

ACTIVITY

9

WHAT'S IN THE WATER?

WHAT IS WATER POLLUTION? WHAT ARE THE EFFECTS OF SEVERAL KINDS OF WATER POLLUTION ON SOME AQUATIC ORGANISMS?

SCIENCE SKILLS:

- classifying
- observing.
- inferring
- predicting
- experimenting
- communicating

CONCEPTS:

- There are many different forms of water pollution.
- Human activities are a primary cause of water pollution.
- Some forms of pollution have a definite point at which they enter the water, while others do not.
- Water pollution can affect plants and animals and humans.

MATH AND MECHANICAL SKILLS PRACTICED:

- use of a camera

SAMPLE OBJECTIVES:

- Students will be able to test the effects of several common household chemicals that frequently find their way into aquatic
- Students will be able to classify pollution sources.

INTRODUCTION:

This exercise, like Activity 8, is spread out over about one month. It takes a simplistic look at the effects water pollution has on aquatic systems. Use several household chemicals that are safe and that students pour down the drain without thinking. The results vary with your choice of materials. Students enjoy checking daily for changes. Like Activity 8, to be scientifically correct you should do two of each test if you possibly can which would double the number of jars needed.

MATERIALS:**Two weeks before class, one set of materials:**

- four clear containers one quart or more (plastic soft drink bottles or canning jars)
- water with algae from a freshwater classroom aquarium or a pond, or purchased pond water from a biological supply company
- plant fertilizer such as Rapid-Gro, Peters or other well-balanced mix (the dye in most these will fade when exposed to light)
- aged tap water
- good light source, either indirect sunlight or strong artificial light

For class:

- "pollutants" of choice by students; the safest to handle might include detergent (not green), cooking oil, vinegar
- camera and roll of 12 exposure print film (35mm or Polaroid best)

INFORMATION:

Detailed information on water pollution is in the Information for Teachers section.

LESSON PLAN:

BEFORE CLASS: Set up the bottles or jars at least two weeks before the experiment begins. Fill the jars with aged tap water. Add one teaspoon of plant fertilizer to each jar and stir it thoroughly. The plants need some nutrients to grow. Nutrients are found in all natural systems. Add to each jar an equal amount of pond water or algal sample. Use as much pond water as you can. Try a bit of soil from the bottom of a pond or gravel from your aquarium tank along with the water. Put the jars near a window where they will get good indirect light or give them strong incandescent or fluorescent light. Do not place them in a location that gets very cold or very hot in direct sunlight.

When pollutants are selected, be careful to consider safety. Animal products of any kind could grow dangerous bacteria. Do not cover jars tightly as you might grow some undesirable bacteria this way. Regular household items should do fine. Vinegar is an acid which acts as acid rain or an acid discharge such as the "pickling liquor" from steel production or the run-off of acid from strip mines. Detergent is a common component of human sewage. Use cooking oil in place motor oil unless you take care not to dispose of the motor oil down the drain. Motor oil is commonly poured down storm drains, an unacceptable practice. Regardless of what you use, make all your observations without coming into contact with the water and dispose of the material carefully after the experiment is over.

DURING CLASS:

METHODS: Start with a classification exercise on the blackboard, explaining that you want the students to see if they can organize what they already know about water pollution. Explain that some water pollution comes from specific sources such as outfalls (and are called POINT SOURCE pollution) while other kinds come from many widespread sources (called NON-POINT SOURCE pollution). Write those words at the head of two columns and have the students begin to suggest things that pollute water. Put them in the general categories found in the chart given in the Information for Teachers section. Students will not name everything in the list.

Explain that they are going to test some pollutants on model water environments. Would it be acceptable to test them by dumping them in a natural environment? No. Models are used for tests to avoid damaging the natural world. Show the students the jars with algae growing in them. Now what does the class choose to test for its effect on an artificial water environment? Let them decide with guidance. For example, if a child wants to test the effect of a dangerous compound, try to discuss why that might not be safe in the classroom environment. Settle on three pollutants. The fourth set of jars are CONTROLS.

When the class has decided what to test, you may have to wait until the following day to add

the material, since it might have to come from home. Add a reasonable amount: two tablespoons of a strong detergent; enough motor oil to just cover the surface; 1/4-1/2 cup of vinegar. Leave the jars or tanks in the light as before. Have the children write their predictions for what will happen to each test container. Two or three times each week for several weeks photograph the jars with labels and a date showing.

RESULTS:

These depend on what you used. A few kinds of pollutants favor plant growth and will cause an algal population explosion. This is not healthy as it disrupts the balance of organisms. When the algae die, the oxygen is used as they decompose. Other pollutants, such as acids, will cause very clear water because they kill everything in it. Needless to say, they are not good for natural systems either. The sample with an oil spill may do better than you expect. If the algae have enough sunlight, they may make enough oxygen to keep things alive below the oxygen impervious oil layer. Many of the effects of oil pollution are long term effects with the exception of oiled birds or mammals.

CONCLUSIONS:

Human activities which result in water pollution can affect water environments in ways that are very bad for natural communities.

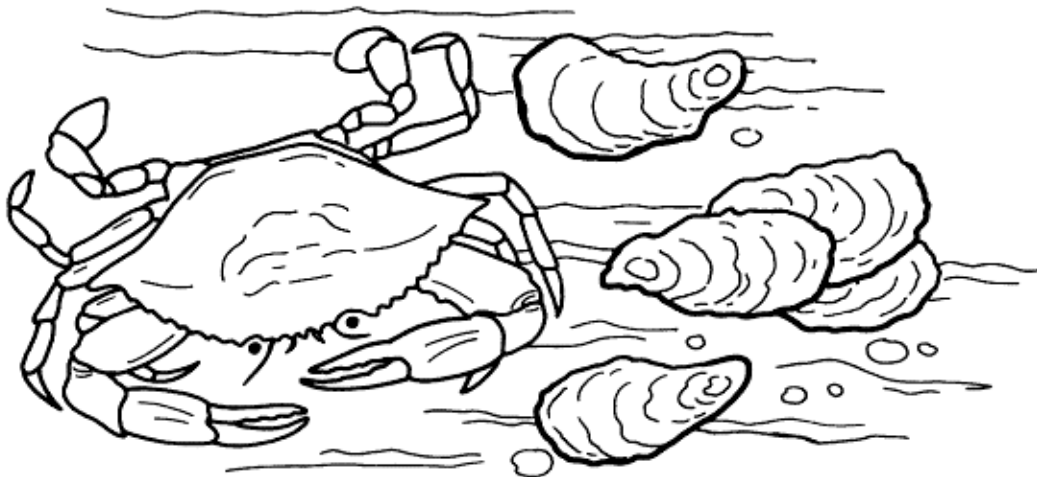
USING YOUR CLASSROOM AQUARIUM:

Does your classroom aquarium grow lots of algae? If you feed fish, they will produce waste products which are very much like fertilizer. Have your students discuss the procedures you use to avoid water pollution in your classroom aquarium. You are careful not to overfeed the fish, you remove algae from the sides of the tank and do water changes which reduce the level of waste products.

EXTENSIONS:

1. There are a number of social studies activities related to this experiment. Who regulates water pollution in your city, county or state? What are the federal regulations on water quality? What is the impact of these regulations on industries? What are the greatest water quality problems in your local area? How do they affect the jobs and health of people living in your area? The natural environment in your area? Have students research these topics.
2. Can any of the polluted systems be reversed and improved?
 - a. Countries such as Sweden have added lime to their acid lakes in an attempt to correct the acidic condition. Your students could use baking soda to turn their acid test back into a neutral environment. Use litmus paper to test for neutrality. Add new algae and see what happens.
 - b. Oil spills may be mopped up with straw, feathers or cotton. Can they skim the oil off of their samples and let the oxygen get through again?
3. If you live in the Chesapeake Bay region, write these folks for booklets that tell what ordinary people can do to reduce water pollution in the Bay:
Alliance for the Chesapeake Bay
6600 York Road
Baltimore, Maryland 21212

Similar booklets are available in many regions from local conservation and water quality organizations. Have students choose which things they and their families can do.



ACTIVITY 9
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Name Possible answers

Arrange all the pictures in order from the first date to the last. Study the changes you can observe over time in each. Write in the pollutant used in each and describe the changes:

Tap water: This jar grew more green, but not very much. It changed just a little bit. The green was algae.

Vinegar (acid) . . . : Everything in this jar died right away, and the water became very clear. It looked clean, but nothing could grow in it.

Dish detergent . . . : I thought this would kill everything but instead the algae grew a little bit. Another group used more, and their pond water died.

Salad oil : The pond water stayed green which was a big surprise. How can they live without air?

Which pollutant had the greatest effect? vinegar-acid like acid rain

Which pollutant had the least effect? salad oil

Were you surprised at the results? How did they compare with your predictions?

Salad oil did not kill everything. Another group used motor oil, and it did kill the pond water plants and animals.

Why did one jar get only tap water? It was the control against which the others could be compared.