Fresh and Salt

A Curriculum Integrating Ocean and Great Lakes Literacy Principles

CoSEE Great Lakes

CENTERS FOR OCEAN SCIENCES EDUCATION EXCELLENCE

A Curriculum Integrating Ocean and Great Lakes Literacy Principles

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Introduction

COSEE Great Lakes—A Regional Project Linking Scientists and Educators to Collaborate on Ocean and Great Lakes Science

The National Science Foundation's Division of Ocean Sciences supports a network of coordinated centers whose mission is to spark and nurture collaborations among research scientists and educators to advance ocean discovery and make known the vital role of the ocean in our lives. COSEE Great Lakes is a member of this network of Centers for Ocean Sciences Education Excellence (COSEE) fostering the integration of ocean and Great Lakes research into high quality educational materials. These centers enable Great Lakes and ocean researchers to gain a better understanding of educational organizations and pedagogy, while providing educators with an enhanced capacity to understand and deliver high-quality educational programs in the ocean sciences.

COSEE Centers also provide material to the public that promotes a deeper understanding of the Great Lakes and the ocean and their influence on quality of life and national prosperity. COSEE's goals include inspiring citizens to become more scientifically literate and environmentally responsible through standards-based science curricula and programs that bridge the ocean and freshwater sciences, while also creating dynamic linkages between the education and research community.

Toward a Fresh and Salt Curriculum

COSEE Great Lakes has continued to meet the challenge of improving today's science education through its professional training for educators and innovative curriculum resources for students and teachers, grades K-16. Our curriculum-based project began with *Greatest of the Great Lakes: A Medley of Model Lessons,* 41 activities for grades 4-10, providing highly relevant and timely lessons. The topics encompass regional fields of science research and at the same time allow us to address the priorities that educators express, those that deal with environmental issues and responsibility.

The culmination of the project includes *Fresh and Salt*, a collection of activities connecting Great Lakes and ocean science topics to enhance teacher capabilities for accessing science information that is vital to maintaining the environmental health and economic benefits of our nation's freshwater and marine systems. This exemplary collection provides teachers with an interdisciplinary approach to ensure students achieve optimum science understanding of both Great Lakes and Ocean Literacy principles. A comprehensive range of instructional modes is offered, including data interpretation; experimentation; simulation; interactive mapping; investigation, and decision-making.

Criteria for Selection

The 14 activities that compose *Fresh and Salt* were selected based on a distinct set of criteria and opportunity to apply the science process skills students need for effective science learning. In seeking recommendations for quality activities, the COSEE Great Lakes educator responsible for this curriculum project contacted other COSEEs, the NOAA Education Office, Sea Grant programs outside of the Great Lakes region, and the National Marine Educators Association through its online website, "The Bridge."

The recommended activities were carefully considered by the COSEE Great Lakes team comprised of education professionals from the

Illinois-Indiana Sea Grant Program, Ohio Sea Grant Program, New York Sea Grant Institute, Pennsylvania Sea Grant Program, Michigan Sea Grant Program, and the Minnesota Sea Grant Program.

To ensure excellence, activities were required to meet the following criteria for selection:

- Enhance learning skills: Inquiry, hypothesis, synthesis, and other essential skills.
- Offer numerous learning applications: Problem-based learning, data gathering and interpretation, and authentic, real world experience.
- Integrate science with other disciplines.
- Provide grade level coverage in elementary, middle, and secondary schools.
- Offer a good representation of activity types, e.g., role playing, decision-making, data interpretation, and experimentation.

Designed to be used by teachers in grades 5-12, these pre-existing materials have been rigorously reviewed and tested in schools. Pilot testers in Great Lakes schools evaluated materials for appropriateness of the grade level, reliability, accessibility, functionality, and relevance to the literacy principles. The final lessons selected were developed by national and regional agencies, institutes, organizations and universities.

Using the alignment tables, educators can see how each activity is matched with State Science Education Standards for Great Lakes states, Great Lakes and Ocean Literacy Principles, and National Geography Standards. This standards-based framework will enable educators to integrate the *Fresh and Salt* curriculum into classrooms and informal learning environments. An Instructional Mode chart is also provided to assist educators in identifying the type of activity and its application to the curriculum.

Using the Fresh and Salt Collection

This curriculum is organized by pairing two activities, typically one freshwater and one saltwater, that are aligned to each of the Ocean Literacy and Great Lakes literacy principles. In each literacy principle section, we have included a preamble that provides an overview of the activity pairs; how they relate to the literacy principle; how they may compare and/or contrast; and comments from teachers who have pilot tested the activities.

Enhancing Great Lakes and Ocean Literacy

Participation in COSEE programs and classroom integration of supplemental curriculum materials provides educators, both formal and informal, with an interdisciplinary means of creating a more scientifically literate work force and citizenry. Educating students about ocean and Great Lakes topics can enhance science, math, geography, and technology skills, as well as foster new understandings about best practices for protecting our local aquatic and marine resources. The new Great Lakes Literacy principles and associated website **www.greatlakesliteracy.net** had its origin in Ocean Literacy, a concise framework for conveying the most important science principles and interconnected concepts that citizens around the globe should know. The Ocean Literacy principles, fundamental concepts, and scope and sequence may be found at **http://oceanliteracy.wp.coexploration.org**.

It is our hope that this new curriculum will engage students in relevant science and help prepare students as responsible decision-makers and future leaders to promote a sustainable society. We now invite you and your students to explore the world of water and spice up your classroom with a little *Fresh and Salt*!

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Aquarius.nasa.gov

Going with the Flow
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Ooze Clues
Written by Lisa Ayers Lawrence, Virginia Sea Grant, Virginia Institute of Marine Science. The Bridge is sponsored by NOAA Sea Grant and the National Marine Educators Association © Virginia Sea Grant Marine Advisory Program, Virginia Institute of Marine Science, College of William and Mary

What Causes the Shoreline to Erode?
Developed from original OEAGLS, with the support of the Great Lakes Protection Fund, Ohio Sea Grant, and The George Gund Foundation, 1993-97.
Modified from the OEAGLS EP-7 "Coastal Processes and Erosion" by Beth A. Kennedy, Ohio and Roseanne W. Fortner, Ohio Sea Grant Education Program, The Ohio State University

Implications of Warming in the Arctic
Lesson is part of Arctic Community Curriculum © 2006, Will Steger Foundation, Elizabeth K. Andre
Globalwarming101.com

How is Coastal Temperature Influenced by the Great Lakes and the Ocean
Written by Rosanne W Fortner and Victor J. Mayer
© Fall 2009, Heldref Publications, heldref.org

Bats and Hot Dogs!
Created by Stephany Hannon - Fairhope HS, Alabama; Becky Kapley - Cuyahoga Community College - Ohio
Distributed by-MBARI: Monterey Bay Aquarium Research Institute George Matsumoto - Education Research Specialist. February 2006, mbari.org/earth/

Being Productive in the Arctic Ocean
Produced by Mel Goodwin, PhD, The Harmony Project, Charleston, SC for the National Oceanic and Atmospheric Administration, NOAA, Oceanexplorer.noaa.gov

Tangled Web
Great Lakes in My World ©2005 by Alliance for the Great Lakes. Curriculum Developers: Anne Richardson and Stephanie Smith; Editor: Sarah Surroz

Sea Connections
Written by Barbara Branca for
Smithsonian Education; Ocean Planet: Interdisciplinary Marine Science Activities

Pollution Solution
Written by Barbara Branca for
Smithsonian Education; Ocean Planet: Interdisciplinary Marine Science Activities

Downeaster Alexa
Produced by the Ohio State University, Co-Directors: Roseanne W Fortner and Victor J. Mayer; Content Advisor: David Bromwich; Curriculum Editor: Tony P. Murphy. © The Ohio State University Research Foundation, 1993

I, Robot, Can Do That!
Produced by Mel Goodwin, PhD, The Harmony Project, Charleston, SC for the National Oceanic and Atmospheric Administration, NOAA, Oceanexplorer.noaa.gov

Calling All Explorers
Developed by Kimberly Williams, Miller Place High School, Long Island, New York for the National Oceanic and Atmospheric Administration,
NOAA Oceanexplorer.noaa.gov

Activities by Grade Level

Fresh and Salt Activities - COSEE Great Lakes	Format	Grade Level
Principle 1: The Earth has one big ocean with many features.		
Density: Sea Water Mixing and Sinking	Experiment	6 - 12
Going with the Flow	Experiment/Data	3 - 5
Principle 2: The ocean and life in the ocean shape the features of the Earth.		
Ooze Clues—Diatom Ooze	Data Interpretation	9 - 12
What Causes the Shoreline to Erode	Investigation	6 - 12
Principle 3: The ocean is a major influence on weather climate.		
Implications of Warming in the Arctic	Cooperative learning/ feeback loops	6 - 12
How is Coastal Temperature Influenced by the Great Lakes and the Ocean?	Investigation/ mapping/ graphing	6 - 12
Principle 4: The ocean makes Earth habitable.		
Bats and Hot Dogs!	Real - time Data Interpretation	6 - 9
Being Productive in the Arctic Ocean	Experiment	9 - 12
Principle 5: The ocean supports a great diversity of life and ecosystems.		
Tangled Web	Simulation	5 - 8
Sea Connections	Food Web Card Game	6 - 8
Principle 6: The ocean and humans are inextricably interconnected.		
Pollution Solution	Experiment/Role-play	6 - 8
Downeaster Alexa: A fishery story	Data Interpretation	6 - 9
Principle 7: The ocean is largely unexplored.		
I, Robot, Can Do That!	Technology Investigation/ Decision - Making	7 - 8
Calling All Explorers	Webquest NOAA	5 - 9