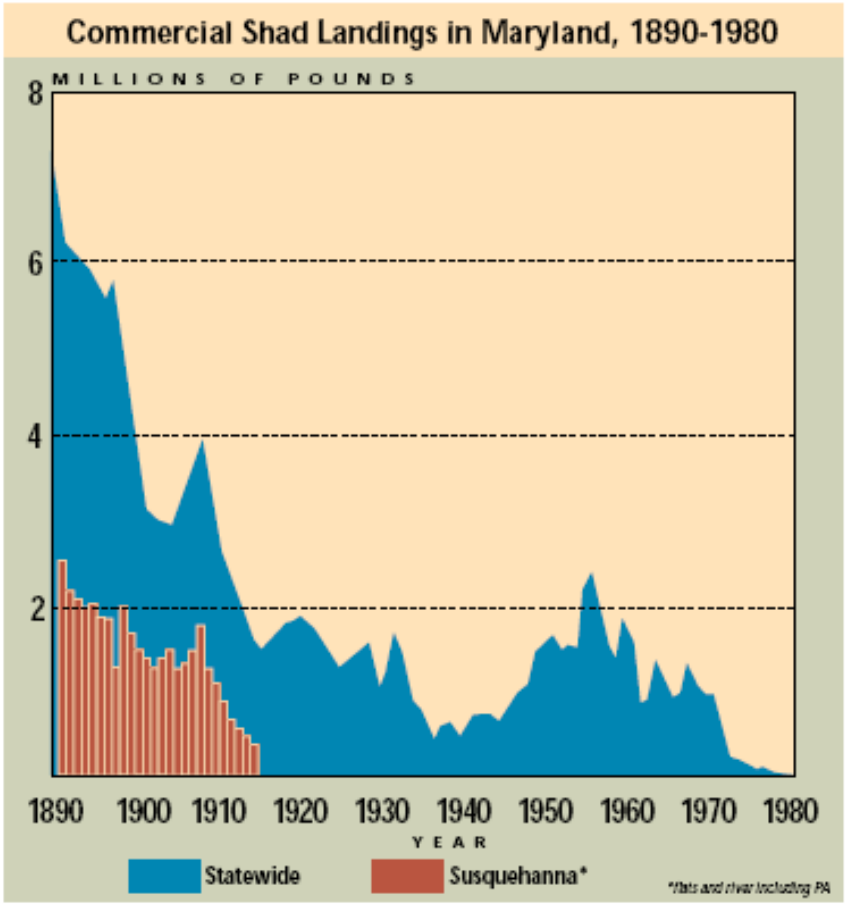
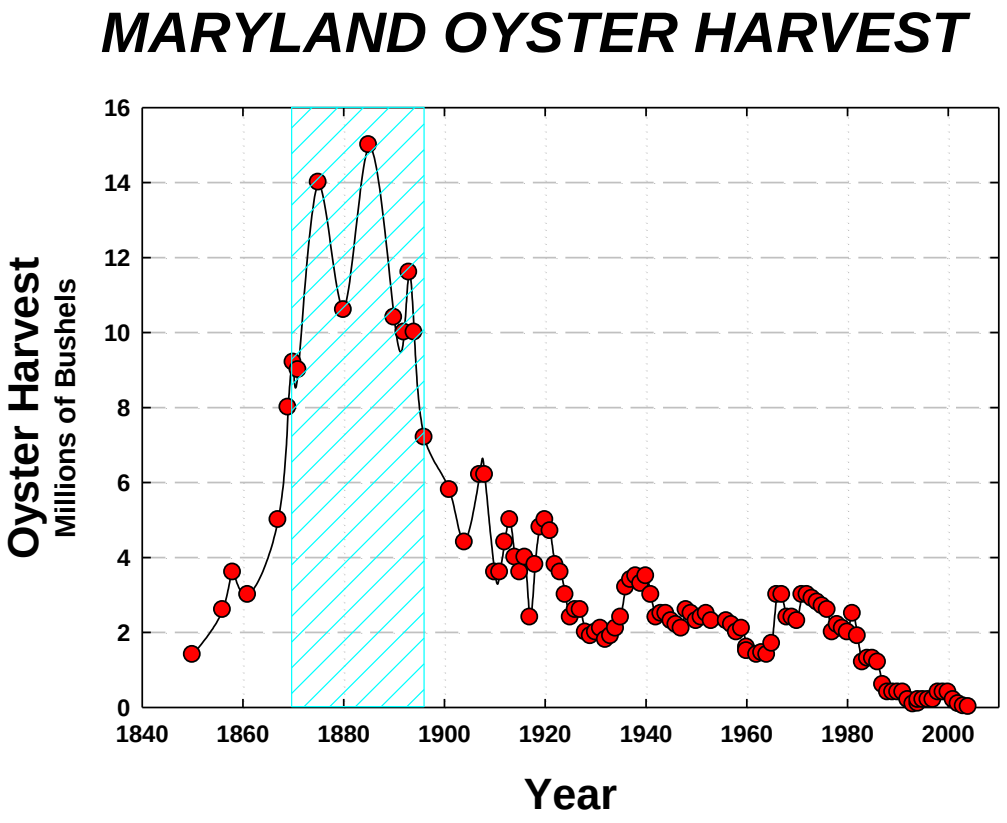

Shifting Baselines in
Chesapeake Bay

History can inform restoration efforts to rebuild Bay resources

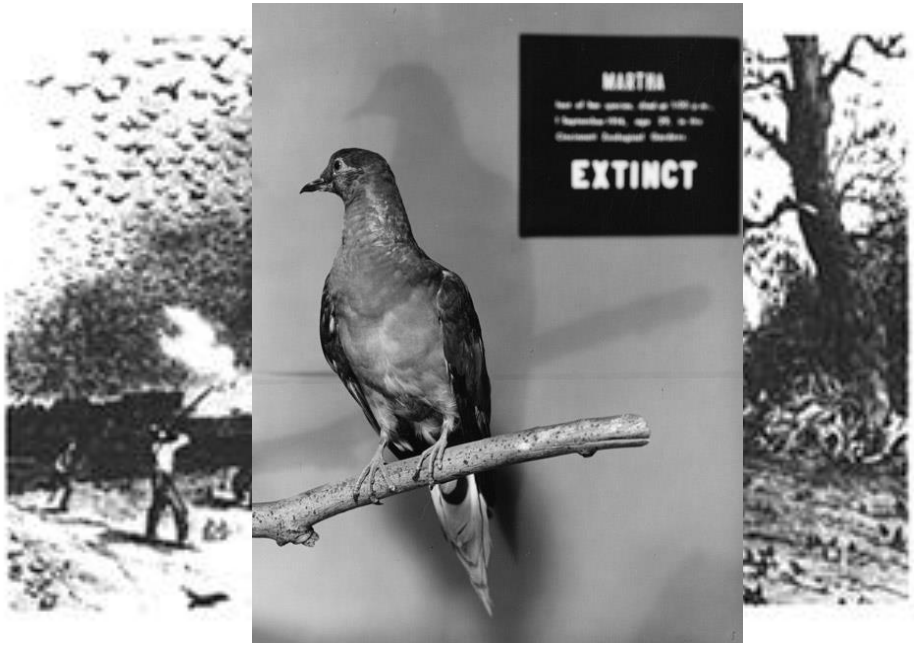




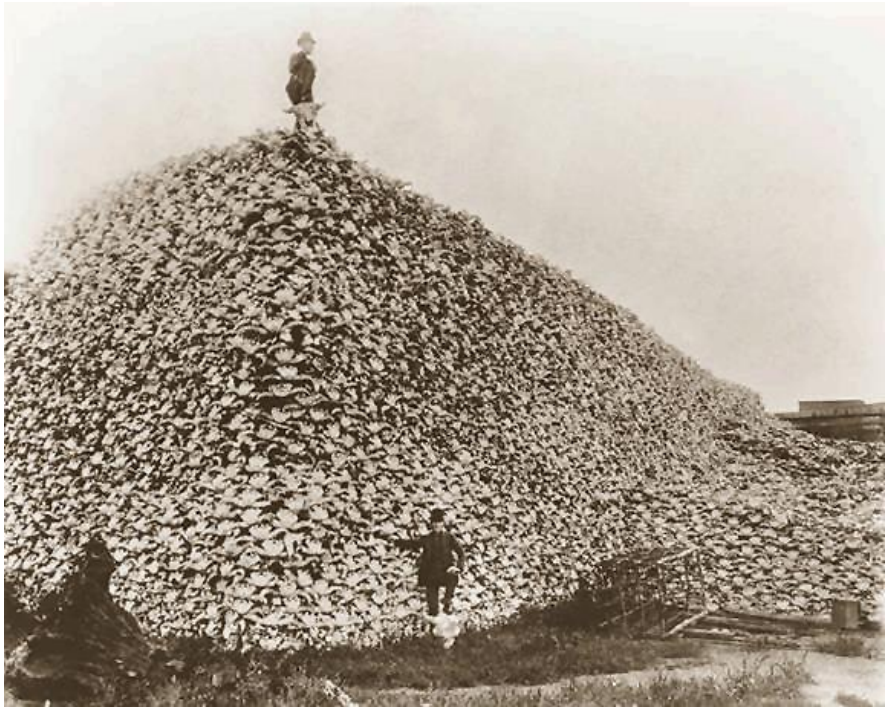
But, shifting baselines can dilute ecosystem restoration goals

- People adjust to continuous degradation of a resource and eventually reduce expectations
- Reference points (baselines) change (shift), affecting restoration objectives
- We need to develop historical insights to support successful restoration

You know about shifting terrestrial baselines

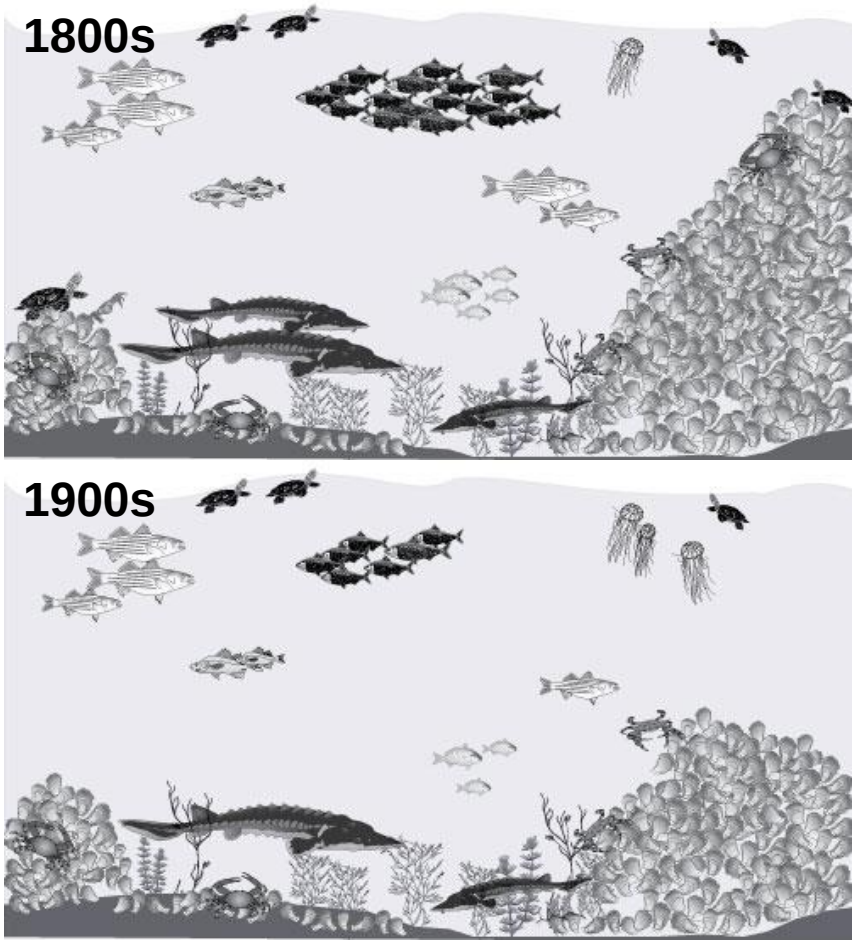


Old magazine illustration of hunters shooting passenger pigeons.
(From copy in Schorger, 1955.)

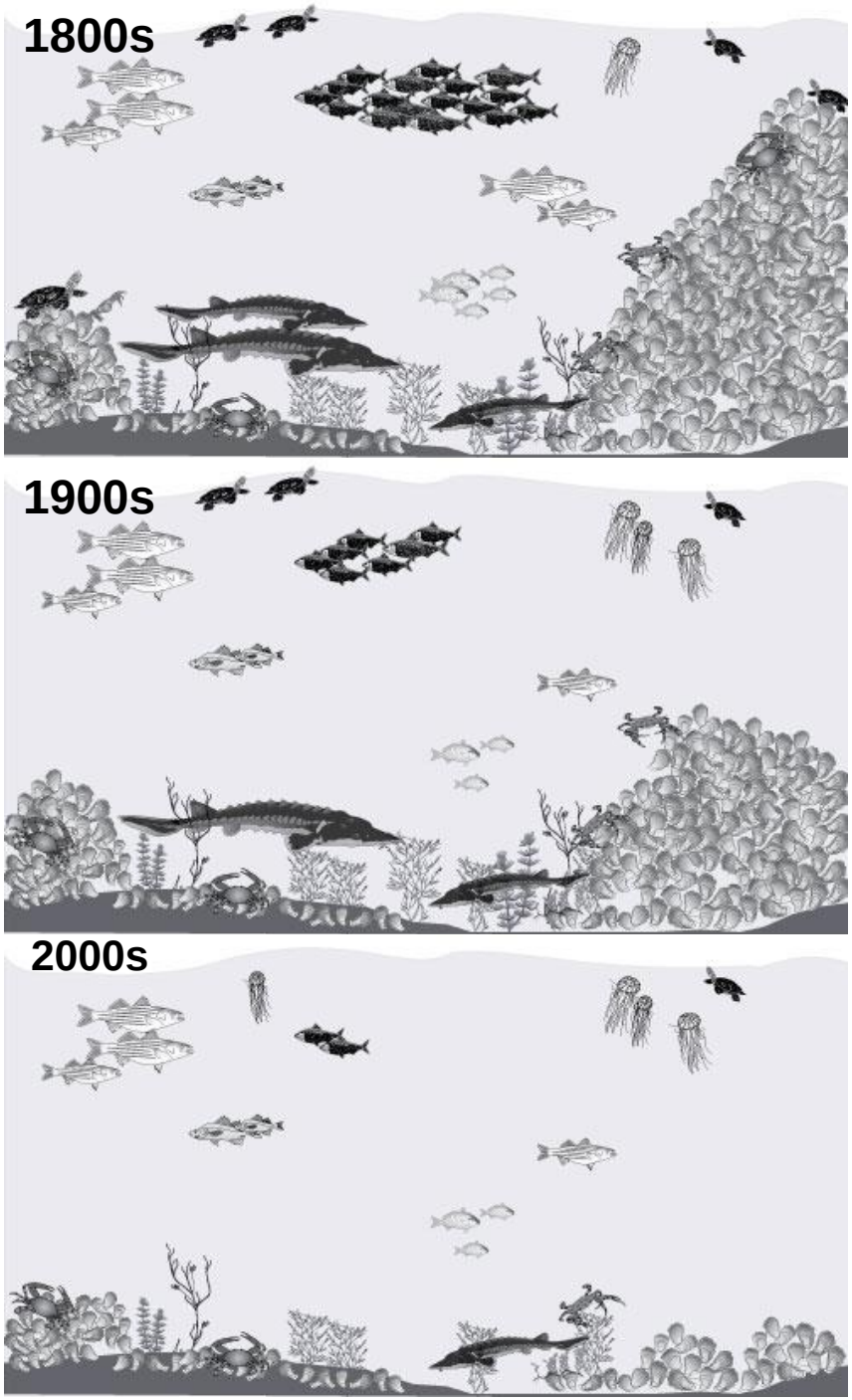


Pile of bison skulls.
http://upload.wikimedia.org/wikipedia/commons

A cartoon of shifting aquatic baselines in Chesapeake Bay



A cartoon of shifting aquatic baselines in Chesapeake Bay

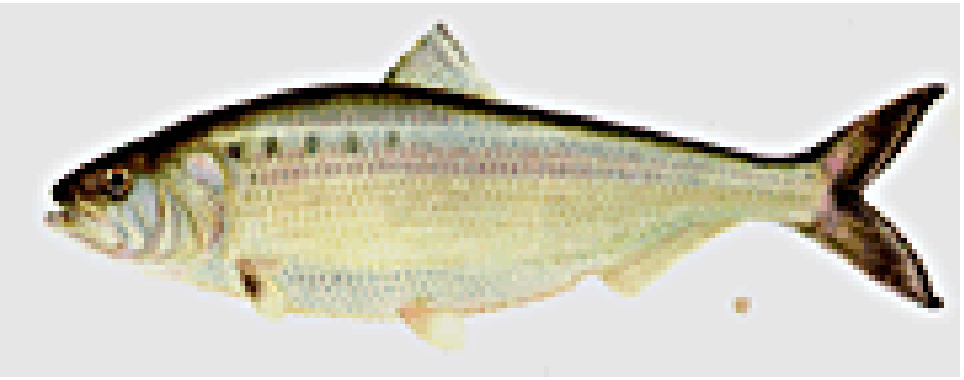


A cartoon of shifting aquatic baselines in Chesapeake Bay

American shad were once hugely abundant

- "From the banks of the river at this fishery could be seen great schools of shad coming up the river when they were a quarter mile distant.
- They came in such numbers and so compact as to cause or produce a wave or rising of the water in the middle of the river extending from shore to shore."

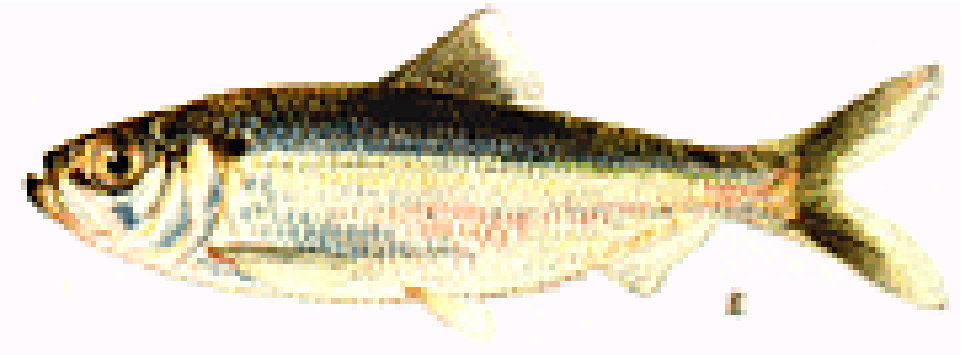
- Letter from 71-year-old Gilbert Fowler about the Webb Fishery in the Susquehanna River near Bloomsburg PA in the **early 1800s** (Bull. U.S. Fish Commission for 1881).



American shad

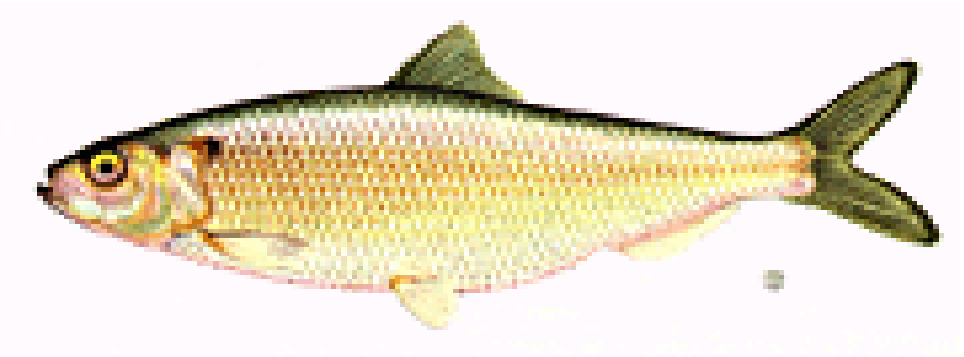
Alosa sapidissima

March



Alewife *Alosa pseudoharengus*

March Branch herring



Blueback herring *Alosa aestivalis*

April Glut herring

Potomac River catches in 1832

- A [relatively small] seine haul could capture 4,000+ shad and 100,000 to 300,000 river herring
- Six-week season yielded 22,500,000 shad and 750,000,000 river herring.
- These catches required 995,000 bushels of salt and 995,000 barrels
- Thousands of people were employed as seiners, processors, barrel makers, etc.

Joseph Martin. 1835. A New and Comprehensive Gazetteer of Virginia and the District of Columbia.

Potomac River catches in 1832

U.S. Fish Commissioner Baird (1889) wrote "…the accuracy of Martin's figures has been disputed by some recent writers. Even if they are, however, twice as large as the fact would justify, the general argument [of the once great historical abundances] would not be invalidated."

Joseph Martin. 1835. A New and Comprehensive Gazetteer of Virginia and the District of Columbia.

Shad-fishing gear: Haul seines

Between 1735 and 1928, up to 453 seine fisheries operated in the Susquehanna River and its tributaries.

Seine size depended on location. In 1883, a Havre de Grace seine was 5,580’ long and 30’ deep. Mesh: 4.5” to 5.5”

A haul might capture 9,000 to 12,000 shad; more usually the average was 10,000 to 20,000 per season per net

Largest seine once used in the Bay

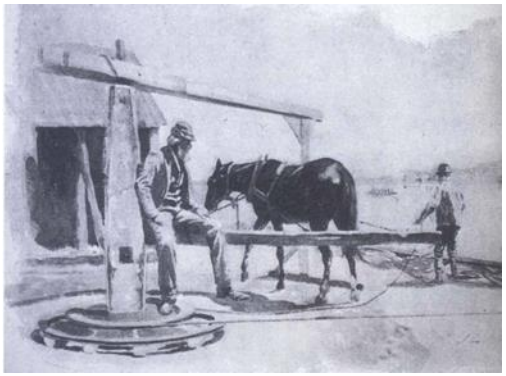
- Stony Point in Potomac River
- 9600’ net + 22,400’ ropes = 32,000’ sweep
- Hauled by steam engine and 80 men
- Up to 3,600 shad & 250,000 alewives were caught in a sweep
- By 1905, only 3,000 shad caught in a season so fishery ended

1908 Bulletin of the Bureau of Fisheries, Volume 28, Part 2, Plate 42

Shad fishing facilities: floats

These were wooden floating structures anchored in a river. Some were 75’ to 100’ wide and 200’ to 300’ long.

They might contain a bunkhouse for up to 100 men, a kitchen, mess area, fish cleaning and washing rooms, barrel rooms, and a stable for horses to turn the seine windlass.



Shad fishing facilities: floats

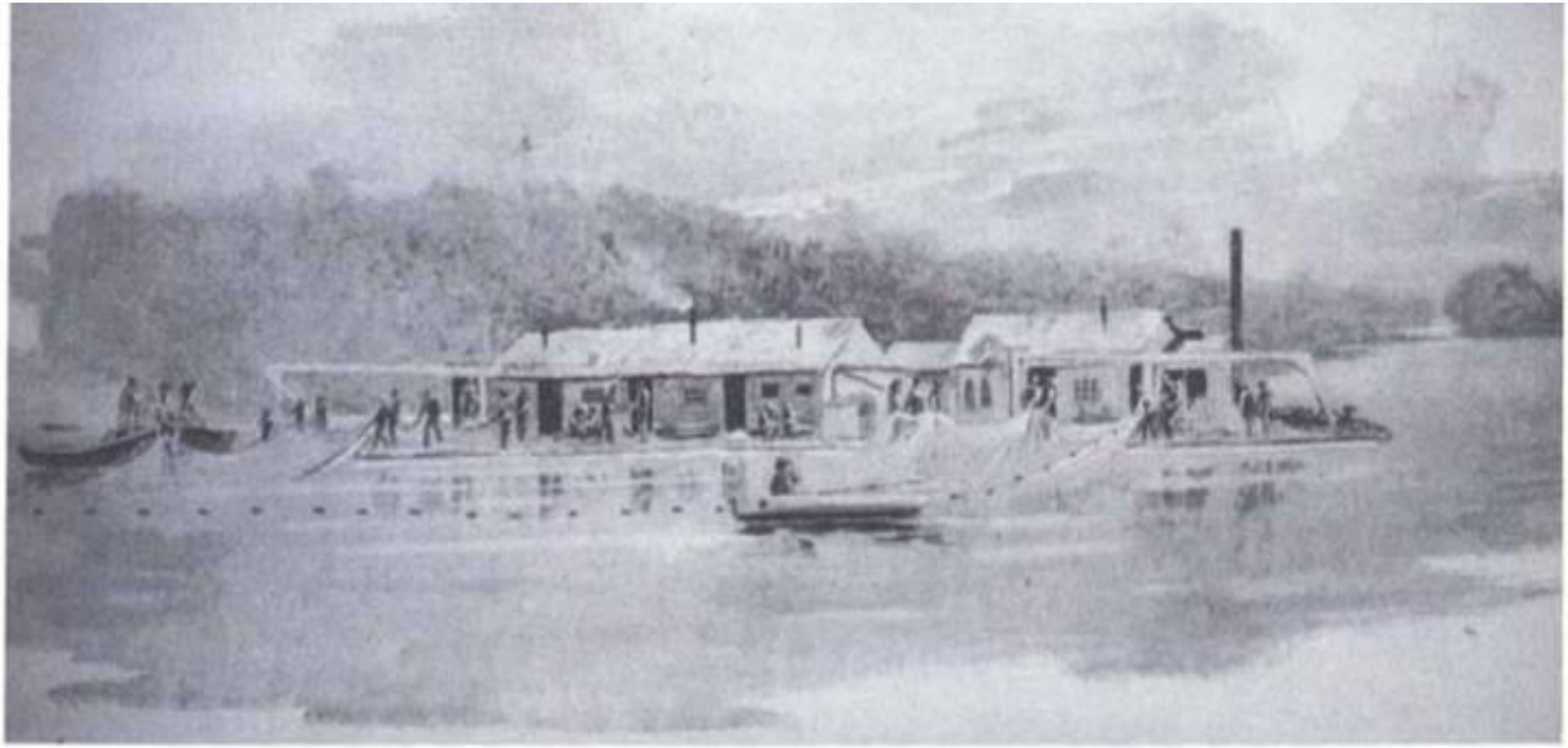


Fig. 6. A Susquehanna River Shad Float. This late nineteenth-century photograph shows a large float anchored in the river with a full crew aboard. The men both lived and worked on the float for about three weeks each spring. (Courtesy, *Harper's Weekly*)

Gerstell 1998

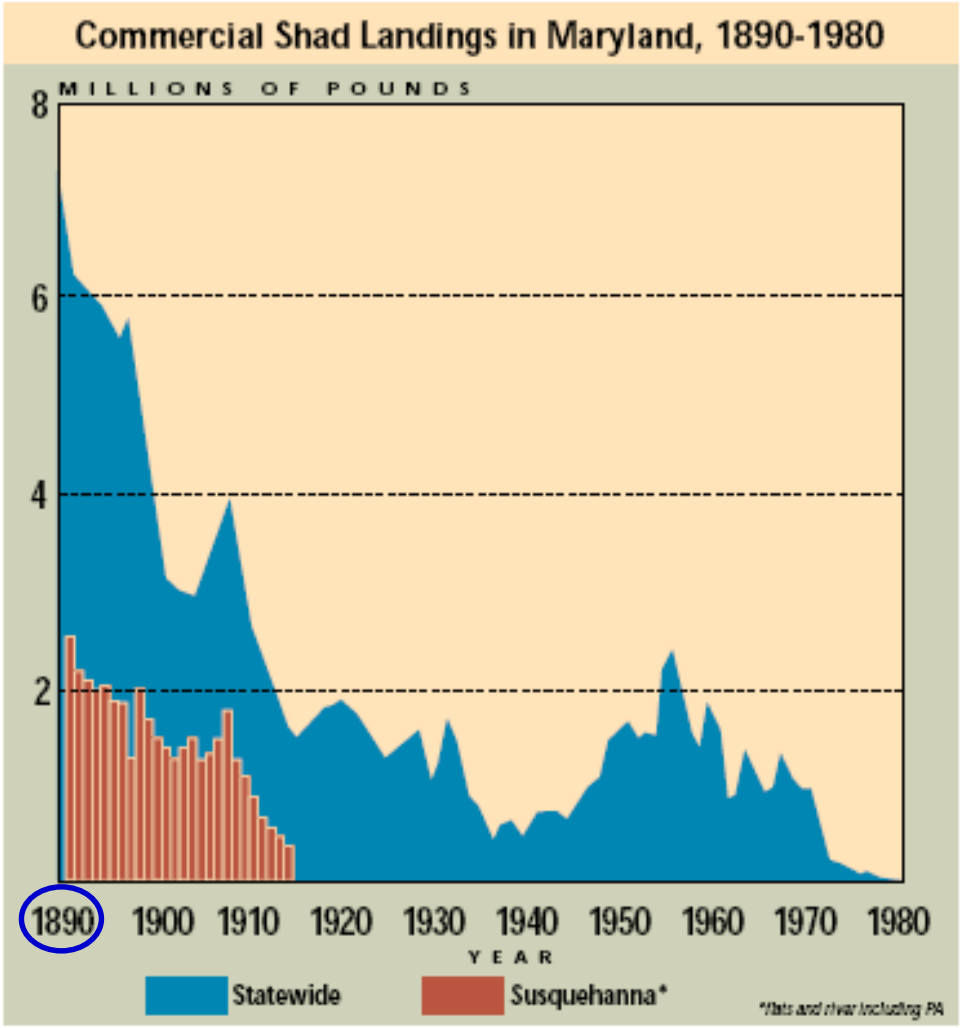
Shad fishing facilities: floats

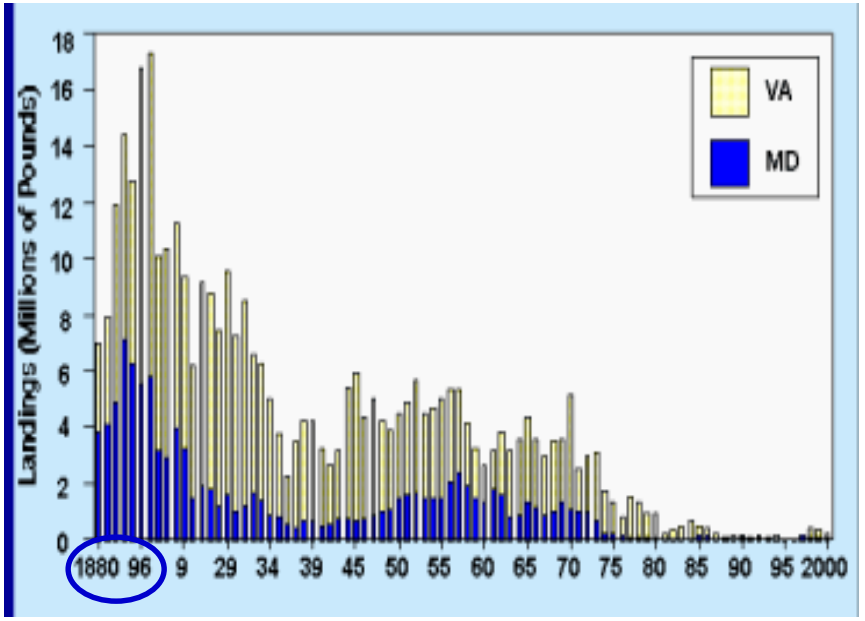
Fig. 7. A Seine Boat En Route to a Shad Float. Along the Lower Susquehanna, local fishing companies used large seine boats to take crew members, supplies, and fish back and forth between headquarters, floats, and fishing grounds. For a few individuals, their assigned duties annually lasted for more than a month during the spring of each year. (Courtesy, Cecil County Historical Society)

Haul seine on the wooden deck of a shad float near Port Deposit 1905

Gerstell
1998

Commercial shad landings in Chesapeake Bay





Reasons for declines in the shad fisheries

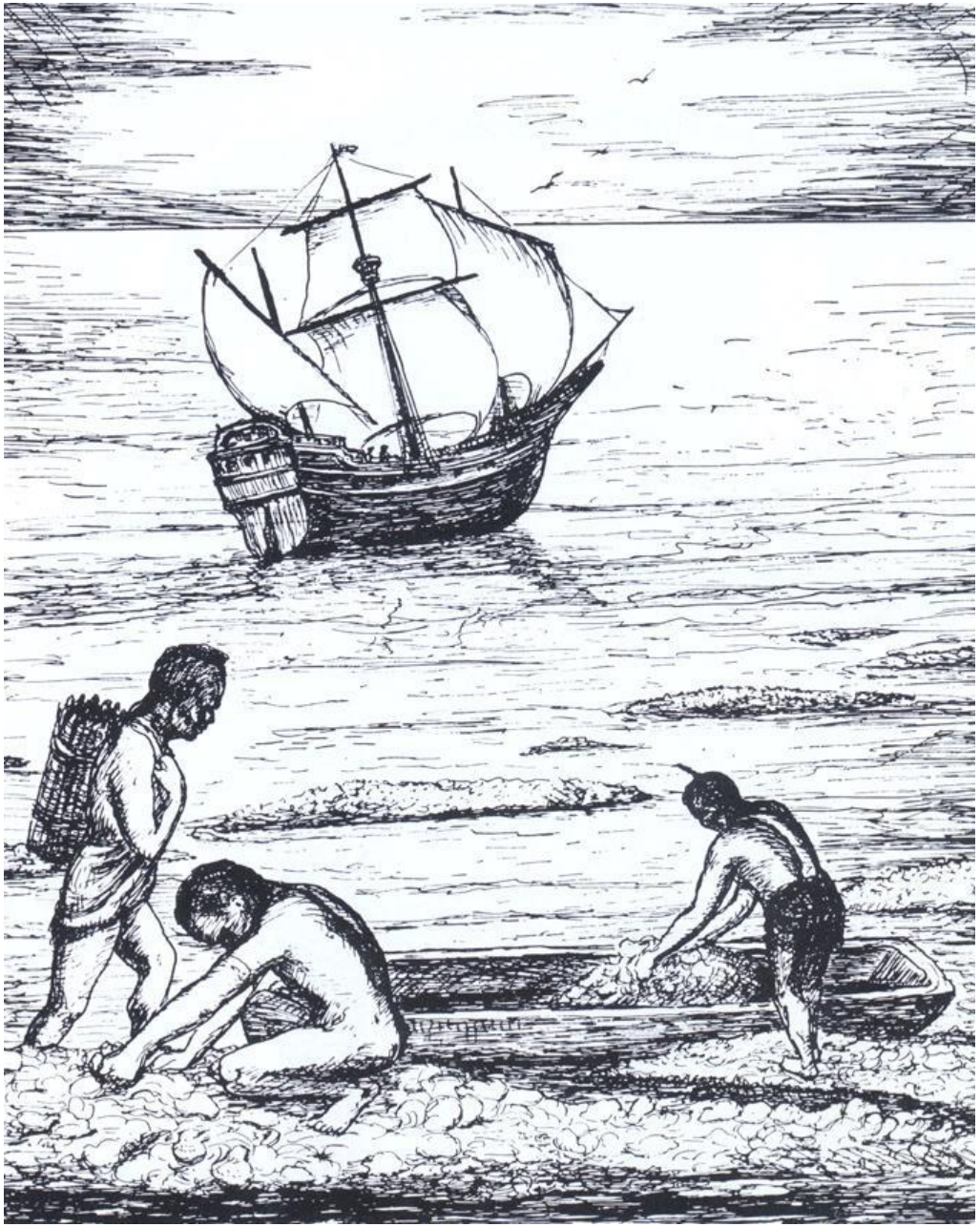
- Overfishing by seines, gill nets, and pound nets
- Pollution (sawdust, chemicals, oils, etc.) that degraded spawning habitat
- Destruction of spawning habitat by dredging for sand and gravel, etc.
- Dams: 18th and early 19th C – mostly lumber & grist mills in tributaries; late 19th and early 20th C - hydroelectric

Chesapeake Bay oysters

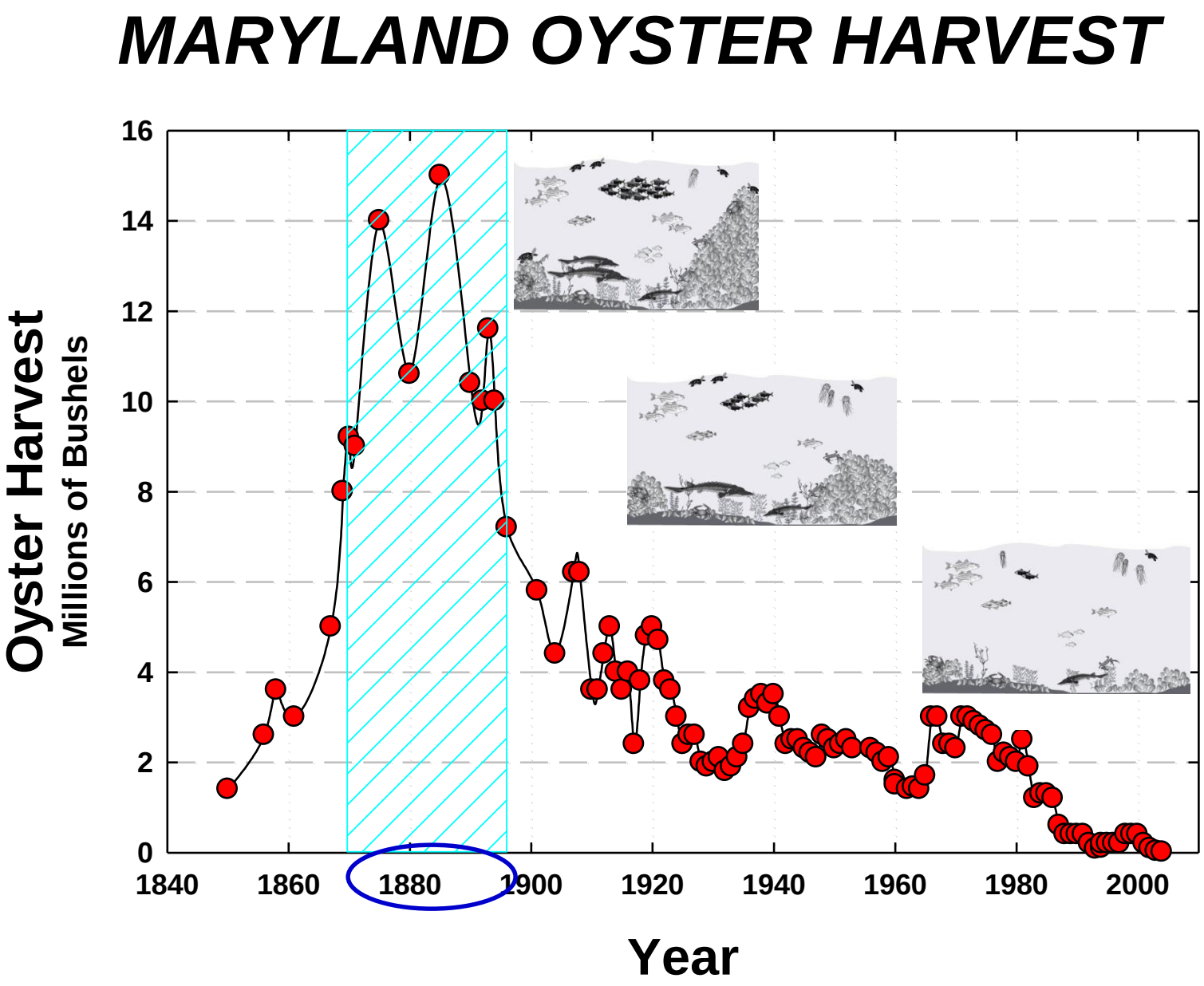
"The abundance of oysters is incredible. There are whole banks of them so that ships must avoid them."

"They surpass those in England by far in size. I often cut them in two before I could put them in my mouth."

Swiss visitor Francis Louis Michel after a visit to Virginia in **1701**

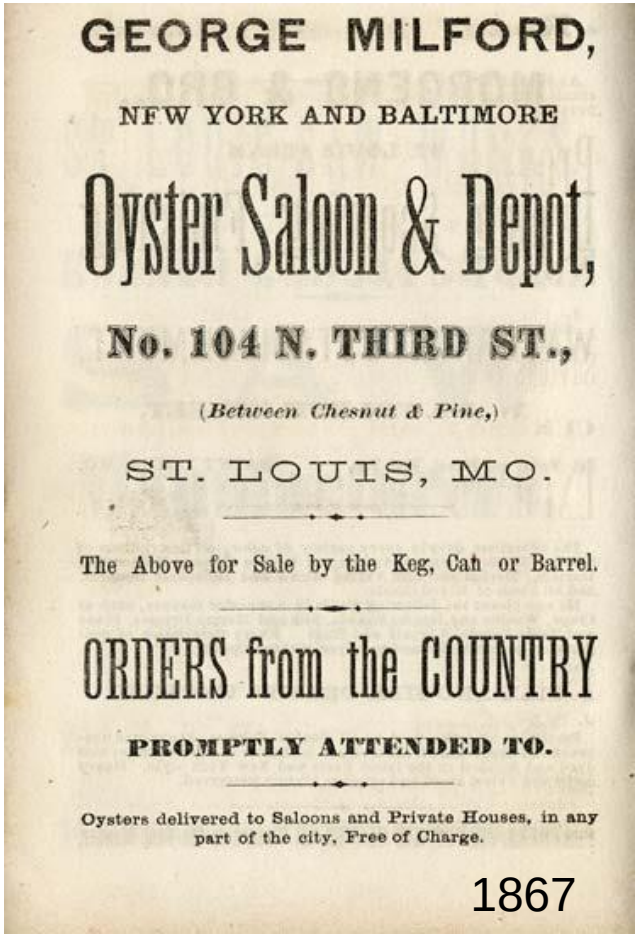


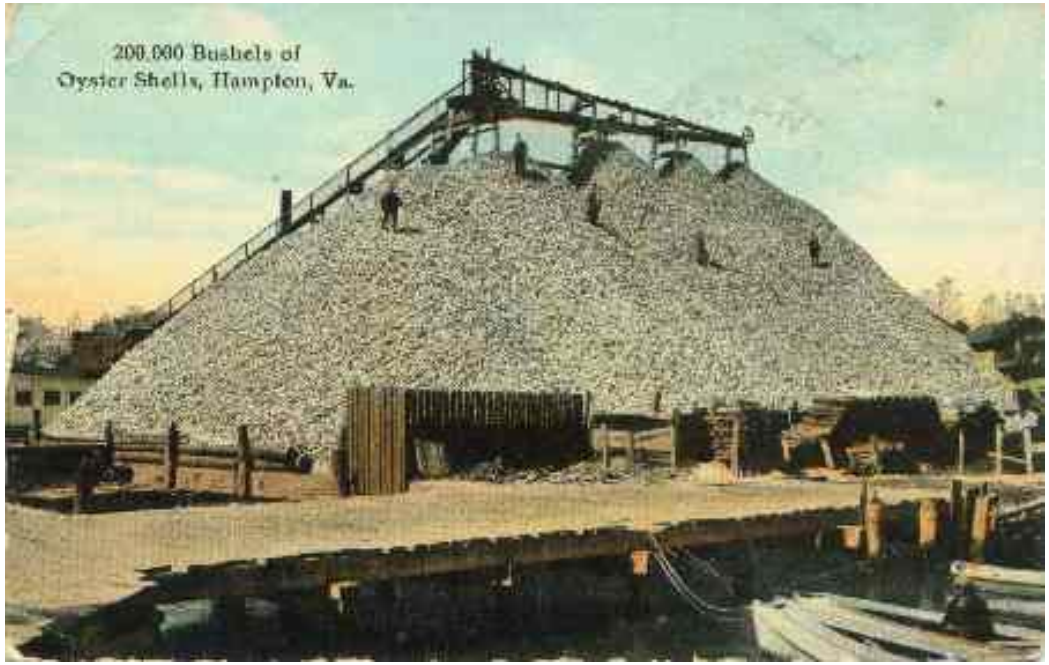
Shifting baselines for Maryland oysters



Oysters were shipped inland and were available whole or in "oyster saloons"

Mankato Minnesota 1881
From *On the Water: Stories from Maritime America*

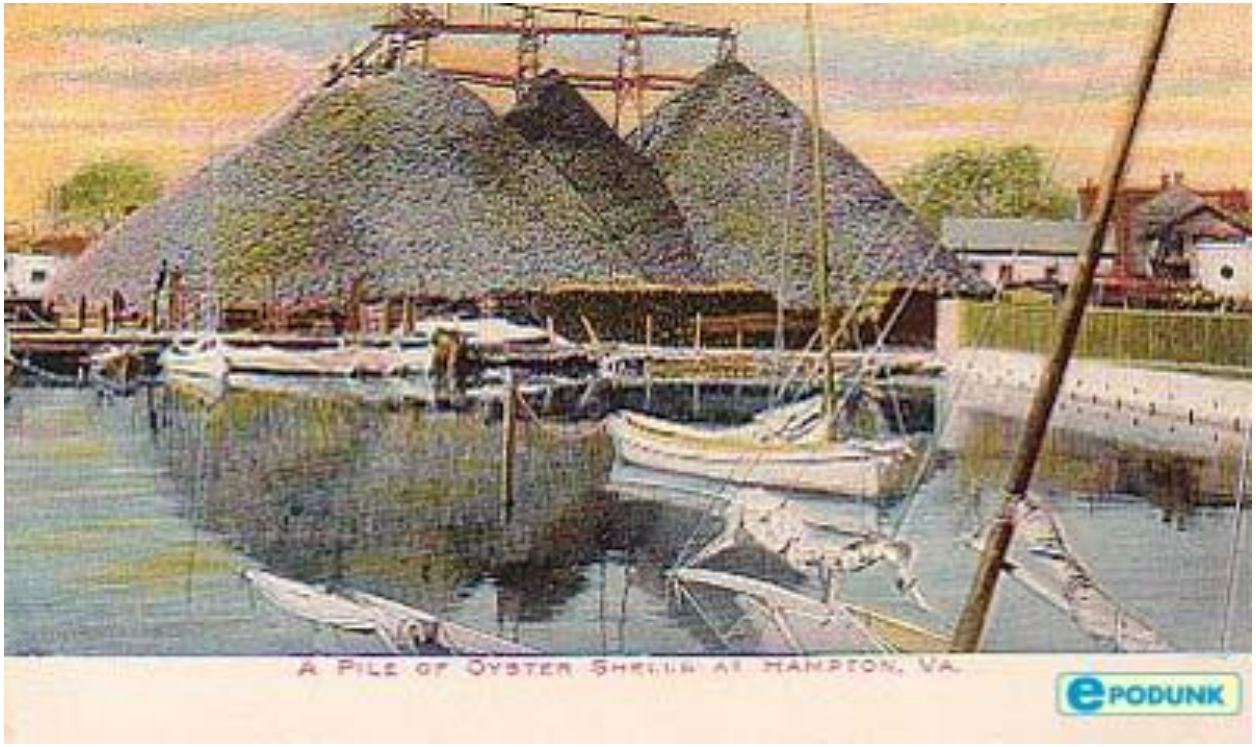




Oyster shell piles, Hampton, VA

Circa 1900

~ 200,000 bushels of shell



Causes of declining oyster populations

1. Overfishing

The Walrus and the Carpenter
Walked on a mile or so,
And then they rested on a rock
Conveniently low:
And all the little Oysters stood
And waited in a row.

“The time has come, the Walrus said,
To talk of many things:
Of shoes--and ships--and sealing-wax-
Of cabbages--and kings--
And why the sea is boiling hot--
And whether pigs have wings."

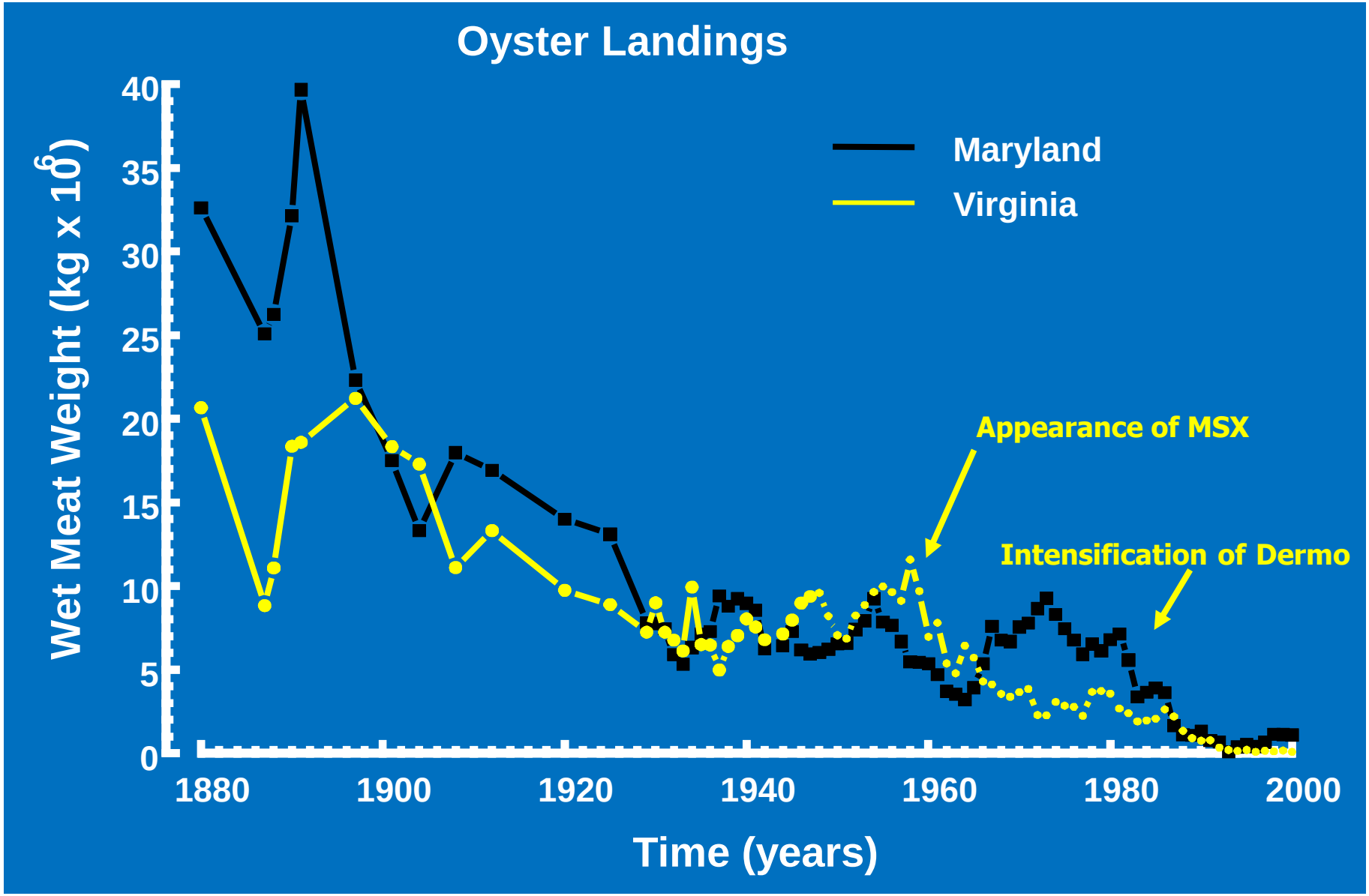
"O Oysters," said the Carpenter,
"You've had a pleasant run!
Shall we be trotting home again?”
But answer came there none--
And this was scarcely odd, because
They'd eaten every one.

Lewis Carroll Through the Looking Glass

Cause 2. Habitat destruction resulted from loss of settlement material

One year's shell from a single Chesapeake Bay shucking house

Cause 3. Disease



How do we deal with the breakdown of expectations of what species should be present in healthy populations, plus societal loss of interest?

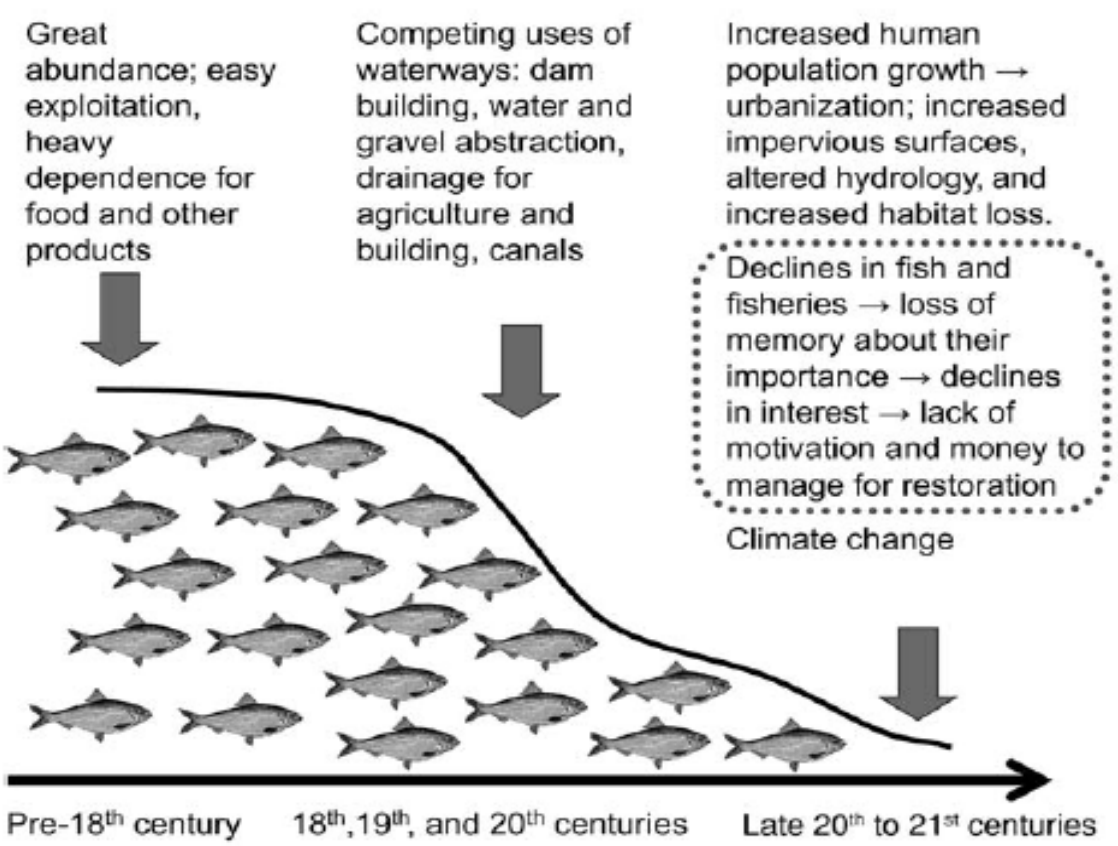


Figure 3. Conceptual diagram of the general history and factors leading to declines in North Atlantic diadromous species. Most species were heavily exploited before industrialization and physical alteration of waterways; further watershed alterations due to human population expansion and climate change increased habitat loss. Gradually, the declines also led to the loss of institutional and societal memory about past abundance and importance (outlined for emphasis).

Limburg, K.E., and J.R. Waldman. 2009. Dramatic declines in North Atlantic diadromous fishes. BioScience 59:955-965.

Shifting baselines for shad

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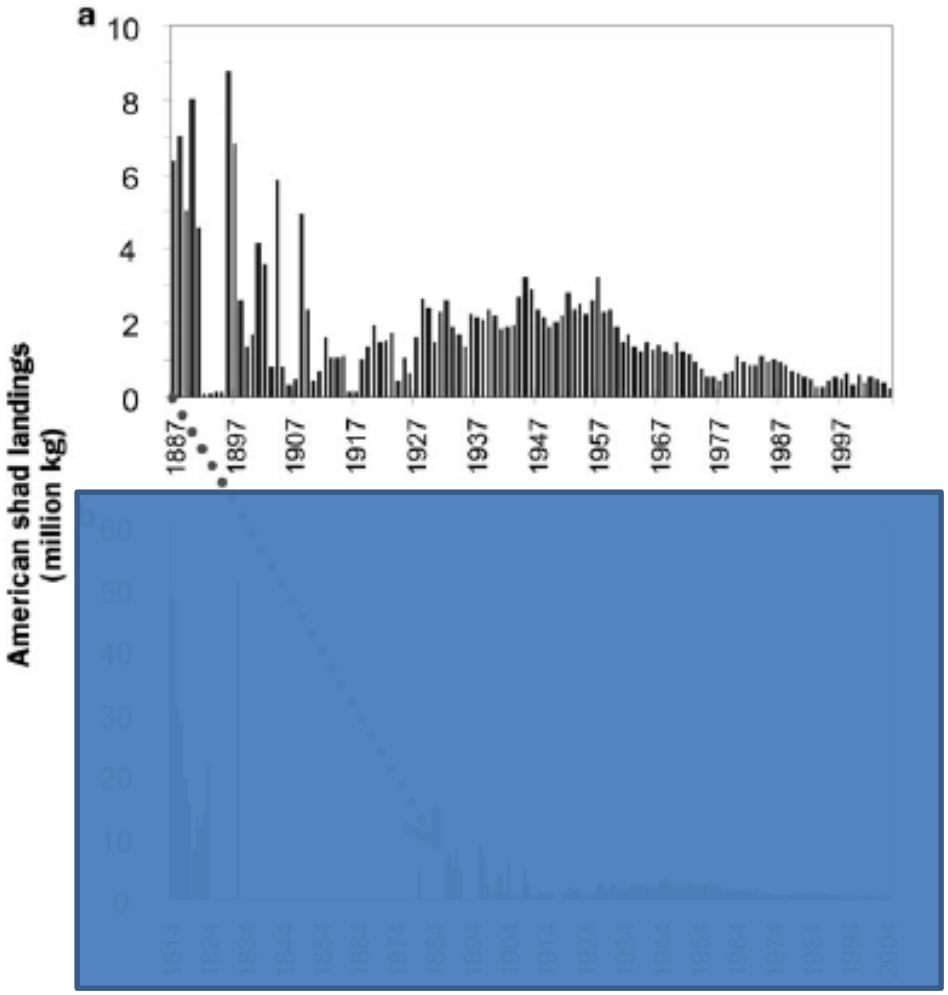

Figure 2. Example of how baselines shift. (a) Baseline for American shad restoration is typically referenced to 1887, when the US Fishery Commission began to collect statistics. (b) Earlier data show that levels for the 1887 baseline are considerably lower than they were in the past. Source: ASMFC (2007).

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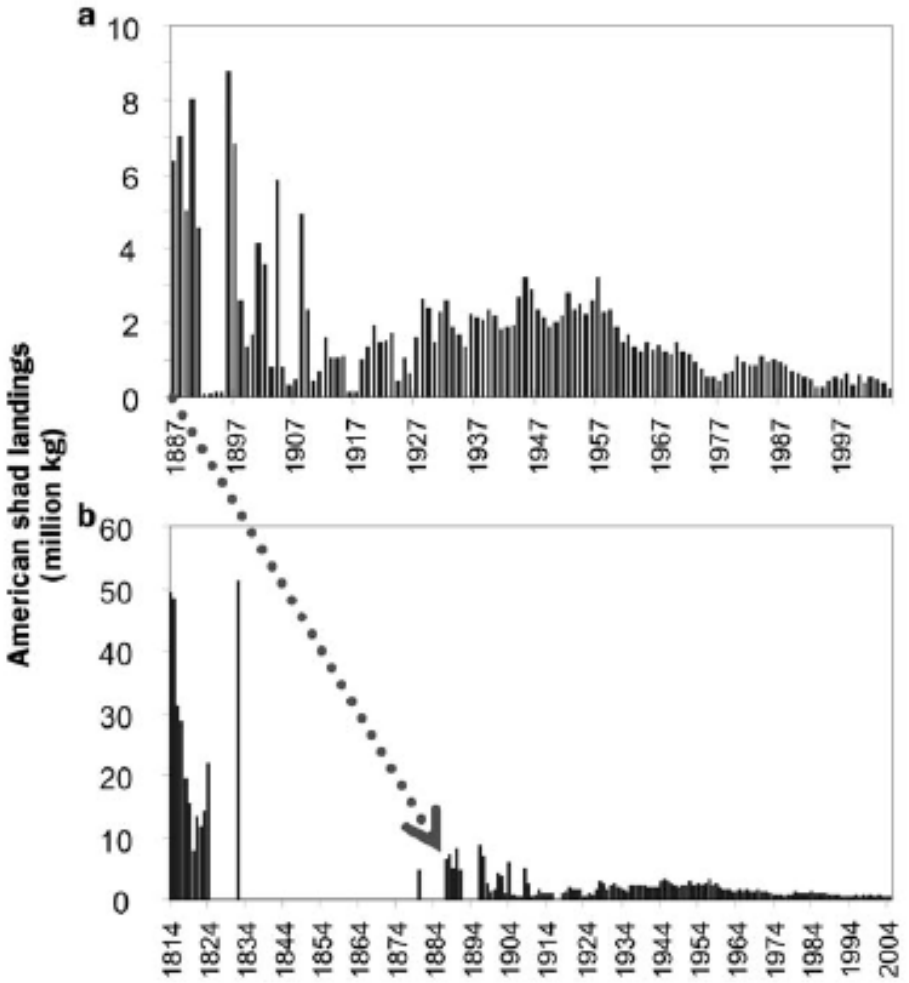

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How do we set a baseline?

- A pristine environment does not exist; humans have always affected aquatic resources
- If we are not aiming towards a pristine environment, what are our aims?
- Do our data go back far enough for us to construct reasonable baselines?
- In a fishery, should a baseline be set according to the *start* of a commercial fishery or the *peak* or *later*?
- How do we account for natural species fluctuations?