Lake Water Quality

A Quick Reference Guide
for Homeowners

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"Is my lake 'healthy'?"

That is the question.

Before embarking on a strategy to combat weed growth, reduce pollution, or any other lake improvement objective, it is important to know, "Is my lake 'healthy'?" In other words, it is important to determine the lake's current water quality.

But what is meant exactly by the term "water quality?" What is good and what is bad? You might think that only a scientist could answer these questions. In reality, there are many important aspects of water quality that no one knows better than you, the lake user. Some of these characteristics include water clarity, rooted plant growth, algae growth, and sediment composition, i.e., whether the lake bottom is sandy or mucky.

However, some questions can only be answers through scientific study. A lake scientist must investigate some of the unseen aspects of water quality, in particular, water chemistry. Information on the lake's water chemistry, along with more detailed observations of the lake's biology (e.g., type and distribution of rooted plants and algae) and physical condition (e.g., water temperature, sediment composition, flow patterns), allow the scientist to better understand why a lake is healthy, or not.

Important measurements used to evaluate lake water quality include temperature, dissolved oxygen, total phosphorus, chlorophyll-*a*, and water clarity. A brief description of these water quality measurements follows.

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Temperature

Temperature is important in determining the type of organisms which may live in a lake. For example, trout prefer temperatures below 68°F. In most deep lakes in the summer, the water separates into a warm upper layer and a cool lower layer. This process is known as "thermal stratification." In the fall, during "fall turnover," the entire lake mixes, and the water is the same temperature from top to bottom. Shallow lakes, on the other hand, tend to have a uniform temperature from top to bottom during all ice-free periods because wind mixing prevents thermal layers from forming.

Dissolved Oxygen

Of all the ways to measure water quality, dissolved oxygen content probably best answers the question, "is my lake healthy?" Although many aquatic organisms can survice with little or no oxygen, most need rather high levels to live and grow. A lack of oxygen can also lead to unpleasant changes in water chemistry. The familiar "rotton-egg" odor can occur when sediments become devoid of oxygen. And, if oxygen levels are not high enough in the water, a fish kill can result. Most warm water fish (like bass and bluegill) need at least 5 parts per million of dissolved oxygen; cold water fish (like trout and whitefish) need at least 7 parts per million.

By reducing the amount of phosphorus in a lake, plant growth may be controlled.

Many deep lakes with abundant plant growth are depleted of deep-water oxygen in late summer as bacteria break down organic matter (plant and animal remains) at the lake bottom. In these lakes, oxygen is not replenished to the bottom waters until the lake mixes during fall turnover. Thus, these lakes cannot support cold water fish such as trout because the cool, deep waters of the lake do not have sufficient dissolved oxygen.

Phosphorus

Phosphorus is the nutrient that most often stimulates excessive growth of aquatic plants and algae, leading to a variety of problems collectively known as eutrophication. In general, lakes with a phosphorus concentration of 20 parts per billion or greater are able to support abundant plant growth and are considered to be nutrient-enriched. By reducing the amount of phosphorus in a lake, plant growth may be controlled.

Algae Growth

Chlorophyll-*a* is the pigment that imparts the green color to plants and algae. As the amount of algae in a lake increases, the water will begin to take on a green tinge. A rough estimate of the quantity of algae present in lake water can be made by measuring the amount of chlorophyll-*a* in a water sample. A concentration greater than 6 parts per billion is considered undesirable in that the lake will begin to appear green in color.

Water Clarity

A Secchi disk is often used to estimate water clarity. The measurement is made by fastening a round, black and white, 8-inch disk to a calibrated line. The disk is lowered over the deepest point of the lake until it is no longer visible, and the depth is noted. The disk is then raised until it reappears. The average between these two depths is the Secchi transparency. Water clarity can be reduced by particles in the water, such as algae and suspended sediments. Secchi transparancy measurements less than 7.5 feet indicate poor water clarity.

Ordinarily, as phosphorus inputs to a lake increase, the amount of algae will also increase. Thus, the lake will exhibit increased chlorophyll-*a* levels and decreased water clarity.

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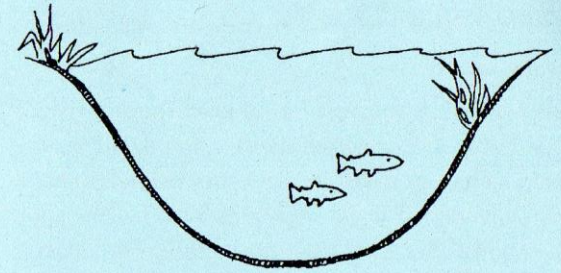
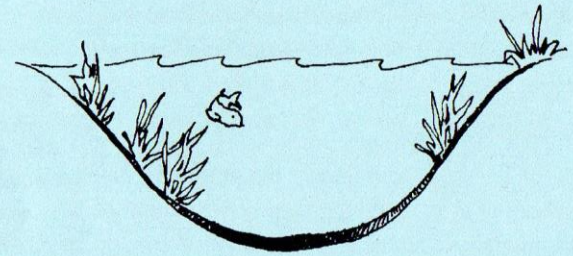
Classifying Lakes

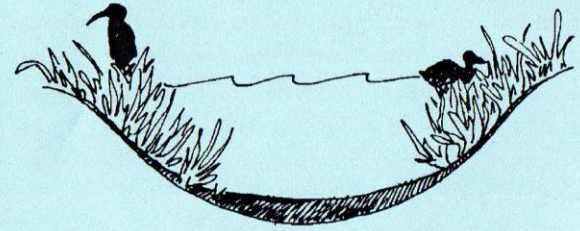
Lakes can be classified based on their ability to support plant and animal life. Oligotrophic lakes are generally deep and clear with little aquatic plant growth. These lakes maintain sufficient dissolved oxygen in the cool, deep bottom waters during late summer to support cold water fish, such as trout and whitefish. By contrast, eutrophic lakes are generally shallow, turbid, and support abundant aquatic plant growth. In deep eutrophic lakes, the cool bottom waters usually contain little or no dissolved oxygen. Therefore, these lakes can only support warm water fish such as bass and pike. Lakes that fall between these two extremes are called mesotrophic lakes. A summary of lake classification criteria developed by the Michigan Department of Environmental Quality is shown in Table 1.



Oligotrophic



Mesotrophic



Eutrophic

TABLE 1 - LAKE CLASSIFICATION CRITERIA

Lake Classification	Total Phosphorus (µg/L)[1]	Chlorophyll-*a* (µg/L)[1]	Secchi Transparency (feet)
Oligotrophic	Less than 10	Less than 2.2	Greater than 15.0
Mesotrophic	10 to 20	2.2 to 6.0	7.5 to 15.0
Eutrophic	Greater than 20	Greater than 6.0	Less than 7.5

[1] µg/L = micrograms per liter = parts per billion