Tracking the Clues

What are some of the signs that a river or stream has poor quality water? People monitoring bodies of water look at a variety of factors that contribute to a stream's health.

- **Muddy water** – The cloudiness of water is called ***turbidity.*** Dirt is the number one polluter in Iowa. It is caused by erosion of uncovered land, commonly from riverbanks, construction sites, and bare farm fields. Planting grass, bushes and trees is the best prevention strategy – their deep roots help hold soil in place. Anything that slows down the flow of water during a rainstorm will cut down on the amount of soil lost. Terraces, berms, grass waterways, wetlands, leaving field residuals, silt fences at construction sites, and using more porous surfaces instead of concrete work well for slowing water and preventing erosion.
- **The Wrong Kinds of Creatures** - Aquatic invertebrates, called macroinvertebrates, spend 99% of their 1-3 year life cycle in the larval stage and are excellent indicators of water quality. By knowing which macroinvertebrates are highly sensitive or somewhat sensitive to water quality changes, people monitoring waterbodies can determine if a river's water quality is decreasing because sensitive macroinvertebrates, such as gilled snails and mayfly nymphs, will be absent and more tolerant species, such as leeches and pouch snails, will be present.
- **Low Dissolved Oxygen** – This refers to the amount of oxygen dissolved in a waterbody. To be classified as a healthy stream, dissolved oxygen levels need to be above 5 ppm (mg/l) to support the plants and animals living there. Oxygen gets in the water mostly in two ways – from water movement, such as waves and rapids, and from water plants releasing oxygen during photosynthesis. Anything that contributes to blocking light from the plants, such as high turbidity or an oil spill, could cause oxygen levels to decrease. The presence of large algae blooms also causes oxygen levels to decrease since the bacteria that decompose algae consume large amounts of oxygen. The presence of nutrients like fertilizer and phosphorus in the water cause this rapid growth of algae.
- **High Nitrate Concentrations** – Nitrate, found in animal and human waste, decaying organic material, and agricultural fertilizer, leaches through the soil into the groundwater or into runoff and then into our surface waters. Nitrate is essential for plant growth, but too much of it can cause harmful pollution. The presence of large amounts of algae in our rivers and lakes often indicates high nitrate levels. Nitrate can be harmful to babies under six months of age because it reduces the ability of their blood to carry oxygen. This may cause "Blue Baby Syndrome," a condition requiring immediate medical attention. The Environmental Protection Agency (EPA) has set a limit of 10 ppm (mg/l) of nitrate for drinking water utilities. If nitrate exceeds this limit, a water utility must notify the public via newspapers, TV, and radio. DMWW is fortunate to have a Nitrate Removal Facility containing eight vessels for removing nitrate, however it is very expensive to run the facility. Proper management of animal waste, keeping septic tanks in good repair, testing soil to find out its fertilizer needs,

and applying fertilizer at appropriate times, such as when no rain is predicted, can all contribute to keeping nitrate levels lower in Iowa's waterbodies.

- **Rapid Temperature Changes** – If the temperature of a waterbody changes rapidly, that is more than 1-2° C or 2-4° F within 24 hours, it can be harmful to the organisms living there. Fish are adapted to normal seasonal temperature fluctuations, but those temperature changes are much more gradual. Rapid temperature changes are usually caused by human behavior, for example by industrial facilities discharging heated water into streams without first cooling it, cutting down trees along streambanks, a large amount of soil erosion that increases the turbidity of the water so that more heat is absorbed, and stormwater that has become super-heated by urban pavement before it enters our rivers in the summer months. Warmer water also holds less oxygen and increases bacterial growth. Regulating industries that discharge water into rivers, planting vegetation to prevent soil erosion, and diverting stormwater runoff from entering streams right away can all help in preventing rapid temperature fluctuations.

In waterbodies that are decreasing in water quality, water monitorers may also encounter **increased carbonic acid levels** (from an excess of decaying matter), **increased levels of bacteria**, **increased ammonia levels** from fertilizer, and **increased levels of phosphates**, also coming from fertilizer.

How Much is a Part Per Million?

Many water contaminants are measured in parts per million (**ppm**). This is also often referred to as milligrams per liter (mg/l). Kids may have a difficult time picturing how much a ppm is, so try these comparisons-

A ppm is the same as –

1" in 16 miles *or*
1 minute in two years *or*
1¢ in $10,000

Water Quality Activities

1. Use a small-holed mesh net to capture macroinvertebrates in a nearby pond, creek or river. Have students identify them using a key like the one found at www.ncsu.edu/sciencejunction/depot/experiments/water/macro to find out if the waterbody is healthy and contains a variety of sensitive creatures or if it is full of less sensitive, more tolerant creatures that might signal decreasing water quality.
2. Purchase inexpensive water monitoring equipment for students to measure water contaminants, such as dissolved oxygen, nitrate, pH, turbidity, and water hardness, from vendors such as: Hach Chemical at www.hach.com/ or Chemetrics at www.chemetrics.com/ or LaMotte at www.lamotte.com
3. Have students perform bacteria testing of a nearby stream. You will find directions for growing bacteria on our website at www.dmww.com under *Education-Water Activities-Examining Bacteria in Water.*