

Lab-wide Learning Outcomes for Nutrient Pollution

Knowledge-Based Outcomes

Upon completion of *Nutrient Pollution*, students should be able to:

1. Explain why nutrients are important to individual organisms and to ecosystems.
2. Understand that algal blooms can be harmful to aquatic systems in two different ways: by lowering dissolved oxygen, and sometimes also by releasing toxins.
3. Describe the chain of events initiated by an increase in a limiting nutrient, which leads to reduced oxygen and ultimately a fish kill.

Skills-Based Outcomes

Upon completion of *Nutrient Pollution*, students should be able to:

1. Conduct and interpret simple experiments to determine if a given nutrient is limiting a particular population of phytoplankton.
2. Interpret graphical data from an experiment with a single quantitative independent variable.

Nutrient Pollution, Part 1: Too Much of a Good Thing

Knowledge-Based Outcomes

Upon completion of *Part 1: Too Much of a Good Thing*, students should be able to:

1. Describe nutrient limitation.
2. Define eutrophication.
3. Identify decomposition of phytoplankton as the cause of hypoxia in eutrophic lakes.
4. Reduce the expression of the misconception that algal blooms result in hypoxic conditions because algae consume oxygen.

Skills-Based Outcomes

Upon completion of *Part 1: Too Much of a Good Thing*, students should be able to:

1. Predict how increasing the availability of a limiting nutrient will impact organisms that directly use that nutrient.

Nutrient Pollution, Part 2: DO or Die

Knowledge-Based Outcomes

Upon completion of *Part 2: DO or Die*, students should be able to:

1. Name three types of organisms commonly found in lakes and describe the trophic position of each one.

Skills-Based Outcomes

Upon completion of *Part 2: DO or Die*, students should be able to:

1. Predict how the effects of nutrient pollution will be indirectly modified by adding or removing higher trophic levels.

Nutrient Pollution, Part 3: Toxins!

Knowledge-Based Outcomes

Upon completion of *Part 3: Toxins!*, students should be able to:

1. Define biomagnification.

Skills-Based Outcomes

Upon completion of *Part 3: Toxins!*, students should be able to:

1. Predict how concentrations of a biomagnifying molecule in a population will qualitatively change over time, depending on the population's trophic level.
2. Determine whether a toxin biomagnifies, based on a graph showing its average concentration in the tissue of organisms at different trophic levels.

Nutrient Pollution, Part 4: Mystery in the Lake

Knowledge-Based Outcomes

Upon completion of *Part 4: Mystery in the Lake*, students should be able to:

1. Explain why the growth of different types of primary producers (i.e., algae and cyanobacteria) may be limited by different nutrients.