LAKE & WATERSHED RESOURCE MANAGEMENT ASSOCIATES
PO Box 65 Turner ME 04282
207-336-2980 · lwrma@megalink.net

2021 Thompson Lake Water Quality Overview

Perspective:

The annual characterization of the water quality of Maine lakes is always somewhat challenging to lake scientists because lake ecosystems experience a high degree of "natural variability". One of the strongest influences on this sometimes confounding factor is the weather, and typically, foremost among the many forces of weather on lakes is precipitation. Many Maine lakes tend to be clearer during drier years, ostensibly because of reduced stormwater runoff during such periods, and stormwater runoff is the vehicle that transports phosphorus and other pollutants from watersheds to lakes. Conversely, lakes tend to be less clear during years when there is more precipitation during the period from January through the middle of summer.

While a majority of Maine's lakes "behave" this way, there are always a significant number of exceptions to this generalized prediction, both in the degree of variability that occurs with individual lakes, and the fact that some lakes respond to precipitation in an opposite manner, for reasons having to do with other weather influences (temperature, wind, etc.), as well as factors pertaining to the unique characteristics of individual bodies of water, including the annual flushing rate, watershed (and lake sediment) geochemistry, bathymetry (depth variability) and much more. Some highly productive lakes that experience regular severe algae blooms can actually benefit from the diluting effects of precipitation, because phosphorus concentrations in the body of water are already high.

Climate warming, and associated extreme weather events, such as drought, unusually warm weather, and high-intensity precipitation events, compound the complexity of tracking,

predicting and characterizing lake water quality. Reduced periods of ice cover, resulting in longer periods of light penetration, and warmer lake water, when combined with additional unusual weather events during the open water season, will almost certainly have a negative effect on the health of many of Maine's lakes over time. In recent years, some lakes that have historically been "on the edge", as well as others that were considered stable, have experienced a significant decline, very likely, in part, to the influences of a warming climate.

Possible Weather Influences in 2021:

The most probably overall influence of weather on Maine lakes in 2021 is likely to have taken place in 2020, when much of Maine experienced moderate to severe drought conditions. Drought influences the indicators used to assess lake water quality in a number of ways, most notably in that many (but not all) Maine lakes appear to be clearer during drought years, very likely due to reduced runoff and phosphorus loading from their watersheds. The effects of drought can last well into the following years, especially in lakes that have relatively low flushing rates (as does Thompson Lake). Did the severe 2020 drought influence Thompson's water quality in 2021? Read on……

2021 Overview and Summary of Findings for Thompson Lake:

The following summary information is based on "baseline"sampling and assessment conducted on Thompson Lake on September 16, 2021. Sampling was conducted at the "deep hole" station located west of Hayes Point in Oxford, where the greatest volume of historical data have been gathered by multiple entities for several decades. Limited sampling in 2021 was due to logistic and safety restrictions associated with the COVID 19 pandemic, as well as a personal health limitation. August and September sampling of Maine lakes is generally considered to be the most critical period of the year for conducting critical baseline water quality monitoring, because conditions in the lake associated with stresses associated with several months of warm weather are often most evident. However, the ability to effectively identify long term trends generally requires greater sampling frequency over a period of several months and multiple years.

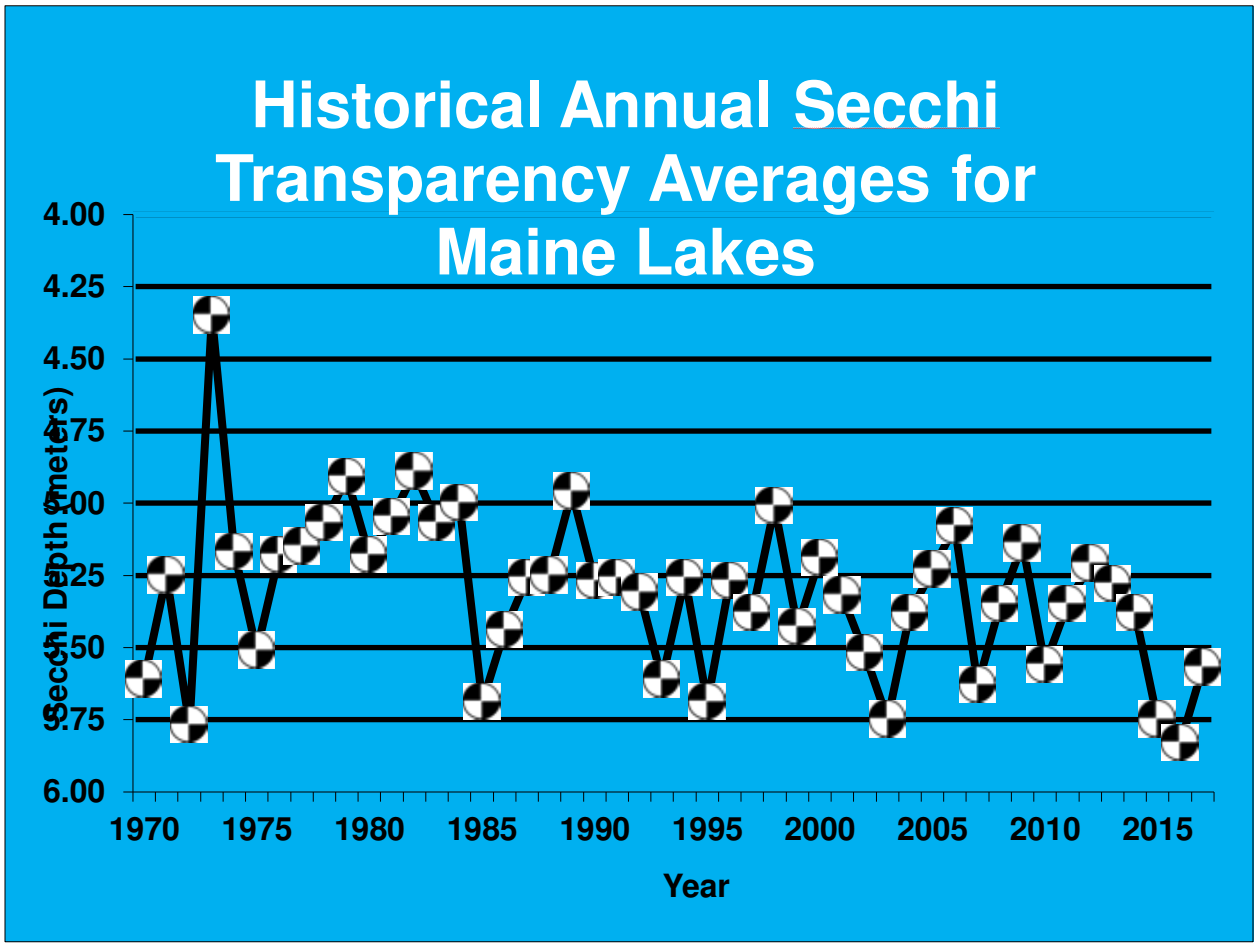
Additional lake Secchi transparency (lake clarity) data that were gathered by Lake stewards of Maine certified citizen lake scientists, Ron Armontrout and John Powers were unavailable from LSM at the time of preparation of this report.

Historical data sources referenced are from the Maine Department of Environmental Protection, Lake Stewards of Maine (www.lakesofmaine.org), and LWRMA field records and reports.

Overall, the water quality of Thompson Lake appears to have been above average in 2021, based on the clarity of the water, the concentration of the nutrient phosphorus, and the concentration of planktonic algae in the lake (from chlorophyll samples) during the summer monitoring period. Please note that this assessment was based on a single set of data gathered in mid-September.

However, conditions at that time were likely representative for overall conditions in the lake through the spring and summer months.

On September 12, lake clarity (Secchi transparency – the distance one can see down into the water from the surface) was 10.7 meters, which is substantially higher (deeper and better) than 9.1 meter historical average for the lake. The historical water clarity average for Maine lakes has varied in the 5.0-5.75 meter range for the past few decades. Thompson has consistently remained one of Maine's clearest lakes.

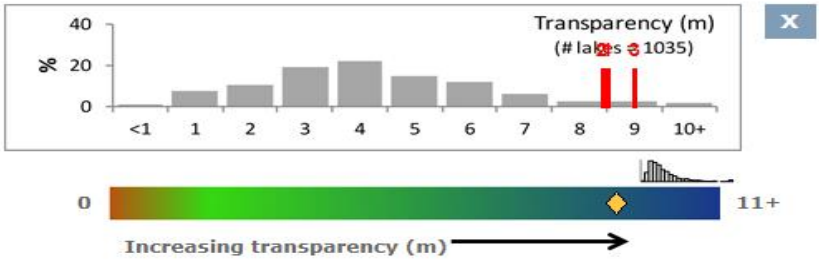


Historical Secchi Transparency (lake clarity) for Maine Lakes Over Time

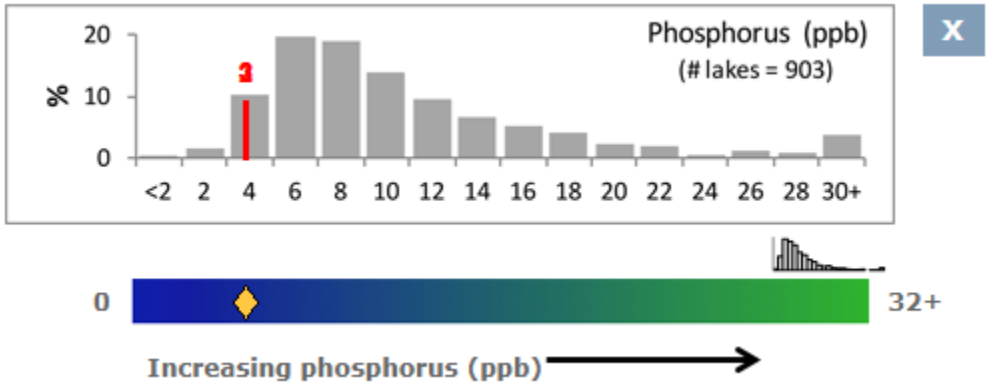
(Data source: Maine DEP)

The "color ramps" below, produced on the www.lakesofmaine.org website, illustrate the range of lake clarity for several hundred Maine lakes. The first ramp shows water clarity, ranging from

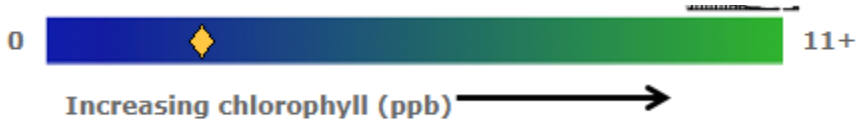
least clear on the left, to clearest on the right. The yellow diamond depicts the historical average for Thompson Lake, illustrating that Thompson is one of Maine's clearest. The bar graph situated above the ramp also illustrates that relatively few Maine lakes are as clear as Thompson



A total phosphorus integrated water column (epilimnetic core) sample taken in September measured 4 parts per billion (micrograms per liter). The historical average for the lake is 5 ppb. The average for Maine lakes is significantly higher. Phosphorus is the critical "limiting nutrient" that most influences the growth of algae in Maine lakes. The graphics below show that the average for Thompson Lake is substantially lower than that of several hundred Maine lakes.



A Chlorophyll-a (CHL) sample taken in August and September measured 2.0 ppb – a very low concentration, indicating low density algae growth in the lake at the time. The historical annual CHL concentration for Thompson is 2.4 ppb. The graphics below clearly show that the historic chlorophyll/algae average concentration in the lake is relatively low. The bar graph (histogram) is somewhat skewed, in that CHL data for Maine lakes is relatively limited.

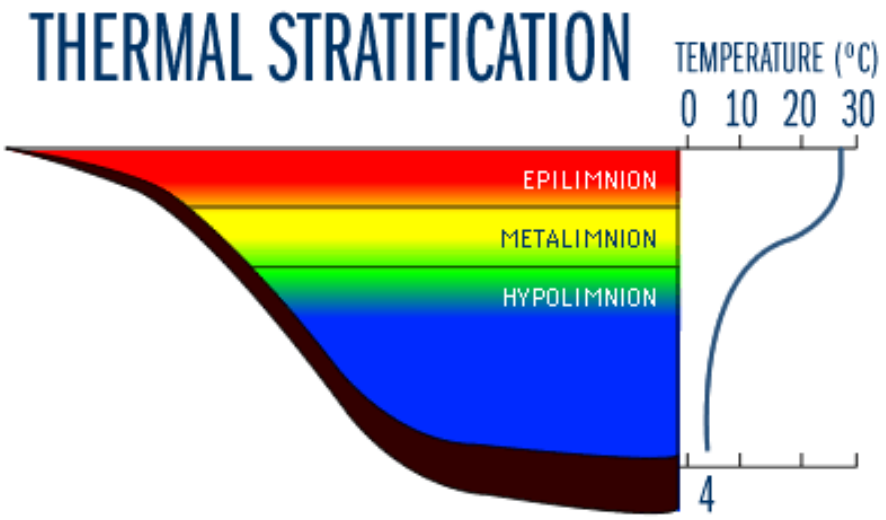


The bar chart above each color ramp is a histogram that illustrates the distribution frequency for Maine lakes for each indicator. The red line in each indicates the historical average for Thompson Lake. This graphic shows where the lake is situated, relative to the total number of Maine lakes assessed/represented (indicated by "# of lakes").

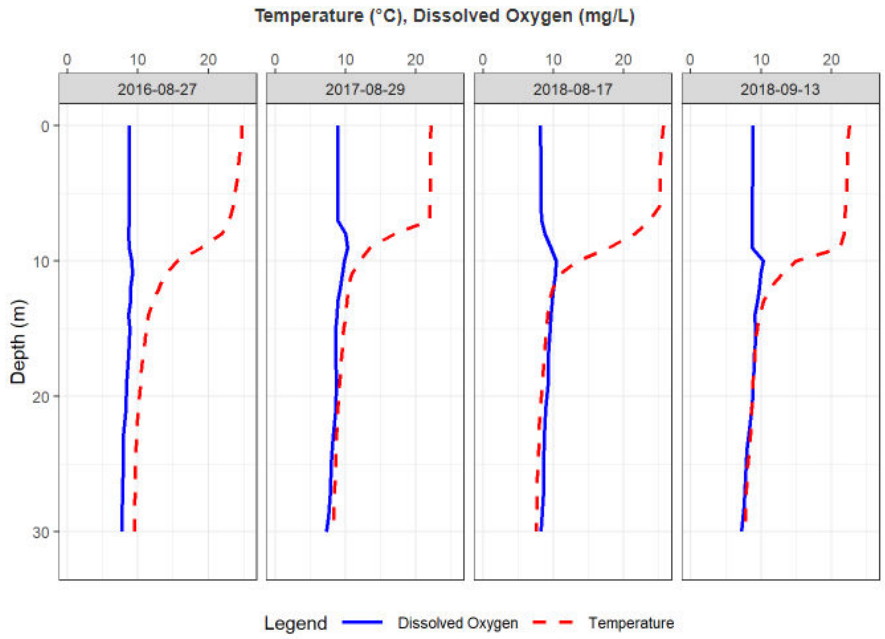
The three "trophic state indicators" of biological productivity (above) in lakes (Secchi transparency, total phosphorus and chlorophyll-a) were strongly correlated in September, 2021.

Temperature and dissolved oxygen profiles were taken on September 16. Readings were taken from the lake surface to the bottom of the lake (approximately 32 meters depth) at 1 meter intervals. *The lake was strongly thermally stratified on both dates, with temperatures ranging from 21.6 degrees C at the surface, to 9.1C at 32 meters, at which time the surface oxygen level measured 8.7 mg/l (aka PPM), and 6.1 mg/l at 32 meters depth.*

The relatively high late summer oxygen levels in the deepest area of Thompson Lake in September (see graphic below) continue to support a healthy coldwater fishery through the most critical period of the year, when the lake is stratified, and oxygen is not able to be replenished until the lake mixes in October or November, depending on weather factors.



Typical Lake Summer Temperature Profile in a Thermally-Stratified Lake



Recent Thompson Lake Late Summer Temperature and Dissolved Oxygen Profiles, Illustrating Moderate DO Concentration in August and September

Gloeotrichia echinulata is a colonial cyanobacteria (aka: bluegreen algae) that has been present at low densities in Thompson Lake during the late summer (Aug-Sept) for at least four decades. Gloeo has been documented in other clear lakes like Thompson throughout New England. In recent years, there has been a significant increase in the density of this organism in many lakes in the region. The presence of Gloeo in lakes does not appear to be tied to lake productivity, or to anthropogenic influences in lake watersheds. High density Gloeo has been documented in a number of lakes throughout the country where there is virtually no human activity in the watersheds of the lakes. The increase in the presence and abundance of this organism in lakes is the subject of ongoing research. There has been speculation that some aspect of climate change may be involved in the phenomenon. The concentration observed in Thompson in September, 2021 was very low (0.5 on a scale from 0-6), and was typical of what has been observed in lake during late summer for more than four decades.

A Magnified Gloeotrichia Colony

A water color sample, indicating the relative concentration of humic compounds, was low in September, consistent with water clarity and historical levels in the lake.

Summary and Recommendations:

Although only a single baseline sampling event was conducted in September, 2021, conditions at that time strongly suggested that the lake experienced above average water quality during the summer. Water quality continues to appear to be relatively stable, and well above the average for Maine lakes. However, during the past decade, several otherwise healthy Maine lakes have experienced a rapid and unanticipated decline in water quality. Climate warming is likely to have been a factor in this phenomenon.

Water quality conservation practices, including maximization of vegetated buffers along the shoreline, tributary streams, and throughout the watershed can help to mitigate the effects of climate warming on lakes. Ongoing efforts by TLEA to protect the lake should continue to focus on buffer enhancement, the prevention and control of soil erosion, and the treatment of stormwater runoff associated with both existing and new development throughout the watershed.

Thompson has sustained excellent water quality during the past several decades, due in no small part to the exceptional diligence and persistence of watershed-based conservation measures and public education initiatives undertaken by TLEA. Such efforts to protect the fragile ecology of Thompson Lake are more important now than ever.

Prepared by LWRMA Senior Limnologist, Scott Williams