Tip of the Mitt Watershed Council

Protecting Northern Michigan's Water Resources

March 1, 2022

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

RE: 2021 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 2021 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.

Upcoming News

The Watershed Council is excited to be improving our lake monitoring program in 2022. First, we are undertaking moving our data to a new database called Water Reporter. Water Reporter not only houses data, but displays it in a user-friendly manner on a map. The tool also allows us to engage with citizens through social media campaigns. We are actively working on transferring our data to this new system so that it is readily available to resource agencies and lake associations. Water Reporter also gives us the ability to collect data electronically, eliminating the need for paper datasheets. We are looking forward to working with select volunteers in 2022 to test this out. Secondly, we will be working with the Michigan Clean Water Corps to update their database. Both the lake and stream databases for MiCorps have been under construction since 2020. We have been asked to provide feedback on the new database to ensure it will work well for the data our monitors collect on nearly thirty lakes. The best part is MiCorps' new database will allow us to import multiple records at one time, ensuring all lake monitoring data is housed in the MiCorps database in addition to the Watershed Council's database.

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. 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* (Table 1). All three parameters were monitored on Torch and Clam Lakes and Lake Bellaire in 2021 and will be used in the following sections to determine overall lake quality.

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

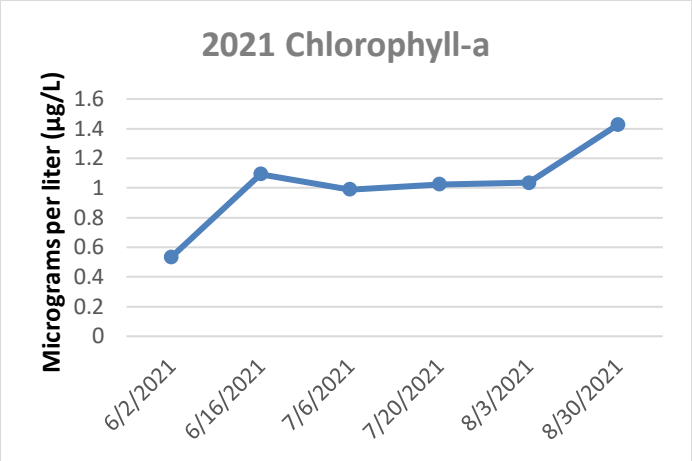
Trophic State	Carlson TSI	TP (ug/L)*	SD-Trans. (ft)*	Chl-*a* (ug/L)*	Lake Characteristics
Oligotrophic	<38	<10	>15	<2.2	Low levels of organic matter, deep, clear, oxygen-rich bottom, cold-water fish species like trout, limited by phosphorus
Mesotrophic	38-48	10-20	7.5-15	2.2-6	More organic matter, oxygen 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

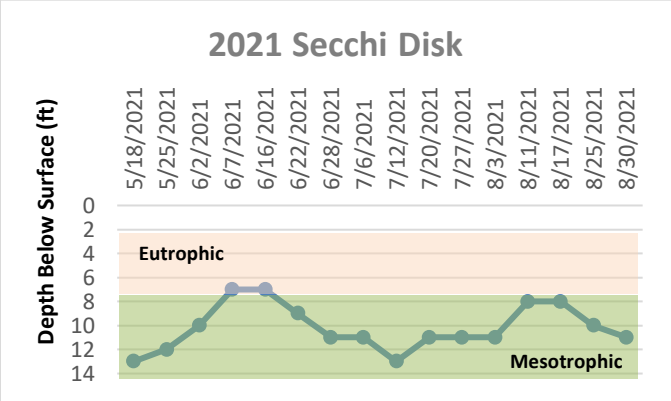
Ecoregions are regions that have relatively similar ecological systems. Ecoregions display regional patterns of environmental factors, such as climate, vegetation, soils, geology, physiography, and land use: the same factors that determine water quality within a watershed. Adjacent watersheds may or 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

2021 Data



Clam Lake's chlorophyll-*a* readings were characteristic of an oligotrophic lake throughout 2021.

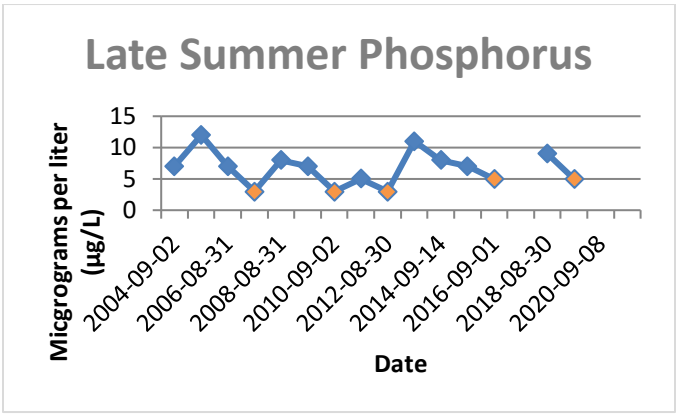


Clam Lake's transparency was characteristic of a mesotrophic lake throughout most of 2021 (shaded green area), with a few weeks of eutrophic conditions in June.

Overall Lake Classification:

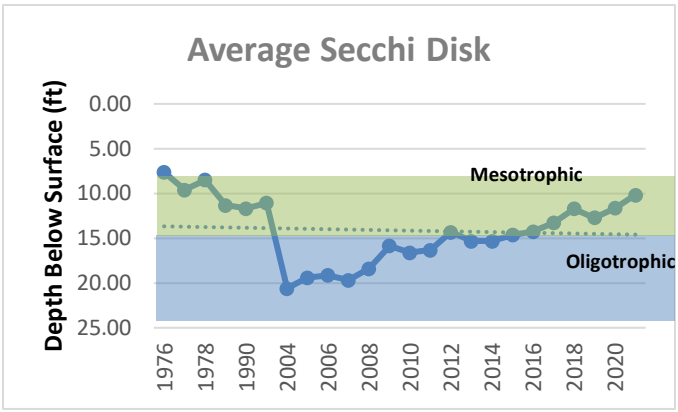
Oligotrophic

Data Trends



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

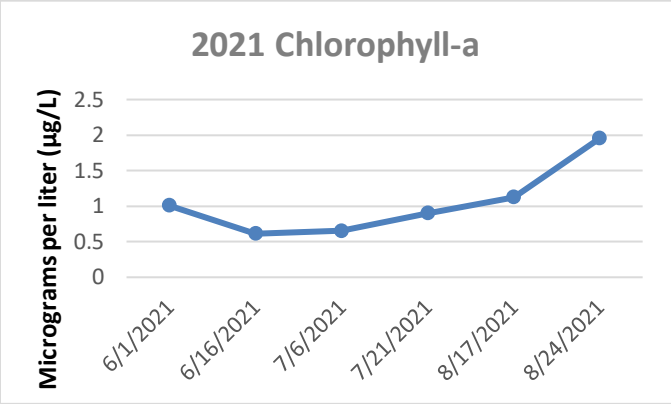
Phosphorus was recorded at 6.41 µg/L in August of 2021. This value is characteristic of lakes with high water quality, according to the U.S. EPA ecoregion criteria.



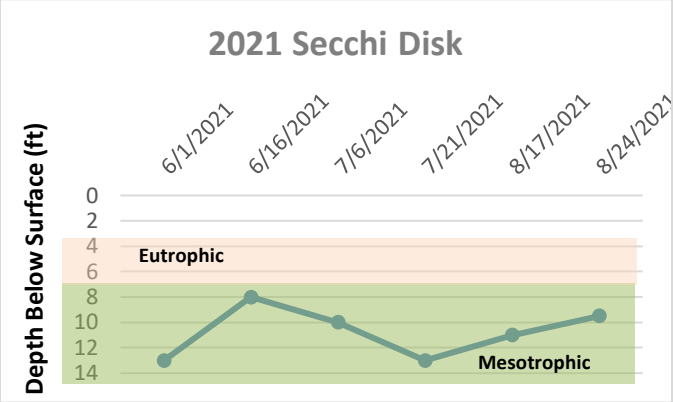
Clam Lake's transparency is on the decline since 2004, possibly a sign that the lake is rebounding from the invasion of invasive zebra mussels. Zebra mussels filter particles out of the water and their invasions are tied to clearer water in many lakes in Northern Michigan. Since 2012, the lake has had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

Lake Bellaire

2021 Data

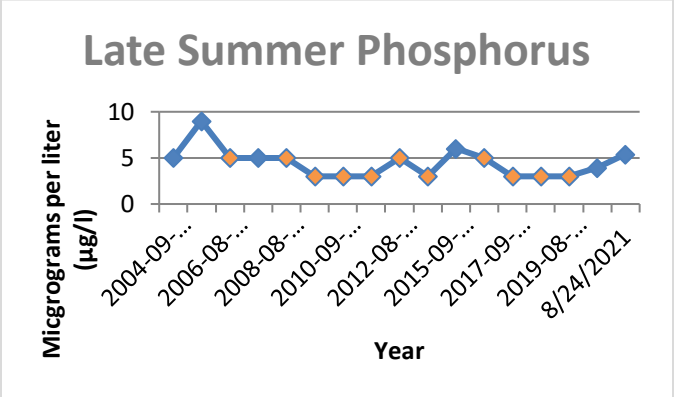


Lake Bellaire's chlorophyll-*a* readings were characteristic of an oligotrophic lake throughout 2021.



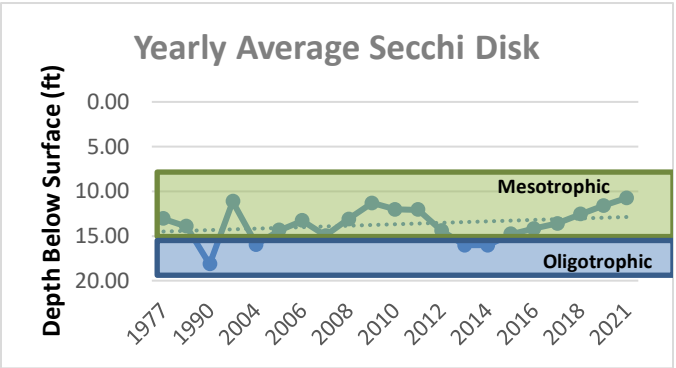
Lake Bellaire's transparency was characteristic of a mesotrophic lake throughout 2021 (shaded green area).

Data Trends



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

Phosphorus was measured at 5.38 µg/L in August of 2021. 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 and 2021. Phosphorus is likely decreasing on Lake Bellaire.



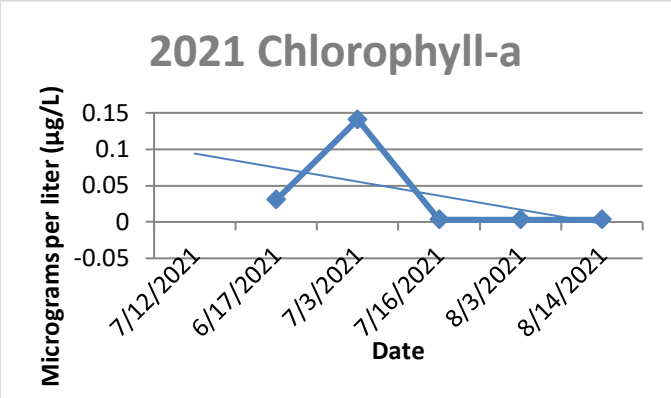
Lake Bellaire's transparency is on the decline since 2014; however, there has been almost no change since Secchi disk readings were first recorded in 1977. Most years Lake Bellaire is considered mesotrophic according to its transparency.

Overall Lake Classification:

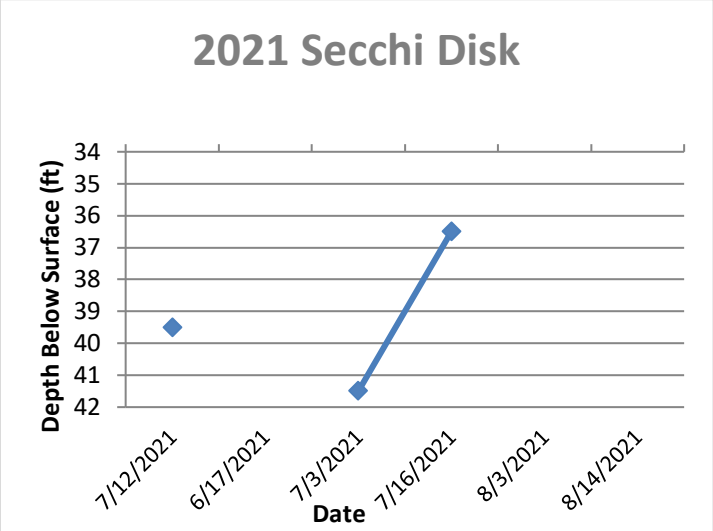
Oligotrophic

Torch Lake, North

2021 Data



Torch Lake's north basin chlorophyll-*a* readings were characteristic of an oligotrophic lake throughout 2021.

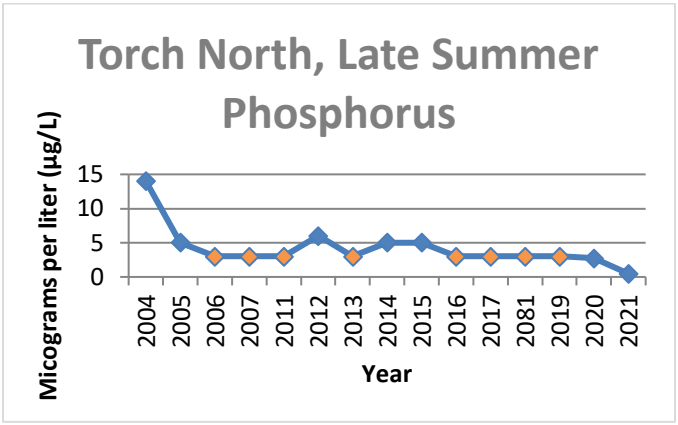


Torch Lake's north basin transparency was characteristic of an oligotrophic lake throughout 2021. *Few Secchi readings due to loss of Secchi disk.

Overall Lake Classification:

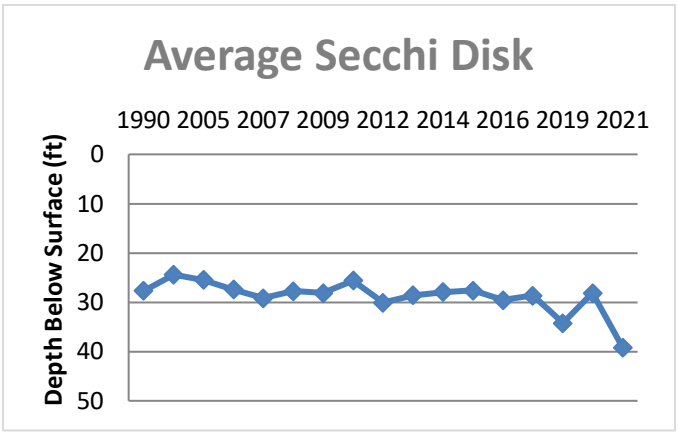
Oligotrophic

Data Trends



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

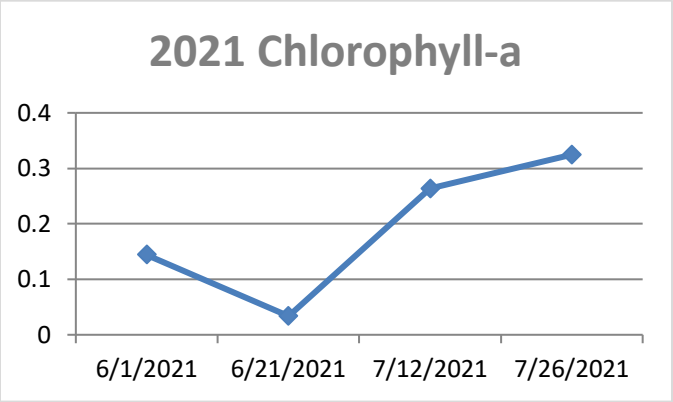
Phosphorus was measured at 0.4823 µg/L in August of 2021. This value is characteristic of lakes with high water quality, according to the U.S. EPA ecoregion criteria. Most total phosphorus results collected prior to 2020 were below the detection limit at the lab used by MiCorps (denoted in orange). The few samples that had reportable values from 2004 through 2020 were more than 2021. Phosphorus is likely continuing to decrease on the Torch Lake's north basin.



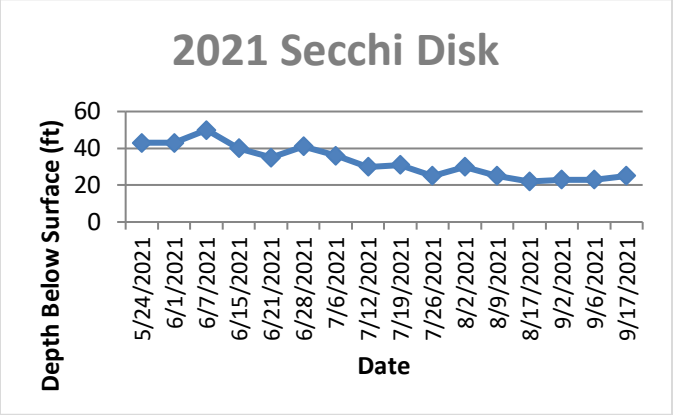
Transparency readings were much deeper than normal on Torch Lake's north basin. The transparency readings have always characterized Torch Lake's north basin as oligotrophic.

Torch Lake, South

2021 Data



Torch Lake's south basin chlorophyll-*a* readings were characteristic of an oligotrophic lake throughout 2021.

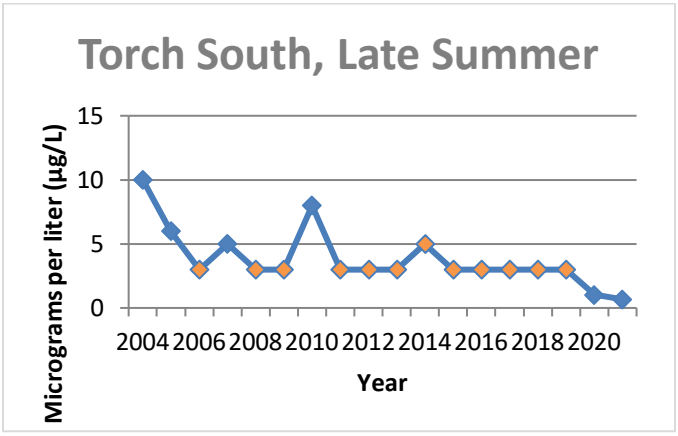


Torch Lake's south basin transparency was characteristic of an oligotrophic lake throughout 2021.

Overall Lake Classification:

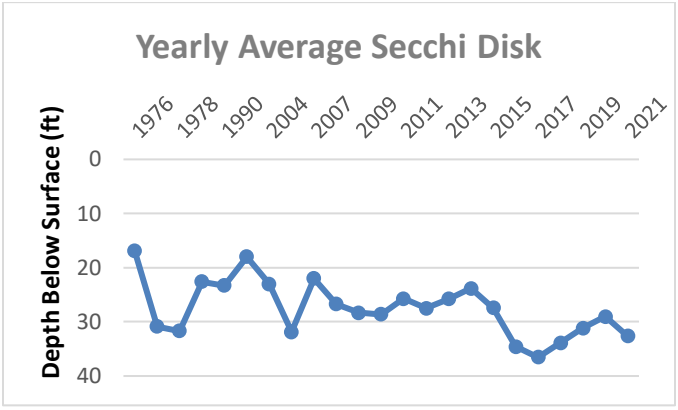
Oligotrophic

Data Trends



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

Phosphorus was measured at 0.6703 µg/L in September of 2021. 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 through 2020 were more than the value observed in 2021. 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.