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College of Agricultural Sciences • Cooperative Extension

School of Forest Resources

Pond Facts #2

Interpreting Water Tests for Ponds and Lakes

A survey of pond owners in Pennsylvania found that most had never tested the water quality in their ponds. As a result, many water quality problems are detected only after they cause an obvious problem. This fact sheet describes parameters included in a new Penn State pond/lake water test kit to help pond owners detect common water quality problems. The recommendations in this fact sheet assume that the pond or lake is used for recreational purposes. If your pond is used as a source of drinking water for livestock, consult the Extension fact sheet entitled *Water Facts #12: Interpreting Drinking Water Results for Dairy Cows* found at http://water.cas.psu.edu.

E. coli Bacteria

These bacteria originate from the wastes of animals or humans. Thus, high numbers of *E. coli* in a pond could come from septic systems, runoff from barnyards, or from wildlife (especially large numbers of waterfowl). Ponds and lakes used for swimming and other recreation should have less than 126 colonies of *E. coli* bacteria per 100 mL of water. High levels of *E. coli* bacteria can be reduced by limiting animal access to the pond, maintaining nearby septic systems, and redirecting runoff from barnyards and other areas where animal wastes accumulate.

Nitrate-Nitrogen and Total Phosphorus

Nitrogen and phosphorus are nutrients that may cause increased growth of aquatic plants and algae. Nitrate-nitrogen concentrations above 3 mg/L and any detectable amounts of total phosphorus (above 0.025 mg/L for our laboratory) may be indicative of pollution from fertilizers, manures or other nutrient-rich wastes. Reducing nutrient levels is critical to control nuisance growth of aquatic plants and algae. This can be accomplished by reducing the use of fertilizers near the water, keeping geese and domestic animals away from the pond, redirecting runoff from barnyards and fertilized areas, maintaining a 30-foot or wider buffer strip of higher grass around the perimeter of the pond and maintaining or relocating nearby septic systems.

Total Dissolved Solids (TDS)

The sum of all the chemical ions dissolved in the water is called total dissolved solids or TDS. TDS is controlled by the natural source of pond water and by nearby land use activities. Some ponds will have naturally high TDS levels while others will be naturally low. Therefore, it is important to monitor TDS in ponds and watch for significant increases over time that might indicate pollution. Single measurements of TDS above 1,000 mg/L could be indicative of a pond that has an existing water quality problem.

pH

The pH of a pond or lake should generally fall between 6.0 and 9.0. Different types of fish tolerate different pH levels but, in general, most fish will do better in ponds with a pH near 7.0. Ponds with a pH less than 6.0 may result in stunted, reduced or even absent fish populations. Low-pH ponds are often treated by applying limestone. This is most easily done by broadcasting pulverized limestone over the pond surface. Application rates of one to two tons of limestone per surface acre of pond are common but will vary depending on the pond pH and the rate of water moving through the pond.

Alkalinity

Measurable alkalinity in a pond provides a buffer that maintains the pH of the pond or lake. The pH of ponds with low or zero alkalinity may easily change resulting in damage to aquatic life. A healthy pond should have some measurable alkalinity. Ponds with less than 20 mg/L of alkalinity are more prone to stunted or absent fish populations. These ponds may benefit from liming to increase the pH and alkalinity as described above.

Hardness

Hardness is a measure of calcium and magnesium concentration in water and is controlled by the source of the pond water. Ponds in limestone areas will generally have harder water than those in areas underlain by sandstone or shale. The hardness of

pond water is usually unimportant except when using some aquatic herbicides. Hardness concentrations above 50 mg/L can reduce the effectiveness of some copper-based herbicides. Consult the label of aquatic herbicides to see if water hardness needs to be considered. Very high levels of hardness, above 150 mg/L, may also cause clogging problems with drip irrigation equipment.

Iron and Manganese

Iron and manganese are most common in ponds in coal mining areas in western Pennsylvania. While these metals are not directly harmful, they may adversely affect pond aesthetics by precipitating as an orange-brown coating on the pond bottom, docks, and vegetation. These precipitates may also smother aquatic life and they may cause injury to plants that are irrigated with water from the pond. Iron concentrations above 0.3 mg/L and manganese concentrations above 0.05 mg/L are problematic.

Aluminum

Aluminum is extremely toxic to aquatic life. Concentrations above 0.1 mg/L have been shown to be toxic to the most sensitive species such as trout and various minnows. High aluminum levels usually result from nearby coal mining or from the release of aluminum from soils near the pond due to acid rain.

Sulfate

High sulfate levels, above 250 mg/L, are indicative of a pond that is impacted by acid mine drainage or acid rain. These ponds usually have a low pH and high levels of metals (iron, manganese or aluminum). High sulfate levels alone are only problematic if the pond water is used for irrigation purposes.

Other Important Pond and Lake Tests

There are other important measures of pond and lake water quality that are not included in the Penn State water test kit because they must be tested directly at the pond or lake.

Water Temperature—a simple thermometer can be used to test pond water temperature. Maximum summer water temperatures are critical for fish and other aquatic life in the pond. Coldwater species like trout must have summer water temperatures below 72°F while warm water fish like bass prefer summer water temperatures above 80°F. Temperature will vary throughout the pond, with surface water affected more by air temperature than deeper water. Little can be done to alter the temperature of pond water

Dissolved Oxygen—dissolved oxygen must be measured quickly at the pond or lake using either expensive meters or less expensive (but less accurate) kits. The amount of oxygen that is dissolved in the water is critical for fish and other pond life. The maximum amount of oxygen that can be dissolved is controlled by the water temperature. Warmer water can hold less dissolved oxygen than colder water. Thus, like water temperature, dissolved oxygen also varies considerably with water depth. Dissolved oxygen is reduced by the biological decay of organic material such as decaying plants and animals or animal and human wastes. Dissolved oxygen levels below about 6 mg/L can begin to have detrimental effects on pond life. A lack of dissolved oxygen is the most common cause of fish kills in ponds. Problems can often be controlled by controlling aquatic plant and algae growth. Aeration devices can be use to increase dissolved oxygen in ponds that experience frequent problems.

Secchi depth

A Secchi disk is a black and white oval that is lowered into the water until it cannot be seen from the water surface. The depth where it is no longer visible is known as the Secchi depth. This measures the cloudiness of the water due to plankton growth or suspended sediment in the water. Ponds with less then one foot of Secchi depth are candidates for lethally low levels of dissolved oxygen levels A Secchi depth of less then three feet suggests a need to reduce nutrient levels in the pond water.

More Information

Consult the Penn State Cooperative Extension pond management web site at: http://water.cas.psu.edu/ponds.htm or by contacting your local county Extension office.

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