



*Protecting Northern Michigan's  
Water Resources*

March 30, 2022

Intermediate Lake Association  
PO Box 795  
Central Lake, MI 49622-0795

RE: 2021 Volunteer Lake Monitoring on Intermediate Lake

Tip of the Mitt Watershed Council is pleased to present the results of lake monitoring performed in 2021 by Intermediate Lake Association volunteers as part of our Volunteer Lake Monitoring Program. We appreciate Intermediate Lake 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 the task of moving our data to a new database called Water Reporter. Water Reporter not only houses data but also displays it in a user-friendly manner on a map. It gives us the ability to collect data electronically, eliminating the need for paper datasheets. 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 with a few clicks of a button. We are looking forward to working with select volunteers in 2022 to test this out.

We will also be working with the Michigan Clean Water Corps (MiCorps) 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 once, saving us time and 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, was collected using a water sampler lowered to twice the depth of the Secchi reading. Water was 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. All three parameters were monitored on Intermediate Lake 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.**

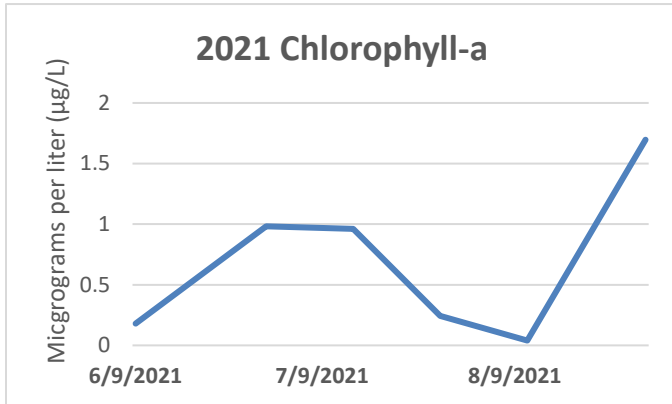
<b>Trophic State</b>	<b>Carlson TSI</b>	<b>Total Phosphorus (ug/L)*</b>	<b>Secchi Disk Transparency . (ft)*</b>	<b>Chlorophyll -a (ug/L)*</b>	<b>Lake Characteristics</b>
<b>Oligotrophic</b>	<38	<10	>15	<2.2	Low levels of organic matter, deep, clear, oxygen-rich bottom, cold-water fish species like trout, limited by phosphorus
<b>Mesotrophic</b>	38-48	10-20	7.5-15	2.2-6	More organic matter, oxygen is low at lake bottom, good habitat for walleye
<b>Eutrophic</b>	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
<b>Hypereutrophic</b>	>61	>50	<3	>22	Nutrient-rich, nuisance algal blooms and plants, low visibility

## **A Note about Ecoregions**

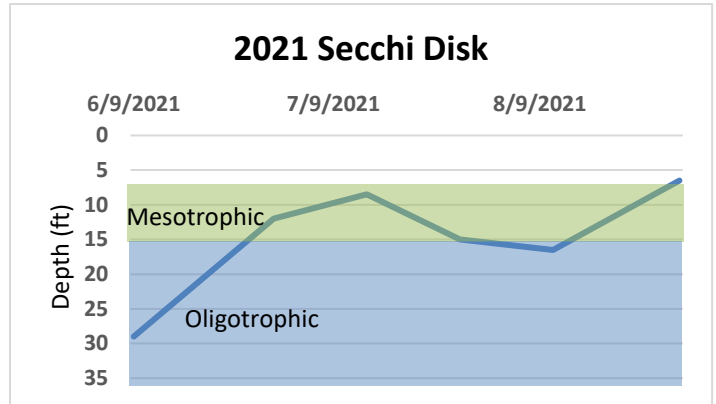
Ecoregions are regions that have relatively similar ecological systems. Ecoregions display regional patterns of environmental factors, such as climate, vegetation, soils, geology, physiography, and land use: the same factors that determine water quality within a watershed. Adjacent watersheds may or 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. Intermediate Lake is a part of the North Central Hardwood Forest ecoregion (#51). Total phosphorus recommendations for reference conditions (the absence of human intervention) in this ecoregion are used to assess results.

# Intermediate Lake

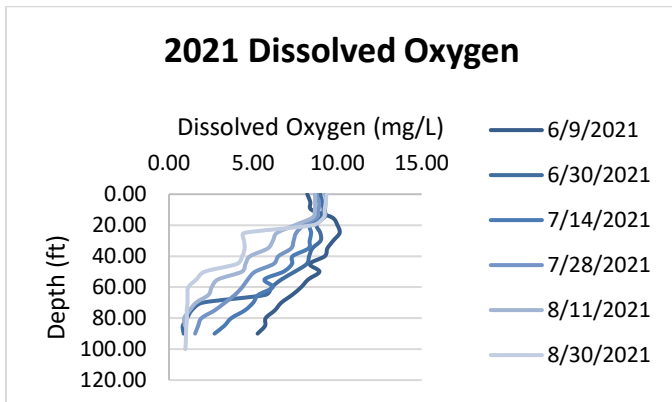
## 2021 Data



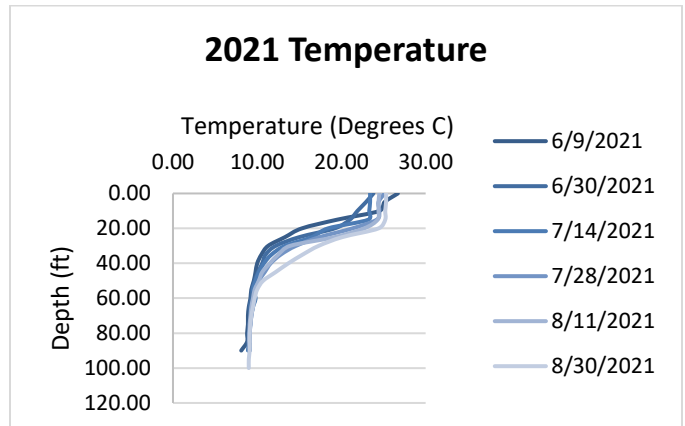
Intermediate Lake's chlorophyll-a readings were characteristic of an oligotrophic lake throughout 2021.



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

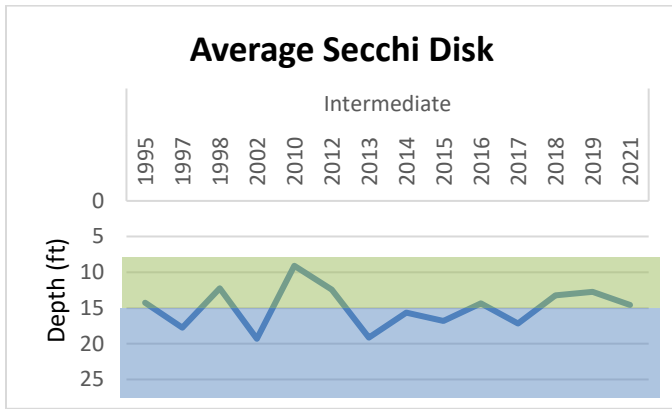


Intermediate Lake is home to fish that are suited to both warm and cold water. Perch can thrive in warm water with lower dissolved oxygen, while trout like cooler water with higher dissolved oxygen. Warmwater fish like 5 mg/L or more of dissolved oxygen, while coldwater fish like 7 mg/L or more of dissolved oxygen. Dissolved oxygen steadily decreased in Intermediate Lake throughout the summer. This is normal as warmer water holds less oxygen and bacteria consistently use oxygen when the lake is stratified. Fish may become stressed as oxygen decreases throughout the summer.

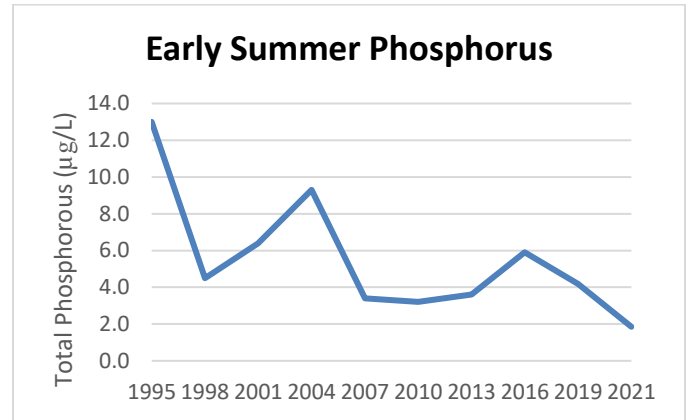


Thermoclines are normal in lakes that separate into two distinct layers in the summer, a process called stratification. The layers can have different temperatures, levels of dissolved oxygen, fish populations, and available food. The thermocline in Intermediate Lake can be observed on the graph above, where the temperature readings start declining rapidly. The location of the thermocline in the water column changed throughout the season: in June it was between 10 and 15 feet and in August it was between 20 and 30 feet.

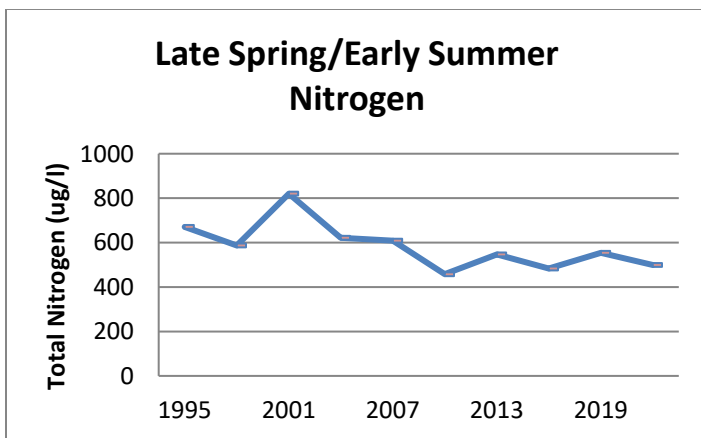
Overall Lake Classification  
Oligotrophic



Intermediate Lake's transparency is nearly unchanged since monitoring began in 1995. Intermediate Lake's transparency was characteristic of a mestrophic lake in 2021, which is typical for this lake. Occasionally the lake is considered oligotrophic based on its transparency, however that has not occurred since 2017.



Phosphorus was recorded at 1.9 µg/L in June of 2021. This value is characteristic of lakes with high water quality, according to the U.S. EPA ecoregion criteria.



Total nitrogen was recorded at 499 µg/L in June of 2021. This value is characteristic of lakes with high water quality, according to the U.S. EPA ecoregion criteria.