

Lesson Title: Oil Spill Along the Shore (Adapted from Angela Capello, Booker Fowler Fish Hatchery, Forest Hill, LA).

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Grade Level
4th - 8th Grades

Activity Time (two hours total)

Day 1: 50-minutes—Discuss the effects of oil spills on plants, animals, and associated habitats and vocabulary.

Day 2: 50-minutes—Implement the activity and respond to questions.

Subject Areas:

- Environmental Sciences
- Biology
- General Sciences
- Earth Sciences
- Physical Sciences
- Chemistry

Objectives

Students will:

- Investigate and demonstrate a variety of oil spill clean-up techniques and their effectiveness on an oceanic basin and/or its coastal watersheds, wetlands, bays, estuaries, marshes, sound, or similar body of water.
- Determine and understand the acute and chronic effects of crude oil on animals and plants.

Vocabulary

Acute Effects - The short-term effects the oil has on animals, plants, coastlines, and substrates/sediments.

Chronic Effects - The long-term effects the oil has on animals, plants, coastlines, and substrates/sediments.

Crude Oil - A dark, sticky substance consisting of carbon and hydrogen.

Dispersant - A soapy-type substance used to react and “break-down” the oil into very small droplets which then allows the oil to be dispersed in the water.

Fire Boom - A metal plate used to contain oil long enough to burn it.

Hard Boom - A floating piece of plastic weighted at the bottom. This is used to force the oil in a different direction.

Sorbent Boom - A “sausage-shaped” material used to absorb oil. This type of boom acts much like a disposable diaper.

Materials (per group of four or five)

- Long, shallow pan or rolling paint pan
- Index Card
- Watch or Timer
- Water
- Small Cups

- Forceps or Tongs
- Vegetable Oil (Three Tablespoons)
- One Tablespoon
- Wooden Craft Sticks
- Cocoa Powder (Two Tablespoons)
- Turkey Baster
- Pipettes or Eye Droppers (several)
- Motor Oil (optional)
- Whisk (optional)

Needed for Oil Spill Clean-Up:

- Paper Towels
- Nylon Net
- Cotton Balls
- Straws
- Absorbent Pad (rags or diapers)
- Nylon Hose
- String (yarn)
- Detergents (dish washing liquid)
- Styrofoam
- Feathers (one)

Suggested Materials for Wetland or other similar watershed:

- Modeling Clay
- Sand
- Gravel (small)
- Florist Foam
- Scraps of Indoor/Outdoor Carpet
- Peat Moss
- Yard Debris (Sticks and Leaves)
- Sponges

Background

Human activity can have diverse effects on the ocean. One of the negative effects was the British Petroleum-Deepwater Horizon Oil Spill. While drilling for oil, a wellhead was “blown out” at a water depth of 5,000 feet. This oil spill “blow out” occurred 41 miles off the coast of Louisiana on April 20, 2010. Approximately two hundred million gallons of crude oil was spilled into the Gulf of Mexico. Crude oil, under normal conditions, is not capable of mixing with water. It has had acute and chronic affects on plants and animals. Some of the acute affects are: fish suffocate; birds ingest toxins while cleaning their oiled feathers; and fur-bearing mammals are vulnerable to hypothermia due to reduced insulation. Some of the chronic effects being studied include: growth of plants, i.e., submerged vegetation, marsh, wetlands, and/or dunes; compromised reproductive cycles of marine organisms; the potential alteration of migration patterns of various sea creatures; the results of “living near or in” oil-embedded substrates/sediments by bottom dwelling animals, such as crabs and flounders; and the effects of eating oil-contaminated animals by sea turtles, dolphins, and other marine life.

There are three main types of booms used to contain and remove spilled oil that occurs in the open ocean: hard boom, sorbent boom, and fire boom. There is another technique for removing oil. It is based on a household idea. This technique uses dispersants. In this experiment, students will use household products and mechanical devices to simulate techniques used in oil spill clean-ups.

Introduction

1. Introduce the lesson by reviewing the background information with the students.
2. Explain that the students will participate in different clean-up activities similar to those used in the British Petroleum-Deep Water Horizon Oil Spill.
3. Create a prediction chart with the students and ask them questions such as: Will the oil float, sink, or mix when it is added to the water? Can the shoreline be protected from the oil? What happens to the oil and the environment if there are conditions of wind and wave action, in varying speeds? Which of the clean-up activities do the students predict would work the best? What will happen if the oil reaches land?

Procedure

1. Distribute student worksheets and explain directions.
2. Create a wetland shore by placing modeling clay in half of the pan. This represents land and

- should slope downward.
3. Put the sponge, carpet, or florist foam over the clay and add the other natural materials on top such as sand, gravel, and yard debris. This represents a wetland. Make sure there are no gaps on the land.
 4. Fill the other half of the pan with water to the base of the land.
 5. Mix the vegetable oil and cocoa together in a small cup with a craft stick. This solution represents crude oil.
 6. Slowly pour the oil from a height of **1 inch (2.54 cm)** on the ocean's surface away from the land. Don't pour oil solution too quickly. The students will answer question 1 on worksheet.
 7. Decide on the type of material to be used as a boom and try to contain the oil. The students will answer questions 2 and 3a.
 8. With a pipette or eye dropper, try to suction some of the oil and observe what happens. The students will answer question 4.
 9. Blow or fan across the surface with an index card to simulate waves. Record students' results on the data sheet. Students will answer question 3b. Remove the boom with tongs or forceps.
 10. Place a small absorbent piece of material into the spill. Using a watch or timer, record the amount of time it takes each absorbent used to clean-up oil. Record students' results on data sheet. The students will answer questions 5, 6, and 7.
 11. When the oil reaches the shore, use a small absorbent piece of material to clean- up the oil from the land. The students will answer questions 8 and 9.
 12. Fill a pipette or eyedropper with clean water. Spray the oil from the shore back into the ocean. Repeat this procedure for effectiveness. Answer questions 10 and 11a,b.
 13. Place the feather into the oil-contaminated water. The students will answer questions 12 and 13.
 14. Place a few drops of dishwashing liquid in the ocean. The students will answer questions 14, 15, and 16.
 15. Clean-up and dispose of the contents of your pan properly.
 16. Discuss whether student groups' predictions were correct and review individual group responses.

Ocean Literacy Essential Principles and Fundamental Concepts (OLEPF&C)

6. The ocean and humans are inextricably interconnected.
 - 6e. "Humans affect the ocean in a variety of ways..."
 - 6g. "Everyone is responsible for caring for the ocean..."

National Science Education Standards (NSES)

Life Science

Organisms and Environments

Diversity and Adaptations of Organisms

Personal and Social Perspectives

Science and Technology in Society

Extension Activities

- 1) Follow media (print, television, radio) coverage twice a week and discuss the updates with your students in class for 10-15-minutes.
- 2) Look at the potential and feasibility of having your students become involved in some aspect of the long-term, clean-up efforts, i.e., marsh or dune plant restoration.
- 3) Research laws pertaining to oil disposal in your local community and organize a day to recycle

motor oil waste.

4) Create a Marine Sanctuary Board Game- design marine animals and board; introduce human-made hazards (oil, marine debris, over fishing); then include clean-up methods and create laws to protect animals and preserve habitat of your marine sanctuary.

Resources

Capello, Angela, "Oil Spill in a Pan," Booker Fowler Fish Hatchery, Forest Hill, LA.

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Ocean Literacy Essential Principals and Fundamental Concepts. 2007. National Geographic Education & Children's Programs. <http://www.nationalgeographic.com>. NOAA Office of Education. <http://www.education.noaa.gov>

Higgins, S., Kesselheim, A., Schilling, M., and Slattery, B. 1995. "Recipe for Trouble," *The Wonders of Wetlands*, page 199-203.

National Marine Educators Association, *The Ocean Literacy Campaign, Special Edition #3*, March 2010.

National Oceanic and Atmospheric Administration,
http://response.restoration.noaa.gov/dwh.php?entry_id=809
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The Jason Project, <http://jason.org/public/jlnoaa.aspx>.

U.S. Fish and Wildlife Service, Alaska, "Exxon Valdez," <http://alaska.fws.gov/>.

Walker, Sharon Dr., Director of Education and Outreach, Institute for Marine Mammal Studies-Center for Marine Education and Research, "May 22, 2010 Oil Spill Questions/Responses."

Western Regional Environmental Council, "No Water Off a Duck's Back," *Project Wild, Aquatic*, 2000, page 307-309.

Student Worksheet Predictions

Oil Spill Data

	Material	Amt. of Time To Clean-Up Oil	Estimate % of Oil Cleaned	Observations
Light Oil (vegetable)				
Light Oil And Rough Water				
Heavy Oil (motor) (optional)				
Heavy Oil And Rough Water (optional)				

Questions:

1. What happened to the oil when poured into water?
2. What different types of booms did you use?
- 3 (a). Did the boom contain the spill? (b). Was the boom effective in wind?
4. Were you successful at suctioning (skimming) the oil in water contained in the boom?
- 5 (a). What percentage of oil did your absorbent material clean-up? (b). How quick did it absorb?
- 6 (a). Is the absorbent “picking-up” water with the oil? (b). How did you make this determination?
7. Does the material sink or float?
8. What did you observe about the condition of the contaminated absorbent material?
9. Are the absorbent materials effective in “cleaning-up” oil on land?
10. Was “washing the oil off the shoreline, back into the body of water” an effective method?
- 11(a). How much contaminated sand/soil would have to be removed if you were using shovels to clean-up? (b). Do you think the shoreline would be clean?
12. What happened to the feather after soaking in oil?
13. How would this affect a bird covered in oil?
14. What happened to the oil spill after detergent was added to water?
15. Where do you think the oil “would go” within our ocean after using a dispersant?
16. How clean is the water now that it has detergent in it?