Popcorn Model Oil Spill

Grade Level: 6-12
Length: 60-90 Minutes
www.pwsrcac.org/lessons

Adapted from OBIS Oil Spill, Delta Education, Box M, Nashua, New Hampshire 03061, used with permission

NGSS Standards

Can Support:
MS-ESS2-4 Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity; and/or

MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth case patterns of atmospheric and oceanic circulation that determine regional climates.

Crosscutting Concepts

Systems & System Models A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

Scale, Proportion, & Quantity In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

Overview

Winds and currents spread oil from a spill very quickly, making it difficult to contain and clean up.

Objectives

- Students will estimate the environmental impact of a simulated oil spill.
- Students will understand the impact of winds and currents on an oil spill.

Materials

- ☐ 20 Liters of Popped Popcorn
- ☐ Impact Challenge Cards
- ☐ Pencils
- ☐ Guides for Identifying Saltwater/Freshwater Organisms
- ☐ 1 Plastic Bucket or Can with a Metal Handle (20 L in volume)
- ☐ 1 50 cm x 50 cm Piece of Plastic Window Screen, Nylon Mosquito Netting, or Several 50 cm x 50 cm Sheets of Small Mesh Cheese Cloth
- ☐ 1 Large Rubber Band, Strip of Inner Tube, or Elastic Band that will Fit Snugly around the Plastic Bucket
- ☐ 3 100-cm Lengths of Wide Duct Tape or Masking Tape
- ☐ 25 Meters of Heavy Twine or Light Rose Marked off in 5-Meter Intervals
- ☐ 1 Mini-Hacksaw, Jigsaw, or Serrated Knife
- ☐ Permanent Marker

Related Resources

Additional Activities Center for Alaskan Coastal Studies' Coast Watch Curriculum: https://www.akcoastalstudies.org/data/CoastWatch_Curriculum_Feb_2014_with_background_info.pdf

Pair With Oil's Wandering Path ROV Lesson

Notes

Background

In spite of precautionary measures to prevent them, oil spills from ships, offshore drilling operations, pipelines, and natural seepage continue. As past spills have so tragically demonstrated, a major oil spill can take a devastating toll on wildlife. Inshore fisheries, shorebirds, intertidal organisms, and shallow subtidal organisms are most often harmed because spills usually occur in the shallow coastal areas where these organisms are concentrated. The environmental impact of an oil spill depends on the size of the spill, the prevailing wind and water conditions during the spill, and the variety and abundance of life (both wild and human) in the affected area.

Preparation

1. To make a popcorn slinger, cut out the bottom of the bucket with a hacksaw, jigsaw, or knife.
2. With the bucket turned upside down, place the screen material over the open end of the bucket. Let the material drape over the side. With the duct tape or masking tape, tightly tape the edge of the screen material to the bucket. Firmly tie the 25-meter line to the metal handle on the bucket and tie a loop (large enough to go over a nearby rock or post) at the other end of the line.
3. Determine the location for your simulated spill. Although developed for the seashore, this activity may also be conducted at a lake, river, or stream. Reduce the amount of popcorn for smaller bodies of water. The activity will be more exciting if you choose a site with strong dispersal features (such as water currents and wind) and an abundance of life. Breakwaters or docks are convenient places from which to toss popcorn into the water. If you conduct the activity at an inland site where oil spills rarely occur, tell students that the activity simulates a toxic chemical discharge from an industrial or agricultural source.

Introducing the Lesson

At the site, tell the students that they are environmental impact experts who have been rushed to the scene of an oil spill to estimate its impact on the environment.

Activity

1. Before you reach the site, discuss safety and assign a buddy system. Keep a special eye on any students that do not know how to swim.
2. At the site, tell the students that they are environmental impact experts who have been rushed to the scene of an oil spill to estimate its impact on the environment. Say that you will simulate the oil spill by tossing out a large bucket of popcorn to represent the oil. Explain you are using popcorn because it will not harm the environment, and it floats like refined oil.
3. Explain to your group of "experts" that they are responsible for estimating the impact of the spill on (a) the landscape, (b) the plant life, (c) the animal life, and (d) human activities. Divide the group into four smaller groups (keep buddies together) and give each group an Impact Challenge Card. Tell the teams to assume that anything the popcorn touches will be covered with oil.
4. Before you toss out the popcorn, ask the students to predict in which direction the spill will move and how long it will take to reach the shore. Have each student think about their prediction and the evidence that supports the prediction. Ask them to then share and discuss with a partner, before you lead larger group discussion.
   - Are their predications based on personal experience of predominant currents?
   - Direct observation of wind direction in the moment?
   - Broader patterns based on knowledge of oceanographic circulation?
   - Movement of water based on gravity.
5. Do their predictions align with what they have been learning about currents, winds, and the cycling of water?
6. Ask someone to measure the time it takes for the spill to reach the shore or some other reference point.
7. Now you are ready to use your popcorn slinger. With the loop of the rope anchored to a rock or post, practice tossing the bucket a few times before putting in the popcorn. Take a strategic but secure position on a dock, breakwater, or large rock. The rope should be loosely coiled on a flat surface below your tossing arm so the rope will fly out freely when the bucket is tossed. Make sure you are not standing on the rope. When you are ready, grab the rope about a meter from the metal handle and start swinging the popcorn slinger over your head. When the bucket has gathered momentum, let it fly out over the water. Try to pick a location where you can toss the bucket with the wind instead of against it.

8. After you have gotten the knack for tossing the bucket, place a small flat rock (about 200 grams) in the bucket and then put in about 20 liters of popcorn. With the teams ready to time and follow the spill, toss out the slinger. After landing, the rock will help pull the bucket under the water and the buoyant popcorn will be forced out the top of the bucket. Let the bucket sink beneath the surface before hauling it in so the spill won't be disturbed.
9. Count the marked intervals on the rope as you haul in the bucket to determine the spill's starting distance from the shore. Ask your environmental experts to begin their investigation. Join in and follow the movement of the spill with the rest of the group.
10. Near the end of the allotted time or after the spill has been thoroughly dispersed, gather the students together to have a SLICK TALK to report their findings. If you would like, you can give students a chance to (safely) attempt to remove the popcorn from the water using a variety of techniques.

Wrap-up

At the end of your SLICK TALK, discuss the following questions or ask students to respond to the following questions in their science notebooks:

- How quickly did the spill reach the shore?
- What agents dispersed the spill? (Wind, tide)
- How might different wind or water conditions affect the spill?
- How could an oil spill be prevented from spreading?
- What sorts of knowledge about currents, tides, wind, and/or cycling of water are important to think about when predicting how a spill will spread?
- Who in your community has knowledge that would be helpful in predicting how a spill will spread?

Assessment

Listen during discussion for predictions and explanations based on personal experience, direct observations, and knowledge of broader patterns of ocean circulation, wind, and water cycling. Students who successfully meet the performance expectation will demonstrate an understanding of how these broader patterns impact the spread of an oil spill.

Pair With

- Oil's Wandering Path ROV Lesson Plan