

Pre-Visit Lesson: What's in a shell?

Enduring Understanding

The decline of resources is often the indicator of environmental problems.

Essential Questions

What was the oyster population like when Europeans first arrived?

What human factors have contributed to the decline of the oyster population?

What environmental factors are inhibiting the revitalization of the oyster population?

What Students Will Learn

Students will be able to identify an oyster and the environmental conditions that are most favorable to its growth and population development.

Students will gain an understanding of the historic oyster population.

Students will gain an understanding of the current state of the oyster population.

Students will identify human factors which have led to the decline of the oyster population.

What Students Will Do

Students will watch a brief movie on the oyster reefs and beds that would have greeted John Smith and be able to both describe the historic oyster population and how the physiology of oysters can describe environmental factors.

Students will critically read articles about the current oyster population and population decline and discuss possible causes delineated within those articles.

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Materials Needed

Each Student will need -

Program Notebook

Copy of the Washington Post June 2, 2008 article -

“Oyster Saving Efforts a Wash in the Chesapeake Bay” by David Fahrenthold,

Teacher will need -

Oyster Shells

Computer with internet connection

LCD Projector

Teacher will need to access the following websites -

Archives at *The Washington Post* -

http://www.washingtonpost.com/wpdyn/content/article/2008/06/01/AR2008060102499_pf.html

National Geographic Jamestown Interactive -

ngm.nationalgeographic.com/2007/05/jamestown/jamestown-standalone

Background Information

This lesson introduces students to the idea that changes in natural resources can serve as indicators of the effects of human activities and land use on the environment. The natural resource investigated in this lesson is the Eastern Oyster (*Crassostrea virginica*). In order to support the student discussion, the text from the Oyster Lifecycle information sheet in the student notebook is included in this background section.

Oysters have been eaten by people in the Chesapeake Bay region for thousands of years. Most of the empty shells were thrown away. These trash piles are known to archaeologists as shell middens and they offer a wealth of information about past cultures and environments. When shells are found in a dated context, such as the 1610 Jamestown Well, they provide more information than just what the colonists had for dinner. The size, shape, and condition of the shells can be studied to learn about what the Chesapeake Bay was like 400 years ago.

Oyster Lifecycle Reading from Program Notebook page 6

All along the bays and rivers of the Eastern United States can be found an adaptive bivalve mollusk known as the Eastern Oyster. These oysters are typically found in subtidal regions where the water depth ranges from 8 to 35 feet and the water salinity ranges between 5 to 40 parts per thousand (ppt.). The ideal salinity range for oyster growth occurs between 15 and 22 ppt. Oysters can survive in a variety of temperatures ranging from -2 °Celsius (C) to 36 °C. (28°F -

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97° F), but the more stable the temperature, the better rate of survival for this species. *C. virginica* particularly does not tolerate wide, sudden fluctuations of temperature.

Temperature and water pH play an important role in oyster reproduction. As the water temperature rises to 20 degrees C, oysters begin to spawn. This is part of the reason for the familiar line “Never eat an oyster in a month without an R.” May through August are the months when the water temperature in the Chesapeake Bay begins to approach the ideal spawning temperature for oysters. For oyster reproduction and growth, the water pH should be between 6.25 and 8.5, and while oysters can survive outside of that range, their ability to produce offspring diminishes. Dissolved oxygen (DO) refers to the amount of oxygen that is present in the water. Fish, crabs and oysters that live or feed along the bottom require oxygen concentrations of 3 parts per million (ppm) and greater. Areas with less than 0.2 ppm of DO are unable to support most forms of life.

The Eastern Oyster plays an important role in the ecology of the Bay. As a filter feeder, the oyster pulls plankton and other particles from the water by opening its shell and forcing water past its gills. This means that oysters assist in maintaining the turbidity, or clarity, of the water that they live in. While some turbidity is normal, in general for the whole ecosystem low turbidity is better. High water clarity means that more sunlight reaches the submerged aquatic grasses that are also important to the Bay's health.

The oyster spat (young oyster) often settles upon other oysters forming oyster reefs. These structures provide important homes to a variety of life forms and have a direct effect on the shape and movement of the waters of the Chesapeake Bay. Oysters are also an important food source to such marine life as blue crab and a variety of fish.

There are many threats to the oysters in the Chesapeake Bay. While over-harvesting may be the most familiar, human pollution has wreaked havoc on oyster populations. Over-sedimentation, the presence of excessive nutrients resulting in excessive algae growth, and heavy metal pollution are important factors in the degradation of oyster populations. Two common ways to measure the nutrients involve looking at nitrates and phosphates which enter the environment through many routes including raw sewage and fertilizer. Any level greater than 1 ppt. can be harmful to the oyster. Additionally, two diseases have ravaged the Chesapeake Bay oysters. Dermo and MSX are two protozoan parasites that have infected oysters within the Chesapeake. Though not known to be dangerous to humans, these diseases pass from oyster to oyster and cause high mortality in their populations. Both diseases arrived in the Chesapeake Bay in the 1950's.

Suggested Sources

Grumet, Robert, *Bay, Plain, and Piedmont: A Landscape History of the Chesapeake Heartland from 1.3 billion years ago to 2000*, National Park Service, Annapolis, Maryland, 2000 - available

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on the Chesapeake Bay Program

<http://www.chesapeakebay.net/pubs/gateways/plainandpiedmont/HF-WHOLE%20BOOK.pdf>

Kennedy, Victor S., Roger I.E. Newell, and Albert F. Eble, ed., *The Eastern Oyster: Crassostrea virginica*, Maryland Sea Grant, College Park, Maryland, 1996.

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

<http://www.stmaryscity.org/Archaeology/Oyster%20in%20Chesapeake%20History.html>

For further information on oysters, water quality and resource issues, view the following websites:

Chesapeake Bay Program - About the Bay - Water Quality

<http://www.chesapeakebay.net/waterquality.aspx?menuitem=13945>

Maryland Sea Grant - <http://www.mdsg.umd.edu>

Filters on the Half Shell

- A. Ask students the following question while showing them an oyster shell.
 - Can anyone identify the object that I am holding in my hand?
- B. Explain to the students that what you have is the shell of an oyster; a shellfish that plays an important role in Maryland's economic and environmental well being.
- C. Ask the students a few questions to show how this creature may directly affect them.
 - How many of the students fish either in the Chesapeake Bay or one of its tributaries?
 - How many have family members who do?
 - How many students go out to eat at local seafood restaurants or eat locally caught seafood at home?
 - How many of them have family members who are watermen for a living now or in the past?
 - How many ever go to the Chesapeake Bay or any of its tributaries to swim, boat, or just play around?
- D. Explain that today we are looking at an animal that plays an important role in all of the activities we talked about just now. Have the students read the information sheet on the

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oyster on page 6 of the Notebook. Have them answer the following questions in their Notebooks on pages 7 - 8:

1. What type of water do oysters prefer?
2. Are there any special temperatures that they prefer, or is it just stable temperatures?
3. Are there any other environmental factors such as acidity or nutrients that are important to oyster growth?
4. Where are oysters in the food chain?
5. Oysters are often called the “filters of the bay.” Why?
6. If the population of oysters has significantly decreased and they can't filter as much algae and nutrients as in the past, could this cause a problem for the Chesapeake Bay?
7. Fill out the “Ideal for Oysters” column in Water Quality Chart 1 on page 14 in the Notebook.

Going, Going, Gone?

- A. Now pass out the Washington Post article “Oyster Saving Efforts a Wash in the Chesapeake Bay” by David Fahrenthold, dated June 2, 2008.
- B. Have the students read the article and answer the following questions on pages 9 - 10 in their Notebooks:
 1. What are three factors that have led to the steady decline of the oyster population?
 2. How does Kennedy Paynter describe the role of the oyster reefs of the Chesapeake Bay?
 3. Approximately how many watermen oystered in the Chesapeake Bay in the 1980's?
 4. How many watermen harvested oysters between 2002 and 2006? What has happened to the number of watermen from the 1980's to the 2000's?

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5. Name one method that the State of Maryland has used in an attempt to create new oyster habitats.
6. Approximately how much of the oysters harvested by watermen were supplied by that method?
7. What percent of the historic Chesapeake Bay oyster population does today's oyster population represent?
8. What is the Army Corps of Engineers doing to its oyster reefs that is different from other man made reefs in the Chesapeake Bay region?
9. What are two possible new oyster strategies mentioned in the article?
10. Based on what you have read, what do you think the chances are that the oyster population of the Chesapeake will begin to make a comeback?

What can they teach us?

- A. While the current outlook for oysters may not be so good; historically oysters played an important role in the diet of Native Americans and European Colonists alike. In addition to the information about what people who once lived here ate, oysters are also providing a lot of information about the environment of the Chesapeake Bay region 400 years ago.

Go to the Jamestown Interactive on the National Geographic website and play the video called "Clues in Oysters." The video is found in the **Explore Jamestown** section of the interactive, under "Impact of Colonization." In it, Juliana Harding tells us about the important information contained in the oyster shells found by archaeologists in the Jamestown Well.

- B. While the students watch both sections of the video, have them answer the following questions in their Notebooks on page 11 - 12:
1. Where did the oyster shells used in Ms. Harding's study come from?
 2. Is it important to know where and when the oyster shells came from? Why?
 3. Why could oysters have posed problems for Capt. John Smith?
 4. In what way can the oyster reefs found in the Chesapeake support other aspects of the environment?

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5. Why do researchers call oysters a “Keystone Species?”
6. Why might not having seen an undisturbed oyster population have an effect on the modern day restoration efforts?

What do you think?

After discussing their answers from the previous section have the students answer the following questions on page 13 in their Notebooks:

1. Based on what you learned today, how much effort and money do you feel should be devoted to the study and restoration of oysters? Explain why using information from today's lesson.
2. Think back to the description of your neighborhood that you wrote in People & Places Lesson (page 2 of Program Notebook). How might what you see in your environment, be it farms or asphalt and sidewalks, affect the oyster population in the Chesapeake based on what you read today?