



Growing Oysters for a Cleaner Bay

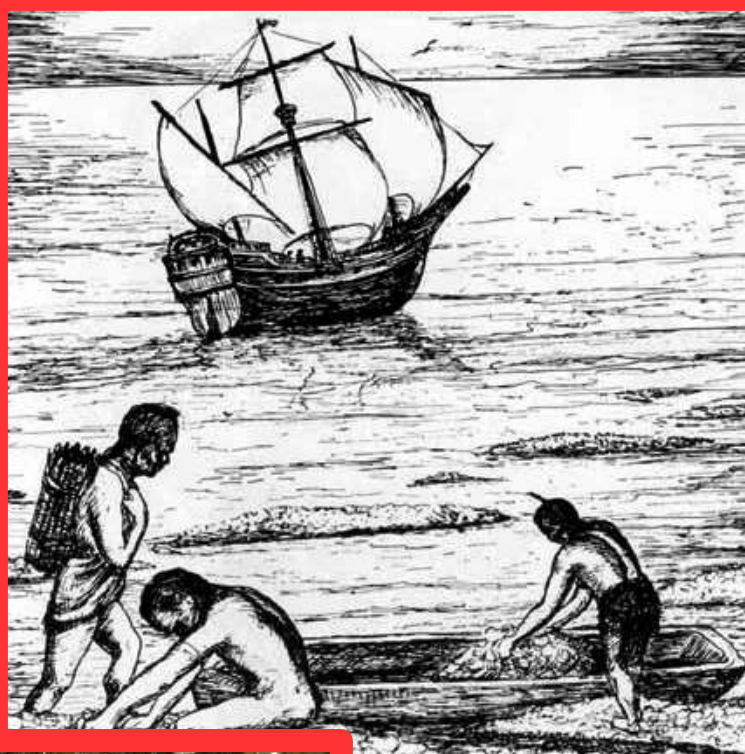
An Overview of the History of Oysters in the Chesapeake Bay

by Vic Spain, Master Oyster Gardener

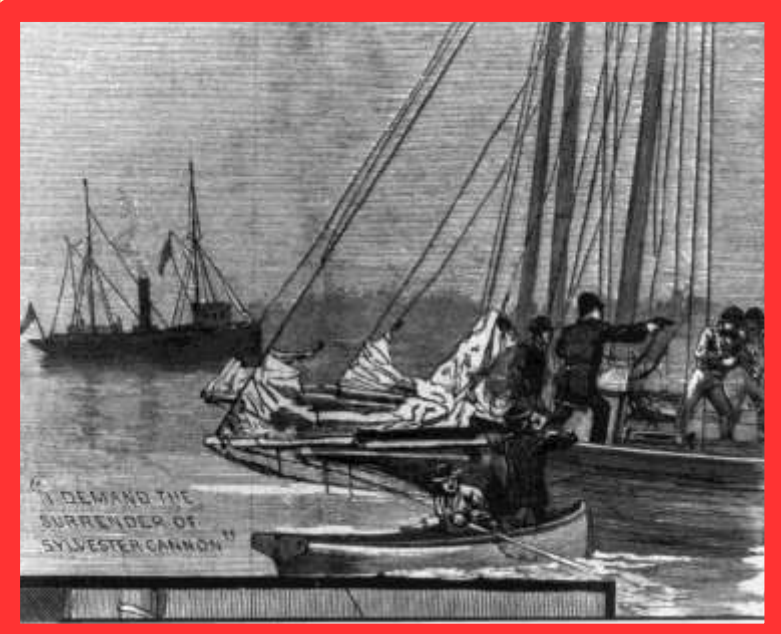


The reefs

The Natives



The wars

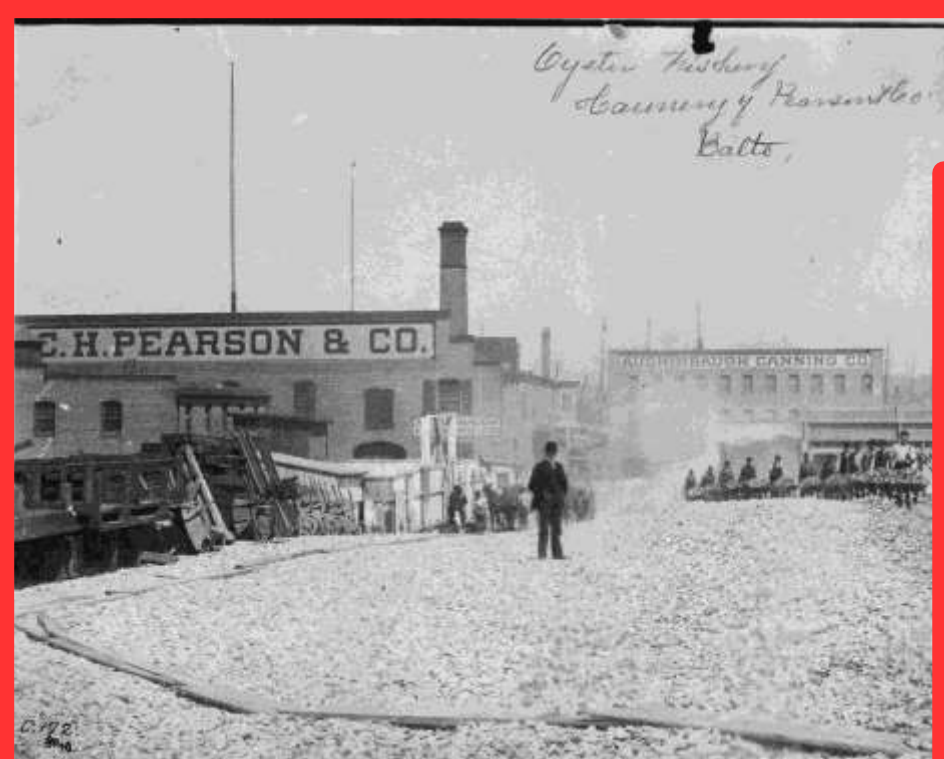


The oyster



"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."
Wennersten, John R.

The collapse



The packing houses



The boats

Aquaculture







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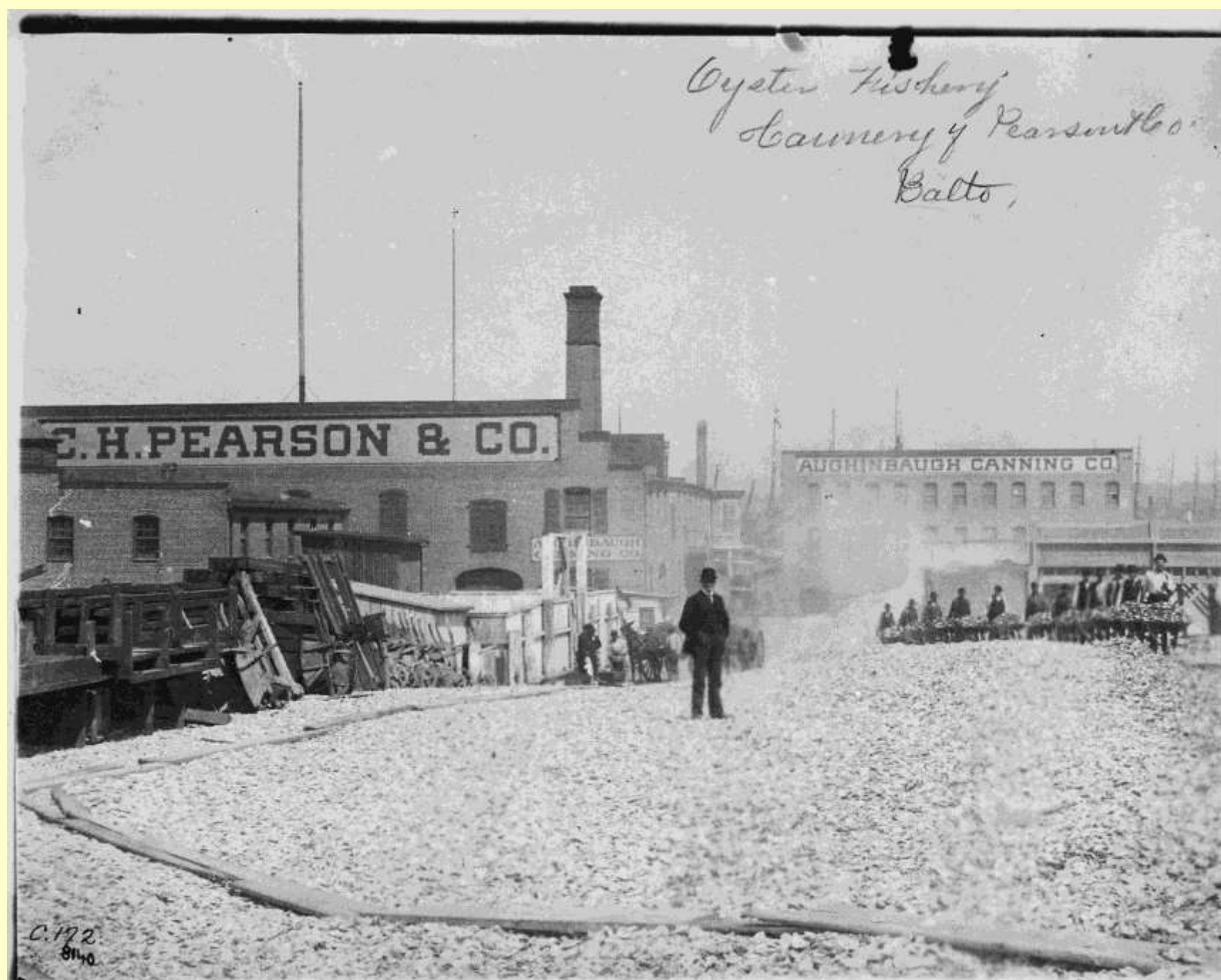
Introduction

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.

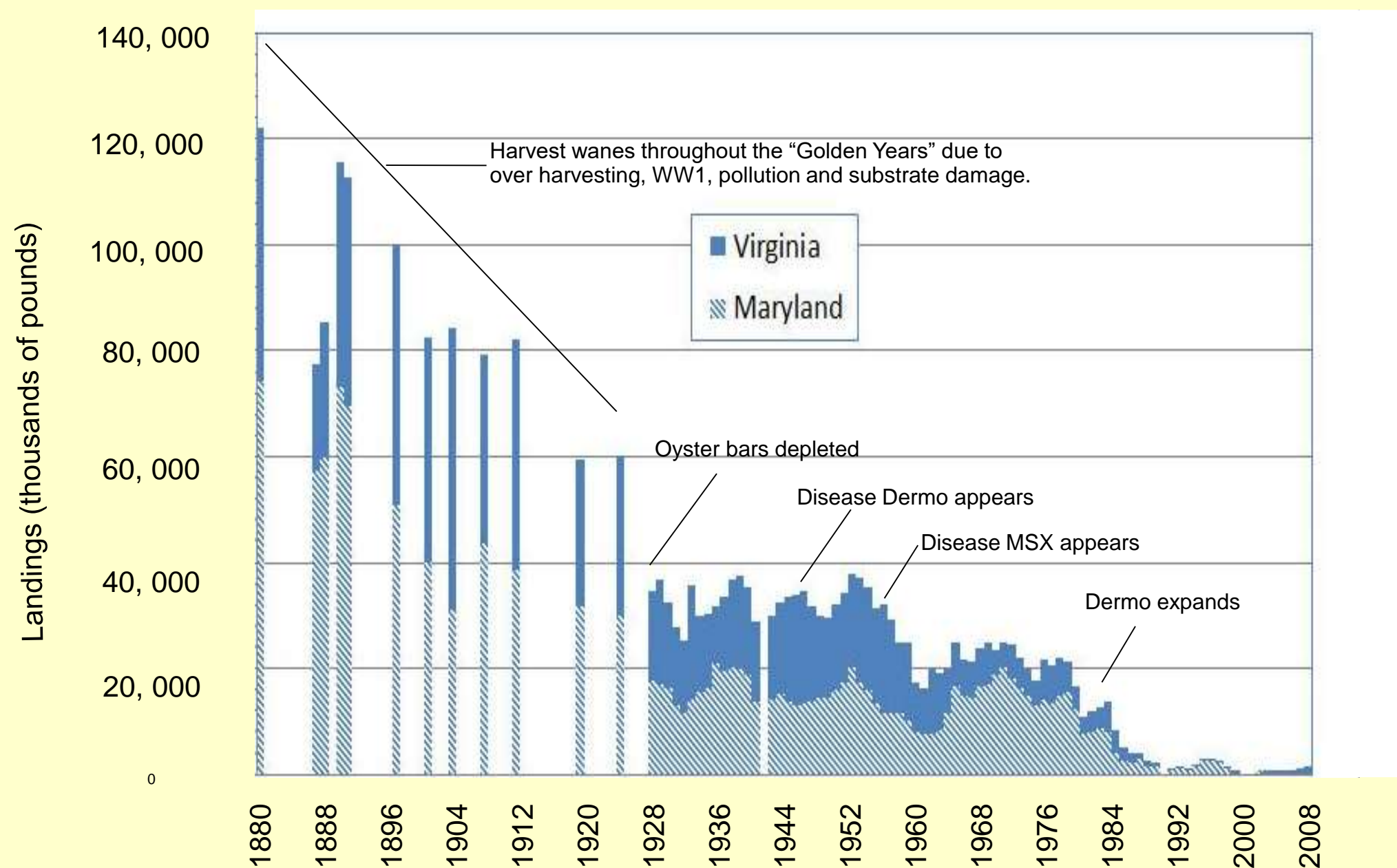
History teaches that dense human populations will exploit a common resource until it is exhausted. So we should not be too surprised by the story that follows.



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



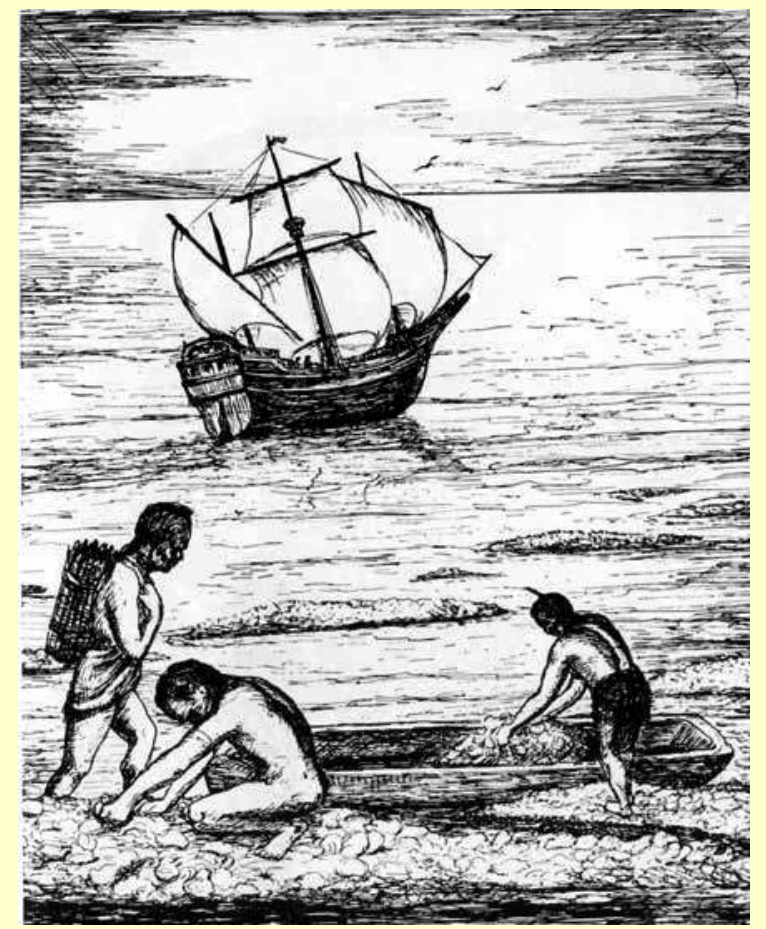
Source of graph-National Oceanic and Atmospheric Administration. Accessed 7/16/2017.
<https://chesapeakebay.noaa.gov/fish-facts/oysters>

3000 years Before Present 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 Gouldman 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 Gouldman Oyster Shell Midden Site
near Colonial Beach, Virginia



Monroe, Elizabeth J. and Goodrich, Kevin with Contributions from: Juliana Harding And Justine McKnight. “Archaeological Data Recovery at the Gouldman 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

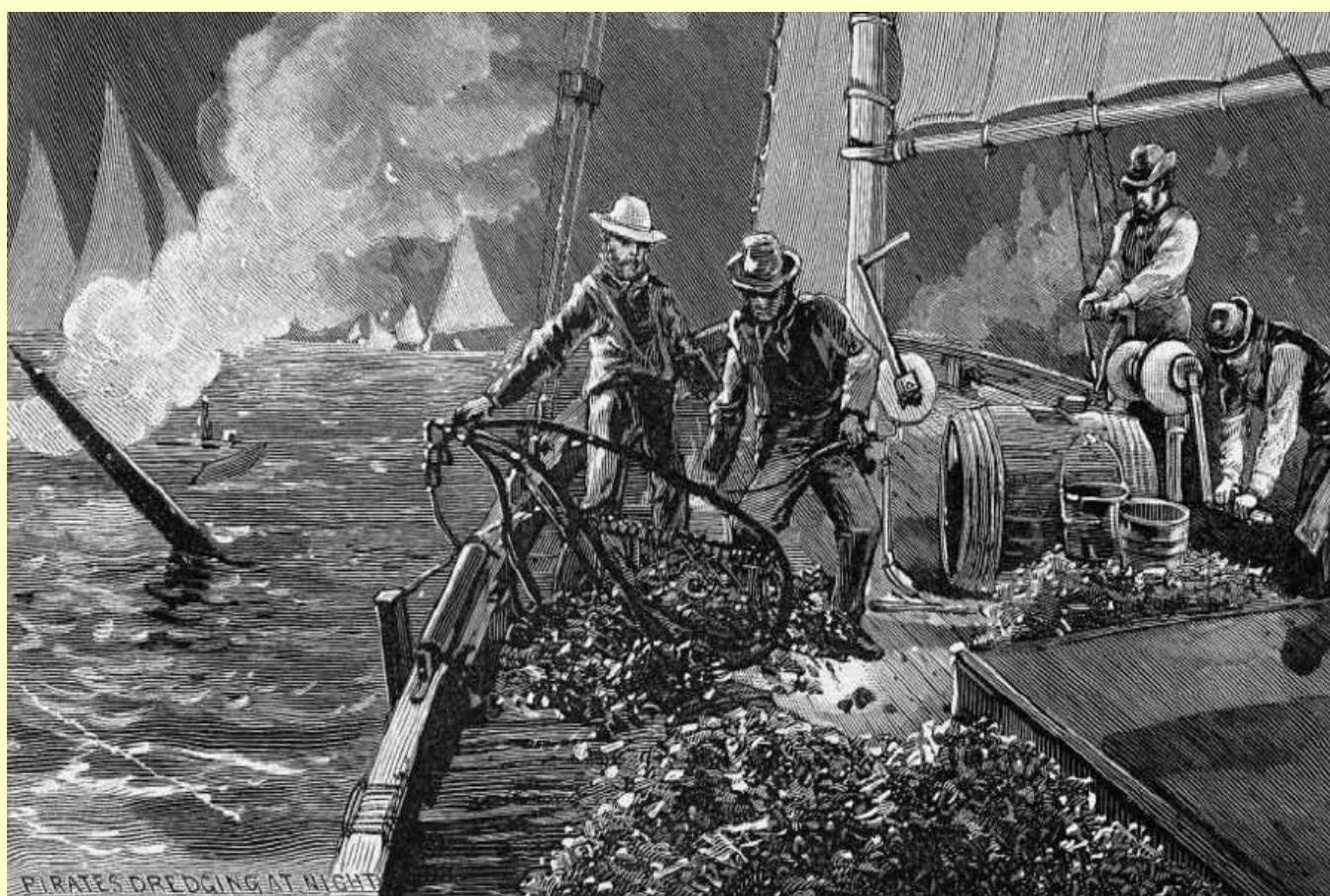
By the early 1800s, New Yorkers and New Englanders had exhausted their oyster grounds. They came into the Bay with the windlass dredge, not then used in the Chesapeake Bay. Virginia, realizing that dredges could rapidly deplete oyster bars and that Virginia watermen used tongs and did not possess dredges, 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.

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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>.



Oyster pirates using windlass dredges.
Wikimedia Commons.



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

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.



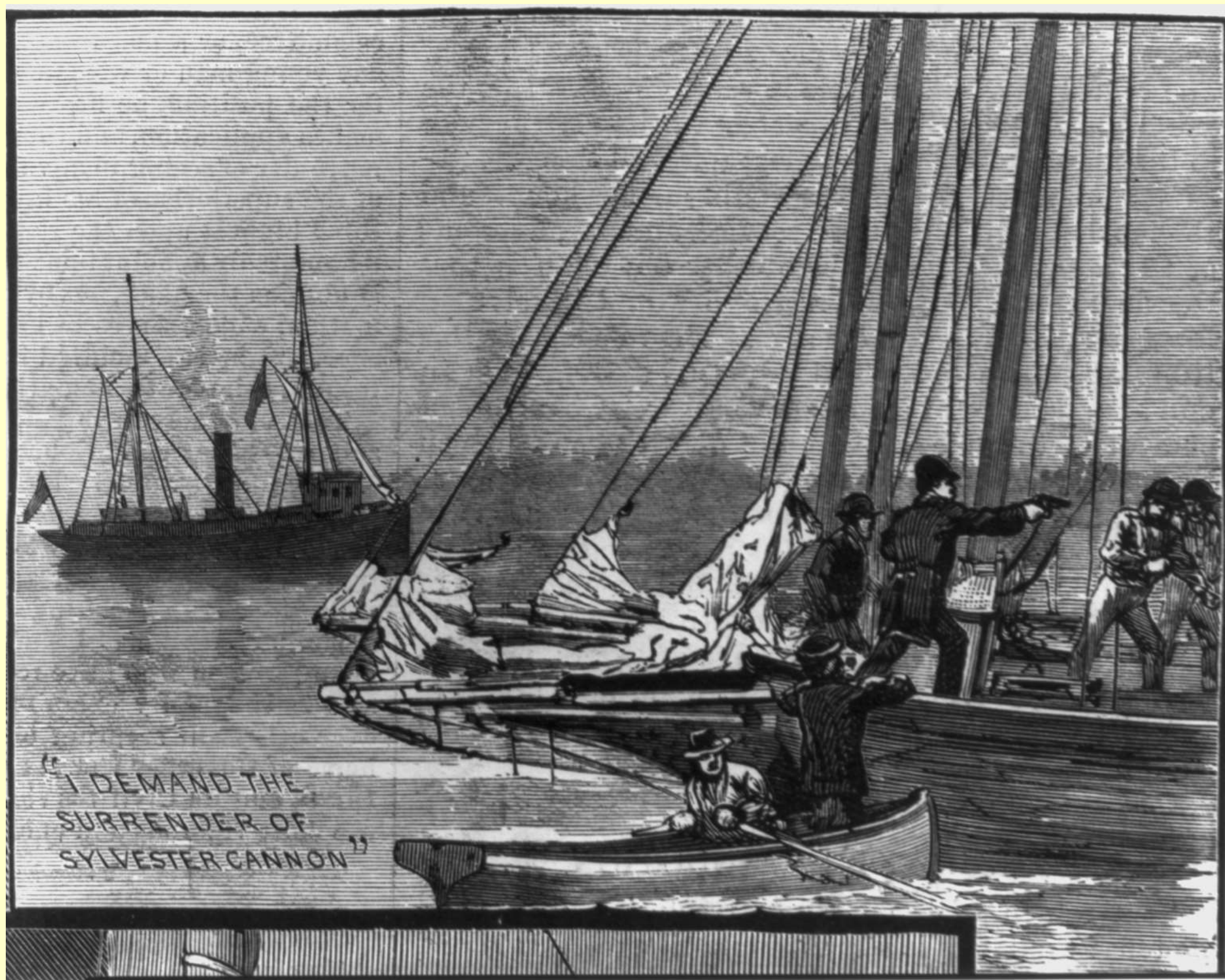
Oyster shucking room, Baltimore Maryland, late 1890s.

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.

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/>)
[Public domain], via Wikimedia Commons

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 2 above, 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.

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

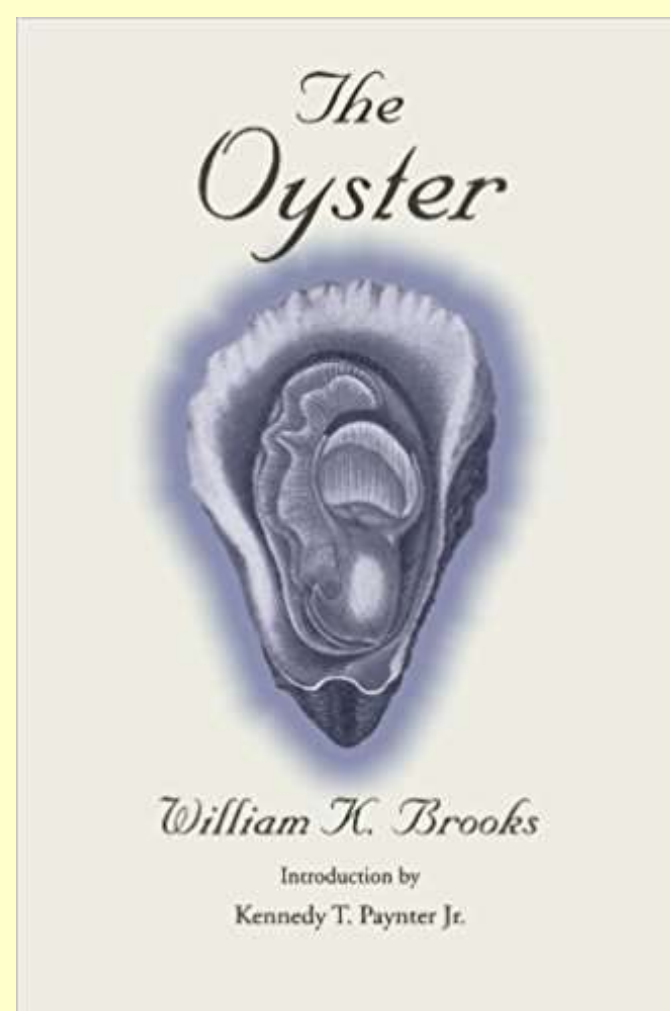
Fincham, Michael W. “The Oyster Dreams of William K. Brooks: Could science save a seafood industry?”, *Chesapeake Quarterly*, (April 2013).

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>.



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 http://www.vims.edu/research/topics/oysters/ts_archive/oyster_buffer.php.



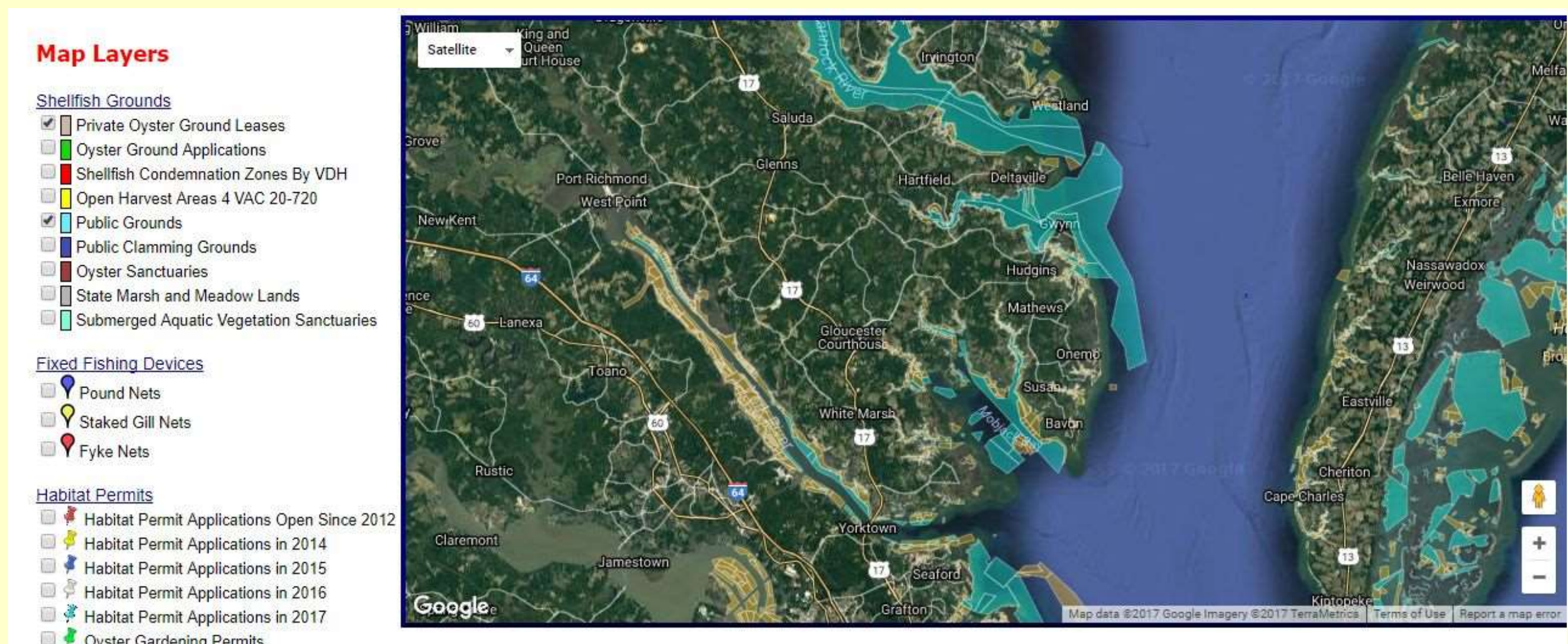
William Keith Brooks in *Popular Science Monthly*, 1899
Wikimedia



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>.



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 2 above. 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 College of 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.



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 Berkley Muse on board a high-speed dredge boat was shot and killed by pursuing Maryland marine police.



The Battle Ground on the Potomac River



Berkeley Muse



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

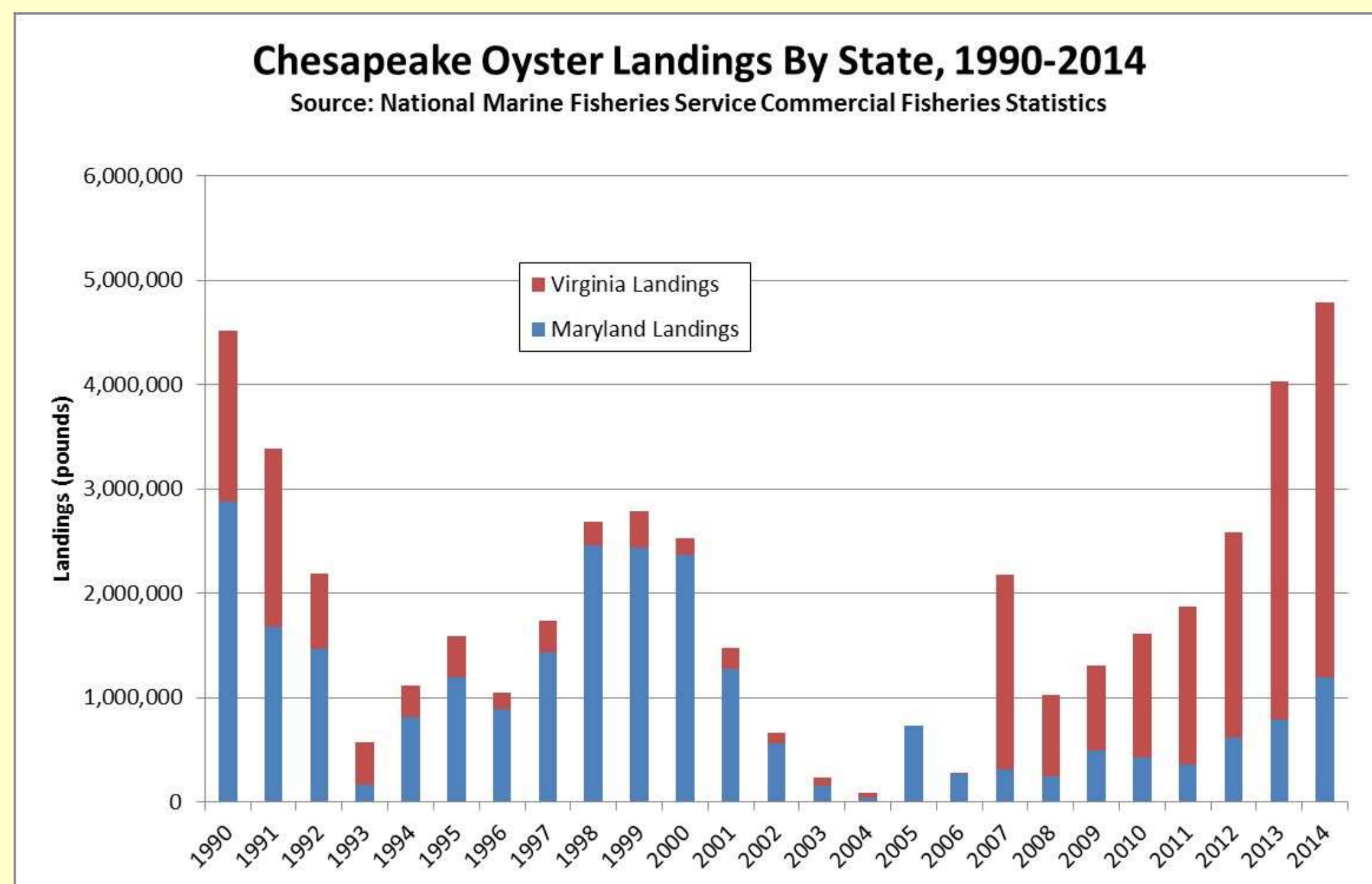
1960s-1990s—Diseases Lead to Further Decline and Collapse of Fishery

The overall decline indicated on page 2 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%.

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



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

1990s to Present—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. Harper, Scott . “Oysters' future rests on shells of ancient bivalves.” Norfolk Pilot, Jul 10, 2013.

https://pilotonline.com/news/local/environment/oysters-future-rests-on-shells-of-ancient-bivalves/article_625567be-6810-53e5-94028760d0fd6cc7.html.
(accessed 8/12/2017).

1997 to Present—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.

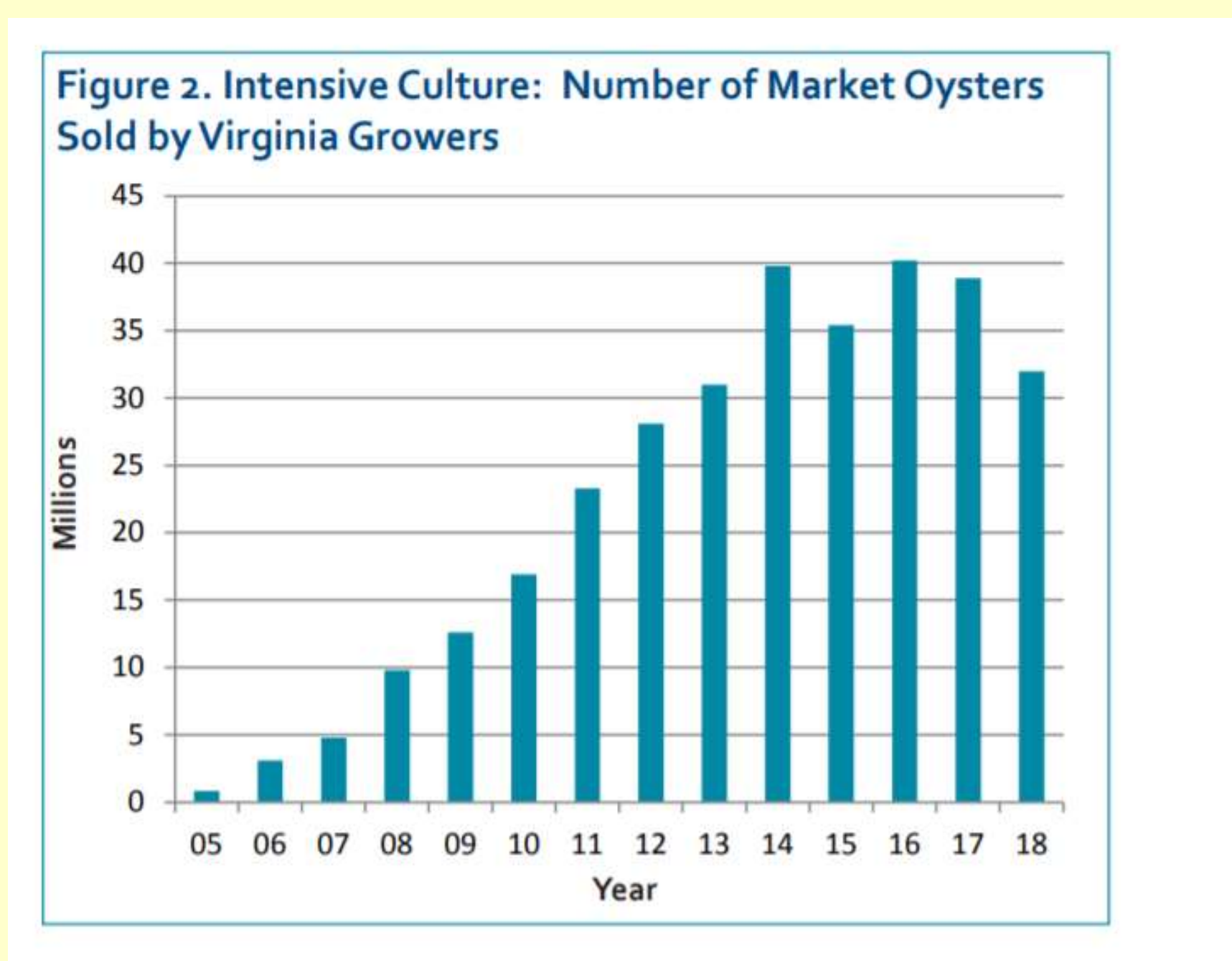


Chart from *Virginia Shellfish Aquaculture Situation and Outlook Report*.
Hudson, Karen. "Shellfish Aquaculture Specialist Results of the 2018
Virginia Shellfish Aquaculture Crop Reporting Survey." (August, 2019)
Marine Advisory Services, Virginia Institute of Marine Science

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.



Aquaculture operation by the Chesapeake Bay Oyster Company.

Oyster Gardening

Oyster gardening is the non-commercial practice of oyster aquaculture. Virginia encourages those who have access to oyster growing waters to garden oysters for personal consumption as well as to help restore the Bay. Virginia requires participants to obtain a free oyster gardening permit (<http://www.deq.virginia.gov/Portals/0/DEQ/CoastalZoneManagement/oysterpermit.pdf>).

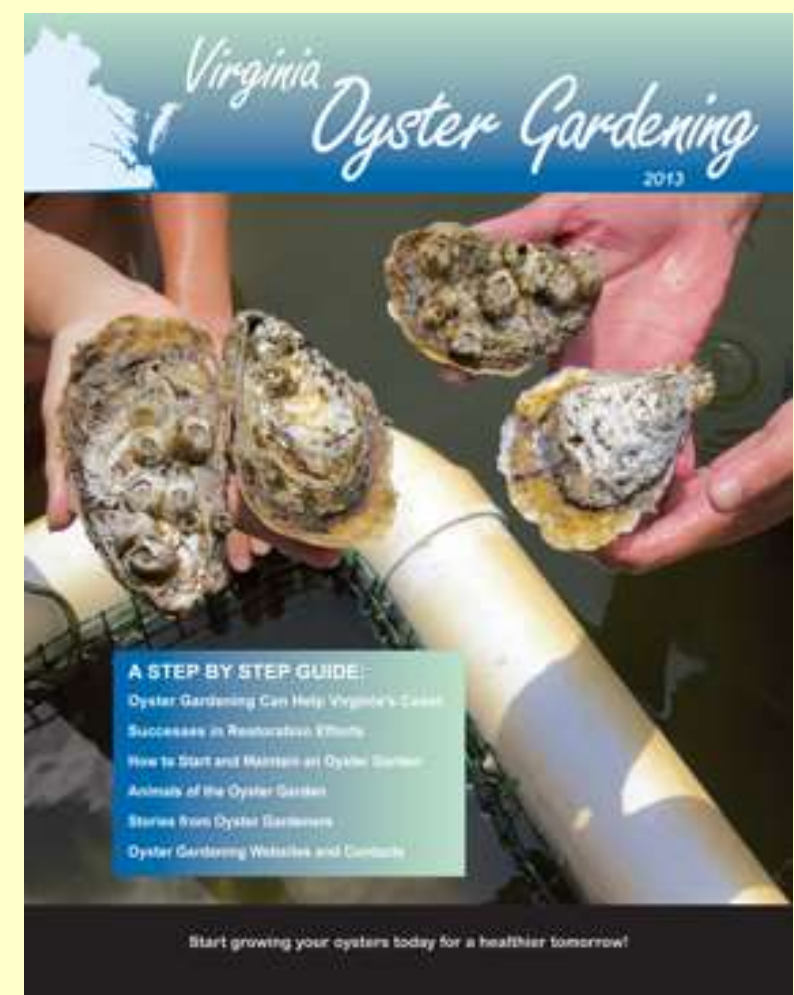
The Tidewater Oyster Gardener Association (TOGA) is an organization of those interested in working together to promote oyster gardening and Bay stewardship. TOGA conducts frequent educational events for the public and along with VIMS conducts advanced learning opportunities for TOGA members. TOGA works with VIMS and VMRC in encouraging safe and environmentally friendly practices and sponsors a VIMS/TOGA Fellowship Endowment for selected VIMS graduate students.

For a more a more detailed description of TOGA and how to oyster garden, see <http://www.oystergardener.org/toga-static-display> and find “click here”.

www.oystergardener.org



Students of all ages learn about oyster gardening.



Virginia Oyster Gardening Guide
<http://www.deq.virginia.gov/Programs/CoastalZoneManagement/CZMIssuesInitiatives/Oysters/Gardening.aspx>

Further Reading

In addition to the references in the main body above,

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Southern Regional Aquaculture Center Publication No. 4307 (February 2012).

Tidewater Oyster Gardeners Association

Growing oysters for a cleaner Bay

www.oystergardener.org

Vision

The Chesapeake Bay repopulated with sufficient oysters to improve water quality and sustain a viable oyster industry

Mission

To motivate citizens to help the Bay by growing oysters.
We accomplish this mission through:

Education: Sponsoring float workshops, Annual Oyster Fair, Master Oyster Gardener Course in cooperation with the Virginia Institute of Marine Science (VIMS), creating educational materials and the TOGA web site: www.oystergardener.org

Experience: Helping citizens establish oyster gardens in tidal creeks and rivers throughout the Bay

Research: Participating in oyster research, habitat preservation, and restoration initiatives

