

## Fertilizing Fish

Age: High School

### Objective

- To investigate the effects of different liquid fertilizers on aquatic environments.

### Background Lesson

Many of us know that fertilizers are added to soil to promote plant growth, but what does this have to do with fish?

Well, when it rains, the water that cannot be absorbed into the soil flows across the ground surface and becomes known as runoff. If runoff travels across a fertilized lawn, many of the components of the fertilizer on the lawn will be dissolved into the water and carried to the nearest river, lake or stream.

Fertilizers contain nitrogen, phosphorous, and potassium which are essential nutrients for plants. Each of these poses a problem for aquatic systems, and can lead to what is known as eutrophication. Eutrophication is defined as an increase in the concentration of nutrients in an ecosystem to the point in which the primary productivity of the ecosystem is compromised. Results of eutrophication include anoxia and a reduction in the water quality and fish populations.

Eutrophication can be reversed but the process takes a very long time as it requires waiting for nitrate in the water to naturally break down.

Phosphorous found in fertilizers is often obtained from phosphorous minerals which also contain heavy metals. Metals such as cadmium and uranium are commonly found in phosphate fertilizers. Heavy metals pose many health risks for animals and plants.

This experiment observes the effects of fertilizers both through pH tests and by observing the response of aquatic organisms to the presence of these chemicals.

### The Activity

#### **Materials**

- Multiple brands of liquid fertilizer
- 12 litres of water (3 gallons)
- Measuring cups
- pH test strips or garden pH reader

- 3 large, reusable plastic containers with lids (each should hold about 6 cups)
- Permanent marker
- Aquatic organisms (at least 2 plants and 2 animals)
  - Most of these can be found at aquarium supply stores:
  - Small, cheap fish
  - Small pond snails
  - Water fleas
  - Aquatic plants like duckweed
  - Algae

### Procedure

1. Rinse out each of the containers using water only (no soap).
2. To each container add 800mL of water and 200mL of liquid fertilizer. Distilled water is preferred as tap water contains added chemicals.
3. Label the containers to indicate which fertilizer was added to each.
4. Add your aquatic life to each container. In order to fairly compare the fertilizer brands, the same number of each organism should be added to each container. Record the number of organisms that were added.
5. Construct a table like the one below.

Brand of Fertilizer	Time of Observation	pH	Observations
	1		
	2		
	3		
	1		
	2		
	3		
	1		
	2		
	3		

Immediately record the pH of the solution using the garden pH reader or the paper test strips. You may observe the containers as many times as you like but you must observe all three containers the same number of times. This experiment could last one day or overnight.

6. Observations include the number of organisms that are still alive at every time of observation. Other information on what you see is also good to include.
7. Finally, make a graph of your results. The x-axis should include the time of observation and the y-axis should show the number of organisms alive at each time. Three different lines will be drawn in different colours to indicate the lethality of the different fertilizers.

### Post Activity Discussion

- Have students interpret their graphs. Which fertilizer was the most damaging to aquatic life? Did one fertilizer lead to damage more quickly than the others?
- Were all organisms affected similarly or differently? Which organisms are most vulnerable to the fertilizer?
- How much did the fertilizer alter the pH of the ecosystem? What may have caused this to happen?

### Possible Assignments

Students can research the effect that different components of fertilizers have on the environment. This can include nutrients such as nitrogen and phosphorous, heavy metals such as cadmium and uranium or organic components known as persistent organic pollutants (POP).

Have students research the difference between organic and inorganic fertilizers.

What are some non-chemical alternatives to fertilizers that yield similar results? Some possible answers include using compost to provide nutrients to the lawn, cutting the grass frequently so that the grass clippings may provide nutrients or creating a natural pesticide using garlic cloves and onion skins blended with water.

One Fish at a Time