Interpretive Guide to CLMN Water Quality Reports

A Citizen Lake Monitoring Network annual water quality report contains a great deal of useful information about your lake, and this information can be used to suggest positive or negative changes in water quality. This concise interpretive guide provides an explanation of what these data mean, and how your lake compares to other lakes in your region. For a more in-depth explanation of water quality data, please visit our website at http://www.uwsp.edu/uwexlakes/clmn . Click on the purple "Resources" button, and look for the *Understanding Lake Data* guide.

The terms defined below are column headings that follow the same order that they are listed in a CLMN water quality annual report. This guide will be most useful if you refer to your annual report at the same time.

Date This column lists each of the dates when water clarity and/or water chemistry data was collected.

SD (ft) = "Secchi depth in feet" and **SD (m)** = "Secchi depth in meters". These are measurements of water transparency – the number of feet or meters that a Secchi disc can be lowered into the lake while remaining visible to someone on the surface. The Secchi depth is one of the measurements we use to estimate the lake's Trophic State Index (TSI) score. This is the quickest and easiest way to estimate a lake's TSI score, but it is less accurate in lakes that are heavily stained with tannins or other color-adding compounds. Click on "Secchi Graph" on your lake's annual report page to see a history of Secchi depth averages on your lake.

Hit Bottom This is a simple yes/no question, indicating whether the Secchi disc hit the bottom of the lake during measurement. If the answer is yes, we know that the true Secchi depth value is actually deeper than the value that was reported, but the disc could not physically be lowered any further into the lake.

CHL = "Chlorophyll-A concentration". This is a measurement of the concentration of algae in the upper layer of the lake. The concentration of chlorophyll-A is usually lowest in cold, deep, or nutrient-poor lakes, and highest in warm, shallow, or nutrient-rich lakes. This is one of the measurements we use to estimate the lake's Trophic State Index (TSI) score.

TP = "Total phosphorus concentration". There are different types of phosphorus that can be measured in a water sample, but we measure all of it collectively (the total phosphorus). Phosphorus concentration is another measurement we use to estimate the lake's Trophic State Index (TSI) score.

TSI (SD) = "Trophic State Index score based on Secchi depth". This value represents the estimated Trophic State Index (TSI) score of your lake based on the observed water transparency, or "Secchi depth". A higher water transparency value results in a lower TSI score. Click on "Trophic State Index Graph" on your lake's annual report page to see a history of TSI scores from your lake, and for more information on TSI scores.

TSI (CHL) = "Trophic State Index score based on chlorophyll concentration". This value represents the estimated Trophic State Index (TSI) score based on the concentration of chlorophyll-A that the State Lab of Hygiene measured in your water sample. A higher chlorophyll concentration results in a higher TSI score. Click on "Trophic State Index Graph" on your lake's annual report page to see a history of TSI scores from your lake, and for more information on TSI scores.

TSI (TP) = "Trophic State Index score based on total phosphorus concentration". This value represents the estimated Trophic State Index (TSI) score based on the concentration of total phosphorus that the State Lab of Hygiene measured in your water sample. A higher total phosphorus concentration results in a higher TSI score. Click on "Trophic State Index Graph" on your lake's annual report page to see a history of TSI scores from your lake, and for more information on TSI scores.

Lake Level The lake level is noted as "high", "normal", or "low" on your report. This is simply an opinion of the person who conducted the monitoring on that date. Compared to what they believe is a "normal" lake level, they indicate whether the level was higher than normal, lower than normal, or at the normal level.

Clarity This column is called "appearance" on the field datasheet. "Clear" is entered if the water appears to be mostly free of algae and other suspended particles. Otherwise, "murky" is entered.

Color One of five color choices is noted in this column: "blue", "green", "brown", "red", or "yellow". The color of a lake's water can be influenced by algae, suspended particles, or dissolved compounds. Green water indicates a large presence of green algae. Yellow or brown colors are caused by dissolved organic compounds that are released from decaying organic matter. Red color can be caused by certain kinds of algae or other microorganisms, or by dissolved iron in the water.
Relatively pure water typically contains low concentrations of algae, suspended particles, or dissolved compounds. It appears blue because of two primary reasons. First, the other wavelengths (colors) of light are absorbed first in a lake, allowing a higher relative percentage of blue light to be reflected back to a person's eye. The deeper the water is, the more pronounced this effect becomes. Secondly, lakes appear bluer on sunny days, because the color of the blue sky is reflected off of the lake's surface.

Perception This column describes the volunteer's opinion of the lake's aesthetic quality on the day of monitoring. It ranges from 1 ("beautiful, could not be nicer") to 5 ("swimming and aesthetic enjoyment of lake substantially reduced because of algae levels").

Interpreting Temperature and Dissolved Oxygen (D.O.) Profile Charts

07/18/2014		
Depth FEET	Temp. DEGREES F	D.O. MG/L
3	70.5	8.0
6	70.1	7.8
9	68.7	7.8
12	63.6	7.7
15	51	8.0
18	47.1	7.5
21	45.3	7.4
24	44.4	6.0
27	44	4.1
30	43.8	3.9
32	43.5	1.2

This temperature profile was taken at intervals of 3 feet. This lake was 70.5 degrees Fahrenheit at 3 feet deep, and 43.5 degrees Fahrenheit at 32 feet deep. The thermocline (a narrow band which divides some lakes into two distinct upper and lower parts) is shown here occurring between 12 and 18 feet of depth. The thermocline can be found by looking for an abrupt change in water temperature, usually between 10 and 30 feet. A thermocline rarely develops in lakes less than 12 feet deep. If present, the depth of the thermocline is influenced by many factors, including a lake's size, shape, and depth, and even the topography of the surrounding landscape.

Dissolved oxygen (D.O.) concentrations are good in this lake. The level of D.O. near the bottom of the lake is getting low, but this is common due to bacterial activity in the sediments consuming oxygen.

08/13/2013		
Depth METERS	Temp. DEGREES C	D.O. MG/L
0	21.8	7.9
1	21.6	7.8
2	20.4	3.5
3	13.8	.6
4	7.7	.6
5	5.7	.7
6	4.6	1
7	3.9	.6
8	3.7	.2
9	3.7	.3
10	3.7	.1
11	3.7	.1
12	3.7	.1
13	3.7	0

This temperature & dissolved oxygen (D.O.) profile was taken at intervals of 1 meter. The thermocline is located at approximately 3 meters deep in this lake. The D.O. concentration in this lake plummets to less than 1 mg/L at the 3 meter depth. This graph is a typical example of a lake with high nutrient pollution and high organic matter content. The upper 2-3 meters of water are receiving oxygen through the atmosphere and through photosynthesis of plants and algae. The rest of the lake is losing oxygen due to decomposition of organic matter, and this process is consuming oxygen faster than it can be replenished. Most fish in this lake would concentrate in the upper 2 meters of the lake.

Oligotrophic vs. Mesotrophic vs. Eutrophic

Your trophic state index (TSI) score places your lake into a category of oligotrophic, mesotrophic, eutrophic, or hypereutrophic. Lakes naturally occur in each of the first three categories, but hyper-eutrophic lakes are within that category because of human-caused nutrient enrichment. Below is a short description of each category.

Oligotrophic lakes are generally very clear, deep, and cold. The lake substrate is typically firm and sandy. Nutrient levels are low, so the lake generally does not support large populations of aquatic plants, animals, or algae. The fish that occur in oligotrophic lakes are often low in abundance, but large in size. Many oligotrophic lakes divide into two layers in the summer, a condition known as stratification. The lower layer, called the hypolimnion, is cold and supports cold-water specialist fishes, like lake trout and cisco. These species require cold temperatures and high oxygen levels, so they remain in the lake's lower level throughout the summer.

Mesotrophic lakes contain moderate amounts of nutrients, and contain healthy, diverse populations of aquatic plants, algae, and fish. Occasional algae blooms may occur. If the lake is deep enough to stratify, the hypolimnion often becomes low in oxygen by the end of summer, and may result in some phosphorus release from the sediments.

Eutrophic lakes are high in nutrients and contain large populations of aquatic plants, algae, and fish. The lake substrate is typically soft and mucky. The aquatic plants and algae often grow to nuisance levels, and the fish species are generally tolerant of warm temperatures and low oxygen conditions. Common fish species include carp, bullheads, and bluegills. If the lake is deep enough to stratify, the hypolimnion is usually very low in oxygen by mid-summer. This results in a release of phosphorus from the sediments, which can fuel algae blooms.

Hyper-eutrophic lakes are very high in nutrients, and often exhibit large algae blooms, which may include dangerous levels of blue-green algae. Fish communities in hyper-eutrophic lakes are dominated by carp and other species that can tolerate warm temperatures and low oxygen conditions. Most hyper-eutrophic lakes are small impoundments of streams, and fed by large watersheds composed of urban and/or agricultural land uses.