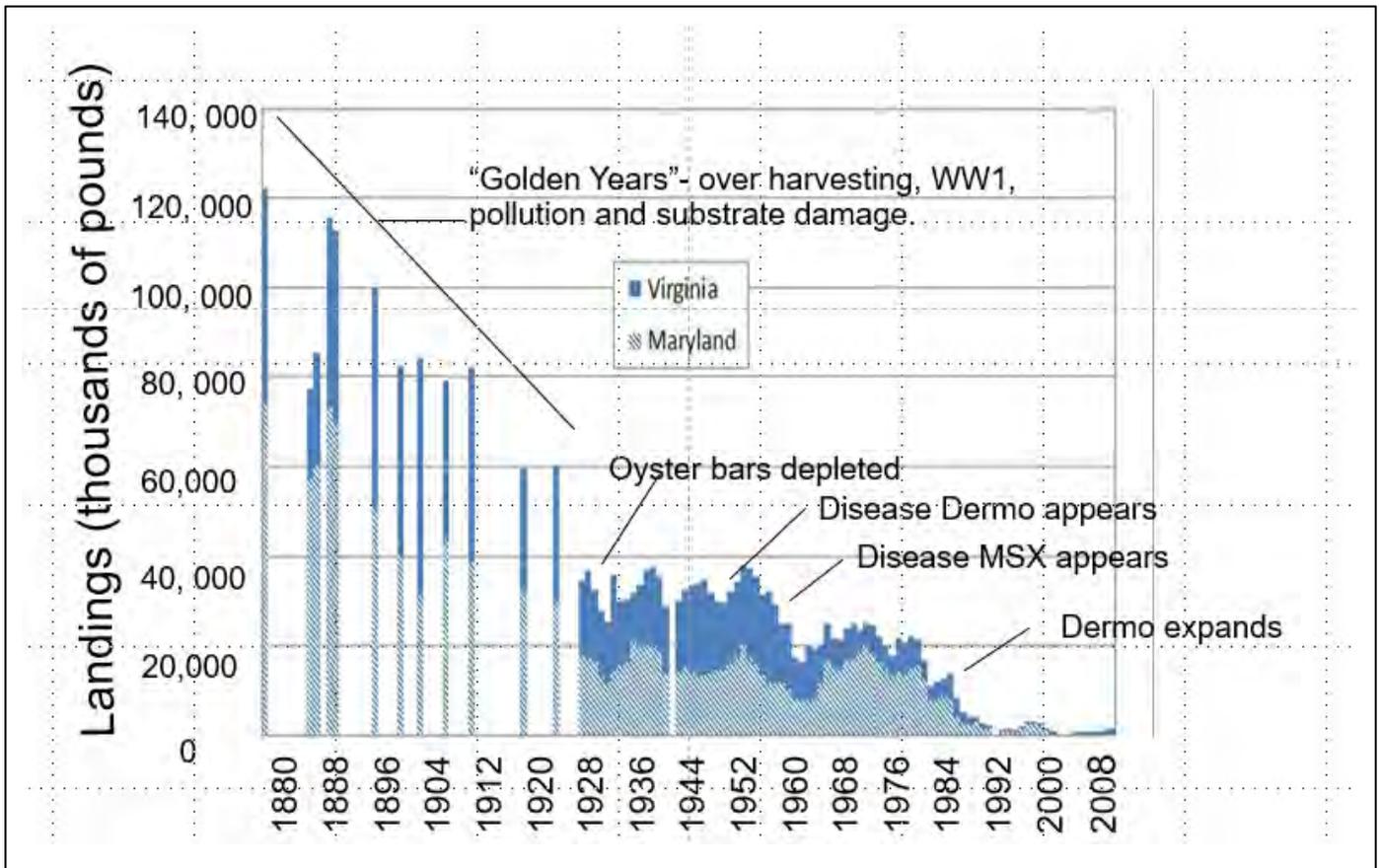
History teaches that dense human populations will exploit a common resource until it is exhausted. So we should not be too surprised by the story that follows.



Chesapeake Oyster History at a Glance

The plot shows how the boom in oyster harvest following the Civil War went into steady decline until the collapse in the 1990s.

Chesapeake Bay Oyster Landings by State, 1880-2011



Source of graph-National Oceanic and Atmospheric Administration. Accessed 7/16/2017.
<https://chesapeakebay.noaa.gov/fish-facts/oysters>

10,000 Years Before Present (BP) to 3,000 years BP How the Chesapeake Bay Formed and was Populated by Oysters

The modern Chesapeake Bay was created by glacier melt running down the Susquehanna River Basin and the rising sea level submerging the enlarged valley. The Bay reached its approximate present day form about 3000 years ago. Oysters (*Crassostrea virginica* aka the Eastern Oyster) populated the Bay and formed reefs that grew vertically and horizontally as sea level rose. Oyster reefs often grew vertically with peaks above low tide level.



Natural oyster reef at low tide in a Georgia preserve.
Photo by Vic Spain, Master Oyster Gardener

References:

Miller, Henry M. "The Oyster in Chesapeake History." Historic St. Mary's City, MD. Accessed 8/2/2017.
<https://www.hsmcdigshistory.org/pdf/Oyster.pdf>.

Harding J. M., Mann, R. *Oyster Reef Communities in the Chesapeake Bay: A Brief Primer*. Virginia Institute of Marine Science, 1999. VIMS VORTEX Program.

3,000 years BP to 1607 Native Use of Oysters

Archaeologists learn about the extensive ancient use of oysters from the many oyster shell middens (ancient shell and debris piles) found throughout the Bay area. For example, the Goldman Oyster Shell Midden Site near Colonial Beach, Virginia was occupied regularly during the Middle Woodland period, approximately 500 B.C.– 900 A.D. Native Americans mostly visited the site in the spring when their other food stocks were running low. The period was determined from analysis, including radiocarbon dating of the pottery scraps, firewood, tools, animal bones and debris found in the middens. The time of the year was determined by the fact that the smaller shells did not show spat (baby or seed oysters) scars, whereas the larger shells did. This indicates that the oysters were harvested before the summer spat set.



**The Goldman Oyster Shell Midden Site
near Colonial Beach, Virginia**

References:

Monroe, Elizabeth J. and Goodrich, Kevin with Contributions from: Juliana Harding and Justine McKnight. "Archaeological Data Recovery at the Goldman Oyster Shell Midden Site (44WM0304) in Westmoreland County, Virginia."

A Project Supported by the Virginia Department of Transportation and the Federal Highways Administration, William and Mary Center for Archaeological Research, (April 2012).
https://www.wm.edu/sites/wmcar/documents/gouldman_osm.pdf.

1607-1781 Colonial Era

The English settlers came to the Chesapeake region with an acquired taste for oysters but they lacked basic survival skills and diplomatic ability with the natives. While starvation and disease were killing most at Jamestown, survivors depended heavily on oysters which were relatively easy to harvest. Archaeological studies of Colonial oyster middens have shown that the coastal communities relied on them throughout the 17th and 18th centuries.

By the Revolutionary War, deforestation and plowing of fields were the beginning of the run-off and siltation process that have plagued the Bay ever since (Livie, Kate, *Chesapeake Oysters, The Bay's Foundation and Future*, American Palate, A division of The History Press, Charleston, SC, 2015.)

Oysters were a local commodity and food source for the colonists, but the relative low density population and lack of shipping capability meant that oysters were not big business and could readily replenish. Oyster shells were used for roads and construction as well as for decorations. Colonial Williamsburg still uses oyster shells in their Christmas wreaths during the holiday season.

Col. Landon Carter (son of Robert "King" Carter of Lancaster County, Colonial Virginia Governor, 1726-1727) relates in his diary:

"Jan. 14, 1770. My annual entertainment (on Rappahannock) began Monday, the 8th and held till Wednesday night. The oysters lasted till the third day of the feast, which to be sure, proves that the methods of -keeping them is good, although much disputed by others".

"July, 1776. Last night my cart came up from John E. Beale for iron pots to make salt out of the Bay water, which cart brot me 8 bushels oysters. I ordered them for family and immediate use....Out of the 8 bushels I had six pickled and two bushels for dressing. But I was ask'd what Beale sent oysters up in July. I answered it was my orders. Who could eat oysters in July said the Mighty man; and the very day shew'd he not only could eat them but did it in every shape, raw, stewed, caked in fritters and pickled."

Landon Carter. "Diary." William and Mary College Quarterly Historical Magazine, XIII, 46; XVII, 17; XXI, 176-7.



Example of tabby concrete walls made by the colonists from burning oyster shell which converts the calcium carbonate to quicklime. Shells were also used as aggregate.

Wikimedia Commons.

Early 1800s Tongs and Dredges

By the early 1800s, New Yorkers and New Englanders had exhausted their oyster grounds. They came into the Bay with the windlass dredge, not then used in the Chesapeake Bay. Virginia, realizing that dredges could rapidly deplete oyster bars and that Virginia watermen used tongs and did not possess dredges, banned them in 1811. Maryland followed suit in 1820. Both the legal and illegal use of dredges has been a major issue ever since.

By the 1830s shipping and railroads had expanded, and Baltimore first opened an oyster packing plant in 1834. In the 1830s and 1840s, large oyster reefs were discovered in Tangier and Pocomoke Sounds, so deep they could only be harvested with dredges. Oysters were becoming big business.



Oyster pirates using windlass dredges.
Wikimedia Commons.



**TOGA member and waterman
Dudley Biddlecomb holding oyster tongs.**
Wikimedia Commons

References:

Miller, Henry M., *The Oyster in Chesapeake History*, Historic St. Mary's City, MD. Date unknown.

Shulte, David M. "History of the Virginia Oyster Fishery, Chesapeake Bay, USA." Department of Fisheries, College of William and Mary, Virginia Institute of Marine Science, Gloucester, VA, USA. *Journal- Frontiers in Marine Science*, May 2017. Retrieved July 16, 2017 from <http://journal.frontiersin.org/article/10.3389/fmars.2017.00127/full>.

1860s Post Civil War

Oyster harvesting was slowed by the Civil War and employment of watermen on military vessels and as spies. The end of the War brought a large labor force and rapid expansion of oyster harvesting, processing, shipping and sales. The dredge was reinstated in Virginia. The Transcontinental Railway (completed in 1869) allowed shipment of fresh Chesapeake Bay oysters to San Francisco. The “Boom” years were coming.



Oyster shucking room, Baltimore Maryland, late 1890s.

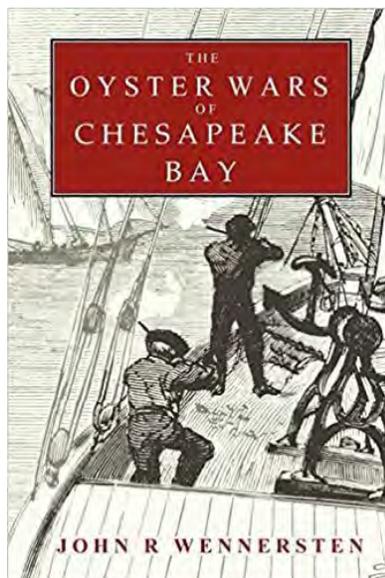
Source:

Stevenson, Charles H. “Preservation of Fishery Products for Food.” Bulletin of the United States Fish Commission, vol. 18, (1898), Washington, DC: Government Printing Office. *Wikimedia Commons*.

1870s

Oyster Wars and Golden Years Begin

Over harvesting and serious destruction of oyster bars were noted by scientists and marine surveyors. Oyster policing began but was often ineffective. Oyster pirates could usually out number, out sail, and out fight law enforcers. A wild and ruthless waterman culture prevailed. Oyster Wars continued off and on until the late 1950s. The wars were between Virginia and Maryland, tongers and dredgers, police and pirates (usually dredgers or “drudgers”), and ship captains and crew. Abduction, enslavement, murder, beatings, shootings, ship ramming and drownings were common.



Best book on the Oyster Wars

Wennersten, John R.

The Oyster Wars of Chesapeake Bay,
Tidewater Publishers, (1981).



Surrender of Sylvester Cannon

Sylvester Cannon was an oyster pirate who threatened a judge and was pursued by Maryland police.

See New York Times "PIRATICAL OYSTER CREWS; THE DESPERADOES VERY FREE IN THE USE OF THEIR FIRE-ARMS. THE POLICE BOAT AND A MAGISTRATE'S RESIDENCE SHOWERED WITH BULLETS—BLOODY DEEDS ANTICIPATED." Feb 15, 1884.

By Schell and Hogan.

(<http://www.loc.gov/pictures/item/2002698358/>)



Best audio about the Oyster Wars

by Ric Cottom, Your Maryland

4 minutes, 33 seconds.

Link:

<https://www.wypr.org/show/your-maryland/2021-03-12/gus-rice>

1880s-1920s The Golden Years, continued

Oyster harvesting peaked. William K. Brooks, pioneering biologist at Johns Hopkins University, published "The Oyster" in 1891 followed by revisions. Brooks discovered how oysters reproduce, argued for organized husbandry of the waters and oysters, and proposed oyster farming. "We have wasted our inheritance by improvidence and mismanagement."

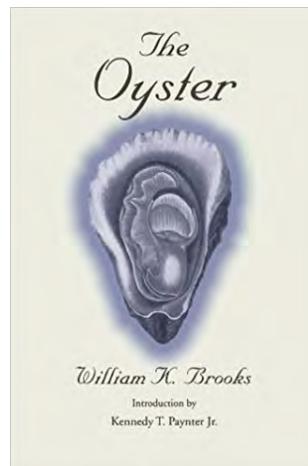
Brook's concerns about mismanagement were validated after the turn of the century. 1904 saw a temporary rebound, but the "Pure Food" scare in Virginia peaked in the 1907-1909 seasons, because of a typhoid outbreak associated with raw sewage, and caused a drop in demand rather than supply. But as shown in the figure on page 3, surveys indicated that important oyster bars were seriously depleted by 1928. Over harvesting, lack of effective controls and removal of shell from the Bay contributed to the decline. The "Golden Years" were over.

Gasoline power dredges were introduced in 1906, replacing the windlass dredge and easing pressure on crew sizes. Legislation was passed to protect crews from abuse. Due to over harvesting and run-off of industrial waste, fertilizer and animal and human waste, the biology of Bay waters began to change to a murky soup with more microscopic animals, bacteria and occasional oxygen-depleted dead zones.



Chesapeake Bay's oyster fishery removed significant amounts of shell, reef framework, and buffering capacity from the Bay.

Source of photo- David Malmquist, *Oyster reefs shown to buffer acidic inputs to Chesapeake Bay*, May 2013, accessed 7/19/2017 from https://www.vims.edu/newsandevents/docs/oyster_buffer.pdf



William Keith Brooks
in *Popular Science Monthly*, 1899
Wikimedia

References:

Brooks, William K. *The Oyster: A Popular Summary of a Scientific Study*. Johns Hopkins University Press, (1891).

Fincham, Michael W. "The Oyster Dreams of William K. Brooks: Could science save a seafood industry?", *Chesapeake Quarterly*, (April 2013).

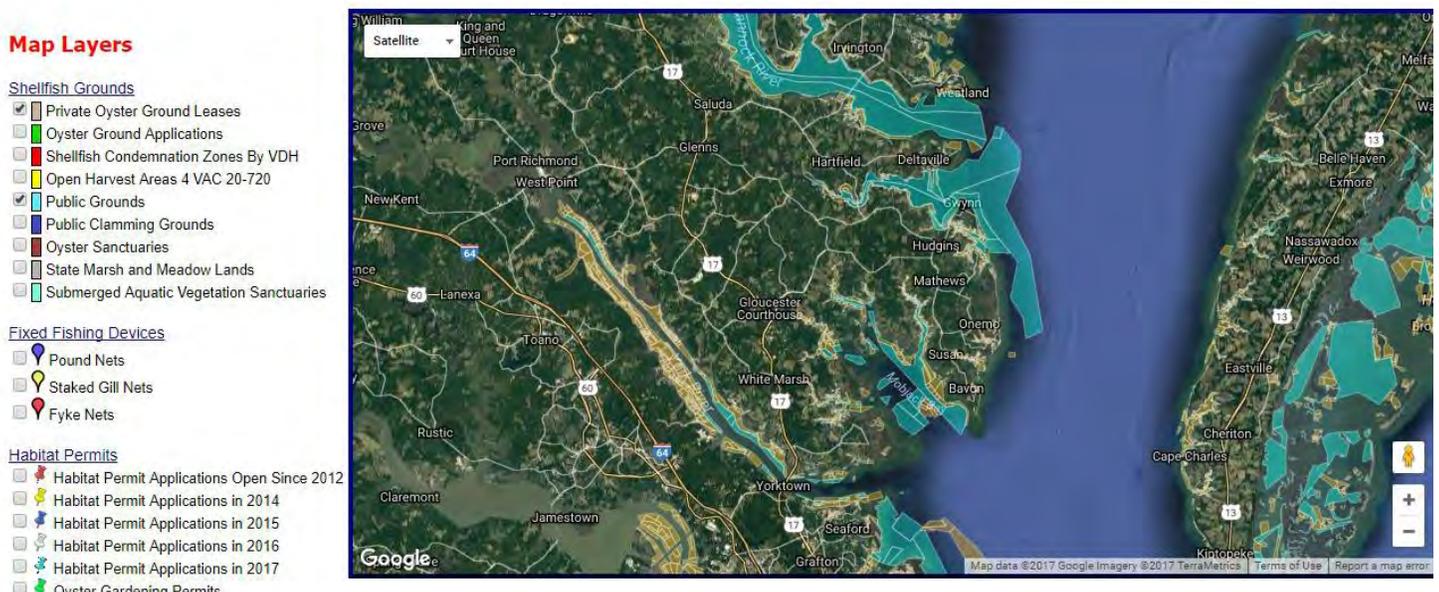
Shulte, David M. "History of the Virginia Oyster Fishery, Chesapeake Bay, USA." Department of Fisheries, College of William and Mary, Virginia Institute of Marine Science, Gloucester, VA, USA, *Journal- Frontiers in Marine Science*, May 2017. Website- <http://journal.frontiersin.org/article/10.3389/fmars.2017.00127/full>.

1880s-1920s The Golden Years, concluded

“The Constitution of Virginia, Article XI, guarantees that the natural oyster beds, rocks and shoals be reserved for public use.” From 1892 to 1894, James Baylor, from the US Coast and Geodetic Survey, surveyed the tidal waters of Virginia to map the naturally productive oyster beds, rocks, and shoals. These became public shellfish grounds. Potentially productive grounds outside public grounds could be leased as private grounds. This system is still in use today. Maryland did not adopt private grounds until the 21st century.

Quote from- Virginia Marine Resources Commission. *Historical Highlights*
<http://www.mrc.virginia.gov/vmrchist.shtm>

<http://www.virginiaplaces.org/natural/oysters.html>



Partial map of Virginia oyster growing area shows public (Baylor) grounds in blue, private leased grounds in beige.

https://webapps.mrc.virginia.gov/public/maps/chesapeakebay_map.php
(Accessed 8/11/2017)

1920s-1960s

Golden Years End, Mini-Boom, Oyster Diseases Invade Bay

The Great Depression and WW2 suppressed the global oyster market, but locally the fishery stabilized at a lower level than in the “Golden Years.” The 1933 hurricane wreaked major damage to watermen communities and equipment. The post-war years are sometimes referred to as the “oyster mini-boom.” See chart on page 3. The Virginia Fisheries Laboratory on the York River at Gloucester Point was founded in 1940 and later named the Virginia Institute of Marine Science and is now part of the William and Mary.

The disease Dermo (*Perkinsus marinus*) was first detected in the 1940s in the Gulf of Mexico and found in the Chesapeake Bay in 1949. It continues to cause significant mortality.

MSX (multinucleated sphere unknown) was detected in the Delaware Bay in 1957 and soon after appeared in the Chesapeake Bay. The organism devastated the Eastern Oyster in the Delaware and Chesapeake Bays, but for 40 years scientists could not determine its source. In the 1990s, genetic testing at VIMS determined that the MSX organism is carried by the *Crassostrea gigas* oyster from Asia which had been brought into the Bay to help rejuvenate the fishery. MSX does not harm the “*gigas*” but is deadly to the “*virginica*.”



The restored 1924 Chesapeake oyster buyboat F. D. Crockett is owned by the Deltaville Maritime Museum (photo used with permission). The buyboat was one of many types of oyster boats used in the 1900s. Buyboat operators would usually buy oysters from other working oyster boats and haul them in for processing, allowing the smaller boat crews to keep dredging or tonging. After the oyster fishery collapse of the 1990s, most buyboats were sold out of the Bay.

References:

Fincham, Michael W. The film “Who Killed *Crassostrea virginica*? The Fall and Rise of the Chesapeake Oyster.” Maryland Sea Grant, (2009).

Virginia Institute of Marine Science. “Oyster Diseases of the Chesapeake Bay.” Fact Sheet by VIMS, Gloucester, VA.

Chowning, Larry S. *Chesapeake Bay Buyboats*. Tidewater Publishers, Centreville Maryland, (2003).

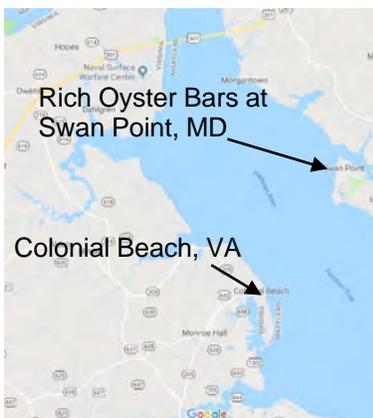
Potomac River Fisheries Commission. “History and Mission Statement of the PRFC.” PRFC.us/history.html.

Virginia Institute of Marine Science. “History: A history of marine science in a historical setting.” <http://www.vims.edu/about/history/>.

1959 The Last Battle of the Oyster Wars

In 1942 a rich oyster bar was found off Swann Point, Maryland, across the Potomac River from Colonial Beach, Virginia. This combined with long-standing disputes between Maryland and Virginia ultimately led to shooting encounters between Maryland oyster police and Maryland and Virginia oystermen poaching with dredges in the Potomac River which is part of Maryland. One night in 1959 a Colonial Beach resident on board a high-speed dredge boat (to keep his friend company) was shot and killed by pursuing Maryland oyster police. That is usually considered the end of the Oyster Wars and led to the formation of the Potomac River Fisheries Commission (PFRC) ultimately signed into law by President John F. Kennedy in 1962.

Colonial Beach resident Berkeley Muse on board a high-speed dredge boat was shot and killed by pursuing Maryland marine police.



The Battle Ground on the Potomac River



Landon Curley's Oyster Packing House in Colonial Beach was a hangout for Virginia oyster dredgers.



Berkeley Muse

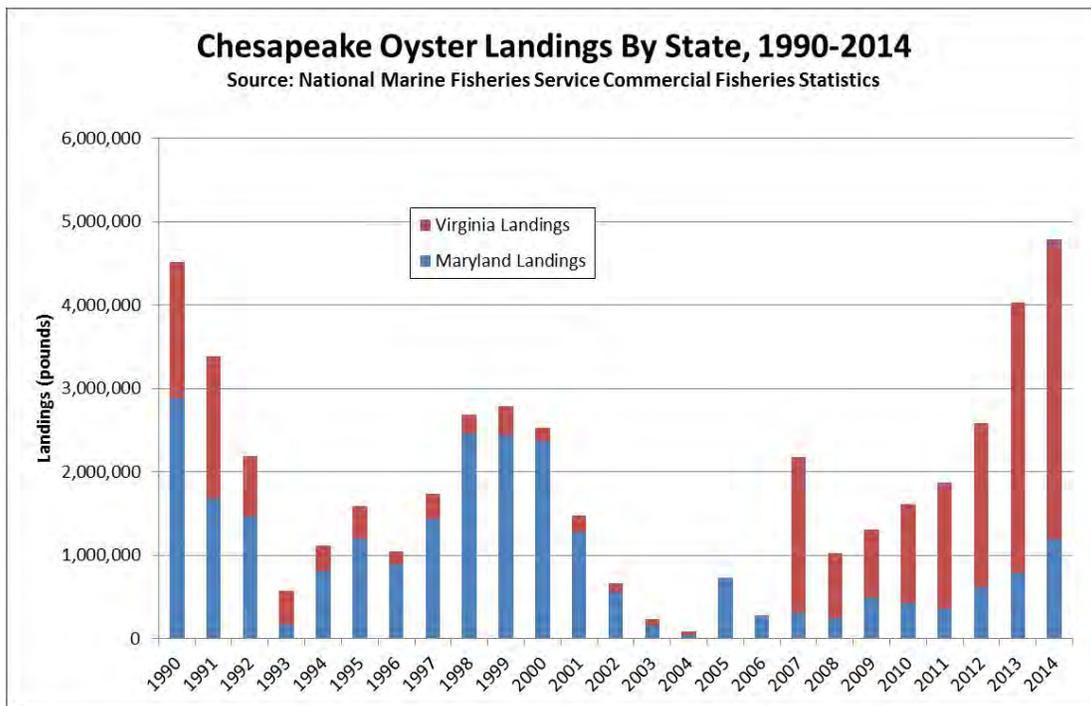
1960s-1990s

Diseases Lead to Further Decline and Collapse of Fishery

The overall decline indicated on page 3 was due to a number of factors: over harvesting, destruction of the natural oyster reefs and estuary bottom because of dredging, pollution and runoff (nitrogen and phosphorus from fertilizer along with industrial, animal and human waste), removal of shell, deteriorating water quality and mismanagement of resources. However, the big killers of oysters after 1960 were Dermo and MSX as described above.

In 1967 the Virginia Commission of Fisheries became the Virginia Marine Resources Commission with a broader mission to protect Virginia's marine resources. While management practices have improved in recent decades, problems associated with runoff of nutrients, dredges and the two diseases are still with us. Oyster larvae naturally strike on clean oyster shell but now find insufficient clean shell mass because of slime from poor water quality and fewer available large and growing oysters. When they do strike, many die from disease before they can produce enough shell for the next generation. These same problems have frustrated massive efforts to restore oyster reefs.

Note in the chart below how the post-1990 peak harvest of about 4,500,000 pounds compares to the 1880 harvest of 120,000,000 pounds, less than 4%.



Source of graph- National Oceanic and Atmospheric Administration. Oysters. Accessed 7/16/2017. <https://chesapeakebay.noaa.gov/fish-facts/oysters>

Reference:

Virginia Marine Resources Commission. "Historical Highlights." <http://www.mrc.virginia.gov/vmrchist.shtm>.

1990s to 2017 Restoration, Repletion and Sanctuaries

Many experts believe that the construction of vertical or 3D reefs in places where natural reefs once existed is the best way to restore the oyster population and eventually enhance the fishery as well. These constructed reefs are designated sanctuaries, meaning they cannot be fished for an indefinite period. Many organizations, such as NOAA, Chesapeake Bay Foundation, The Army Corps of Engineering, VIMS and VMRC are involved in these projects.

Sustaining the Virginia oyster fishery is the responsibility of VMRC and involves the addition of shell and spat to public grounds to enhance harvest. This has been done since the 1930s and can be funded by the State and sometimes with federal dollars. In the 1990s this repletion process became critical because of the collapse described above.

In the 1990s VMRC's Dr. Jim Wesson and his team studied 3D sanctuary reefs while continuing with repletion of the working public grounds. After 10 years of study, he concluded that 3D reefs would produce enough young oysters to increase the population for a few years, but ultimately return to the state the grounds were in prior to reef construction. It seems that the poor water quality of modern times causes the shell to be coated with silt. The shell then deteriorates and becomes unsuitable for new spat set. This and disease prevent many young oysters from growing large enough to provide shell for the next generation.

The VMRC team knew that oyster bars would not grow on their own, as they once did, but an annual supply of fresh shell would keep the fishery going and has now proven successful as shown on the chart (2007 to 2014) on the previous page. A rotational harvest system was also implemented which allows specific areas to "rest" for 2 to 3 years to allow stocks to rebuild. This system, however, is expensive and shell are becoming more difficult to obtain. (Timothy B. Wheeler, *Virginia's oyster wrangler retires, but isn't done yet with the Bay's bivalves*, VMRC chief of conservation and repletion oversaw a resurgence in the state's shellfish production. Bay Journal, February 12, 2017.)

Another factor in the modest improvement in traditional oyster harvest is that wild oysters appear to be gradually developing disease resistance. Wild spat strikes have been noticeably better in the last few years and larger oysters are naturally appearing in Bay waters more than in the 1990s.



Water cannons used to spray fossilized shell on working oyster grounds on the James River.

July 10, 2013. <https://www.pilotonline.com/2013/07/10/oysters-future-rests-on-shells-of-ancient-bivalves-2/>

1997 to 2017

Breakthroughs in Aquaculture Begin at VIMS Gloucester Point

In 1997 the Virginia Institute of Marine Science (VIMS) at Gloucester Point initiated an oyster breeding program in the Aquaculture Genetics and Breeding Technology Center (ABC) following an initiative by the Virginia General Assembly (see <http://www.vims.edu/research/units/centerspartners/abc/about/index.php>). The program has accomplished 2 important objectives: through selective breeding, developed highly disease-resistant strains of the native oyster (*Crassostrea virginica*) and produced a sterile oyster that grows fast and can be harvested year round. This has led to successful aquaculture in the Chesapeake Bay. By 2007 (Shulte) more market oysters were from aquaculture than from the traditional wild harvest and aquaculture has continued to grow.

The chart below shows the dramatic increase in oyster aquaculture harvest since the beginning of the VIMS ABC program. A number of commercial hatcheries obtain strains of selected disease-resistant and salinity-specific oysters from VIMS to use as brood stock. Using the selected brood stock, the hatcheries produce the oyster larvae or spat and sell it to the oyster farmers who grow out the oysters for wholesale or retail sales.

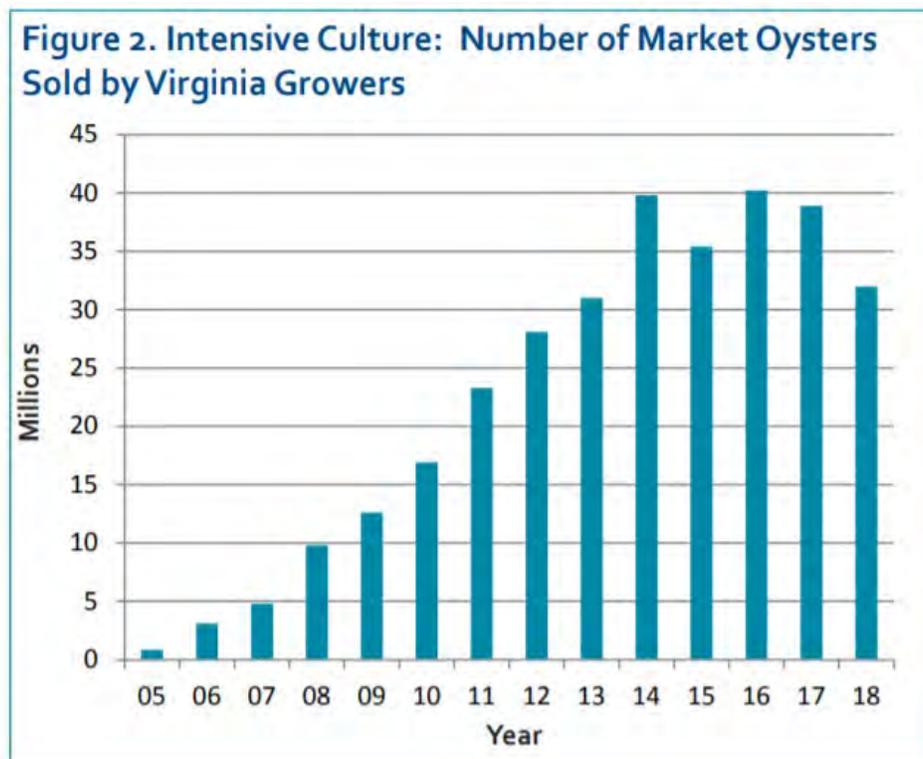


Chart from *Virginia Shellfish Aquaculture Situation and Outlook Report*. Hudson, Karen. "Shellfish Aquaculture Specialist Results of the 2018 Virginia Shellfish Aquaculture Crop Reporting Survey." (August, 2019) Marine Advisory Services, Virginia Institute of Marine Science

2017 Aquaculture Grows

Although wild oysters have been decimated, there is good reason to believe there will be a gradual comeback, but it will not be easy. In the meantime, the aquaculture industry has been growing and making oyster consumption a pleasure people can again afford. Some enjoy growing their own oysters non-commercially for consumption or restoration. This practice is known as oyster gardening.

With the advances in oyster aquaculture started at VIMS and built on by commercial hatcheries and oyster farmers, the oyster fishery in the Chesapeake Bay is now growing again, although in a different form than the old days. Aquaculture puts oysters in the water that filter and help clarify the water, along with the wild oysters, and provides employment and a boost to the economy.



Richard Burlingame shakes an oyster cage once against the side of the boat before it is lowered into the water at Rappahannock Oyster Company in Topping, Virginia, on May 9, 2016.

(Image by Will Parson, from article by Joan Smedinghoff, Chesapeake Bay Program, February 27, 2017)

3000 Years BP to 2023

2023 Update with Recent Information

Summary of Updates

Since the 2017 release of this document, important recent events, listed below, call for an update.

In 2019 an archeological study was released detailing the use and importance of oysters at Kiskiak Village in the vicinity of Indian Field Creek and present-day Yorktown Naval Weapons Station.

VIMS published the Virginia Oyster Productivity Information Tool on the internet in 2020.

VIMS reported on the research led by Dr. Ryan Carnegie that explained the devastating die-off of wild oysters in the Chesapeake Bay and East Coast in the 1990s.

VMRC reported on the Virginia Oyster Harvest of 2022-2023 which was the largest since 1987.

3000 years BP to 1607 Native Use of Oysters, Recent Findings, Continued

In the reference below, Jenkins and Gallivan describe a 3000 year history of a mostly sustainable oyster fishery by First Americans who occupied sites on present-day Naval Weapons Station Yorktown (NWSY), specifically Indian Field Creek.

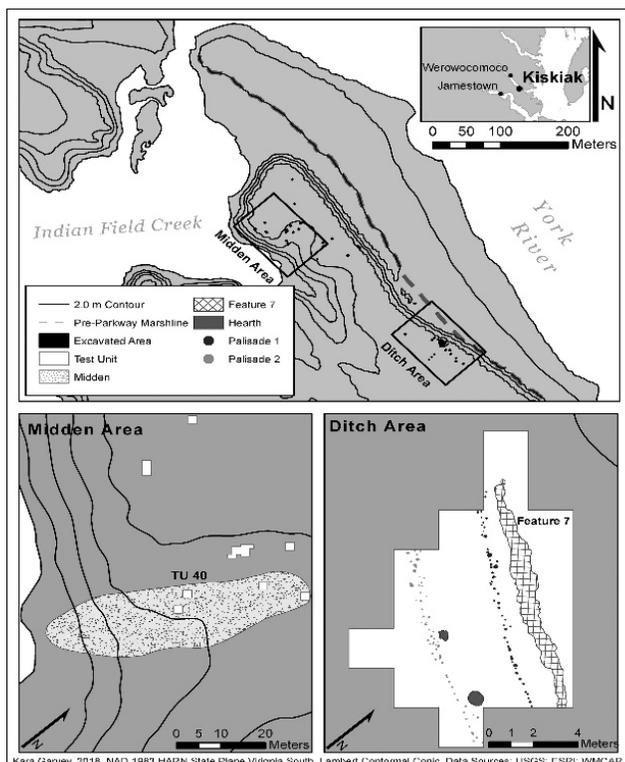
The in-depth archaeological survey of oyster middens describe an oyster fishery that was sustained for at least 3000 years. The older encampments were typically on the higher grounds of NWSY, and the occupants harvested oysters only seasonally. Around 200 AD, Algonquin speakers occupied sites on the lower land on Indian Field Creek near the York River. This group evolved into the Kiskiak Tribe, a chiefdom of the Powhatan Confederacy.

The Kiskiak Town was occupied year round and the residents harvested oysters intensely, discarding their shells on oyster middens. A large midden extends approximately 50 by 25 meters and 2 meters deep. Pole stains indicate the presence of structures, probably for cooking and drying their catches. This site was most likely used for daily subsistence. The shells were small and come from easy-to-access shallow and inter-tidal waters.

Another oyster midden, called the ditch, was used for special occasions, ceremonies and gift-giving. These oysters were generally larger and harvested from offshore reefs.



Sign on Colonial Parkway near Naval Weapons Station Yorktown



Kiskiak site, including overall plan, midden area and ditch



At Kiskiak, the larger shells on the left came from deep-water reefs, evidenced by the wormholes. The smaller shells on the right were from easy-to-access intertidal areas. Nuisance critters in oysters usually die when exposed to air.

References:

Shell on Earth: Oyster Harvesting, Consumption, and Deposition Practices in the Powhatan Chesapeake. Jessica A. Jenkins^a and Martin D. Gallivan^b
^a Anthropology, University of Florida, Gainesville, Florida, USA ^b Anthropology, William and Mary, Williamsburg, Virginia, USA

THE JOURNAL OF ISLAND AND COASTAL ARCHAEOLOGY, 2020, VOL. 15, NO. 3, 384-406
<https://doi.org/10.1080/15564894.2019.1643430>

3000 years BP to 1607 Native Use of Oysters, Recent Findings, Concluded

Another use for oysters by Algonquians

Professor Martin Gallivan, William and Mary Anthropologist, also authored *The Powhatan Landscape*, available at Amazon. He describes native pottery discovered in the riverine areas on the James-York peninsula. Mockley sherds have been found in abundance in the Kiskiack middens, predominantly from 500 AD to 900 AD, and in lesser quantities until contact with the colonists.

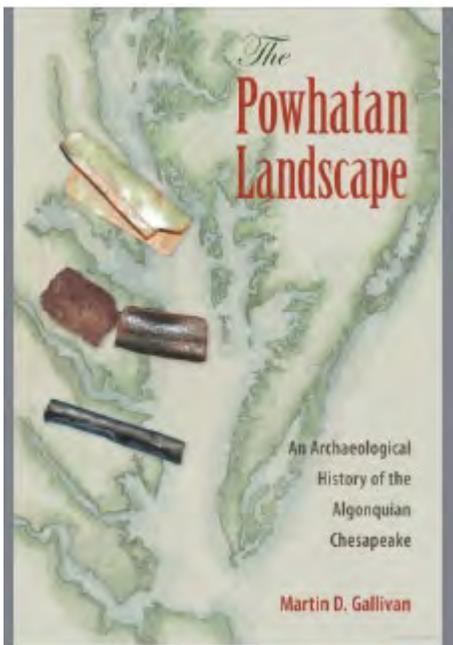
Mockley ceramic sherds have also been found along the mid-Atlantic region in other middens left by native settlements. Mockley is made from medium fine clay and tempered with 20% to 30% crushed oyster and clam shell and then finished with imprints of cord or netting before being fired.



Mockley ceramics



Mockley vessel



Published Sep. 17, 2018,
University Press of Florida



A hearth: Madeline Gunter (left) and Jessica Bittner confer with Martin Gallivan about a newly found hearth feature discovered on the last day of the 2015 dig at Kiskiack. Photo by Joseph McClain

From Archaeologists extract clues from Kiskiack's pre-colonial past,
W&M NewsArchive, by Joseph McClain | July 30, 2015

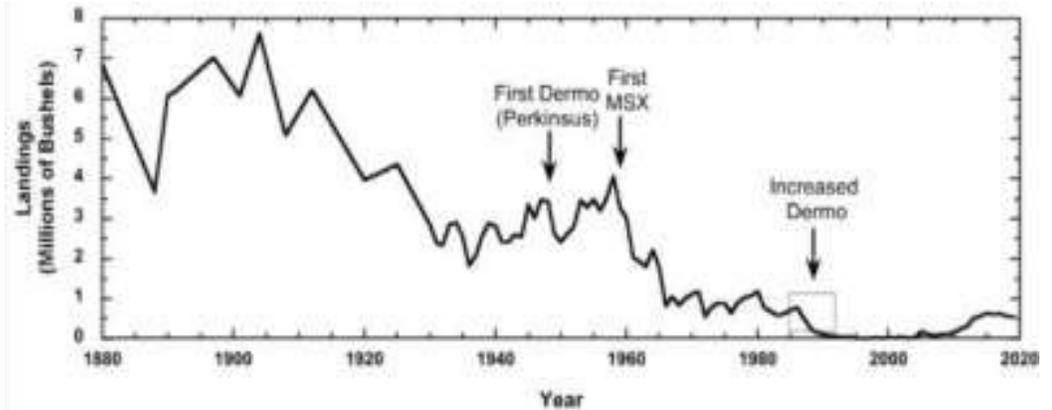
<https://www.wm.edu/news/stories/2015/archaeologists-extract-clues-from-kiskiacks-pre-colonial-past123.php>

1950-2020

Recent Virginia Oyster Fishery History- The Collapse and Gradual Recovery

Thanks to recently released publications from scientists at VIMS and elsewhere, we have learned much more about what has been happening to both wild and hatchery-spawned oysters in Virginia. The following charts are from the History section of the Virginia Oyster Productivity Information Tool (Mann *et. al.*).

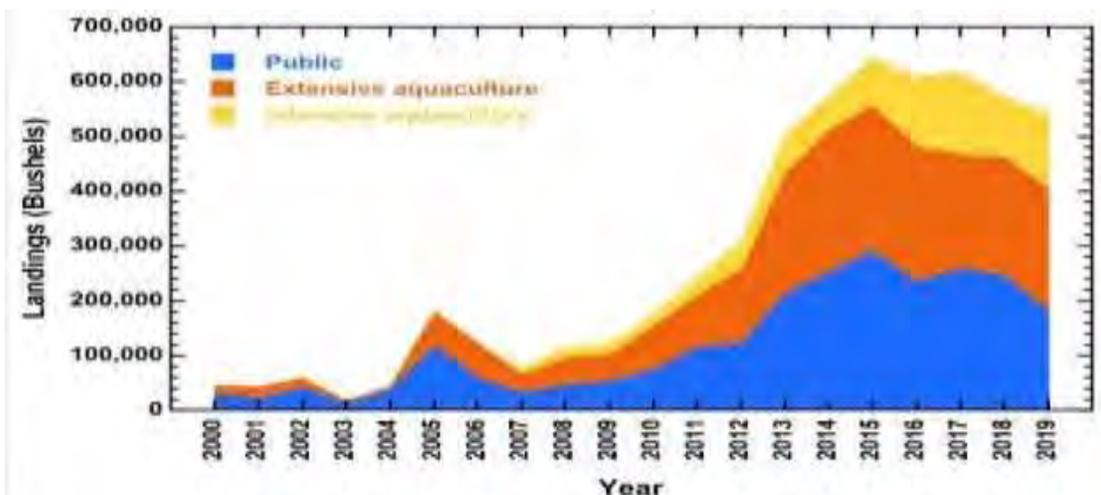
In the mid-1950s, oyster production was expanding despite decades of over-harvesting, pollution, and poor management. Then we see the huge drop-off when MSX ravaged the Bay's oyster population. To add insult to injury, Dermo disease worsened in the middle 1980s.



During the 1990s, VIMS and many agencies began trying to clean up the Bay and restore the oyster population. In 1997, the Virginia General Assembly authorized the Aquaculture

Genetics and Breeding Technology Center (ABC) at VIMS “to use a combination of selective breeding and genetic research to domesticate the native eastern oyster *Crassostrea virginica* for aquaculture and to improve on its traits.” This effort, led by Dr. Stan Allen, ultimately resulted in the hatchery-based aquaculture industry we enjoy today. (accessed 8-4-2021 at <https://www.vims.edu/research/units/centerspartners/abc/about/index.php>)

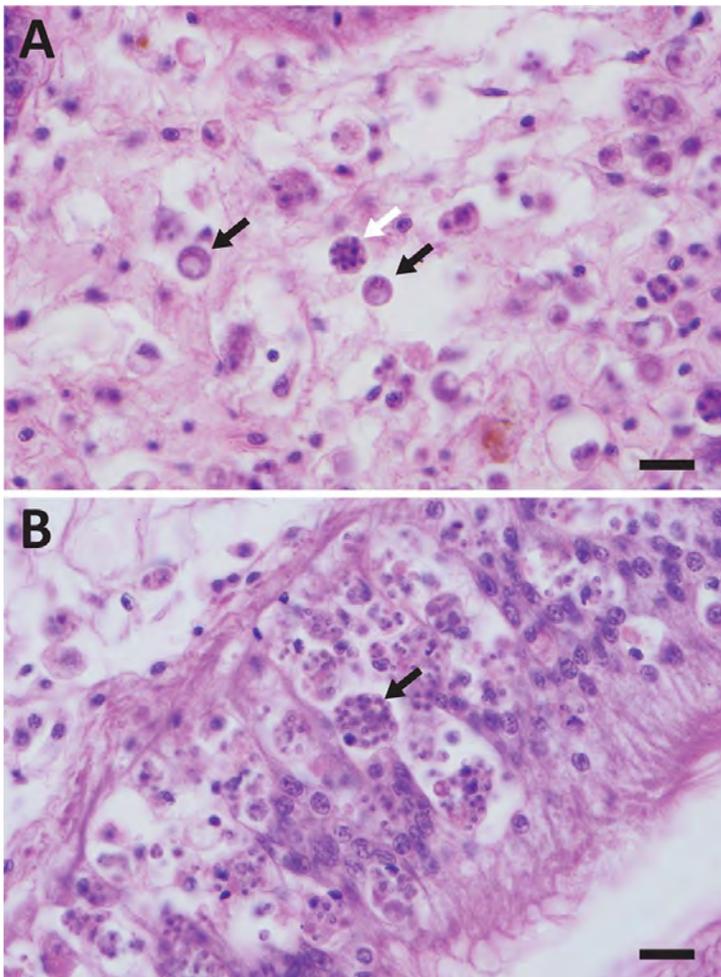
The chart below shows how both hatchery-based aquaculture and wild oyster production have grown since about 2004. The blue (dark gray in B&W) is the public (Baylor) grounds which are maintained by VMRC. The red (medium grey, extensive aquaculture) is a mix of wild oysters and hatchery-spawned spat-on-shell grown on leased (private) grounds. Yellow (light grey, intensive aquaculture) is commercial caged aquaculture, also grown on leased grounds.



2021

VIMS Describes Deadly Evolution of Dermo

The references below describe how Dr. Ryan Carnegie and his team discovered how Dermo disease (caused by the *Perkinsus marinus* pathogen) changed in the mid-1980s. By examining paper-thin slices of tissue from infected oysters prepared in the 1960s through 2018, they were surprised to find a distinct shift in the infection site. Around 1985, the parasite cells, formerly in the digestive tract, had become much smaller and could be seen in the blood cells of the stomach lining.



Dermo was first found in the Bay in 1949 and caused significant oyster mortality. Then MSX was introduced by Asian oysters in the 1950s and devastated the public fishery. The researchers concluded that Dermo was under evolutionary pressure because of competition from MSX. By the 1980s, the oyster harvests had declined significantly but had leveled out. Around 1987, most of the Bay oysters started dying off until a modest recovery in the early 2000s. The huge die-off compelled the state of Virginia to start an oyster aquaculture program, to be led by VIMS.

**Figure 1. from the first reference below-
Histological presentation of *Perkinsus marinus*
phenotypes.**

A. Original phenotype, with relatively small numbers of large *P. marinus* cells primarily infecting oyster connective tissues. Black arrows indicate two *P. marinus* trophozoites; white arrow indicates a multinucleate schizont.

B. Contemporary phenotype, with large numbers of small parasite cells primarily infecting digestive epithelia. Arrow indicates a mass of *P. marinus* cells inside a moribund oyster hemocyte. Scale bars for both panels represent 20 microns.

References:

A rapid phenotype change in the pathogen *Perkinsus marinus* was associated with a historically significant marine disease emergence in the eastern oyster

Ryan B. Carnegie^{1*}, Susan E. Ford^{2,4}, Rita K. Crockett¹, Peter R. Kingsley-Smith³,
Lydia M. Bienlien¹, Lúcia S. L. Safi¹, Laura A. Whitefleet-Smith¹ & Eugene M. Burreson¹

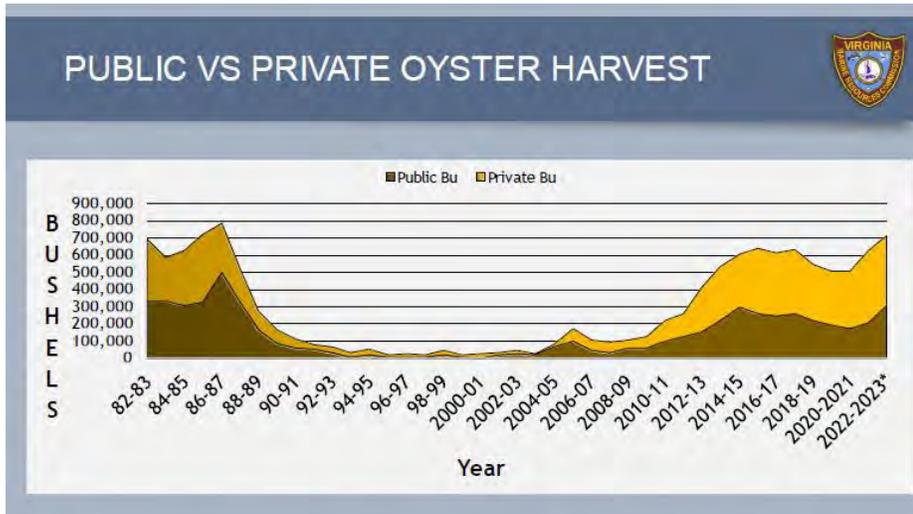
VIMS study uncovers new cause for intensification of oyster disease
by David Malmquist | **June 18, 2021**

Link to Dr. Ryan Carnegie's paper.-https://www.vims.edu/newsandevents/topstories/2021/dermo_intensification.php

Video- Dr. Ryan Carnegie on VIMS Oyster Disease Studies- <https://youtu.be/iypzpMSblAQ>

2022-2023 Wild Oysters on the Comeback in Virginia

“Virginia oyster harvest, on cusp of 35-year high, gets a two-week extension” were the headlines in a March 2, 2023 article in the Bay Journal. Andrew Button, Virginia Marine Resources Commission (VMRC) Deputy Chief of Shellfish Management, stated: “We are on track to harvest for the first time since 1987-88 over 300,000 bushels, likely.”



Plot provided by
Andrew Button, Virginia
Marine Resources
Commission (VMRC)
Deputy Chief of
Shellfish Management

The chart above shows the 2022-2023 oyster harvest in Virginia returning to the 1987 levels and shows that both the private and public sectors are improving. The improvement in the public sector is especially gratifying because these are all wild oysters, showing how Mother Nature (with help from many organizations and volunteers) is bringing back our natural wild heritage. All data from the 2022-2023 season have not been compiled, so based on Button’s comments, the 2022-2023 bar has an estimated 100,000 bushels more than the 2020-21 total. We are seeing a 35-year-high.

Many old timers remember when all the oysters on the banks of our rivers quickly disappeared. VIMS Pathologist Dr. Ryan Carnegie showed in 2021 that the well-known disease Dermo evolved into a much deadlier variant in the mid-1980s; see <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8213716/>. This started the severe downhill slide shown in the graph.

In the 1990s, VMRC, Chesapeake Bay Foundation (CBF), Virginia Institute of Marine Science (VIMS) and many more agencies and groups got busy. VMRC, led by Dr. Jim Wesson, upped the repletion efforts, CBF fought for the adoption and enforcement of the “Blueprint for the Chesapeake Bay,” and VIMS began its highly-successful development of disease-resistant aquaculture oysters. Man-made oyster reefs were built, many of which died out, but the agencies and volunteers did not quit. For the last 10 to 15 years, wild oysters have been showing up and are very visible at low tide along many water bodies in Tidewater, Virginia. The diseases MSX and Dermo are still there and killing many juvenile oysters before reaching harvest size, especially Dermo, but reproduction is improving and overall mortality is down compared to 20 years ago.

Researchers at Cooperative Oxford Laboratory on Maryland’s Eastern Shore and VIMS agree that wild oysters are developing resistance or tolerance to the diseases by natural selection. See: <https://chesapeakebaymagazine.com/bay-oysters-may-be-building-up-resistance-to-two-deadly-diseases/>.

TOGA

Tidewater Oyster Gardeners Association
Growing Oysters for a Cleaner Bay



Old and new images from around the Chesapeake Bay