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2019 Thompson Lake Water Quality Overview

Perspective:

The annual characterization of the water quality of Maine lakes has always been a challenge to lake scientists because aquatic ecosystems experience a high degree of "natural variability". One of the strongest influences on this natural process 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 exceptions to this simplistic generalization, 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 lake ecosystems, including the annual flushing rate, watershed geochemistry, bathymetry and much more. Highly productive lakes that experience regular algae blooms sometimes benefit from the diluting effects of precipitation, because phosphorus concentrations are already moderately high.

Climate warming is compounding 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 more severe weather events during the open water season, will almost certainly have a negative effect on the health of Maine's lakes over time.

Some lakes that have historically been "on the edge", as well as some that were considered stable, have experienced a significant decline in recent years, very likely, in part to a warming climate.

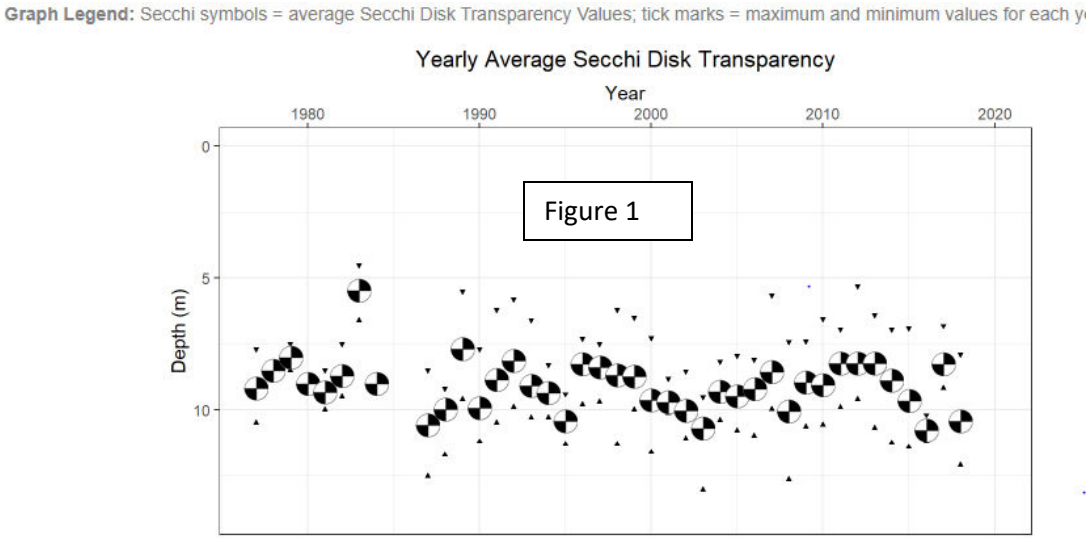
Thompson Lake 2019 Overview and Summary of Findings:

The following summary information is based on sampling conducted on Thompson Lake from May through early October, 2019. Historical data reference sources are from Maine Department of Environmental Protection database sources, Lake Stewards of Maine (www.lakesofmaine.org), and LWRMA field records and reports.

Please refer to Table 1, below regarding all data obtained in 2019.

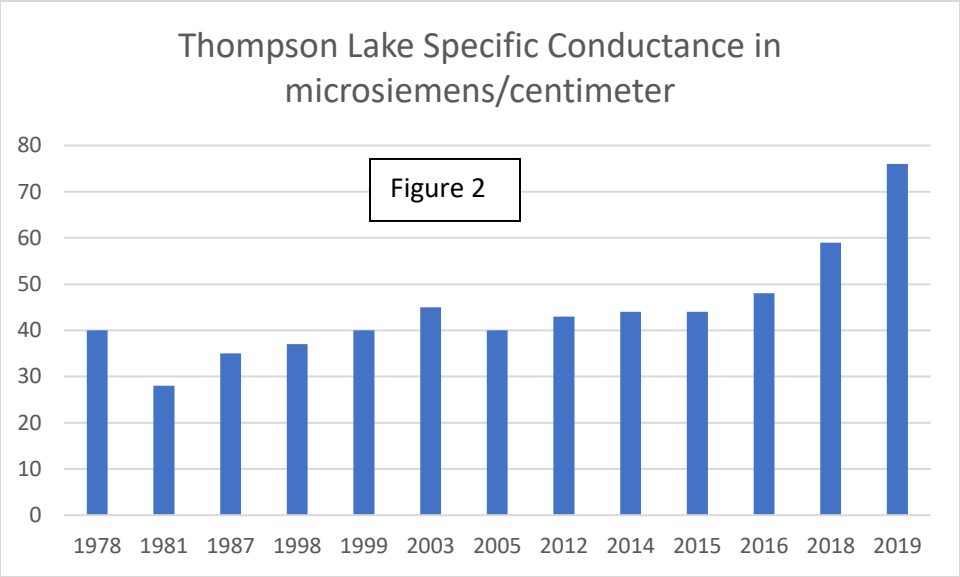
Overall, the water quality of Thompson Lake continues to be relatively stable, and significantly above average, when compared to Maine lakes as a whole. The three primary "trophic state" (biological productivity) indicators for the lake (water clarity or transparency, total phosphorus and chlorophyll-a) were all close to the historical average for the lake, as shown in Table 1 below. Water clarity averaged 8.80 meters depth, total phosphorus averaged 4.6 parts per billion, and chlorophyll-a (a direct measure of the planktonic algae density in the lake) averaged 2 parts per billion during the monitoring period. Table 1 also shows the range of values for each indicator in 2019.

Figure 1 illustrates the annual variability in Secchi transparency (lake water clarity) during the historical period for which data are available for Thompson Lake.



True Color, measured in August (11 SPU) was close to the historical average of 9.6 SPU..

pH from the August sampling was higher (more alkaline) than the historical average for the lake. Both Total Alkalinity and Specific Conductance (SC), measured in August, were significantly higher than the historical average for the lake, following an apparent trend for a number of lakes throughout Maine in 2019, possibly related to heavy precipitation early in the season. The 2019 SC sample represents the highest concentration on record for Thompson Lake. The high Specific Conductance (76 microsiemens/cm, compared to 42 average) could be due to an increase in the rate of winter salt application on public and private roads during the previous winter and spring. However, as the graphic below (Figure 2) illustrates, SC has been slowly increasing in the lake during the period for which there are data for this indicator that may suggest an increase in watershed runoff from development over time.



However, a number of Maine lakes sampled in August, 2019 showed spikes in specific conductance, possibly to some unknown (at this time) influence of weather. The majority of historical samples taken for these additional indicators have been taken in the month of August.

Gloeotrichia (cyanobacteria) colonies were observed in Thompson Lake at the deep sample station in July and October at very low density, consistent with historical "Gloeo" concentrations in the lake during the late summer/early fall. However, on August 20, Gloeo density was moderate (LSM/DEP density scale). Although this colonial cyanobacterium has been observed in Thompson Lake for more than 4 decades at very low density, it has been observed sporadically at higher densities in recent years. Ongoing research regarding the ecology and phenology of this organism in New England Lakes has thus far not suggested that Gloeo is associated with lake watershed development. High densities of this alga have been observed in remote lakes where there has been no disturbance/development of any form in their watersheds. Even so, there remain many unanswered questions concerning the role that Gloeo may play in influencing lake water quality over time.

The baseline ratio of the photosynthetic pigment phycocyanin, to other forms of chlorophyll was low (good), as expected. The purpose of this analysis is to observe the extent to which the ratio changes over time – a possible indicator of a shift from the normal assemblage of algal species in the lake to one that is more dominated by cyanobacteria/bluegreen algae. This was only the second year during which this analysis has been conducted. Data cannot be interpreted until multiple years of information has been gathered.

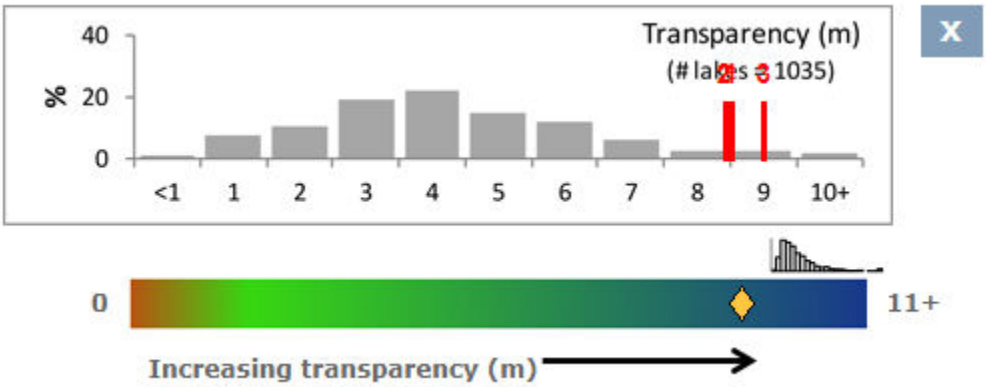
Dissolved oxygen concentration in the deepest area of the lake remained at healthy levels to support the Thompson's cold water fishery. No significant change has been document for late summer dissolved oxygen levels in Thompson Lake.

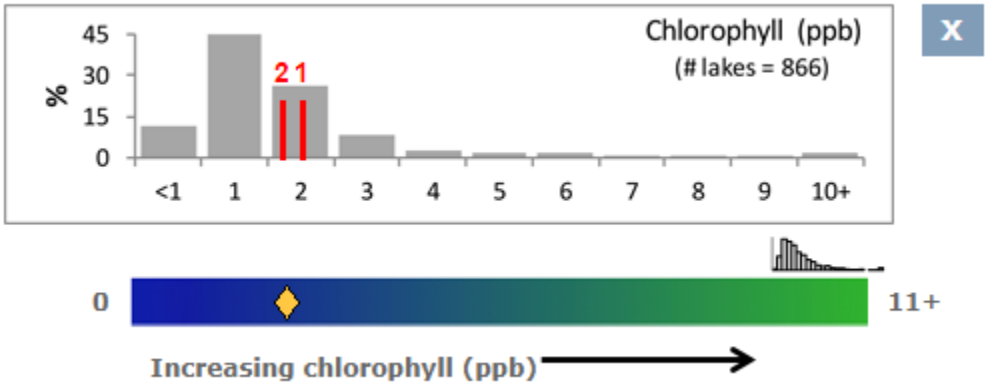
Table 1

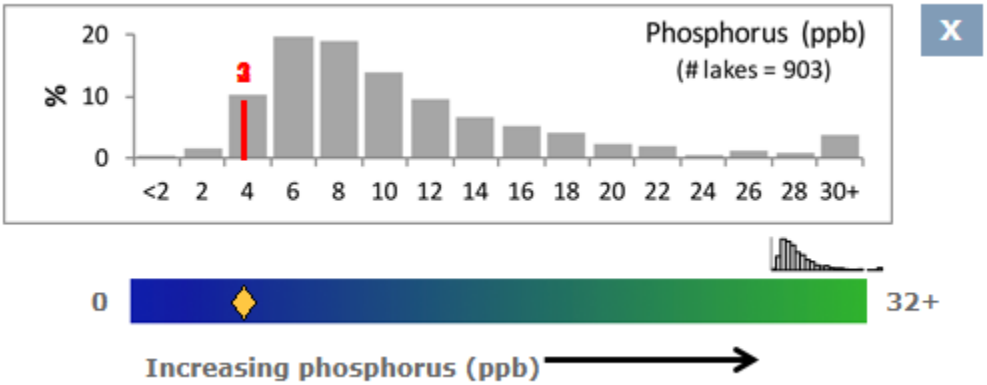
Indicator	Range	2019 Average	Historical Average	Notes
Secchi Transparency in Meters	6.25-10.65	8.80	9.1	
Total Phosphorus in ppb	3-7	4.6	5	
Chlorophyll-a in ppb	1-3	2.0	2.4	
True Color (SPU)	8-15	11	9.6	
pH (std units)	August	7.25	6.8	
Total Alkalinity in mg/l	August	10.5	7.4	
Specific Conductance (MicroSiemens/cm	76	76	42	Many Maine lakes experienced higher than average in 2019
Gloeotrichia	0.3-2.5 LSM Density Scale	1.1	N/A	
Dissolved Oxygen mg/l	October Hypolimnetic Minimum	6.4	N/A	Lowest reading at bottom of deepest point in the lake on October 1
Phycocyanin/ CHL Ratio	August Sample. Second Year	0.3	2018-19 Limited Baseline Data. Average not yet meaningful stat.	Two years data insufficient to establish a baseline frame of reference

The graphics below illustrate the historical average (yellow star) for each of the three primary water quality indicators (Secchi Transparency, Total Phosphorus and Chlorophyll-a). 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 accompanying each of the color ramps is a histogram that illustrates the distribution frequency for a large number of Maine lakes for each indicator. The red lines indicates the historical average for Thompson Lake. Multiple red lines indicate averages for different sampling stations on the lake. This graphic shows where the average is situated, relative to several hundred Maine lakes (indicated by "# of lakes)". The majority of historical data gathered for Thompson Lake has taken place at sample station #1. Numbers may be blurred when multiple stations are shown on the same point in the graphic.







Summary and Recommendations:

Thompson Lake continues to experience above average water quality, compared to the average for Maine lakes. For several decades, TLEA has played the critically important role of raising public awareness of the many threats to the health of the lake. Focused efforts to involve the public in minimizing impacts to the lake from new development, and identifying and resolving existing problems has unquestionably contributed to continued health of the lake.

Even so, a high percentage of Maine's lakes could experience change in both expected and unanticipated ways in the future as a result of climate change. Our lakes may be more highly colored (and less clear) from increasing humic acids, and also less clear from increasing planktonic algae growth, caused by reduced periods of ice cover and warmer water temps. Some lakes will experience severe cyanobacteria/bluegreen algae blooms, which can result in toxic conditions in the lake. In recent years, several lakes situated in southern and central Maine have experienced unanticipated, severe algal blooms, including at least two lakes with historically above average water quality.

Conservation practices that have been promoted by TLEA will continue to serve the lake well as our climate warms. The preservation of vegetated buffers throughout the shoreline and watershed is one of the most effective measures for offsetting the effects of a warming climate. Minimizing sources of soil erosion and stormwater runoff will also continue to be very important, as will be efforts to control new shoreline and watershed development.

Special thanks to Lake Stewards of Maine Certified Volunteer Lake Monitors, Ron Armontrout and John Powers for their additional contributions to the Secchi transparency data cited in this report.

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