

Effect of nutrients on water sources

Focus questions	What is the effect of added nutrients on water sources? What is the source of these added nutrients?
Vocabulary	Runoff, submerged aquatic plants, dissolved oxygen, decomposition, hypoxic

Phosphorus and nitrogen are limiting factors in waterways. If they are not present in large quantities, the ecosystem will stay in balance. The algae that is naturally present is kept in check by a lack of these nutrients. When these nutrients increase, it can result in an algal bloom. As the algae increases, waters become less clear, which can block sunlight to **submerged aquatic plants**, causing them to revert to cellular respiration to obtain energy. This requires oxygen, and makes less oxygen available to other organisms as result. Competition increases between the algae for decreasing oxygen amounts, and eventually they begin to die. The process of decomposition also requires oxygen, causing the **dissolved oxygen** level to fall further. This can result in massive fish kills. The massive mats of algae can also make these bodies of water unappealing for recreation. If toxins are present, the water can be dangerous to swim in or drink.

Surface water is judged on its quality, using several parameters. The diversity and amount of biotic life, as well as the chemical composition of the water, plays a role. The amount of dissolved oxygen in a body of water is critical to supporting biotic life. Different water dwellers can tolerate different levels of dissolved oxygen. An area in a body of water that has little or no dissolved oxygen is called **hypoxic**.

Fertilizers are an input on farm fields. The nutrients in fertilizer include **nitrogen (N)**, **phosphorus (P)**, and **potassium (K)**. Different fertilizers include varying amounts of N, P, and K and are used for different crops. Crops need all three nutrients in order to grow and produce seeds. Each serves a specific function in plants, and different plants have different requirements for each nutrient. The effect on water is determined by the salinity level and the plant life. N is a limiting factor in salt water (such as the Gulf of Mexico) and P is the limiting factor for fresh water. A limiting factor determines how much plant growth might occur if there is excess N or P in the water.

How do excess N and P get into water sources? When farmers apply fertilizers to fields, there is a specific amount applied per acre depending on the available nutrients in the soil and the crop that is planted. Those nutrients, if not incorporated into the soil right away, may be washed away by a rainstorm. Even if incorporated, some of those nutrients may be eroded before the plants can utilize them.

In this experiment, inorganic nutrients will be added to water collected from the environment and grown in the classroom under fluorescent lights or by a bright window.

Materials

- 1000 ml natural source of water (pond, lake, stream)
- Liquid NPK fertilizer
- 5 Beakers (or other containers: erlenmeyer flasks, tupperware containers, clear plastic cups, 2L bottle)
- 10 ml Graduated cylinder
- 100 ml graduated cylinder
- plastic pipettes
- microscope
- markers/labeling tape

Procedure

1. Label 5 containers: control, 2 ml, 4ml, 6 ml, 8 ml
2. Fill each of the containers with 200 ml of your water source.
3. One of the containers will be the control.
4. Add 2 ml of liquid fertilizer to the second container.
5. Add 4 ml of liquid fertilizer to the third container.
6. Add 6 ml of liquid fertilizer to the third container.
7. Add 8 ml of liquid fertilizer to the third container.
8. Prepare a microscope slide with a drop of water from your control. Use a microscope to look for life in the water. Make observations in your lab notebook about what you see in the water.
9. Put the containers in a bright window or under grow lights or shop lights for 3 days.
10. After 3 days, observe the containers for signs of algae growth. Put the cups on a white surface or on a piece of white paper and look down on the water from above the cup.
11. Prepare a microscope slide with a drop of water from each container. Use a microscope to look for life in the water. Compare each container and make observations in your lab notebook.
12. If a centrifuge is available, mix the water sample well and pour about 5 ml of each sample into a centrifuge tube. Centrifuge the sample to obtain a pellet of algae. Compare the size of the pellets between samples by mass or volume.
13. If nutrient test kits are available, the samples could be tested for the levels of nitrogen, phosphorus, and potassium.
14. Record your findings in the data table.
15. Let the samples sit for another 4 days. Make another observation.

Results

Record the amount of N, P, and K that was in the liquid fertilizer used by your group.

Observations of water samples at 3 and 7 days

Day/date	2 ml	4 ml	6 ml	8 ml	Control
Start date:					
Day 3					
Day 7					

Describe the results you observed. Which amounts of added nutrients produced the most algae? Which conditions allowed for the most growth?

Analysis

With your group, research and discuss the effects of excess nutrients on the stability of an ecosystem.

Rubric for self-assessment

Skill	Yes	No	Unsure
I am able to analyze the data collected.			
I am able to see relationships between data collected and variables tested in the lab.			
I am able to explain the relationships between data collected and variables tested in the lab.			