

TEACHER

ACTIVITY OUTLINE

wyland ocean challenge

AQUATIC ECOSYSTEMS

Activity No.

EIGHTEEN

Title:

POLLUTION AND SOLUTIONS

O OBJECTIVES: *{students will be able to}*

- Describe the effects of pollution on the ecosystem being studied
- Understand the processes involved in cleaning up pollution
- Describe different types of pollution, including trash pollution, oil spills, and chemical pollution

S SUMMARY:

Students will learn about different forms of pollution. Through experiments simulating trash pollution, oil spills and chemical leakage, they will plan, predict, and perform clean-up efforts associated with each type of pollution. To learn about the difficulty in cleaning up oil spills, students will learn how oil and water react to one another by creating an oil painting and will also use feathers and oil to learn about the effects of pollution on animals in their ecosystem.

t TIME NEEDED:

1-4 sessions

m MATERIALS:

SCIENCE MATERIALS:

- Students' Field Notebooks
- Plastic tub, pie tin, or other container (1 per group)
- Cooking oil
- Water
- Items to aid in clean-up, like cotton swabs, nylons, sand, cotton balls, string, toothpicks, pipe cleaners, yarn, bottle caps, pipettes, tongs, etc.
- Feathers – 2 for each group (you can get these at a craft store, it is best to use non-dyed feathers, although they will work with the experiment as well)
- Liquid detergent
- Watch, stopwatch, or clock
- Food coloring
- Various pieces of trash for each group

ART MATERIALS:

- Powdered tempera paint
- White all-purpose or construction paper
- Small containers for mixing oil paints
- Forks, coffee straws, plastic combs, or other interesting tools for swirling oil paint
- Brushes
- Water
- Small cups for rinsing brushes
- Newspaper or drying rack for artwork
- Non-native species cards from the California Coastal Commission

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P PREPARATION:

- Read background Types of pollution
- Have materials ready for students (you can pre-separate items for groups into kits)
- Go to www.epa.gov/oilspill for background on oil spills, how they happen, and how they are handled.

a ACTIVITY INTRODUCTION:

1. Ask students to brainstorm different types of pollution. List student ideas on the board.
2. Ask students how they think these types of pollution get into ecosystems. Do you think weather can affect these pollutants? What about how water carries materials through the watershed? What happens when snow melts? Recreational activities? Pollutants can get into water systems through roadways (oil and chemicals), salt and sand spread to melt snow on roadways, accidental spills, natural seepage, illegal dumping, using water as a universal dumping ground, groundwater, unintentional litter, dumping or activities.
3. Break students into groups to think about properties of the pollutants. You can have one group brainstorm one pollutant and share with class, or each group can think about all three types. Ask students what kinds of trash have they seen in water systems or on the side of the road? What are some of the properties of trash? Have students think about texture, color, mass, what can break down (degrade) or not, weight, etc. Most plastics float and don't break down. Very few plastics are designed to break down, or degrade. They can be carried by wind and currents. Styrofoam breaks apart but does not break down. Balloons are let free into the sky and are rubbery, flexible, sea jelly-like, can suffocate, are non-breathable. Oil does not mix with water, is slimy, floats, etc. Chemicals can dissolve in water, can come in liquid form, can come in powder form, come in multiple colors, can be odorless and colorless. Some examples of chemical pollutants are bleach, car wash soap, detergents, phosphorous, acids, anti-freeze/coolant, paint, fertilizers, cleaning agents, and pesticides.
4. Tell students that they will be conducting some experiments on how these pollutants affect their ecosystem and how they get cleaned up. They will be completing three sessions. Each activity will have a time limit. Pass out student activity sheets.

e EXPLORATION:

1. Pass out materials for each group. Each group should start with a tub with water, a little sand and a few rocks in it, a collection of trash, and their clean-up materials.
2. Give directions for first activity. Instruct students to put their trash into the tub of water. Tell them they will make predictions, plan their clean-up, and document their efforts on their student worksheets. The time limit for this session is ten minutes, which includes the planning part through the end of the clean-up. Feel free to lengthen or shorten time limits depending on your students.

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e EXPLORATION: *{continued}*

3. After students have finished documenting their first clean-up efforts, tell them their next effort will be to clean up an oil spill. Before they start their clean-up effort, they'll learn a little about how oil and water react when mixed by creating a piece of art. Students should have their tub about half full of water. Have students mix powdered tempera with oil to create "oil paint" (the consistency should be like cream). They can make small amounts of several different colors. Ask students what they think will happen when they pour gumball size amounts of the oil paint into the water? Tell students to proceed with pouring a small amount of one color oil paint of the paint into water. Instruct them to use the swirling tools (fork, comb, blowing gently through stirring straw, etc.) to experiment with the paint. Did the results surprise them? Have students add more colors as desired and create their oil painting by laying a piece of white paper over the top of their tub. Let the paper sit for about a minute and then remove it. Lay the paintings on a drying rack, newspaper, or other surface to dry. Have students think about how the water and oil reacted to one another when they do the next clean-up activity. (Oil and water will not mix).

4. Give directions for the second activity. Give students a brief background on oil spills, including natural seepage and large accidental tanker spills. Oil seepage is a naturally occurring process and the earth has systems in place to handle the amount of oil that comes out of the ground. In Santa Barbara, California, there are naturally occurring seeps in the area. Pieces of tar and oil are often found on the beach and along the coast. There are also places with large tar pits, like in La Brea, CA, Trinidad and Tabago, and a tar lake in Venezuela. You can visit www.epa.gov/oilspill, and <http://evostc.state.ak.us> for information on oil spills. Talk about where these events might occur (tankers travel through oceans and large rivers). Review the properties of oil that students came up with.

5. Tell students that you will be coming around to create an oil spill in their ecosystem tubs. They will have 20 minutes to complete this session. Start each group with a fresh tub of water and pour about 1/4 cup of oil into each group's water container to create their oil spill.

6. After students have completed documenting the second session clean-up, introduce the third session. These last clean-up efforts will simulate chemical pollution. You will add a bit of food coloring to each groups tub. You can use different colors and different amounts of drops for each tub, including some that are so light that it is nearly impossible to see the pollution. Give students 20 minutes to complete this section.

7. After students have completed their worksheets and disposed of their clean-up materials, have students get fresh water in their tubs. Ask students which clean-up session was the most difficult. Which was the easiest? Do they think that these experiments can translate to real life situations?

8. Tell students that their experiments measured some of the effects of pollution on abiotic or non-living parts of the ecosystem. What about biotic or living components of the ecosystem? How might they be affected? Have students brainstorm what animals and plants that might be affected and how they might be affected. Give each group 1 feather and tell them to observe it in the water. What does it do? Does it float? Sink? Have students write down their observations on their worksheets. Discuss what feathers are used for- insulation, buoyancy/floating, water proofing, etc. Also, feathers have a 'zipper' adaptation to help maintain insulation and water proofing. This 'zipper' gets ruined when oil damages the feather.

9. Walk around and give a little bit (less than a teaspoon – just enough to coat the feather) of oil in a small cup to each group. Tell students to coat the feather with oil. Have students describe the feather on their worksheets.

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e EXPLORATION:

{continued}

10. Direct students to use a little liquid detergent and water to clean the oil off their feather. Place it back in the water and observe the feather. Record observations on student worksheet. Hand out clean/non-oiled feathers for students to compare.

C COMMUNICATION:

{and assessment}

1. Discuss the results of the different experiments as a class. How might these pollutants affect the abiotic and biotic factors of the ecosystem? Remind students that plastics floating in water might look like food to animals. Some plastics break apart and resemble small particles of food or eggs that animals like to eat. Oil floats on the water's surface. Which animals have to come up for air? Which ones live on the surface? Float on the surface? Which animals drink from, bathe in, catch food in your ecosystem that normally don't live in the water? (Think about birds, bears, deer, alligators, moose, squirrels, water skimmers, etc.) Chemicals can interfere with reproductive health (DDT affects birds' eggshell hardness), can be instantly fatal, can accumulate in animals' systems over time (bioaccumulation), can cause mutations, etc. The challenges ecosystems face, due to pollution, can be more complicated than the obvious impacts of feeding, destruction of habitat and coat/feather damage. Pollutants can also affect the genetics and physiology of animals (inability to produce strong eggs, physical mutations, accumulation of toxins, etc). In addition, pollution in one ecosystem/habitat can often affect the health of an associated or near by ecosystem/habitat (watersheds, migrations, etc). Tell students about some real life solutions to cleaning up pollution. Have them compare their solutions to real life ones.

2. Students should answer the following questions in their field notebooks:

- What is one way each type of pollution (trash, oil, and chemicals) could affect your ecosystem?
- What was the most difficult type of pollution for you to clean up? Why?
- Which of your clean-up procedures is most like a real life procedure? How is it different?
- Can you think of ways to prevent these kinds of pollution? Describe your ideas.

3. Art Challenge: Look at the non-native species cards discovered by the California Coastal Commission. Create your own description of a non-native species you may have encountered. Include a common name, a scientific name, the type of trash, its behaviors, and where they are found. Submit your non-native species to the California Coastal Commission: www.coastal.ca.gov/ccd/ccd23.html

California Coastal Commission/Non-Native Species

Attn: Eben Schwartz

45 Fremont Street, Suite 2000

San Francisco, CA 94105

4. Create a book of non-native species in found in your area. Have each student contribute at least one species they have studied.



CALIFORNIA
COASTAL
COMMISSION

Special Thanks!

Thank you to the California Coastal Commission for contributing their Non-Native Species activity to the Art Challenge. More information is available at: www.coastal.ca.gov/ccd/ccd23.html

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ADAPTATIONS:

For younger students:

Simplify the activity to focus on properties of oil and water. Do the art project, oil clean-up activity, and feather activity.

For older students:

Have older students research actual water pollution disasters such as the Exxon Valdez oil spill, the Hudson river catching on fire, the Jilin chemical plant explosions, the giant floating island of plastic debris in the North Pacific Gyre. Students can write up an explanation of how the situation was handled and if they feel, based on what they have learned, that the situations could have been handled differently.

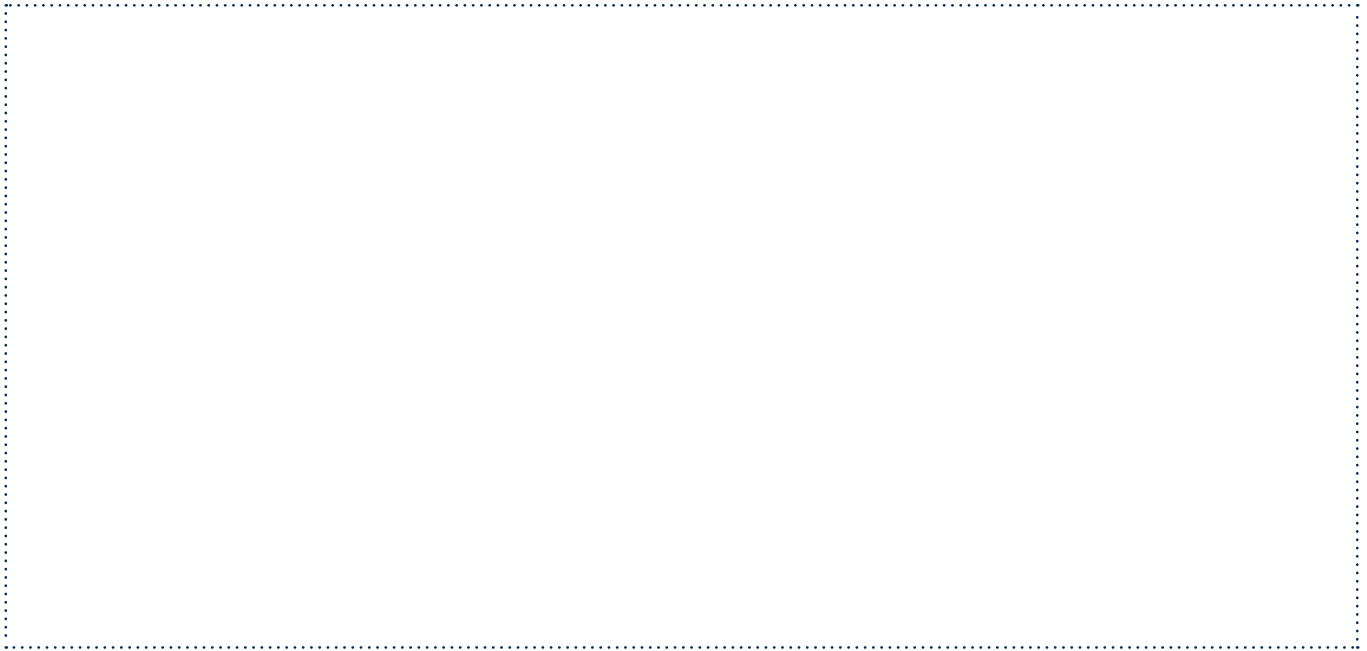
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TASK 1: Trash Pollution

1. What pieces of trash do you think will be easiest to clean up?

2. Which clean-up items will you see? Draw a sketch and write a description of your clean-up plan.



3. Time your process. How long did it take? _____

4. What was the easiest to clean up? _____ What was the most difficult? _____

5. Were your clean-up efforts successful? Why or why not? _____

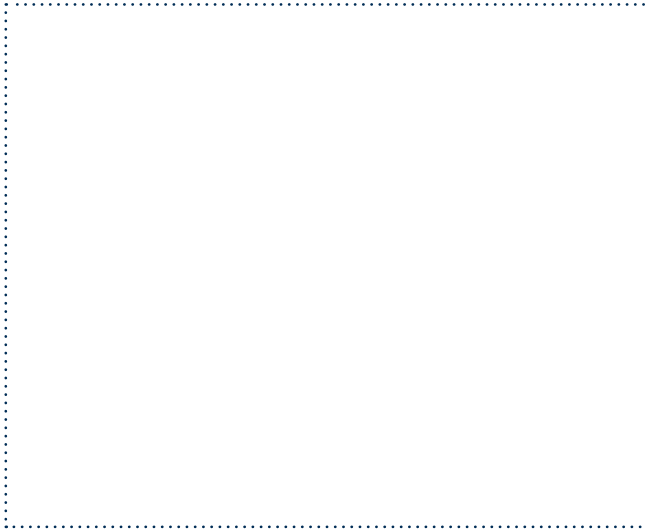


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Date: _____

TASK 4: Oil and Feathers

1. Draw a picture of how the feather looks and describe how it feels. Put it in the water and describe what happens.



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2. Draw a picture of the oil coated feather and describe how it feels. Put it in the water and describe what happens.

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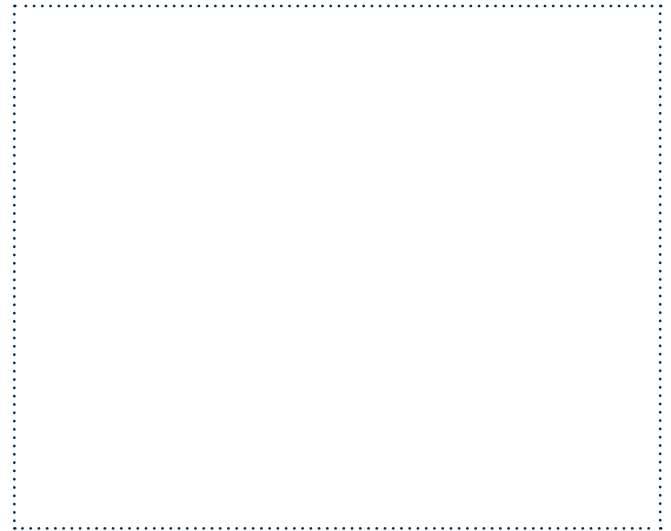
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3. What happened after the feather was cleaned and you put it back in the water again? What did you observe? How does it compare to the feather in its natural state?

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