


NOAA Science Module Development

Oysters in the Chesapeake Bay

Introduction

The conceptual ideas presented in "A Framework for K-12 Science Education" from the National Research Council articulates a vision of the scope and nature of education in science, engineering, and technology in which students, over multiple years of school, actively engage in scientific and engineering practices, and apply crosscutting concepts to deepen their understanding of the core ideas in these fields. The learning experience provided for students should engage them with fundamental questions about the world and with how scientists have investigated and found answers to those questions.

NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States.* Washington, DC: The National Academies Press.

This Oyster curriculum project represents a collaborative effort to identify and build an engaging set of K-12 education resources that comprehensively support the vision for science education using the Eastern Oyster in Chesapeake Bay as the organizing theme.

Important shifts in science education include:

1. K-12 Science Education should reflect the interconnected nature of science as it is practiced and experienced in the real world.
2. Students must be engaged in learning that incorporates all of three dimensions:
    - Science and Engineering Practices
    - Crosscutting Concepts

    - Disciplinary Core Ideas
3. Three Dimensional Learning provides a more seamless blending of practices with core ideas and crosscutting concepts.
4. There is a coherent investigation of core ideas across multiple years of school.
5. Foundational understanding of science supports ALL students.

NOAA recognized that few science education materials were available within the NOAA collections that thoroughly reflected these shifts in pedagogy to support Three-Dimensional education thinking. This project was developed to address this gap and support the development of a model for the identification and development of education resources supportive of Three-Dimensional learning.

In order to increase the number of science education materials within the NOAA collections that reflect current science education research, the NOAA Education Council formed a working group to increase the capacity of NOAA educators to understand and use three dimensional learning in future product development.

A small team of NOAA educators volunteered to develop a sample module using NOAA science in elementary through secondary classrooms. Professional development of other educators would follow the review, revision, and field testing of these materials.

Why Oysters?

Overfishing, disease, and pollution have left the Chesapeake Bay with less than one percent of the oysters it once had. NOAA and its partners are working to restore 10 Bay tributaries by 2025 with healthy oysters and viable habitat starting with Harris Creek, a tributary off of the Choptank River on the Eastern Shore of Maryland. Additional tributaries in both Maryland and Virginia have since begun oyster restoration projects, including the Tred Avon and Little Choptank rivers in Maryland, and the Lynnhaven, Lafayette, and Piankatank Rivers in Virginia. Restoring oysters and the habitat they provide for a multitude of other fish and animals is essential to improving the health of the Bay. The topics of the K-12 learning sequence modules target Chesapeake Bay-based Oyster Restoration.

Education specialists from **NOAA's National Ocean Service** and the **National Marine Fisheries Service** identified both formal and non-formal educators to bring their classroom expertise to develop a K-12 learning sequence of classroom materials about the factors influencing oyster habitats, and develop classroom-based and field-based experiences that incorporated appropriate science and stewardship activities.

Project Goal

Incorporate three dimensional learning in a NOAA-related science as a demonstration for others within the agency:

- Use oyster science as a context for science learning in the Chesapeake Region
- Oyster science is of economic, ecological, and cultural significance
- Learning sequence give teachers the latitude to make learning locally relevant by connecting to things happening in students' own communities

Partnership support

Annapolis Maritime Museum
Chesapeake Maritime Museum
Maryland Sea Grant
NOAA Educators
Maryland Department of Natural Resources

- Classroom teachers from Anne Arundel, Montgomery, Somerset, and Wicomico Counties, MD;

Washington, DC; and Virginia

Process – 3-Day Interactive Workshop

I. Science content - Science, Habitat, or Restoration Experts

- NOAA Fisheries, Habitat Conservation
- University of MD Sea Grant
- MD Department of Natural Resources
- University of MD Horn Point Laboratory

II. Evaluate existing resources

Identify connections (Disciplinary Core Ideas, Science & Engineering Practices, and Crosscutting Concepts) through grades K-12.

III. Organize and modify existing activities, and develop new activities to fill in the gaps

Teachers and NOAA education staff compiled existing oyster-related lessons and activities that targeted one primary Disciplinary Core Idea (DCI), *LS2.A, Interdependent Relationships in Ecosystems*, and followed it through from kindergarten to the high school level. Where gaps were identified, teachers developed new activities or adapted existing activities to better meet the goals of the Disciplinary Core Ideas. In addition, Crosscutting Concepts, and Science and Engineering Practices were identified throughout the K-12 learning sequence.

Disciplinary Core Ideas in Life Science

A core idea for K-12 science instruction is a scientific idea that:

- Has broad importance across multiple science disciplines, or is a key organizing concept of a single discipline;
- Provides a key tool for understanding/investigating more complex ideas and solving problems;
- Relates to the interests and life experiences of students;
- Is teachable and learnable over multiple grades, increasing levels of depth and sophistication.

The primary Disciplinary Core Ideas (content) that the team of educators chose to use as an example for developing a K-12 Learning Sequence was best connected within the realm of the

Life Sciences (LS2.A: Interdependent Relationships) to illustrate how the learning sequence advances content and skills over the K-12 education career of a student.

The following DCI's were also included in the sequence:

LS1: From Molecules to Organisms: Structures and Processes

LS1.A: Structure and Function
LS1.C: Organization for Matter and Energy Flow in Organisms
LS2.C: Ecosystem Dynamics, Functioning, and Resilience
LS4.D: Biodiversity and Humans

LS2: Ecosystems: Interactions, Energy, and Dynamics

LS2.A: Interdependent Relationships in Ecosystems
LS2.C: Ecosystem Dynamics, Functioning, and Resilience
LS2.D: Social Interactions and Group Behavior

LS4: Biological Evolution: Unity and Diversity

LS4.D: Biodiversity and Humans

ESS2: Earth's Systems

ESS2.E: Biogeology
ESS3.A: Natural Resources
ESS3.C: Human Impacts on Earth's Systems

ETS1: Engineering, Technology and Applications of Science

ETS1.A: Defining and Delimiting an Engineering Problem
ETS1.B: Developing Possible Solutions
ETS1.C: Optimizing the Design Solution

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