Teaching Great Lakes Science: Measuring Water Quality

Scientists measure a variety of properties to determine water quality. Some common properties are: temperature, acidity (pH), dissolved oxygen, phosphate, nitrate, particulate matter (turbidity), biochemical oxygen demand (BOD), and coliform bacteria. Each reveals something different about the health of a water body.

The result of a single measurement, however, is actually less important than monitoring changes over time. For example, if you measure the pH of the creek behind your house and find that it is 5.5, you might think it is acidic. But a pH of 5.5 might be "normal" for that creek. If the pH or the turbidity of your creek begins to change, however, something may be happening that is affecting water quality. Taking routine measurements at scheduled intervals allows you to monitor overall changes in water quality.

These properties are important in determining water quality:

- *Temperature*: Important to fish and aquatic plants. Water temperature can affect the level of oxygen, as well as the ability of organisms to resist certain pollutants.
- *pH:* A measure of the hydrogen ions present in the water, telling us whether it is acidic, basic, or neutral. Most animal species cannot survive if the water is too acidic (below 5.0), or too basic (above 9.0). Optimal pH for many species is between 7.0 and 9.0.
- *Dissolved oxygen*: Dissolved oxygen, also called DO, is vital to the health of aquatic habitats. Plants and animals need oxygen to survive. A low level of oxygen in the water is a sign that the habitat is stressed or polluted.
- *Phosphate:* Phosphorus, in the form of phosphate, is an essential element for plant life. Excess phosphorus can come from urban and agricultural runoff and causes overgrowth of aquatic plants and algae.
- *Nitrate:* Nitrogen, in the form of nitrate, is a nutrient needed for plant growth. Excess nitrogen can be introduced through pollution from sewage and fertilizer, causing overgrowth of aquatic plants and algae.
- *Turbidity*: The amount of particulate matter (such as clay, silt, plankton, or microscopic organisms) suspended in water. Water with high turbidity is cloudy or opaque, and it blocks the sunlight that plants need to produce oxygen for fish and other aquatic life.
- *Biochemical Oxygen Demand (BOD)*: Measures how much oxygen is needed to break down organic material in the water. Sources of organic material include: topsoil, leaves and woody debris; animal manure; effluents from pulp and paper mills, wastewater treatment plants, feedlots, and food-processing plants; failing septic systems; and urban stormwater runoff. BOD directly affects the amount of dissolved oxygen in rivers and streams. The greater the BOD, the more rapidly oxygen is depleted in the stream. This means less oxygen is available to higher forms of aquatic life. The consequences of high BOD are the same as those for low dissolved oxygen: aquatic organisms become stressed, suffocate, and die.
- *Coliform bacteria*: Common water test done to determine drinking water safety. Coliform bacteria are found in human and animal waste and are often referred to as "indicator organisms" because they indicate the potential presence of disease-causing bacteria in water.