

No Water Off a Duck's Back



Objectives

Students will (1) identify ways oil spills can adversely affect birds; and (2) describe possible negative consequences to wildlife, people, and the environment from pollutants caused by humans.

Method

Students conduct an investigation using water, oil, hard-boiled eggs, detergent, and feathers.

Materials

Cooking oil, shallow containers, eye dropper, hand lens, feathers (natural); liquid detergent solution (made with one part dishwashing liquid to 100 parts water), hard-boiled eggs

Grade Level: 5–8

Subject Areas: Science, Mathematics, Environmental Education

Duration: one to two 45-minute sessions or longer

Group Size: small groups of three to four recommended

Setting: indoors

Conceptual Framework Topic Reference: HIIIB, HIIIB5

Key Terms: pollution, oil spill, trade-off

Appendices: Using Local Resources, Metric Conversion Chart

Background

The impacts of environmental pollution are often difficult to see. A major oil spill, however, provides dramatic evidence of potential harm to wildlife. Oil spills along coasts affect many parts of the environment, both nonliving such as water, ocean bottom, and shoreline and living such as sea birds, marine mammals, and shellfish. Examples include damaging feathers of waterfowl, killing embryos when oil seeps into eggs, suffocating fish when gills are clogged, and killing marine and terrestrial animals by ingesting food and water contaminated by the oil. Oil-soaked animals may try to clean themselves and, in so doing, often ingest oil that kills them.

Federal, state, and local spill-response teams, as well as organizations and industry representatives, have prepared contingency plans for oil spill emergencies. When a spill occurs, the teams swing into action using the plans. Trained responders try to keep oil away from animals and marshes with floating barriers called booms. They try to haze or encourage un-oiled animals, usually waterfowl, to move to safe areas away from the spill.

A rescue and treatment center is set up for animals injured by spilled oil. Oiled animals need trained people to collect, clean, and rehabilitate them in a facility with space, ventilation, controlled temperature, and hot and cold water. Professional bird-rescue organizations often have volunteers who have been trained in advance for oil spills. Efforts by untrained people may have unfortunate consequences, such as frightening vulnerable birds and causing further injury as the birds

continued

attempt to flee. The process of using detergents to clean oil from the feathers of birds caught in spills may also damage the birds' feather structure and arrangement, and thus the birds' waterproofing.

Large oil spills account for just one way oil can pollute the environment. Many people who work on their own vehicles dispose of their waste oil improperly. They pour waste oil into storm drains, into sewers, or on the ground. Many people are surprised to learn that they and their neighbors can account for more pollution than large corporations.

Oil spills are just one example of the kinds of pollutants that can have adverse short- and long-term effects on wildlife, people, and the environment. Excess fertilizers, herbicides, and insecticides from agricultural lands and residential areas run off the land and can get into lakes, rivers, wetlands, and coastal waters. Bacteria and nutrients from livestock, pet wastes, and faulty septic systems can likewise move over and through the ground into water sources and habitats. Soil from disturbed sites, including agricultural land and construction areas, is also pollution. It is a major "nonpoint source" pollutant (can't be traced to a single source) in our waters, and soil often carries other harmful substances with it.

The major purpose of this activity is for students to examine some of the possible consequences of human-caused pollution for wildlife, people, and the environment.

Procedure

1. Divide the group into teams of three or four. Each team needs a shallow pan partially filled with water. Add 1 teaspoon (5 milliliters) of oil to the water. Observe the interaction of oil and water. Measure the area covered by the oil. There are 768 teaspoons in a gallon (1,000 milliliters in a liter). Calculate how much area could be covered by 1 gallon (4 liters) of oil. Using this information, estimate the area that might be affected by an oil spill involving the following:
 - a. A tanker truck holding 8,000 gallons (32,000 liters),
 - b. A ship holding 300,000 gallons (1.2 million liters), or
 - c. A supertanker holding 83,000,000 gallons (332 million liters).

Discuss and compare estimates with other groups. Graph estimates and compute average figures.
2. Put enough oil in a small container to submerge three hard-boiled eggs. Add the eggs. Put the eggs under a good light, and watch closely. Remove one egg after 5 minutes and examine it—before, during, and after peeling off the shell. Try to remove the excess oil from the outside before attempting to peel the egg. Remove the second egg after 15 minutes and the third egg after 30 minutes, repeating the procedure, examining each carefully. Discuss the observations. What effect could oil have on the eggs of birds nesting near the water?
3. Have the students examine a feather with a hand lens and sketch their observations. Next, have the students dip the feather in water for 1 or 2 minutes, examine it again with a hand lens, sketch their observations, and compare them to the original observations. Place the feather in oil for 1 or 2 minutes; then examine it with a hand lens, sketch it, and compare the sketch with other sketches. Clean the feather in detergent, rinse it in water, and dry it. Examine it with a hand lens, sketch it, and compare the drawing with previous sketches. Discuss any changes in the feather after exposure to oil and then to detergents. What effect could these changes have on normal bird activity?
4. Discuss other possible effects on birds from an oil spill. Discuss possible effects on other wildlife species, on humans, and on the environment. What trade-offs are involved? Do we have to choose between oil and birds, as well as other wildlife? What are some alternatives? What are other examples of

human-caused pollutants that can have negative consequences for wildlife, people, and the environment? What is being done or can be done about these as well?

OPTIONAL: Ask each student to write a report summarizing the findings of the experiment and providing recommendations on what can be done to reduce pollution caused by humans.

Extensions

1. A variety of oils—cooking oil, motor oil, crude oil—can be used to produce effects similar to the original experiment. Food coloring can be added to clear oils to observe their effects. Before using motor oil, crude oil, or similar products, devise a plan for properly disposing of the waste materials including the oil, polluted water, and items used to clean the feathers. More oil is improperly placed in the environment by end users than commercial transporters. Take this opportunity to learn how to properly dispose of hazardous wastes in your own community. Research local laws pertaining to oil disposal.
2. Contact the local city or state environmental department to determine what forms of

pollution cause problems in your area. A local wildlife rehabilitator or wildlife pathologist can provide insight into common pollution problems for nearby wildlife. These professionals may also be able to give information about the impact of improperly disposed of toxins on local wildlife populations.

Aquatic Extension

What are the consequences of oil spills for other species of aquatic wildlife (e.g., fish, marine mammals)?

Evaluation

1. How could an oil spill affect the success of birds nesting near the water?
2. Describe some possible effects of oil on a feather.
3. Explain why the effects of oil are different from those of water.
4. Describe some possible negative effects of three other human-caused pollutants on people, wildlife, and the environment.

