



*Protecting Northern Michigan's
Water Resources*

April 5, 2021

Three Lakes Association
P.O. Box 689
Bellaire, MI 49615

RE: 2020 Volunteer Lake Monitoring on Torch and Clam Lakes and Lake Bellaire

Tip of the Mitt Watershed Council is pleased to present the results of lake monitoring performed in 2020 by Three Lakes Association volunteers as part of our Volunteer Lake Monitoring Program. We appreciate Three Lakes Association's commitment to protecting our shared water resources and look forward to working together in the future.

How to Understand This Report

Volunteers collected data following protocols outlined in Tip of the Mitt Watershed Council's Volunteer Lake Monitoring Quality Assurance Project Plan. Water transparency was measured weekly by lowering a black and white Secchi disk into the water and recording the depth at which it is no longer visible. Chlorophyll-*a*, a pigment found in all green plants and algae, is collected using a water sampler lowered to twice the depth of the Secchi reading. Water is then filtered and later analyzed to estimate the density of phytoplankton in the water column. Higher chlorophyll-*a* concentrations indicate greater phytoplankton densities, which reduce water clarity. These two parameters together can tell us about a lake's productivity, or ability to support aquatic life. Water that is clear can indicate a lake without a lot of plant growth, while water that is turbid, or cloudy, can indicate abundant plant life. While phosphorus is normally collected on Torch and Clam Lakes and Lake Bellaire in the spring and late summer, only the late summer sample was collected in 2020 due to a COVID-19 stay-at-home order. It should be noted that the sample for Torch Lake's south basin was collected in October, rather than the usual early September in other years. Most lakes in Northern Michigan are phosphorus-limited, meaning the biological productivity (i.e., algal growth) is limited by the amount of phosphorus available. Phosphorus is an important nutrient for plant and algal growth; however, too much can have a negative impact on water quality.

A Note about Trophic Levels

Trophic state index (TSI) is a way to classify lakes using Secchi disk, chlorophyll-*a*, and total phosphorus measurements. Nutrient availability, water volume, and the rate at which water is added to or lost from a lake are just a few of the factors determining productivity. TSI values

range from 0 to 100. See Table 1 to learn about each category. A water body's TSI is determined by total phosphorus concentration, Secchi disk transparency, and chlorophyll-*a* (**Error! Reference source not found.**). All three parameters were monitored on Torch and Clam Lakes and Lake Bellaire in 2020 and will be used in the following sections to determine overall lake quality.

Table 1. Trophic state indices and their relation to lake characteristics.

Trophic State	Carlson TSI	TP (ug/L)*	SD-Trans. (ft)*	Chl-a (ug/L)*	Lake Characteristics
Oligotrophic	<38	<10	>15	<2.2	Low levels of organic matter, deep, clear, oxygen-rich bottom, cold-water fish species like trout, limited by phosphorus
Mesotrophic	38-48	10-20	7.5-15	2.2-6	More organic matter, oxygen is low at lake bottom, good habitat for walleye
Eutrophic	48-61	20-50	3-7.5	6-22	High amount of organic matter, lots of plant growth, poor clarity, no oxygen at lake bottom
Hypereutrophic	>61	>50	<3	>22	Nutrient-rich, nuisance algal blooms and plants, low visibility

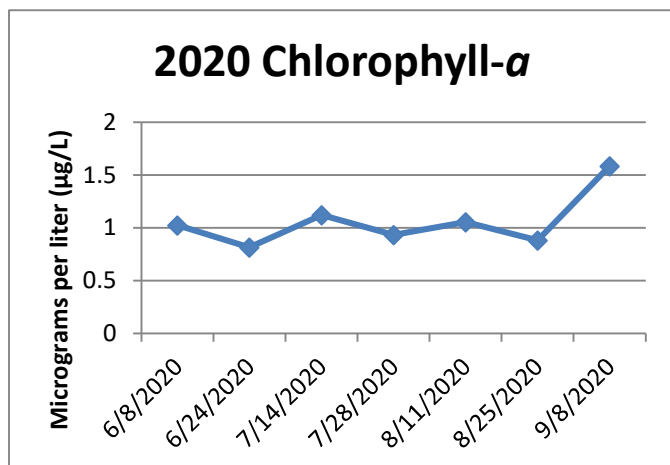
A Note about Ecoregions

Ecoregions are regions that have relatively similar ecological systems. Ecoregions display regional patterns of environmental factors, such as climate, vegetation, soils, geology, physiography, and land use: the same factors that determine water quality within a watershed. Adjacent watersheds may or may not be within the same ecoregion. The ecoregion concept is not new, having been described as early as the 1950s. Subsequently, a number of ecoregion classification schemes have been developed. A widely utilized classification scheme identifying 120 ecoregions throughout the continental United States was developed by the U.S. Environmental Protection Agency (U.S. EPA) in the 1980s. Torch and Clam Lakes and Lake Bellaire are part of the North Central Hardwood Forest ecoregion (#51). Total phosphorus

recommendations for reference conditions (the absence of human intervention) in this ecoregion will be used to assess results.

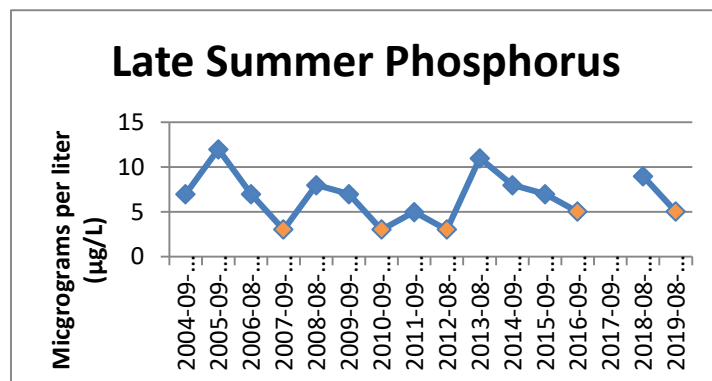
Clam Lake

2020 Data



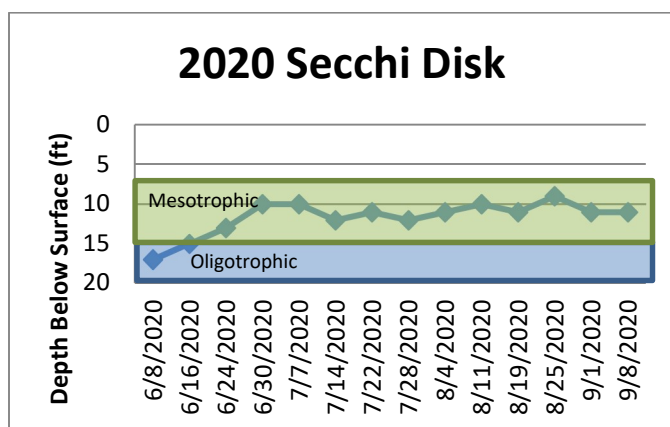
Clam Lake's chlorophyll-a readings were characteristic of an oligotrophic lake throughout 2020.

Data Trends

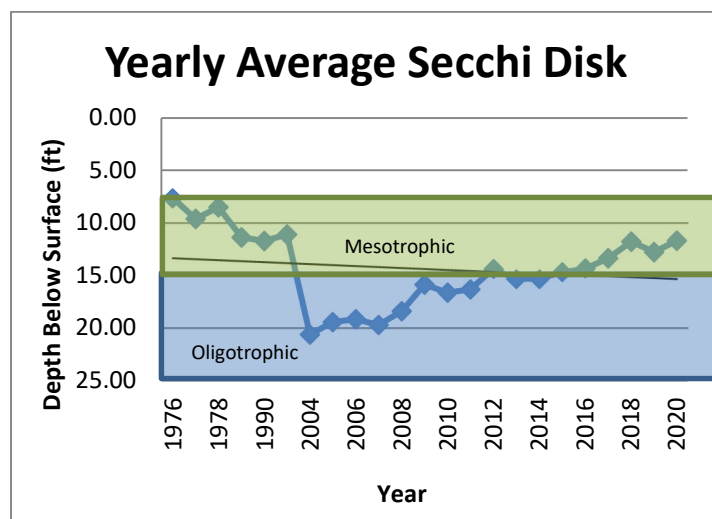


*Note orange markers denote detection limit. Sample value was below detection limit. 2017 data was rejected.

Phosphorus was recorded at 4.87 µg/L in September of 2020. This value is characteristic of lakes with high water quality, according to the U.S. EPA ecoregion criteria.



Clam Lake's transparency was characteristic of a mesotrophic lake throughout most of 2020 (shaded green area).

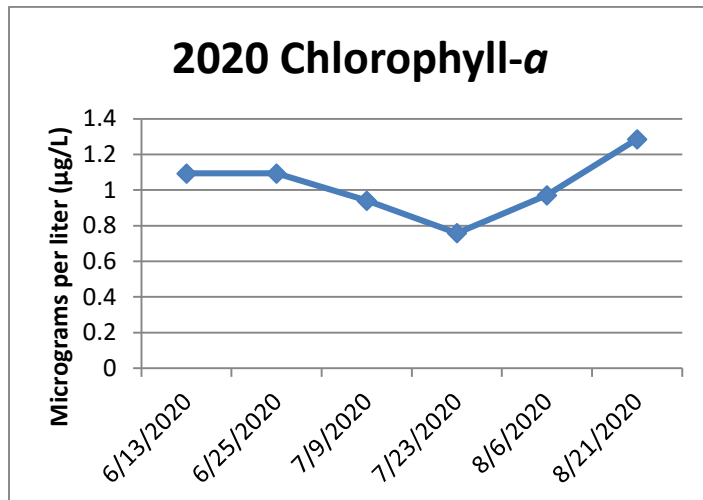


Clam Lake's transparency is on the decline since 2004, possibly a sign that the lake is rebounding from the invasion of invasive zebra mussels. Zebra mussels filter particles out of the water and their invasions are tied to clearer water in many lakes in Northern Michigan. Since 2012, the lake has had transparency characteristic of a mesotrophic lake.

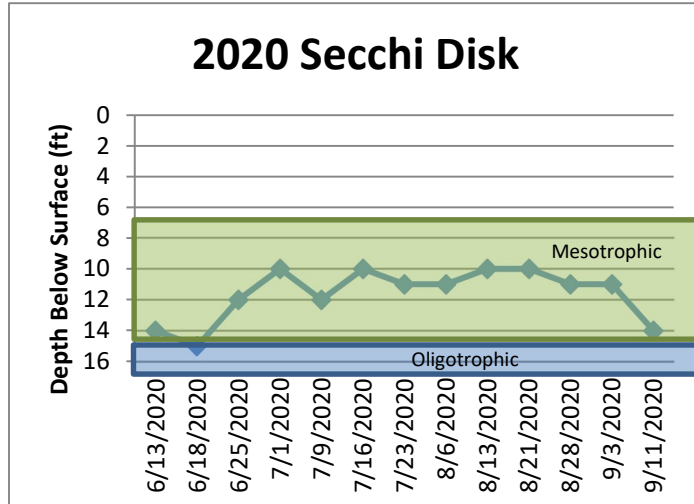
Overall Lake Classification
Oligotrophic

Lake Bellaire

2020 Data



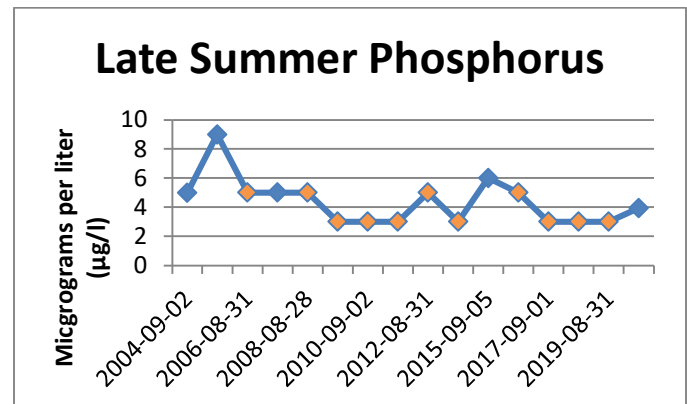
Lake Bellaire's chlorophyll-*a* readings were characteristic of an oligotrophic lake throughout 2020.



Lake Bellaire's transparency was characteristic of a mesotrophic lake throughout most of 2020 (shaded green area).

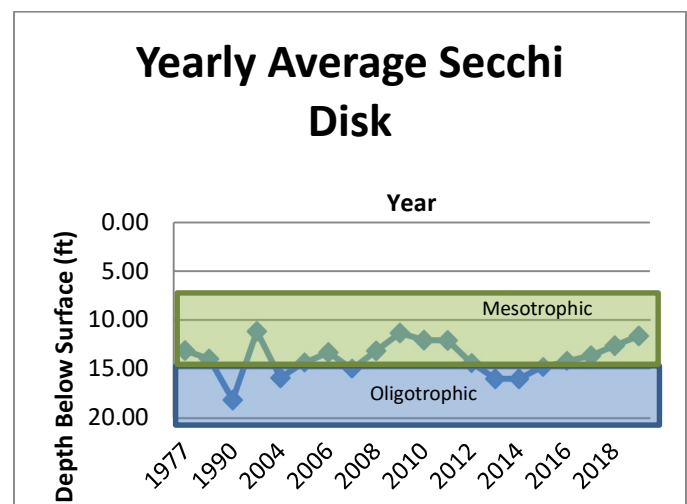
Overall Lake Classification
Oligotrophic

Data Trends



*Note orange markers denote detection limit. Sample value was below detection limit.

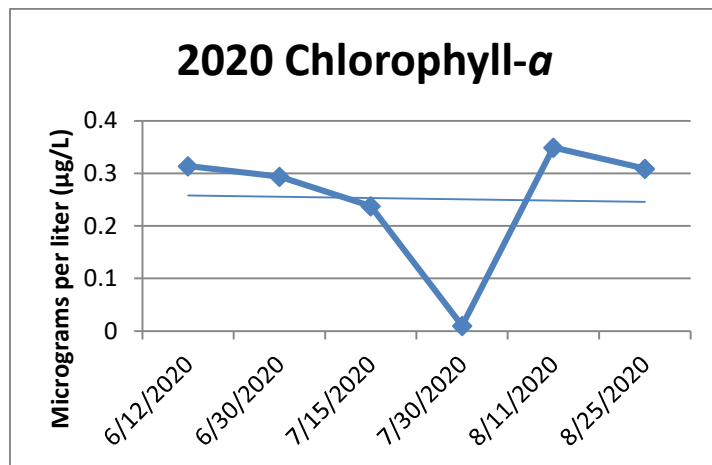
Phosphorus was measured at 3.95 µg/L in September of 2020. This value is characteristic of lakes with high water quality, according to the U.S. EPA ecoregion criteria. Most total phosphorus results collected prior to 2020 were below the detection limit at the lab used by MiCorps. The few samples that had reportable values from 2004 to 2019 were more than the value observed in 2020. Phosphorus is likely decreasing on Lake Bellaire.



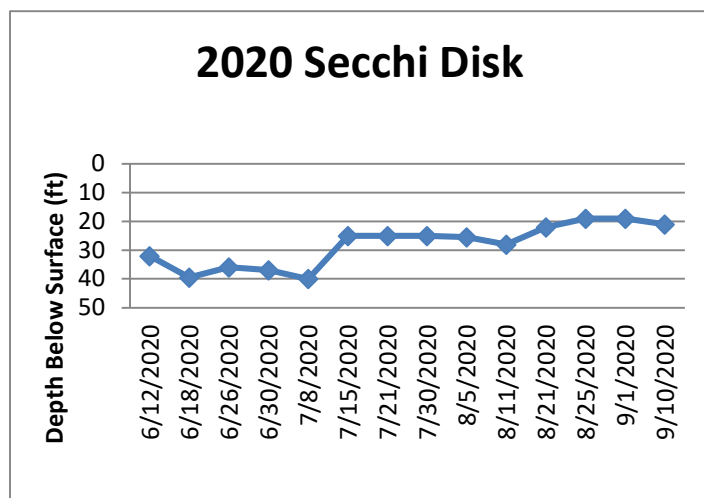
Lake Bellaire's transparency is on the decline since 2014; however, there has been almost no change since Secchi disk readings were first recorded in 1977. Most years Lake Bellaire is considered mesotrophic according to its transparency.

Torch Lake, North

2020 Data



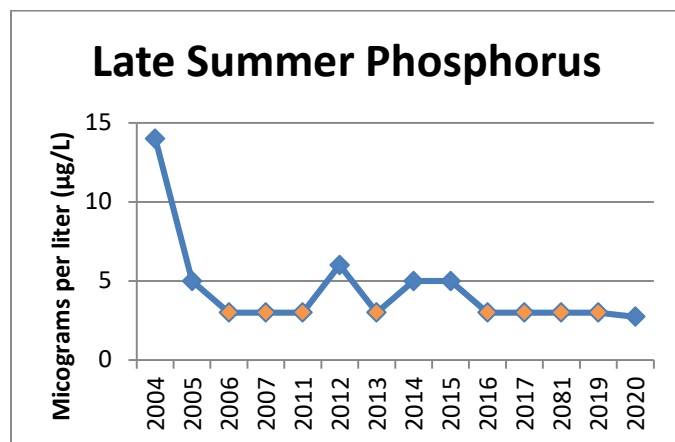
Torch Lake's north basin chlorophyll-a readings were characteristic of an oligotrophic lake throughout 2020.



Torch Lake's north basin transparency was characteristic of an oligotrophic lake throughout 2020.

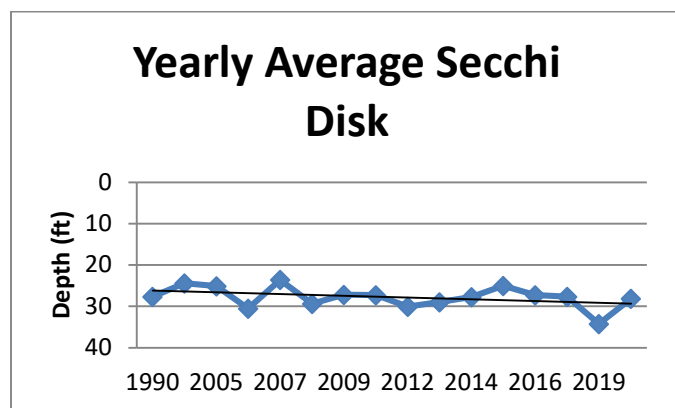
Overall Lake Classification
Oligotrophic

Data Trends



*Note orange markers denote detection limit. Sample value was below detection limit.

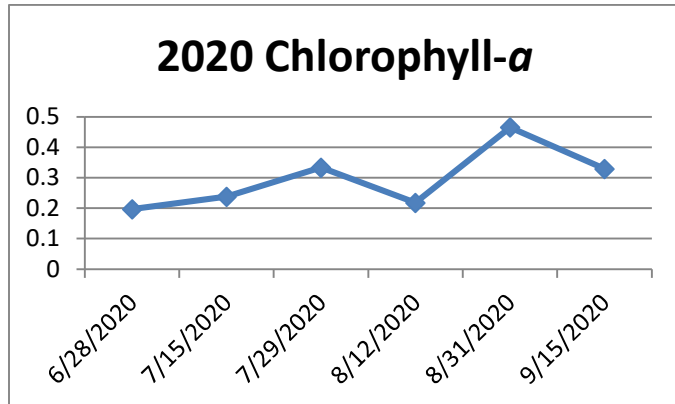
Phosphorus was measured at 2.739 µg/L in October of 2020 (technically this sampling date is outside of the recommended sampling period, which is recommended the first week of September). This value is characteristic of lakes with high water quality, according to the U.S. EPA ecoregion criteria. Most total phosphorus results collected prior to 2020 were below the detection limit at the lab used by MiCorps (denoted in orange). The few samples that had reportable values from 2004 to 2019 were more than the value observed in 2020. Phosphorus is likely decreasing on the Torch Lake's north basin.



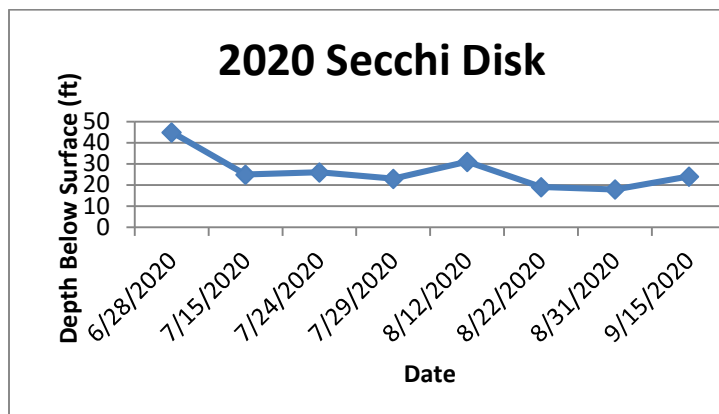
Little change has occurred in the transparency of Torch Lake's north basin since 1990. The transparency readings have always characterized Torch Lake's north basin as oligotrophic.

Torch Lake, South

2020 Data



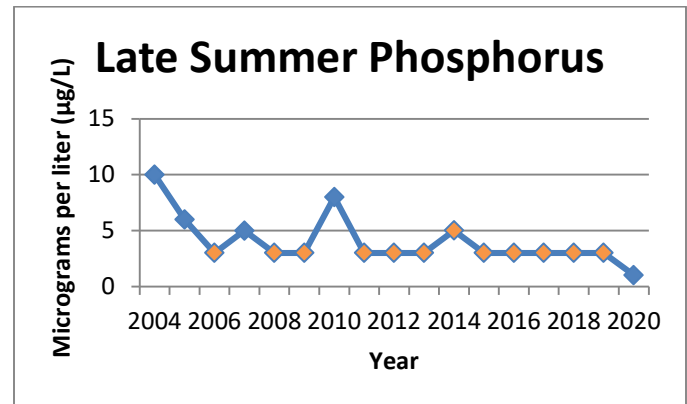
Torch Lake's south basin chlorophyll-*a* readings were characteristic of an oligotrophic lake throughout 2020.



Torch Lake's south basin transparency was characteristic of an oligotrophic lake throughout 2020.

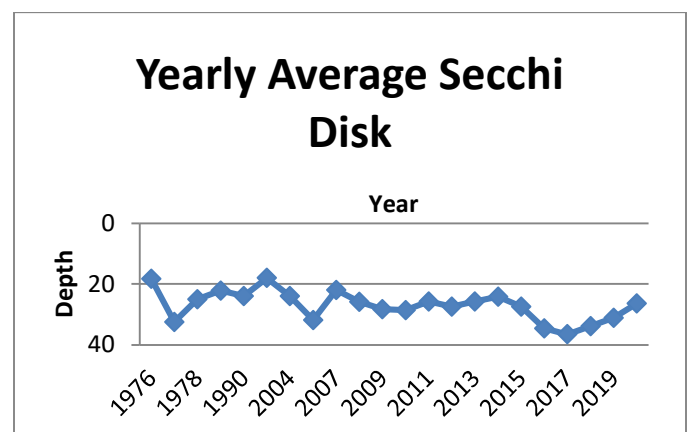
Overall Lake Classification
Oligotrophic

Data Trends



*Note orange markers denote detection limit. Sample value was below detection limit.

Phosphorus was measured at 1.03 µg/L in September of 2020. This value is characteristic of lakes with high water quality, according to the U.S. EPA ecoregion criteria. Most total phosphorus results collected prior to 2020 were below the detection limit at the lab used by MiCorps (denoted in orange). The few samples that had reportable values from 2004 to 2019 were more than the value observed in 2020. Phosphorus is likely decreasing on the Torch Lake's south basin.



Transparency on Torch Lake's south basin has been consistently deeper than 15 feet, meaning Torch Lake's south basin has sustained oligotrophic characteristics since 1976.