Down Jersey LESSON PLAN

Operation Oyster

A Look at the History of Oystering

Theme: **Maritime History**

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Subject Areas
Mathematics, Science, Social Studies and History

Duration
One or two class periods

Setting
Indoors

Skills
Graphing, charting, inferring, correlating, deducing, hypothesizing, demonstrating, explaining

Charting the Course
Relating the historical harvest of oysters to significant events that impacted the industry will show the significance of the relationship that existed in the Down Jersey region between man, the sea, and its resources.

Vocabulary
Spat, dredge, MSX, schooner, harvest, seed oyster, fishery

Correlation to NJ Core Curriculum Content Standards

Mathematics
4.1 (3, 4, 5, 8)
4.2 (1, 2, 4)
4.3 (6, 7)
4.4 (2, 5)
4.6 (7, 8)
4.11 (2, 5, 7)
4.12 (1, 3, 5)

Science
5.2 (5, 9, 10)
5.5 (4, 5, 6, 7)
5.7 (4, 8, 9)
5.12 (1, 2, 3, 4, 5, 6, 7, 9)

Social Studies
6.6 (2, 3, 4, 5)
6.9 (1, 2, 3)

Operation Oyster — *A Look at the History of Oystering*

Objectives

Students will be able to:

1. Describe the methods utilized for harvesting oysters
2. Provide possible reasons for the decline of oyster harvest along the Delaware Bay of Southern New Jersey
3. Discuss the factors that allowed the oyster industry to have such a significant economic impact on the region.
4. Interpret the relationship between the amounts of oysters harvested and other events and developments within the region.
5. Create a graph and hypothesize cause and effect.

Materials

Large sheets of paper (one for each group of four or five students)

Yardsticks (or other straight edge for making the graph)

Copy for each Team of: Background Information, oyster harvesting records and significant events cards and year cards

Markers, glue/tape, scissors

Student Handout — copy for each Team

Making Connections

The Oyster Industry of the Maurice River Cove — Reprinted from the Delaware Bay Schooner Project

In the southern part of New Jersey, on the shores of the Maurice River, is located the largest oyster- producing region entirely in the jurisdiction of any single state in the union. In fact, we may consider that New Jersey leads the world in oyster production because the yield of oysters in other countries is negligible compared to that of the United States. Both in number of pounds of meats and total value of the product, New Jersey far exceeds any other State. The total value of the industry is more than that of the next two highest competing States combined.

Earle B. Perkins, Ph.D. — NJ Oyster Laboratory 1931

Background

(See also Oyster Fact Sheet)

(*Historic Themes and Resources* book pages 46 -51)

Reprinted from *The Delaware Bay Schooner Project lesson on Oystering*, by Greg DeCowsky

From the earliest days of native American settlement on its shores, the Delaware Bay was a highly productive source of seafood. One of the most important resources was the American (or Eastern) oyster. With the coming of European settlers, oystering increased dramatically. Laws to regulate overfishing were passed in 1719 in New Jersey, and in 1812 in Delaware, but they had little effect.

In 1876, the railroad came to the Maurice River, making it possible to ship large quantities of oysters, thus causing a boom in the oyster industry. Ten years later, more than 90 railcars of oysters were shipped every week from Bivalve, the center of the New Jersey oyster industry. By the turn of the century, oysters were America's number one fishery product and New Jersey was the number one oyster supplier. They were a staple part of the region's diet, and you could buy them from street vendors in Philadelphia, much the way we buy pretzels and hot dogs today.

At the height of the fishery, more than 500 schooners and other boats, and 4,000 people worked in commercial oystering in Cumberland County — this is not including the numerous others involved in processing, shipping, shipbuilding, and other industries dependent on the oyster.

Entire towns grew up around the oyster industry: Port Norris, Bivalve, Shellpile, and Maurice River in South Jersey; Bowers Beach, Leipsic, and Little Creek in Delaware. At the peak of the oyster fishery, Port Norris could claim more millionaires than any other town in New Jersey! The prosperity extended throughout the region, even as far as Philadelphia, where some business and ship shareholders were based.

Most of the ships used in oystering on the Delaware Bay were built on the Maurice and Cohansey Rivers: Leesburg, Dorchester, and Greenwich were among several major South Jersey shipbuilding centers. The A.J. Meerwald was built in Dorchester in 1928. It's typical of the later style of wooden, two-masted, "Bald-headed," centerboard schooners used in the Delaware Bay for oyster dredging.

Most of the oysters were taken by dredging from sailboats: dragging a rake-like device with a mesh bag across the bottom. (On the Chesapeake Bay, hand or mechanical tongs or diving are used too, but dredging has long been the method of choice on Delaware Bay.) This method yields large quantities of oysters with comparatively little effort, but it tends to flatten the oyster beds, making it more likely that they will be buried in the mud.

On the Delaware Bay, oysters are usually dredged from "Seed" beds in the spring and "Planted" on other beds to grow out to market size (3" is the legal minimum). Oyster planting in the Delaware Bay was first done in the 1820's in the Maurice River Cove and off Port Mahon and Little Creek in Delaware.

After World War II, dredging under power was allowed, and most of the old schooners cut down their masts and converted to power, allowing more oysters to be caught with less effort. In the late 1950's, Delaware Bay oystering collapsed, primarily because of an oyster disease called MSX. The oyster catches dropped 98% in two seasons. The industry has never recovered, and the loss of the oyster business turned many south Jersey and Delaware communities into ghost towns. MSX and another oyster disease, called Dermo, have continued to prevent the restoration of a commercially viable oyster fishery, and much scientific knowledge about the diseases has been gained due to extensive research.

It is not (and may never be) certain whether humans helped cause the decline of oyster population, although there are several possibilities:

1. The MSX and Dermo organisms themselves may have come to the Delaware Bay from elsewhere in the world on ships (i.e., in ballast water, or on oyster seeds brought into the bay, or oysters that were brought in by the public and "put over the side to keep.")
2. Stress to the oysters from pollution or eroded sediment may have weakened them and made them more susceptible to disease
3. Changes in salinity due to water use or removal of plant cover upstream or channel dredging may have stressed the oysters or otherwise helped the diseases to spread.
4. Or, none of the above.

Oyster Biology/Pollution Effects

Oysters live in shallow brackish or salty water and tend to grow in piles or clumps known as "beds." They need hard bottom habitat — shell or rock — and cannot survive being buried in the mud.

(Where is the natural hard bottom of the Delaware Bay?)

One of the most interesting things about the oyster is that it can actually clean the water it lives in! The oyster feeds by pumping water through its body and filtering out its food (mostly algae and detritus — decaying plant material). A healthy market-size oyster can filter 50 or more gallons of water a day! Also, a natural oyster bed provides the habitat — shelter and food — for a community that includes many other organisms: plants, crabs, worms, fish, etc. Among the creatures you may see are such predators as oyster drills, moon snails, or whelks,

snails that feed on oysters by drilling holes through the shells.

What else eats oysters? The spat or larvae are very vulnerable. They are eaten by a wide variety of fish and invertebrates. Large oysters may be eaten by crabs, fish (rays, skates, drum), starfish, worms, or birds (i.e., oystercatchers). Boring sponges are commensal, meaning that they use the shell as their home. They don't actually eat the oysters, but they can kill them.

Oyster spawn or reproduce (mostly in summer) by releasing eggs and sperm into the water. Usually almost all the oysters in a bed will spawn at once when the temperature reaches about 70° F. The fertilized eggs become larvae ("spat") which eventually settle and attach themselves ("set") to hard bottom, usually another oyster's shell. So, it's important to return old shell to the oyster beds.

A practice long ago started by the oystermen in the Delaware Bay.

Although it's not known for sure whether human activities promoted the spread of oyster diseases, it's generally true that when an organism is stressed (by pollution, climate, inadequate food, etc.), it becomes more susceptible to disease or predation (so that in nature, weakened members of a species are often "weeded" out). So, an oyster choked by sediment or sickened by disease MAY be more likely to die of disease.

One of the problems for oysters is the erosion of sediment (soil) from the land, especially land from which the natural plant cover has been removed. Sediment in the water can "choke" an oyster's gills, slowing both breathing and feeding. It can also settle out and cover oyster beds, cutting off their supply of clean, oxygen-containing water. Excess sediment can be the result of what is called Nonpoint Source Pollution (or NPS), which is pollution that can't be traced back to a particular point. NPS pollution consists largely of runoff from farms, streets, and lawns, and often carries pesticides, fertilizers, oils, and other toxic materials, as well as sediment.

Forests and wetlands tend to act as filters or sponges, absorbing rainwater — and NPS pollution — before it reaches the River and Bay. Paved land doesn't absorb rainwater, but funnels runoff, and the pollutants it carries, directly into streams before it can be filtered through the soil and plants.

Sediment has also created new shoals (sand bars) and mud flats, and filled in many streams and channels. For example, Mauricetown was formerly a deepwater port for oceangoing ships, however, few of those ships could get there today. Other ports, and indeed the main River-Bay channel, need frequent dredging to keep them open. Perhaps the channel (and the transportation it allows) is too deep for the system to support? This dredging can cause sediment and other contaminants that have already settled out to be resuspended in the water, exposing oysters and other animals to the "recycled" pollution. Under-dredged ports lose their access to trade, and often become ghost towns.

5) Procedure

Warm Up

Discuss with the class the history of oystering and its significance to the region. Refer to the film *Down Jersey* and ask students to recall any references to the oyster or oystering made in the film. Does anyone know of someone who is/was an oysterman? Do another activity on oysters or oystering from this packet.

The Activity

Part One

1. Remind students of graphing techniques and procedures. Define the x-axis and y-axis if necessary. Explain to them that in this activity, the x-axis is the year, and the y-axis is the amount of oysters harvested. They will be constructing a bar graph, and they should make it as large as the paper allows.
   This could be modeled by the teacher while the students work at their tables and follow along.
2. Using the data sheet provided, graph the historical harvest of oysters. Again, depending on the graphing experience and level of the students, this could be done in their independent groups or modeled by the teacher first or simultaneously.
3. Complete the graph by coloring in the bars. Or, cut out appropriate sized pieces of construction paper to illustrate the amount and have students glue them to the graph.

Part Two

1. Now, each team should have a large graph depicting the fluctuations in the oyster harvest over time. Initiate some basic discussion regarding the graph.

Sample questions:

Did the amount of oysters harvested remain constant over time?

Does there seem to be periods of very high/very low oyster harvest?

What factors could influence the amount of oysters harvested? Generate a list of possibilities.

2. Tell the students that they are going to try to match significant events in the history of oystering with the year (or period) in which it occurred. The basis of their hypotheses will be the amount of harvest in a given time period. Distribute the sheet of significant events cards.

3. The team challenge:
   As a team, try to match the significant event card to the bar on the graph. (I.e., based on the information on the card, what impact would it have had on the oystering industry, or vice-versa. Could the oyster population be the cause of the event?) Have other teams challenge the hypothesis. What else might have happened?

4. The cards should be cut apart. When the team agrees with the choices made, the cards should be taped/glued to the graph in the appropriate location, based on the year or period of time that the team believes that particular significant event took place.

5. Each team should have a completed graph/poster that illustrates the history of the oystering industry for the region.

Wrap Up

Discussion questions: Could be used as a homework assignment/individual classroom assignment for the following day, or an open-ended class discussion.

Sample questions include: *(student handout — one copy for each team)*

1. How has the oyster harvest changed over time?
2. What are the possible causes of increasing harvest? List them.
3. What are the possible causes of decline in harvest? List them.
4. Were the factors that caused the rise and fall of the oyster industry naturally occurring or due to people's influence? Could human impact (over-fishing, pollution, destruction of the oyster beds by dredges, etc.) have been factors? (Possibly, but not necessarily; we still don't know for sure.)
5. What could have been done differently to help insure a continued bountiful oyster harvest? What would have been the consequence of these actions?
6. What happens if a community depends solely on the harvesting of a natural resource (such as the oyster) if suddenly, there is a tremendous drop in the population available for harvest, or the demand for the product (the oyster) decreases dramatically?

7. How can communities protect themselves from the collapse of a fishery (or other industry)? How do the human and ecological communities benefit from diversity?
8. How can logging, wetlands destruction, farming, etc., many miles away endanger the health of oysters? How does the action of someone else from somewhere far away threaten the livelihood of people on the Delaware Bay?
9. Does our experience with the oyster fishery suggest any lessons for managing other fisheries (crabs, clams, finfish, etc.)? How might they differ? Who is responsible for the management of wildlife? How do we hold them accountable?
10. What should be done now, if anything, to try to restore
    a) the oysters and
    b) the communities that once thrived on them?

    Talk about what people can do in terms of both individual behavior and the community planning and decision-making process. What are the costs? Who will pay?

Action (Optional)

Have students investigate the current status of the oyster harvest on the Delaware Bay. What trend does the population of oysters seem to be following? Complete the graph based on this new information.

Students could extrapolate the estimated oyster harvest for the future based on current trends for the year 2,000, 2005, 2010, etc.

Using the Collecting Oral Histories activity, students could identify and conduct interviews of a variety of people who were somehow impacted by the oyster "rise and fall."

Students could individually research and investigate one of the "significant events" presented for this activity. Their findings could be presented to the class.

Assessment

Student teams should each present their findings orally to the class.

Students could decorate their posters with drawings, illustrations, etc. to go with each major event.

Display them on a bulletin board, around the classroom, etc.

Extensions

Comparing different modes of transportation

Transportation methods vary based on cost-effectiveness and time. Transporting oysters by rail car versus trucking explains the reason why the industry depended on the railroad. A rail car can hold 100 tons of cargo, 3,500 bushels or 30,240 gallons. In contrast, a large semi truck can hold 28 tons, 910 bushels, or 7,865 gallons of cargo.

A sample Math problem:

If 90 rail cars of oysters were leaving Bivalve every week in 1886, how many tons, bushels, gallons of oysters were being shipped out of there? How many trucks would that same amount require? Why was the railroad so critical to the oyster industry?

Investigate the impact of refrigeration on the oyster industry.

Resources

***Beneath the Shell**, NJDEP, Office of Environmental Planning, CN 412, Trenton, NJ 08625, Haskins Research Laboratory, Bivalve*

***Living Resources of the Delaware Estuary.** Produced by The Delaware Estuary Program. Ford, S.E., Haskin, H.H., and Kraeuter, J.N. 1995 Eastern Oyster. Pages 105-111 in L.E. Dove and R.M. Nyman, eds.*

***The Delaware Bay Schooner Project**, both Museum and activities aboard the AJ Meerwald.*

Student Handout

Operation Oyster — A Look at the History of Oystering

One copy for Each Team. Cut the cards apart.
Teams should work together to match the event with the year by using the background information provided.

Significant Event Cards

1

The railroad arrived and the already booming oyster industry went into overdrive.

2

Ninety rail cars of oysters were leaving Bivalve every week.

3

Central Railroad recognized a profitable investment opportunity and built oyster wharves in Bivalve.

From the Bridgeton Evening News:

"There will be thirty-two offices and thirty-two store rooms for the shippers. Also each shipper will have a space of 20 x 26 feet on the second floor for storing purposes."

4

Significant commercial harvesting of oysters using patented hand tongs operated from the decks of small sloops.

5

Soon to be bustling town of Port Norris had eight dwellings.

6

The peak of the New Jersey oyster industry in the Maurice River Cove.

7

The oyster dredge —
a straightrake trailing a chain basket —
was introduced by Europeans.
Improved amount of harvest.

11

Literally hundreds of vessels engaged in
the trade of oyster harvest.

Hint: At the peak of the industry # 6.

8

Following the construction of railroads
to the mouth of the Maurice River in
Bivalve (Port Norris' waterfront section),
the population jumped from a mere eight
dwellings 40 years prior, to 885 people.

12

Economic troubles came to the oyster fleet
with the onset of the Great Depression.

Hint: No new schooners were built
after this point as the decline of
consumer purchasing power decreased
for delicacies like oysters
(i.e., supply and demand).

9

The population of Port Norris is up to
1800 people.

Hint: 20 years after the answer to #8.

13

Most of the young men employed
as the crew on the oyster schooners
were off fighting World War II

Hint: Many boats were converted
to power and their masts and rigging
were removed.

10

The demand grew and the sloops gave way
to two-masted schooners that utilized
chain mesh dredges operated by
winding motors to bring in as much as
500 bushels of oysters per day.

14

New laws permitted oyster dredging
under power which began to do damage
to the beds, tearing them up and
spreading silt over seed oysters
which then failed to mature.

15

MSX disease wiped out whole beds on both sides of the Delaware Bay and drove out all but the most resilient oystermen out of business.

16

The MSX problem spread throughout the seed beds and reached almost all of the oyster-producing areas within the bay. In only seven years, an industry worth $2.7 million has decreased to a mere $18,000.

17

Natural sets offered the possibility of slightly improved disease resistance. This fostered a brief revival of the oyster industry more than a 15 year period.

18

First appearing in the Delaware oysters in the next two years, MSX killed between 50 and 95 percent of all the bay's oysters.

19

Dermo disease discovered in several New Jersey locations along the Delaware Bay. Dermo disease is caused by a parasitic protozoan like MSX and kills the oysters.

20

Oystering is a $10 million /year industry.

21

300 dredgeboats and 3,000 men involved with Delaware Bay oystering.

22

500 active dredge boats oystering and 4,000 people involved with the oyster industry

23

Only 30 oyster boats work the bay.

25

In the spring seed oyster season, 20 boats moved about 100,000 bushels of seed oysters. Also, 3,000bushels of oysters went directly to market.

(The first market oysters from the Delaware Bay in three years, and the first direct — without being transplanted — since the late 1800s.)

24

Oyster planting was first done in the Maurice River Cove.

Student Handout

Operation Oyster — A Look at the History of Oystering

One copy for Each Team. Cut the cards apart.
Teams should work together to match the event with the year by using the background information provided.

Year Cards

1876	1904	1920s
1886	1830s	1892
1870s	Mid-1800s	1880s–1890s
Peak of Industry Late 1920s–1930s	1872	1929

1945 WWII	1957	Late 1800’s
1949	1990s	1991
1961	1920–1930	1820s
1950s	1917	1995
1970s–1980s		

M16a

Answer Sheet

Operation Oyster — A Look at the History of Oystering

(The # refers to the card #)

1) 1876 (Railroad)
2) 1886
3) 1904
4) 1870s
5) 1830s
6) Late 1920s to 1930s (Peak of industry)
7) Mid-1800s
8) 1872
9) 1892
10) 1880s–1890s
11) 1920s
12) 1929
13) 1945 (WWII)
14) 1949
15) 1950s
16) 1961
17) 1970s–1980s
18) 1957
19) 1990s
20) 1917
21) Late 1800s
22) 1920–1930
23) 1991
24) 1820s
25) 1995

Oyster Harvesting Data

The quantity of oysters harvested in New Jersey is given below in both millions of bushels and millions of pounds for approximate five-year intervals between 1880 and 1995. (The year listed is dependent on the available data.)

	Millions of Bushels	Millions of Pounds	Price Per Pound
1880	2.4	17.74	$0.12
1886	1.7	12.80	$0.12
1890	1.4	10.21	$0.12
1897	1.5	11.25	$0.12
1901	2.7	18.79	$0.11
1908	1.1	8.25	$0.11
1911	1.2	8.69	$0.09
1921	1.9	14.17	$0.15
1929	2.2	19.92	$0.17
1933	0.9	7.61	$0.08
1938	0.8	5.80	$0.12 (for 1940)
1943	0.8	6.02	$0.52 (for 1944)
1948	0.7	5.99	$0.37 (for 1947)
1953	1.1	8.48	$0.50
1958	0.1	0.83	$0.81
1963	0.1	0.52	$1.09
1968	0.2	1.32	$0.81
1973	0.2	1.40	$0.95
1978	0.3	1.55	$1.30
1983	0.1	0.71	$2.08
1988	0.0	0.01	$4.24 (for 1987)
1993	0.0	0.0059	$4.79
1995	0.0	0.156	$3.23

Data provided by Haskins Shellfish Laboratory.