Unit Introduction

Grade Level: Elementary

Timeframe
Integrated throughout year or semester

K-5 Overview

The elementary portion of the *Oysters on the Chesapeake Bay* learning sequence consists of six lessons; one for each grade in Kindergarten through 5th. Each lesson targets an important area in the study of oysters: individually, as part of an ecosystem, and in oyster restoration. While not directly building on each other, the lessons incorporate age-appropriate skills used in previous lessons and build new skills.

Kindergarteners begin by learning about pollution in water, and in subsequent years build knowledge about oyster shells, oyster reefs, and oyster internal anatomy. By fifth grade, students consolidate their learning, examine other perspectives, and demonstrate their mastery of ecological principles. They investigate and communicate conflicting interests in oyster harvest and restoration and learn how science can be helpful in navigating the complexity of biological and sociological interactions.

The lessons are an introduction for educators to creating three-dimensional learning activities for their students that incorporates the K-12 Framework for Science Education with connections to Common Core, and the Maryland Environmental Literacy Standards. A team of educators from the Chesapeake Region created the framework and wrote the activities in the sequence:

- Dale Glass (National Presbyterian School)
- Shannon Ricles (Monitor National Marine Sanctuary)
- Molly Harrison (NOAA Fisheries Service/National Ocean Service).

Three Dimensions of Learning

Dimension 1: Science and Engineering Practices (SEPs) describe behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems.

Dimension 2: Crosscutting Concepts (CCs) have application across all domains of science. As such, they are a way of linking the different domains of science. Patterns, similarity, and diversity; Cause and effect; Scale, proportion and quantity; Systems and system models; Energy and matter; Structure and function; Stability and change.

Dimension 3: Disciplinary Core Ideas (DCIs) have the power to focus K–12 science curriculum, instruction and assessments on the most important aspects of science. They must have broad importance across multiple sciences of engineering disciplines, provide a key tool for understanding or investigating, relate to the interests or life experiences of students, and be teachable over multiple grade levels to increase depth of understanding.

Essential Questions, Learning Objectives, and Three Dimensions

Lesson 1: Dirty to Clean in 15 (Kindergarten)

Students learn about water pollution and cleaning polluted water with filters. The students "pollute" the water with everyday items such as packing peanuts, pieces of plastic garbage bags, or pencil shavings. They filter the water leading to a discussion of the role oysters play in cleaning the water in the Chesapeake Bay while filtering nutrients out of water to live. The students extend their learning by testing different filters at home and by designing filters for another type of pollutant.

Learning Objectives

Students will be able to:

Explain the importance of clean water to living organisms.
Explain how oysters clean water.

Essential Question

What role do oysters play in cleaning the water of the Chesapeake Bay?

Kindergarten Dimensions

- Science and Engineering Practices
  - Analyzing and interpreting data.
- Crosscutting Concepts
  - Patterns
- Disciplinary Core Ideas
  - LS1.C Organization for Matter and Energy Flow in Organisms

Lesson 2: Oysters – The Tale of Two Shells (1st Grade)

Students learn the anatomy of an oyster shell and the role shells play in protecting the oyster. They observe, manipulate, and investigate oyster shells and discuss the characteristics that make them good protection for the oyster. Using their knowledge, the students engineer a protective cover for a delicate object using everyday items. They test and modify their designs and identify patterns in the construction. Students extend their learning by reading a fact-based story about an oyster and his reef and discussing the benefits of a reef structure versus a single oyster shell.

Learning Objectives
Students will be able to:

Label the exterior parts of the oyster.
Explain the importance of the oyster shell in protecting the animal.

Essential Question
What role do oyster shells play in protecting the oyster?

1st grade dimensions

- Science and Engineering Practices
  - Constructing Explanations and Designing Solutions
- Crosscutting Concepts
  - Structure and Function
- Disciplinary Core Ideas
  - LS1.A Structure and Function

Lesson 3: A Perfect Home (2nd Grade)

Students learn about oyster reef building and the inhabitants of those reefs. They build model reefs using everyday materials and refine or rebuild their models based on additional information. To extend their learning, they investigate other animals that grow or build their homes as the oyster does and then create an imaginary animal and design the perfect shelter for it.

Learning Objectives
Student will be able to:

Explain the role of Eastern oysters in the Chesapeake Bay
Explain the importance of an Eastern oyster reef to oysters
Use a model and a diagram to explain an idea

Essential Question
How can we clean the water of the Chesapeake Bay to improve the habitat for plants and animals?

2nd grade Dimensions

- Science and Engineering Practices
  - Planning and Carrying Out Investigations
  - Engaging in Argument from Evidence
- Crosscutting Concepts
  - Cause and Effect
- Disciplinary Core Ideas
  - LS4.D Biodiversity and Humans
  - ETS1.B Developing Possible Solutions

Lesson 4: It's a Group Thing (3rd Grade)

Students are given an oyster reef-related problem in the Chesapeake Bay. To find a solution, they learn about the properties and functions of oyster reefs, and using that knowledge, they build and test reef models in a simulated bay. Through the engineering process, students learn why being part of a healthy reef if crucial for Eastern oysters. They extend their learning by discussing various scenarios that could be harmful to oyster reefs and deciding if the reef structure helps or hinders the oysters.

Learning Objectives

Student will be able to:

Explain the function of healthy Eastern oyster reefs.

Explain why being part of a healthy reef helps Eastern oysters obtain food, defend themselves and cope with changes.

Essential Questions

1. What role do Eastern oyster reefs play in the Chesapeake Bay?
2. How and why is a reef structure beneficial to the Eastern oyster?

3rd Grade Dimensions

- Science and Engineering Practices
  - Engaging in Argument from Evidence
- Crosscutting Concepts
  - Cause and Effect
- Disciplinary Core Ideas
  - LS2.D Social Interactions and Group Behavior

Lesson 5: What's Inside? A Simple Oyster Dissection (4th Grade)

Students will learn about the internal and external structure of oysters as an example to help them understand that all organisms have parts that help them survive and grow. They will also learn how the functions of the oyster help the ecosystem in which it lives and the benefits to

humans. To extend their learning, students should research and present information about other filter feeders and the effects the animals have on their environments.

Learning Objectives

Student will be able to:

Explain how an oyster eats.

Explain how and why the functions of oysters are critical to the Chesapeake Bay ecosystem.

Essential Question

Why is the Eastern oyster important to the Chesapeake Bay ecosystem and to the people of Maryland and Virginia?

4th Grade Dimensions

- Science and Engineering Practices
  - Engaging in Argument from Evidence
- Crosscutting Concepts
  - Systems and System Models
- Disciplinary Core Ideas
  - LS1.A Structure and Function

Lesson 6: The Great Oyster Debate (5th Grade)

Students will consolidate their learning about oysters, examine the various community perspectives, and demonstrate their mastery of ecological principles by debating the introduction of the Asian oyster. They learn there are conflicting interests, but science can be helpful in navigating the complexity of biological and sociological interactions. As a learning extension, students debate the introduction of another animal such as the nutria.

Learning Objectives

Student will be able to:

Integrate learning and demonstrate understanding of current ecological issues.

Argue an issue based on scientific principles and not belief.

Apply scientific knowledge to social and economic issues.

Essential Question

Would the health of the Chesapeake Bay improve if the Asian Oyster was introduced?

5th Grade Dimensions

- Science and Engineering Practices
  - Engaging in Argument from Evidence
- Crosscutting Concepts
  - Systems and System Models
- Disciplinary Core Ideas

- LS2.A Interdependent Relationships in Ecosystems

References and Resources

- Maryland Environmental Literacy Standards
  - http://marylandpublicschools.org/programs/Documents/Environmental/MDEnvironmentalLitStandards.pdf
  - C3 Framework for Social Studies State Standards, http://www.socialstudies.org/system/files/c3/C3-Framework-for-Social-Studies.pdf
- Maryland Environmental Literacy Requirement: Origin & Development
  - http://maeoe.org/maryland-environmental-literacy-requirement-origin-development/
- Three Dimensional Learning
  - http://www.nextgenscience.org/three-dimensions
- Framework for K-12 Science Education
  - https://www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts
- Common Core State Standards
  - http://www.corestandards.org/ELA-Literacy/RST/introduction/