



LAKE & WATERSHED RESOURCE MANAGEMENT ASSOCIATES

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2020 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.

Maine Lakes in 2020:

Maine experienced two simultaneous forms of extreme weather in 2020. Much of Maine was in a state of moderate to extreme drought during the period. And by mid-July, lake surface water temperatures in southern and central Maine were as much as 10 degrees warmer than their historical average. "Fish kills" were documented in a number of lakes throughout the state, including nearby Saturday Pond in Otisfield. Maine DIF&W fishery pathologists determined that the mortality was the result of parasitic infections enhanced by stress from the unusually warm water.

Multiple articles pertaining to the unusual weather influences on Maine lakes in 2020 can be found in the newsletter of Lake Stewards of Maine at the following link:

<https://www.lakestewardsofmaine.org/wp-content/uploads/2021/02/LSM-tWC-2020-21-WebR2.pdf>

2020 Overview and Summary of Findings for Thompson Lake:

The following summary information is based on sampling conducted on Thompson Lake, situated in the Towns of Oxford, Otisfield, Poland and Casco, Maine, in August and September, 2020. Sampling was conducted at the "deep hole" station located west of Hayes Point in Oxford, where the preponderance of historical data have been gathered by multiple entities for the past several decades. The reduced sampling in 2020 was due to logistic and safety restrictions associated with the COVID 19 pandemic. August and September sampling of lakes is generally considered to be the most critical period of the year for assessing annual water quality, although effective long term trend analysis generally requires greater sampling frequency during a period of several months.

Additional lake Secchi transparency (lake clarity) data were gathered by certified citizen lake scientists, Ron Armontrout and John Powers, who took readings from June through September.

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

Overall, the water quality of Thompson Lake was average to slightly above average in 2020, 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.

In 2020, the average lake clarity (Secchi transparency – the distance one can see down into the water from the surface) was 9.15 meters, which is also the historical average for the lake (9.1M). Clarity readings ranged from a low of 8.3 meters on June 16, to a high of 10.39 meters (exceptionally clear) on August 31. Two readings taken in September were also above 10 meters depth.

Three Total phosphorus samples taken in August and September each measured 3 parts per billion/micrograms per liter – averaging 3 ppb – very low for Thompson Lake. The historical average for the lake is 5 ppb. Chlorophyll-a samples taken in August and September measured 2.0 and 1.0 ppb – averaging 1.5 ppb. The samples were very low, indicating very low density algae growth in the lake during the period. The historical annual CHL concentration for Thompson is 2.4 ppb.

The three “trophic state indicators” of biological productivity in the lake correlated well in 2020.

Temperature and dissolved oxygen profiles were taken on August 13 and September 9. 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 27.5 degrees C at the surface, to 8.7C at 32 meters on August 13, at which time the surface oxygen level measured 8.1 mg/l, and 7.8 mg/l at 32 meters depth.

On September 9, the surface to bottom water temperature ranged from 22.9C to 9.4C, and dissolved oxygen ranged from 8.7 mg/l to 6.7 mg/l at the deepest point in the lake. The relatively high late summer oxygen levels in the deepest area of Thompson Lake 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 annual weather).

Gloeotrichia echinulate 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 2021 was very low, and is not a cause for concern.

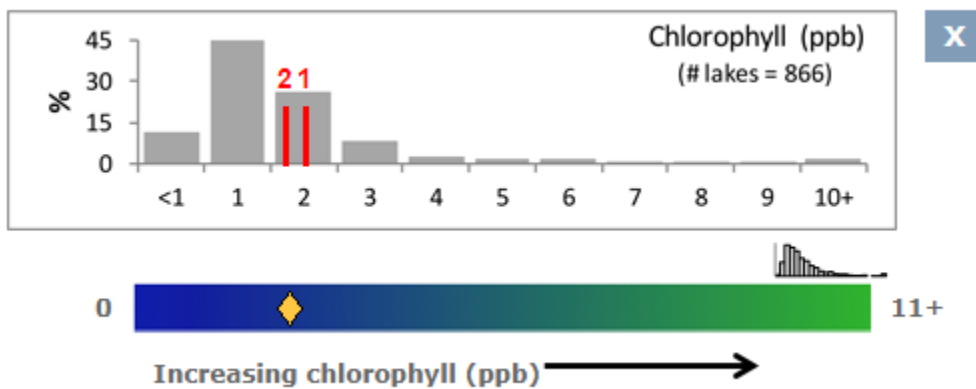
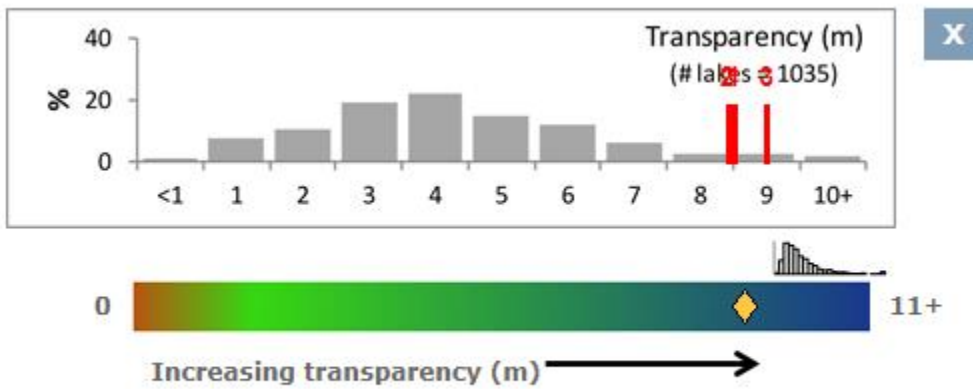
True Color, pH, Specific Conductance, and Total Alkalinity were not sampled in 2020, due to limited available support from the Maine DEP laboratory last summer.during the pandemic

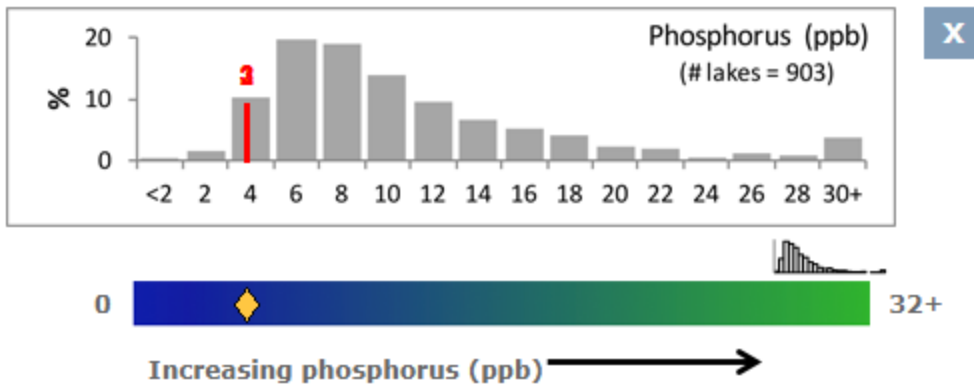
Table of Indictors Measured in 2020

Indicator	Range	2020 Average	Historical Average	Notes
Secchi Transparency in Meters	8.3-10.4 Meters	9.15	~9.10	5 months of data
Total Phosphorus in ppb	Three samples, each measuring 3ppb	3 parts per billion	5 ppb	August and September data
Chlorophyll-a in ppb	1.0-2.0 ppb	1.5 ppb	~2.4 ppb	August and September data
True Color	N/A DEP Lab		9.6 SPU	
pH	N/A DEP Lab		6.8	
Total Alkalinity in mg/l	N/A DEP Lab		7.4 mg/l	
Specific Conductance	N/A DEP lab		42 ms/cm	
Gloeotrichia 0-6 Density Scale	1.0-1.3	~1.0	Low, but present in the lake during late summer for more than 4 decades	Typical late summer concentration in Thompson for 4 decades
Dissolved Oxygen mg/l	Saturated at water surface to minor depression at bottom	Very similar to historical profiles for the lake	Typically some minor DO depression at the deepest point in September	August and September data
Phycocyanin to CHL Ratio	N/A DEP Lab			The ratio in Thompson during the past few years has been very low

The graphics below illustrate the historical average for each of the three primary water quality/trophic state indicators. Each color “ramp” shows the continuum of data for Maine lakes. In each case, the long-term average for Thompson Lake is indicated by the yellow diamond above the bar. Note that while “Increasing Transparency” (water clarity) indicates better water quality, the reverse is true for both chlorophyll (algae pigment) and phosphorus, which is why the diamonds are nearer the lower end of the scale for the latter two indicators. Graphics are courtesy of www.lakesofmaine.org.

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”).





Summary and Recommendations:

The water quality of Thompson Lake continues to appear to be relatively stable, and it is well above the average for Maine lakes. Thompson is among Maine's clearest and cleanest lakes.

However, during the past decade, several clear Maine lakes have experienced dramatic unanticipated downward water quality trends. Climate warming is thought to have been a factor in this phenomenon. Water quality conservation practices, such as vegetated buffers, also help to offset climate warming, and the effects that it may have on lakes over time.

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