Aquatic Environment Report

Manitouwabing Lake

October 1, 2025

Prepared by

generations effect®
Sustainable Solutions
Practical Results

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Executive Summary

Generations Effect, a social enterprise of the Georgian Bay Mnidoo Gamii Biosphere, has prepared this Aquatic Environment Report for the Township of McKellar and Manitouwabing Lake Community Association (MLCA) to provide residents and cottagers with one report summarizing water quality and fish community monitoring data for Manitouwabing Lake. In addition, the report provides recommendations for further monitoring as well as possible stewardship activities. The report is divided into three sections to reflect this purpose—water quality, fish communities, and recommendations.

Water Quality

Volunteers on Manitouwabing Lake participate in the Lake Partner Program (LPP) and the MLCA and McKellar Township initiated a benthic monitoring program in 2020 (Figure 1).

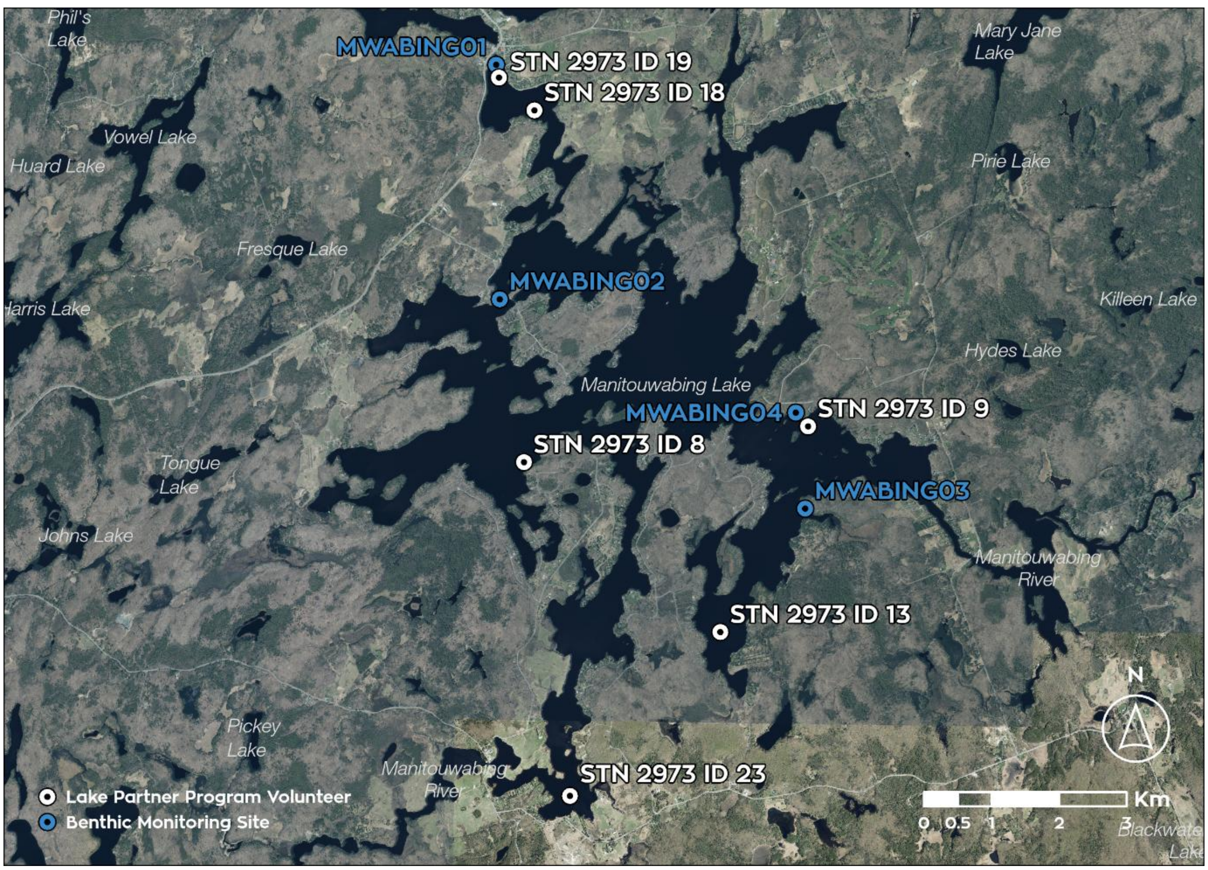

Figure 1. Active and recently active LPP and benthic monitoring sites on Manitouwabing Lake.

The LPP collects data about phosphorus, water clarity, calcium, and chloride from volunteers. The simple tests provide a strong basis for assessing the health of the ecosystem.

Monitoring total phosphorus (TP) is very important as phosphorus is the nutrient that controls plant growth (including algae) in lakes. Measuring TP year after year is necessary to detect long-term changes in water quality that may be due to impacts of shoreline development, climate change, and other stressors.

A high-level summary of current Manitouwabing Lake LPP results is presented in Table 1.

Table 1. Overview of Manitouwabing Lake LPP sampling results (Station 2973).

	Site ID 8	Site ID 9	Site ID 13	Site ID 18	Site ID 19	Site ID 23
Average TP	11.4 µg/L	13.3 µg/L	11.8 µg/L	10.2 µg/L	10.4 µg/L	11.4 µg/L
TP trend	No trend	No trend	No trend	No trend	No trend	No trend
Trophic status	Meso-trophic	Meso-trophic	Meso-trophic	Meso-trophic	Meso-trophic	Meso-trophic
Average Clarity	2.3 m	1.5 m	1.9 m	2.2 m	2.7 m	1.7 m
Average Calcium	3.9 mg/L	4.9 mg/L	3.1 mg/L	4.0 mg/L	3.9 mg/L	3.9 mg/L
Average Chloride	2.4 mg/L	0.7 mg/L	1.1 mg/L	7.0 mg/L	7.1 mg/L	2.0 mg/L

Note: TP is reported as an average for sites with three to five years of data or where there is no apparent trend. Trends are reported for sites with more than five years of data. Trophic status is described in terms of three broad categories—oligotrophic, mesotrophic, and eutrophic. TP concentrations between 10-20 µg/L indicate a mesotrophic or moderately enriched environment.

Volunteers with the MLCA also began monitoring water temperature and a variety of other parameters (e.g., dissolved oxygen, total dissolved solids, pH) in 2022. This additional monitoring, along with continued E. coli monitoring, is a joint effort by MLCA and the Township of McKellar and is overseen by a limnologist on the township's Lake Stewardship and Environmental Committee. These data can be viewed on DataStream and found on the Township of McKellar website.

Benthic monitoring was initiated in 2020 at four locations throughout the lake following the Ontario Benthos Biomonitoring Network (OBBN) protocol. Benthic macroinvertebrates, or benthos, are small aquatic organisms (e.g., insects, crustaceans, worms) that spend all or part of their lifecycle living at the bottom of the lake. Some benthos can only be found in waterbodies with very good water quality, while others can tolerate poor water quality (Figure 2).

Benthic monitoring is a type of biological monitoring that uses an "effect-based approach" to provide information about how an ecosystem has responded to a stress. This complements water chemistry monitoring (e.g., TP, pH, dissolved oxygen) which looks at water quality from a "stressor-based approach", providing information about an ecosystem's exposure to stress. Together these approaches offer a more complete picture of aquatic ecosystem health (i.e., the lake's exposure to stress and associated ecological response).

Site MWABING03 was discontinued in 2024 following the sale of the property on which sampling occurred. Sampling has continued at the remaining three sites. Currently, the benthic communities at each site are considered 'typical' when compared to other lakes in the region. This means that the benthic community in the lake is typical of what we would expect to find in this region.

A thorough review of existing water quality data for Manitouwabing Lake was conducted by aquatic scientist Bev Clark and published in 2018. The report indicates that TP concentrations throughout the lake are very similar among monitoring sites and between years. There is no clear evidence of increasing TP concentrations over time. The lake is at the lower end of the mesotrophic range (10-20 µg/L), meaning that it will share characteristics more like oligotrophic lakes. In addition, the lake is highly influenced by its watershed. This means that water in the lake will have water quality characteristics similar to the water coming in from the various sources, such as Manitouwabing River.

Figure 2. Benthic macroinvertebrates found in Manitouwabing Lake and their pollution sensitivities.

Fish Communities

Manitouwabing Lake is home to a variety of fish species. Table 2 provides a high-level overview of the fish communities in the lake.

Table 2. Summary of Manitouwabing Lake fish communities (see link).

Major fish species	Largemouth bass (introduced), smallmouth bass (introduced), walleye (introduced), black crappie (introduced), northern pike (introduced)
Other fish species	Lake whitefish, creek chub, brown bullhead, yellow perch, bluntnose minnow, eastern blacknose dace, cisco, pumpkinseed, rock bass, common carp, white sucker
Lake trout management	Not designated
Current stocking	None
Historic stocking	Walleye (1938, 1950-2010), smallmouth bass (1941, 1950-1966)
Contaminants (species tested)	Northern pike, walleye, black crappie

The most recent surveys conducted on Manitouwabing Lake were part of a Nearshore Community Index Netting (NSCIN) project undertaken in 2014 and 2015. Findings from the project suggest that the fish community of Manitouwabing Lake has changed significantly since the next most recent survey in 2004 (Figure 3). Since 2004, black crappie were illegally introduced to the lake and have become a major component of the fish community. Brown bullhead declined in abundance from the peak seen in 2004. Largemouth bass catch rates have increased steadily over the successive surveys, although they still comprise a small portion of the catch. Catch rates of the other species did not display any major changes. Based on the 2014-2015 NSCIN project, further walleye stocking is not advised by the Ministry of Natural Resources and the lake should instead be managed as a natural walleye lake.

Fish consumption advisories for Manitouwabing Lake are determined by the Ministry of Environment, Conservation and Parks. Fish are exposed to, and absorb, contaminants in the water in a variety of ways (e.g., consuming contaminated food) and pass those contaminants on to humans when consumed. In Manitouwabing Lake, mercury is the contaminant of concern. Table 3 summarizes the Manitouwabing Lake fish consumption advisories.

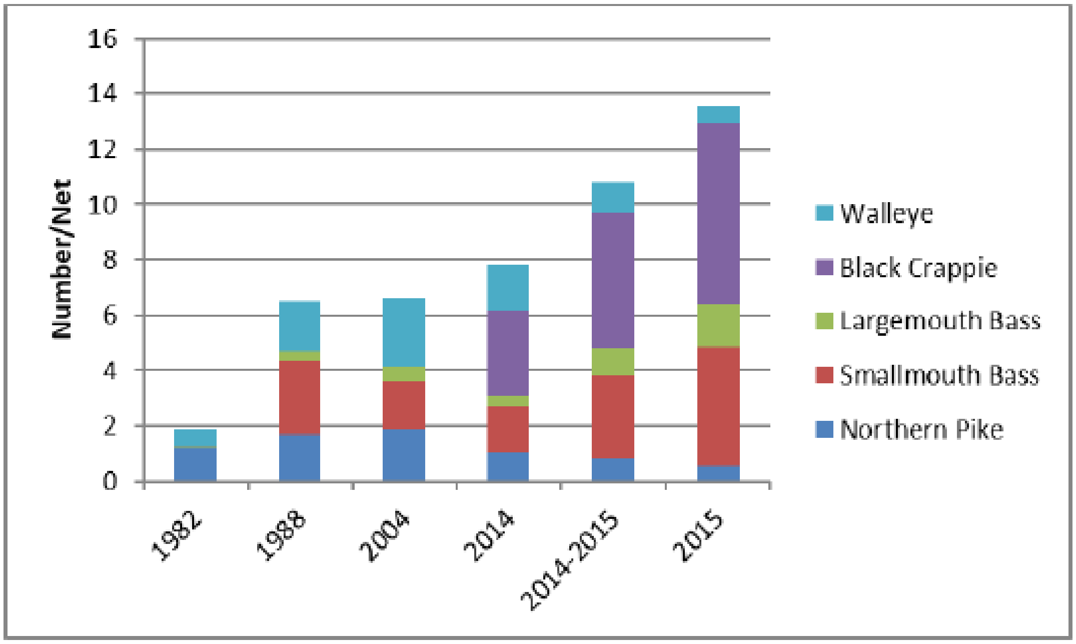

Figure 3. Catch rate (number/net) of major game fish species from 6' trap nets in Manitouwabing Lake, by year (Scholten, 2020).

Table 3. Fish consumption advisories for Manitouwabing Lake (see link).

Species	General Population	Sensitive Population*
Black crappie[1]	• max 32 meals/month of fish 20-25cm • max 12 meals/month of fish 25-30cm	• max 12 meals/month of fish 20-25cm • max 4 meals/month of fish 25-30cm
Northern pike[1]	• max 16 meals/month of fish 30-35cm, 35-40cm, and 40-45cm • max 12 meals/month of fish 45-50cm • max 8 meals/month of fish 50-55cm, 55-60cm, and 60-65cm • max 4 meals/month of fish 65-70cm, 70-75cm, and >75cm	• max 8 meals/month of fish 30-35cm and 35-40cm • max 4 meals/month of fish 40-45cm, 45-50cm, 50-55cm, and 55-60cm • no meals of fish >60cm
Walleye[1]	• max 8 meals/month of fish 25-30cm and 30-35cm • max 4 meals/month of fish 35-40cm, 40-45cm, and 45-50cm • max 2 meals/month of fish 50-55cm, 55-60cm, and 60-65cm • no meals of fish >65cm	• max 4 meals/month of fish 25-30cm • no meals of fish >30cm

* Women of child-bearing age and children under 15; [1] Mercury

Recommendations

Based on results from LPP sampling, benthic monitoring, Clark's (2018) water quality report, and the most recent fish community survey, several recommendations are made in this report.

Water Quality

1. Continue annual LPP sampling at several sites. Preference should be given to sites that are spread throughout the lake and that have the longest datasets. Suggested sites are Station 2973, Site IDs 8, 9, 13, and 18.
2. Continue with annual benthic monitoring. With lakes in the region facing many threats (e.g., climate change, biodiversity loss, development, pollution), benthic communities act as a barometer of ecological change and impacts. Continuing to monitor the benthic community in Manitouwabing Lake will allow for trends to be tracked over time and the observation of any notable shifts (statistically significant changes) that would be cause for further investigation and potentially require remedial actions.
3. Continue with the additional water quality monitoring that was started on Manitouwabing Lake in the fall of 2022.
4. Should the MLCA wish to continue with bacteria monitoring, it should happen in the framework of a scientific investigation focused on testing specific hypotheses on potential sources of contamination through a focused sampling program. For example, recreational sites (e.g., beaches) could be considered for bacteria monitoring as per the province's Beach Management Guidance Document.

Fish Communities

1. Anglers should make the switch to non-toxic tackle. Individuals can participate in the MLCA supported "Let's Get the Lead Out Campaign" by turning in their old lead tackle and receiving a voucher for the purchase of lead-free tackle products.
2. Anglers should familiarize themselves with regulations for the sale and possession of live bait in Ontario. Highlights include:
    - A valid fishing license is required to catch your own live baitfish, leeches, crayfish, and northern leopard frogs.
    - There are specific fish species that can and cannot be used as bait in Ontario (see permitted list of baitfish here).
    - Bait can only be caught in your home Bait Management Zone (BMZ) and cannot leave your BMZ.
    - Baitfish and leeches you catch cannot be sold unless you are a licensed dealer.

- If you fish outside your home BMZ, you must buy your baitfish and leeches locally, keep a receipt, and use or dispose of your bait within two weeks of the purchase date.

3. The app MyCatch by Angler's Atlas can be used by people fishing on the lake to log fishing trips and share fishing data confidentially with biologists.

Stewardship Activities

1. Encourage Manitouwabing Lake property owners to maintain and/or restore natural shorelines. GBB's Life on the Bay Stewardship Guide and Planting for Pollinators guide are helpful resources for property owners interested in native plants and naturalization. Native plants can be sourced from the MLCA Native Plant Seedling Sale and the annual GBB Native Plant Fundraiser (check the GBB events page in the spring).
2. Property owners interested in minimizing their ecological footprint can utilize GBB's Life on the Bay Stewardship Guide.
3. There are many citizen science programs for interested cottagers and residents to get involved in (e.g., invasive species reporting, IceWatch, FrogWatch, Canadian Lakes Loon Survey).

1. Introduction

Manitouwabing Lake is situated within the Williams Treaty of 1923 and the Robinson-Huron Treaty of 1850 (Ministry of Indigenous Affairs, 2022) in the traditional territory of Wasauksing First Nation and Shawanaga First Nation (Figure 4).

Figure 4. Signatories to the Robinson-Huron Treaty of 1850 and Williams Treaty of 1923.

Manitouwabing Lake is located almost entirely within the geographic and municipal township of McKellar (Figure 5). It is one of the largest lakes in the Parry Sound area, measuring roughly 1,200 hectares in size (Scholten, 2020). The lake collects water from a fairly large watershed through numerous inflows including the Manitouwabing River, and outflows at the south end of the lake (Clark, 2018). Lake water level is regulated by a dam located on the outflow at Hurdville which has raised the water by approximately 2.5 m from its natural level (Scholten, 2020). The dam is owned and operated by Parry Sound Generation Corporation for the purpose of hydroelectric power generation downstream at Parry Sound (McIntyre, 2005).

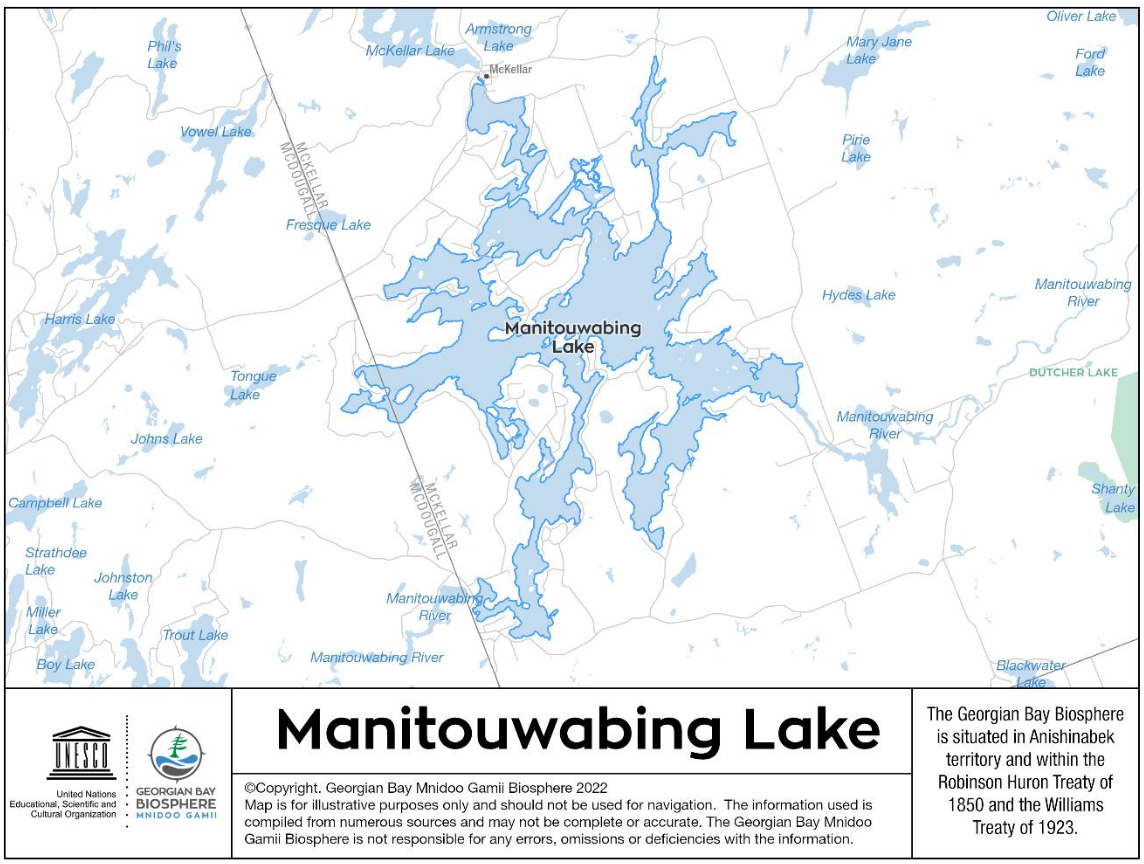

Figure 5. Manitouwabing Lake and surrounding area of McKellar.

The lake has a maximum depth of 33.6 m (110 ft), a mean depth of 5.6 m (18.4 ft) (McIntyre, 2005), and a flushing rate of 2.8 times per year (Clark, 2018). A diverse cool/warm water fish community is supported by the lake, dominated by northern pike, smallmouth and largemouth bass, black crappie, and walleye (Scholten, 2020).

Manitouwabing Lake is the site of six resorts and over 1,000 private residences (MLCA, 2019). Public access to the lake is possible from several boat launches as well as public docks.

2. Water Quality

2.1 Overview

Volunteers on Manitouwabing Lake participate in the Lake Partner Program (LPP) run by the Ministry of Environment, Conservation and Parks (MECP). All past and present LPP data for Manitouwabing Lake are available through the Lake Partner Program open data website.

Volunteers also began monitoring water temperature and a variety of other parameters (e.g., dissolved oxygen, total dissolved solids, pH, E. coli) in 2022. This additional monitoring, along with continued E. coli monitoring, is a joint effort by MLCA and the Township of McKellar and is overseen by a limnologist on the township's Lake Stewardship and Environmental Committee. These data can be viewed on DataStream and found on the Township of McKellar website.

Additionally, benthic monitoring is conducted at several sites on the lake (Figure 6).

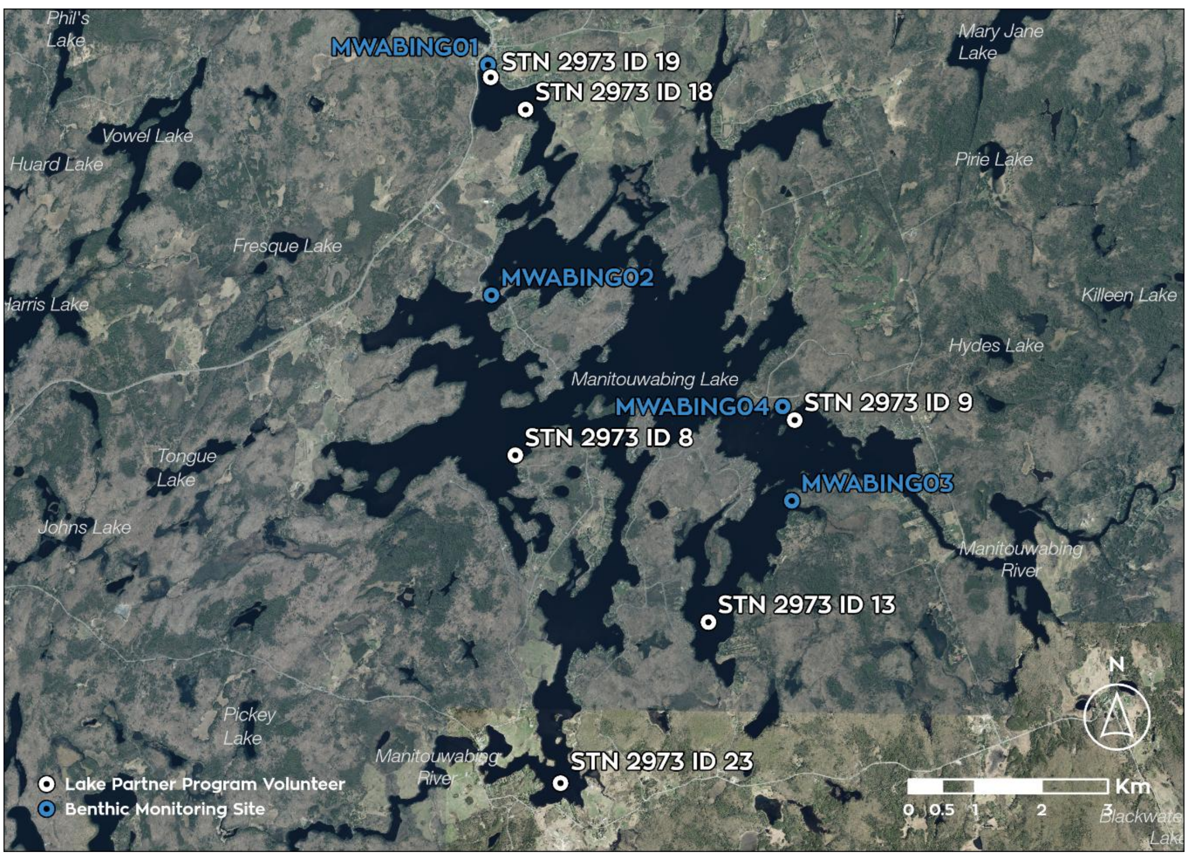

Figure 6. Active and recently active monitoring sites on Manitouwabing Lake.

2.2 Lake Partner Program

The Lake Partner Program (LPP) is an Ontario-wide, publicly funded, free program that collects data about phosphorus, water clarity, calcium, and chloride. The simple tests provide a strong basis for assessing the health of the ecosystem.

Monitoring TP is very important as phosphorus is the nutrient that controls plant growth (including algae) in lakes. Measuring TP year after year is necessary to detect long-term changes in water quality that may be due to impacts of shoreline development, climate change, and/or other stressors. Inland lakes require TP data to help assess background concentrations relative to present day concentrations. Data collected by volunteers are analyzed by the Dorset Environmental Science Centre (DESC) which makes all data available online.

2.2.1 Methods

As a general rule, only one representative sampling location is required for each lake even in large convoluted lakes with multiple arms. In the event that there are compelling reasons to believe that water quality in different areas of the lake would be influenced differently by rivers or development, for example, or there are local observed differences or perceived problems, more sites might be recommended. Generally speaking, if the watershed influences are similar across a lake, the water quality will be similar as well.

Spring total phosphorus sampling (following LPP protocols) is sufficient for most locations in the region, as there are few areas that experience fall algal blooms. Additionally, Secchi disc water clarity measurements are taken each month at the same location as the TP samples. The black-and-white Secchi disc is lowered into the water until it is at the absolute limit of being visible. This depth is the Secchi depth of visibility, which is directly related to water clarity and can be used as a simple and effective monitoring tool for determining the effects of human activities on water clarity and, indirectly, on the nutrient content in the water.

The materials and instructions needed to take the water samples and conduct water clarity measurements are sent to volunteers by the province. Samples are returned (postage paid) to DESC for analysis and Secchi observation sheets are mailed to DESC in November.

2.2.2 Interpreting Results

Only data collected after the MECP took over coordination of the LPP (2002 to present) are shown in graphs and labelled on figures. Since 2002, LPP phosphorus samples have been analysed on a low-level phosphorus analyser that has increased the precision of results from +/- 6 µg of phosphorus per litre to +/- 0.7 µg/L. Complete data for all historical and active sampling locations, including data collected prior to 2002, are available through the Lake Partner Program open data website.

Water Clarity

In general, water clarity, as measured by Secchi depth, tends to be higher in open areas with good water circulation. Water clarity tends to diminish (smaller Secchi depth values) in enclosed bays, near wetlands or sources of organic material, and in lakes or areas that have higher nutrient levels either from natural or anthropogenic sources.

Secchi depth values should be compared over several years to assess whether there are water clarity trends for a particular area. Where more than one year of water clarity data exists for a sampling location, Secchi depth in metres is graphed and an average depth is given.

Calcium

Calcium is a nutrient that is required by all living organisms. Some organisms, including those that make up the lower food web, use calcium in the water to form their calcium-rich body coverings. The lower food web forms the foundation of a healthy food web. Prey fish and juvenile predatory fish (piscivores) rely on the lower food web as a main source of food for growth, and predators depend on plentiful prey for their growth. If the lower food web is in poor condition, in time higher levels of the food web will respond and reflect that condition. These organisms of the lower food web, like Daphnia, mollusks, clams, amphipods, and crayfish, are very sensitive to declining calcium levels.

Calcium concentrations have been shown to be decreasing in Canadian Shield lakes in response to depleted watershed stores of calcium caused by logging and decades of acid loading associated with acid rain. Combined with lower food availability and warmer temperatures predicted as part of a changing climate, this decrease represents an important stressor for many aquatic species.

Calcium concentrations should be considered over the long term to identify trends. Where more than one year of data exists for a sampling location, calcium concentration in mg/L is graphed.

Chloride

Chloride is a naturally occurring ion found dissolved in water. It can come from natural sources (e.g., weathering of rocks and soils) as well as human sources (e.g., road salt, water softener discharge, agricultural activities). Chloride is often measured as an indication of salinity, although other ions also affect salinity including calcium, magnesium, sodium, and others.

Lakes and rivers naturally contain low concentrations of chloride (generally <100 mg/L). Too much chloride can be toxic to freshwater plants and animals. The Canadian Council of Ministers of the Environment set the Canadian Water Quality Guidelines (CWQG) for the protection of aquatic life against effects of chronic exposure to chloride at a concentration of 120 mg/L.

A study by Sorichetti et al. (2022) found clear evidence of anthropogenic impact on chloride concentrations in Ontario inland lakes and that the primary source is runoff from de-icers and road salts. The authors state, "relatively higher and increasing historical chloride concentrations are measured in lakes that have winter-maintained roads or urban land use within their watersheds" (Sorichetti et al., 2022, p. 521). Most lakes examined in the study (79%) had chloride concentrations below 5 mg/L, 19.5% were between 5 and 40 mg/L, and 0.5% were above 40 mg/L (Sorichetti et al., 2022). These concentrations are well below the CWQG for the protection of aquatic life from exposure to chloride (120 mg/L). However, recent studies have shown that the CWQGs may not be protective of all taxa, "namely cladoceran zooplankton, particularly in low nutrient and soft-water lakes such as those on the Canadian Shield" (Sorichetti et al., 2022, p. 524).

Similar to calcium, chloride concentrations should be considered over the long term to identify trends. Where more than one year of data exists for a sampling location, chloride concentration in mg/L is graphed.

Total Phosphorus

As phosphorus is the nutrient that controls the growth of plants (e.g., algae) in the aquatic environment, TP concentrations are used to interpret nutrient status. The nutrient status of an aquatic environment is described in terms of three broad categories—oligotrophic, mesotrophic, and eutrophic (Figure 7).

- Oligotrophic or nutrient-poor = TP concentrations below 10 µg/L
- Mesotrophic or moderately enriched = TP concentrations between 10 and 20 µg/L
- Eutrophic or nutrient-rich = TP concentrations over 20 µg/L

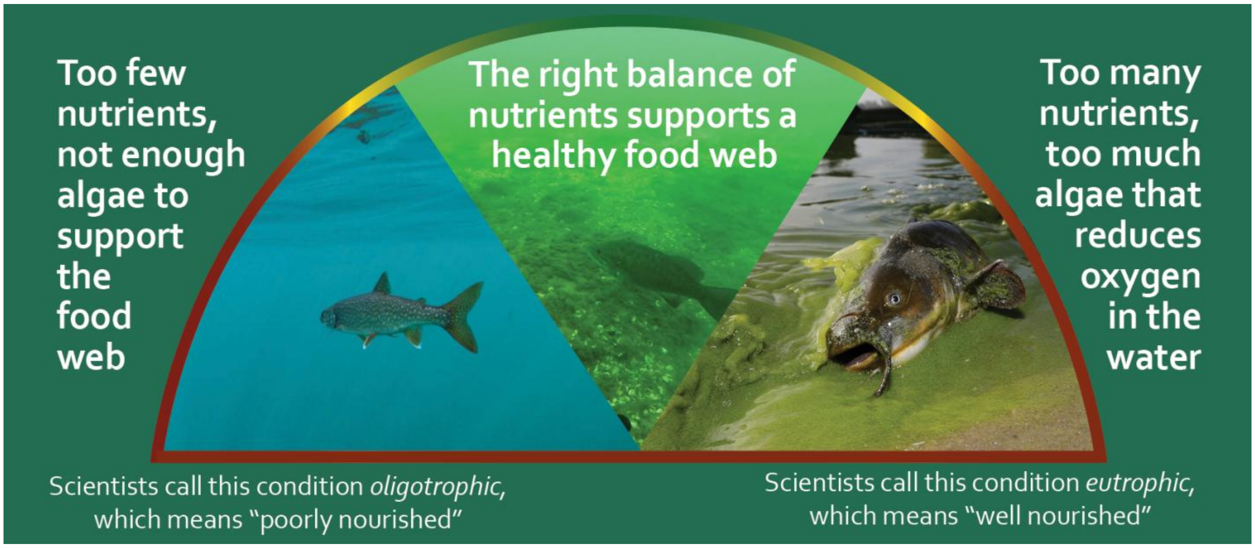

Figure 7. Visual representation of how nutrient levels affect aquatic ecosystems (International Joint Commission).

The Interim Provincial Water Quality Objective (PWQO) for TP in lakes is 20 µg/L. This measure is intended to serve as a warning for, and to prevent, conditions that could result in the nuisance growth of algae. Results in this report are used to characterize trophic condition and assess TP trends (e.g., upward, downward). When interpreting data, the MECP cautions that although only three years of data are required to establish a reliable, long-term average to measure current nutrient status, a longer data set is required to examine trends. Some aquatic environments exhibit relatively large differences in TP between years, highlighting the need for long-term data collection to distinguish between natural variation and true anomalies.

Average TP is calculated for sampling locations with between three and five years of data, as well as, locations with five or more years of data for which there is no apparent trend. For sampling locations with five or more years of TP data and for which there is an apparent trend, a trend line is shown on the TP graph and average is not calculated. Visible outliers are removed for the purpose of determining whether a trend exists.

The LPP database (available here) contains TP data from over one thousand sampling locations across Ontario. Readers may find the database useful in understanding how Manitouwabing Lake TP concentrations compare to other waterbodies across the province.

2.2.3 Results

All sites recently sampled on Manitouwabing Lake through the LPP have TP concentrations indicating mesotrophic conditions. This means the lake is moderately enriched with TP concentrations ranging from 10 to 20 µg/L.

Station 2973, Site ID 8	
• Description: West of Maplewood	• Average TP: 11.4 µg/L
• Data collector: LPP volunteer	• Average Secchi depth: 2.3 m
• Trophic status: mesotrophic	• Average calcium: 3.9 mg/L
• TP trend: no apparent trend	• Average chloride: 2.4 mg/L

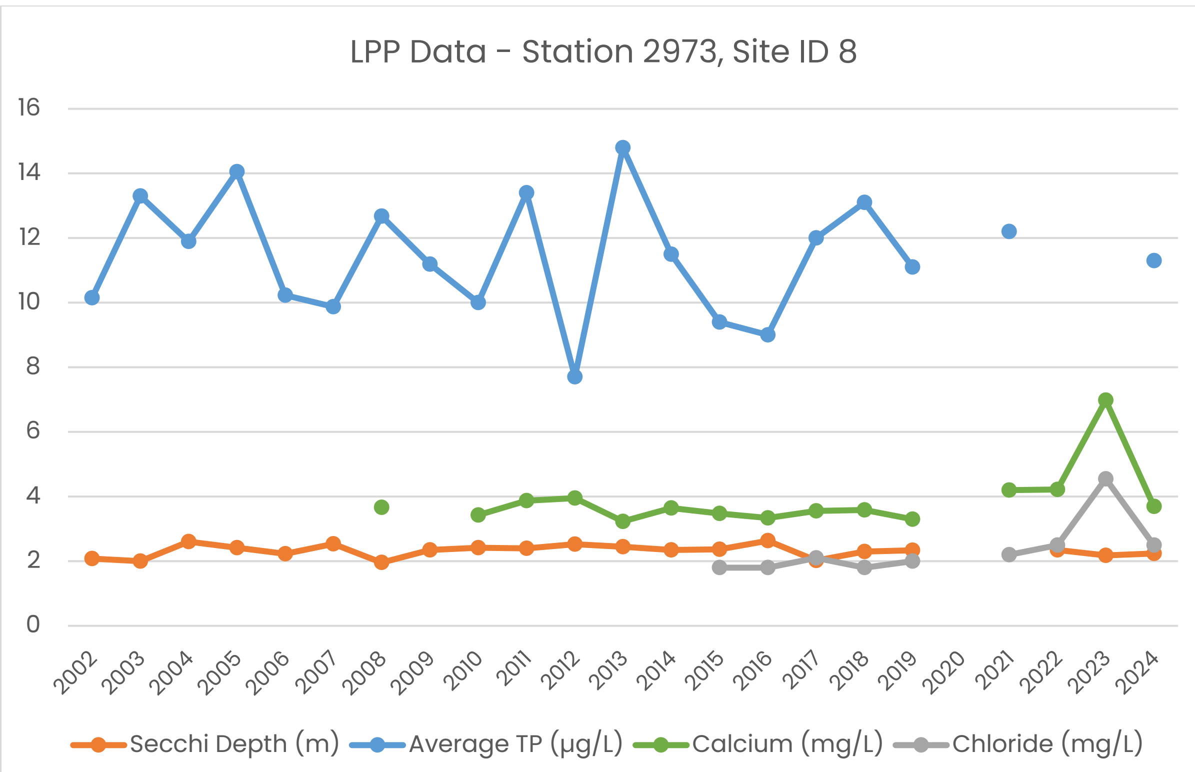

Figure 8. Lake Partner Program data for water clarity, calcium, chloride, and total phosphorus at Station 2973, Site 8. Note: TP data for 2022 and 2023 are considered outliers and are not shown on the graph.

Station 2973, Site ID 9	
• Description: E of Longhorn, Hardle's Cr	• Average TP: 13.3 µg/L
• Data collector: LPP volunteer	• Average Secchi depth: 1.5 m
• Trophic status: mesotrophic	• Average calcium: 4.9 mg/L
• TP trend: n/a	• Average chloride: 0.7 mg/L

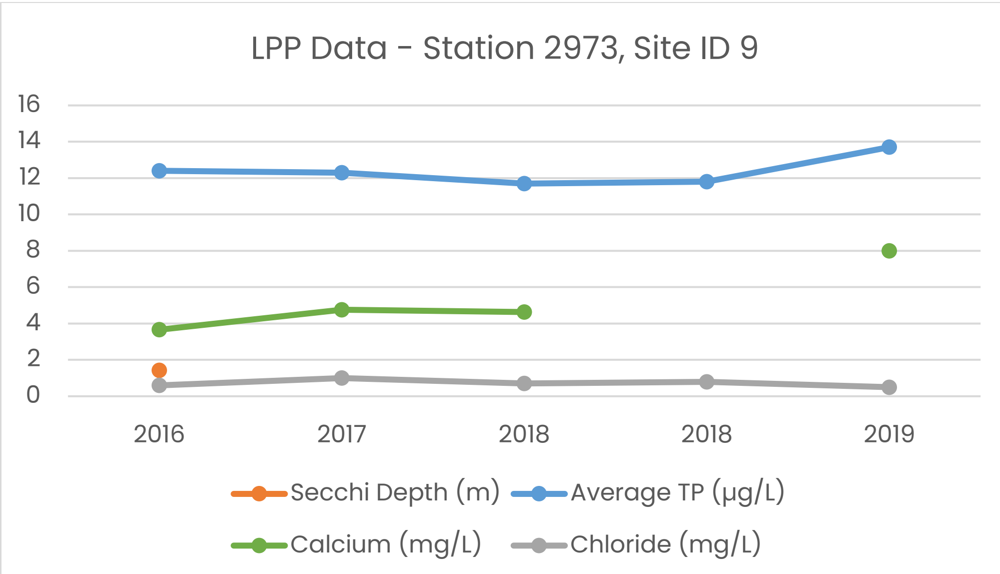

Figure 9. Lake Partner Program data for water clarity, calcium, chloride, and total phosphorus at Station 2973, Site 9. Note: two TP and chloride data points are given in the LPP database for 2018.

Station 2973, Site ID 13	
• Description: Jones Bay	• Average TP: 11.8 µg/L
• Data collector: LPP volunteer	• Average Secchi depth: 1.9 m
• Trophic status: mesotrophic	• Average calcium: 3.1 mg/L
• TP trend: no apparent trend	• Average chloride: 1.1 mg/L

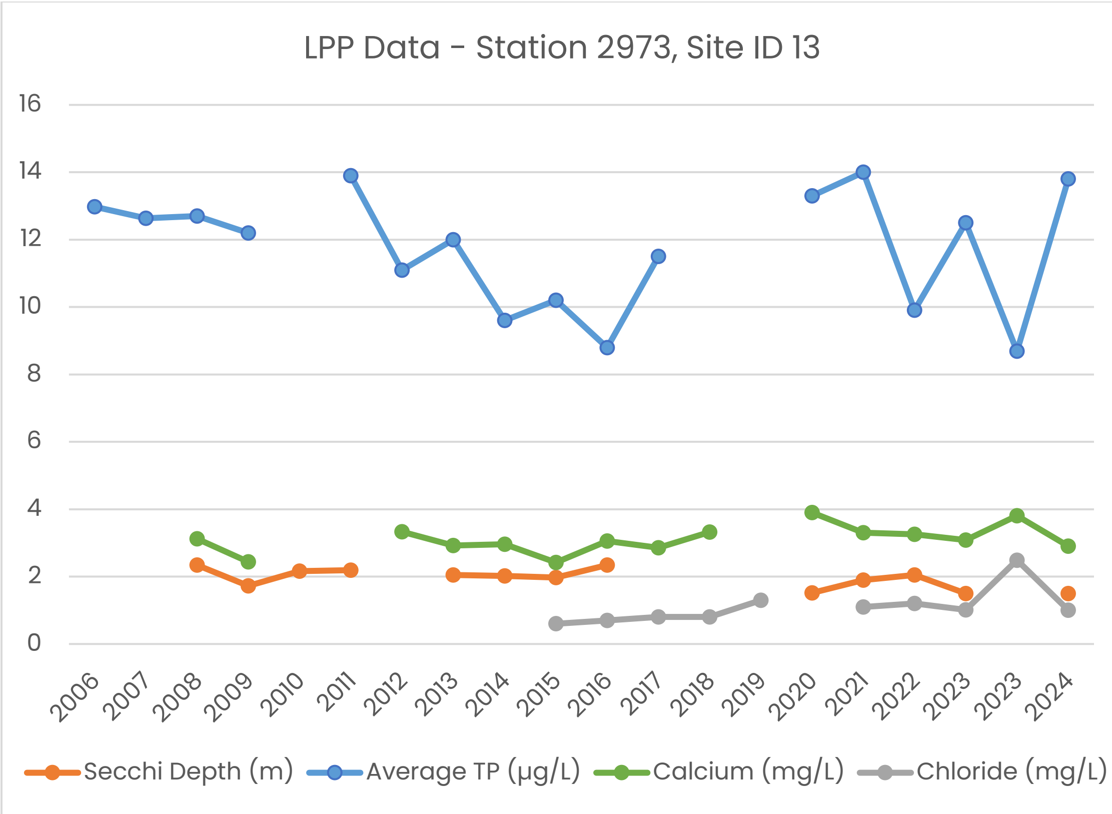

Figure 10. Lake Partner Program data for water clarity, calcium, chloride, and total phosphorus at Station 2973, Site 13. Note: two TP, calcium, and chloride data points are given in the LPP database for 2023.

Station 2973, Site ID 18	
• Description: McKellar Bay	• Average TP: 10.2 µg/L
• Data collector: LPP volunteer	• Average Secchi depth: 2.6 m
• Trophic status: mesotrophic	• Average calcium: 4.0 mg/L
• TP trend: no apparent trend	• Average chloride: 7.0 mg/L

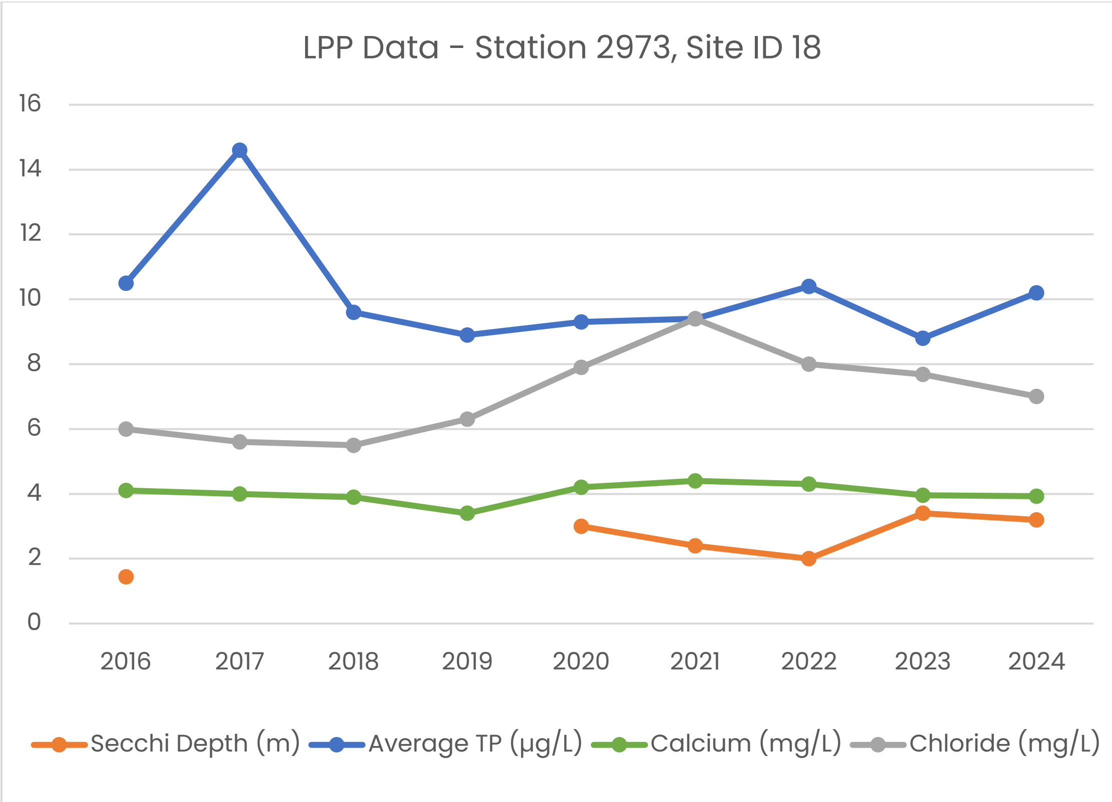

Figure 11. Lake Partner Program data for water clarity, calcium, chloride, and total phosphorus at Station 2973, Site 18.

Station 2973, Site ID 19	
• Description: McKellar Bay, near dock	• Average TP: 10.4 µg/L
• Data collector: LPP volunteer	• Average Secchi depth: 2.7 m
• Trophic status: mesotrophic	• Average calcium: 3.9 mg/L
• TP trend: no apparent trend	• Average chloride: 7.1 mg/L

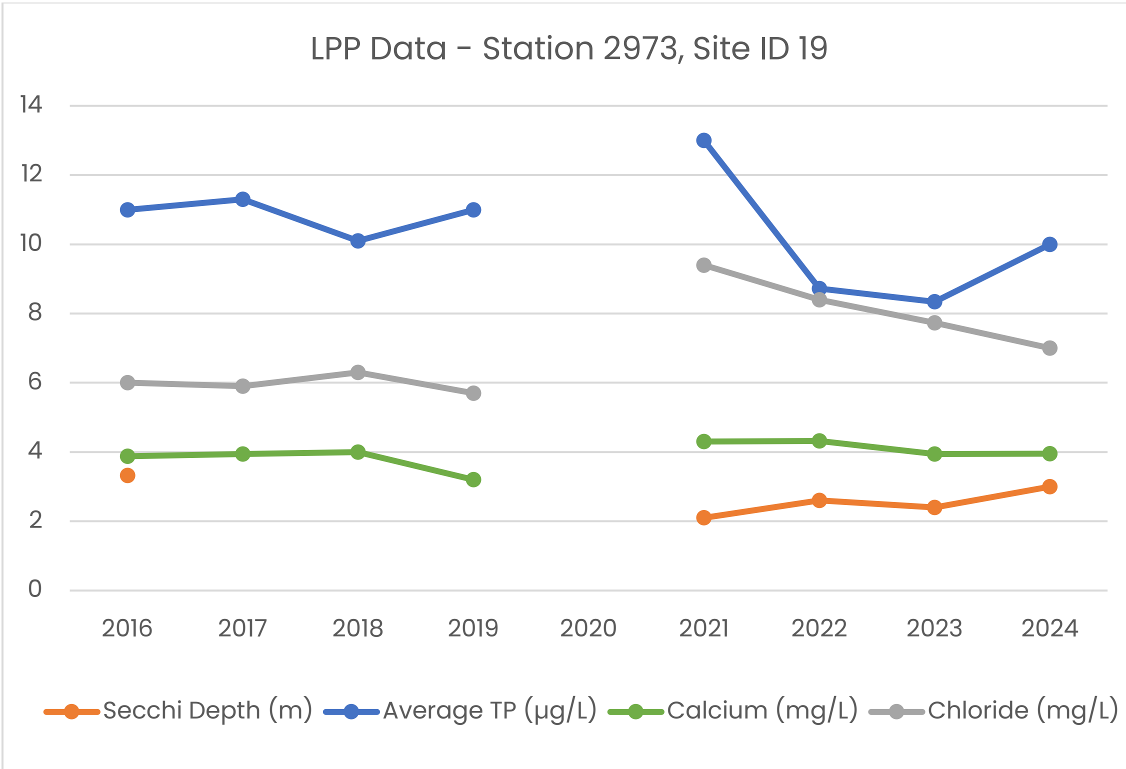

Figure 12. Lake Partner Program data for water clarity, calcium, chloride, and total phosphorus at Station 2973, Site 19.

Station 2973, Site ID 23	
• Description: East of Hurdville	• Average TP: 11.4 µg/L
• Data collector: LPP volunteer	• Average Secchi depth: 1.7 m
• Trophic status: mesotrophic	• Average calcium: 3.9 mg/L
• TP trend: no apparent trend	• Average chloride: 2.0 mg/L

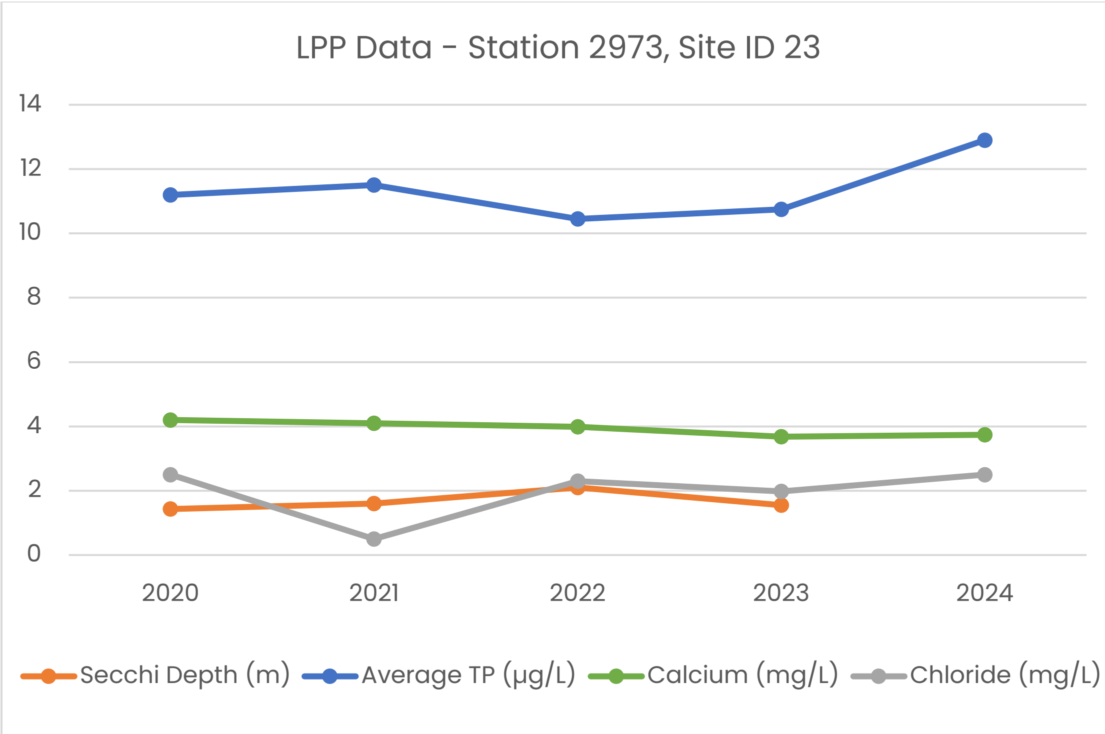

Figure 13. Lake Partner Program data for water clarity, calcium, chloride, and total phosphorus at Station 2973, Site 23.

2.2.4 Recommendations

Continue LPP sampling annually. Prioritize locations that have a long, continuous history of sampling or areas with notable water quality concerns. Suggested sites are Station 2973, Site IDs 8, 9, 13, and 18.

Continue with the additional water quality monitoring that was started on Manitouwabing Lake in the fall of 2022.

2.2 Benthic Monitoring

Different types of water quality monitoring provide environmental managers with complementary information. Most people are familiar with the idea of looking at water quality from a "stressor-based approach". This includes monitoring water chemistry parameters like pH, dissolved oxygen, total phosphorus, and others. Stressor-based monitoring approaches provide important information about an ecosystem's exposure to stress, but they leave unanswered questions about the significance (or effect) of that stress.

Biological monitoring (e.g., benthic monitoring) uses an "effect-based approach" to provide information about how ecosystems have responded to a stress, for example by looking at fish communities or benthic macroinvertebrates. However, effect-based approaches leave unanswered questions about what stresses are being responded to. Therefore, these approaches (chemical and biological monitoring) are complementary and together provide a more complete picture of aquatic ecosystem health (i.e., the lake's exposure to stress and associated ecological response).

For example, volunteers on Manitouwabing Lake monitor phosphorus levels which provide a measure of exposure to stress (e.g., impacts from humans, climate change, invasive species). These measures could be phosphorus levels going up, going down, or staying the same. But what is the impact from these trends on the ecosystem? By adding benthic monitoring, we can start to see if and how the ecosystem is reacting to a stressor.

Over the last three decades, the use of biological monitoring in Ontario has increased dramatically. Researchers, water managers, and the larger scientific community are recognizing the ability of biological monitoring to reflect the impacts of stressors on aquatic ecosystems including the effects of non-point-source and episodic pollution, habitat changes, and the cumulative effects of multiple stressors.

Accordingly, the use of biotic changes to evaluate ecosystem condition and water management performance has grown in relevance and legitimacy – to the point that legal and regulatory frameworks in many countries now require information on biological condition. Ontario's Water Resources Act (R.S.O 1990, C. 040) and Environmental Protection Act (R.S.O. 1990, C. E19), for example, define impairment and adverse impact in clearly biological terms.

Benthic macroinvertebrates (or benthos) are small aquatic organisms (including insects, crustaceans, worms, and mollusks). The term benthic macroinvertebrate can be broken down to better understand the nature of these organisms. Benthic macroinvertebrates spend all or part of their life cycle living at the bottom of the lake (benthic), they are quite small but can generally still be seen with the naked eye (macro), and they lack a backbone (invertebrate).

These animals are well suited as indicators of water and sediment quality as they spend most or all of their lives (1-3 years) in constant contact with the benthic environment in a specific area. Furthermore, they are relatively easy and inexpensive to sample, and have varying tolerances to disturbances and pollution.

A healthy lake will support high richness (the number of species) and abundance (the number of individuals). If a lake has low species richness and mainly pollution-tolerant species, the lake could be impaired. Figure 14 highlights common taxa found in lakes throughout the Parry Sound-Muskoka District, including Manitouwabing Lake, and their varying pollution tolerances.

Figure 14. Benthic macroinvertebrates found in Manitouwabing Lake and their pollution sensitivities.

It is important to note that an aquatic ecosystem with pollution tolerant species is not necessarily a cause for concern. If pollution sensitive species are also present in the same area, this indicates that the water quality must be good enough for the pollution sensitive species to thrive, along with those that are less sensitive. When an aquatic ecosystem hosts pollution tolerant species with no evidence of pollution sensitive species, this could indicate a need for further investigation into potential water quality issues.

Changes in the benthic community of a lake (e.g., changes in the types of organisms, abundance) can indicate changes in the lake ecosystem (e.g., improvements in water quality, habitat alteration, introduction of invasive species).

Benthic macroinvertebrates are also an important part of the food web of a lake. Many benthic macroinvertebrates are critical food sources for a variety of fish species, while others play a key role in decomposing organic matter.

The objectives of the Manitouwabing Lake benthic monitoring program are to:

- Determine the ecological condition of Manitouwabing Lake and compare it;
- Compare Manitouwabing Lake to similar lakes in the Parry Sound-Muskoka District; and
- Compare sites within Manitouwabing Lake.

2.2.1 Methods

Certified Generations Effect staff oversee benthic macroinvertebrate sampling using the standardized Ontario Benthos Biomonitoring Network (OBBN) protocol for lakes. For each of the three sites monitored annually, three shallow, nearshore areas representative of the lake are selected as test sites (referred to as "lake segments" in the protocol) and sampled using the travelling-kick-and-sweep method. The individual doing the sampling disturbs the bottom of the lake in transects from 1 m depth to the water's edge for approximately 10 minutes. Using a net, the dislodged material is collected and placed in a bucket. These samples are then processed to count and identify the different types of benthos in the sample (video available here). There are 27 different groups of benthos that are searched for, ranging in sensitivity to water pollutants and water quality.

2.2.2 Interpreting Results

Manitouwabing Lake has had benthic macroinvertebrate sampling conducted each year since 2020. The objective of the benthic monitoring is to characterize the average benthic community of the lake and compare it to lakes in the Parry Sound-

Muskoka District to determine whether the benthic community in Manitouwabing Lake is considered typical of what would be expected for a lake in this region.

The District Municipality of Muskoka has been working with lake associations to conduct benthic monitoring throughout the district since 2004. This rich Muskoka dataset, combined with additional benthic data for lakes in south-central Ontario from the DESC and from Jones et al. (2007), provides the basis needed for regional comparisons among lakes.

As detailed in the 2018 Muskoka Watershed Report Card Background Report, the Muskoka Watershed Council (MWC) reports on lake benthic communities in terms of the percentage of pollution-sensitive taxa found. Specifically, the pollution-sensitive taxa include larval mayflies (*Ephemeroptera*), dragonflies and damselflies (*Odonata*), and caddisflies (*Trichoptera*), collectively referred to as EOT. These taxa are very sensitive to pollution and habitat alterations, meaning that their numbers will be highest in healthy lakes and lowest in unhealthy or disturbed lakes. The average %EOT for a lake is compared to the normal range for %EOT in lakes in the region. In other words, this monitoring seeks to answer the question, does the %EOT for the lake of interest fall within the normal range of what would be expected for a lake in the region?

The normal range for %EOT in lakes in the region was determined by MWC for the Muskoka Watershed Report Card by "randomly selecting one data point from each lake sampled between 2012 and 2017 and characterizing the distribution of values observed among these lakes" (MWC, 2018, p. 46). The resulting range of %EOT values is shown in Figure 15 and is used for analysis in this report.

Following the methodology used by MWC (2018), the average %EOT was calculated for each of the three sampling locations using data collected between 2019 and 2023. The average %EOT for each site was then compared to the normal range (Figure 15) to determine whether the lake is considered typical, atypical, or extremely atypical. These categories are defined by MWC (2018) as follows:

- **Typical**: %EOT is between the 10th and 90th percentile. These lakes resemble the majority of lakes in the region, and therefore are comprised of typical percentages of EOT species.
- **Atypical**: %EOT is between either the 5th and 10th percentile or the 90th and 95th percentile. These lakes are outside of the normal range of the majority of lakes in

the region. The percentages of EOT species may be slightly higher or lower compared to the majority of lakes in the region.

- **Extremely Atypical**: %EOT is less than the 5th percentile or greater than the 95th percentile. These lakes do not represent the majority of lakes in the region in terms of the percentages of EOT species. These lakes may have very high or very low percentages of EOT species compared to the majority of lakes in the region.

If a lake is considered atypical or extremely atypical, additional monitoring may be necessary to try to understand potential causes and/or contributing factors.

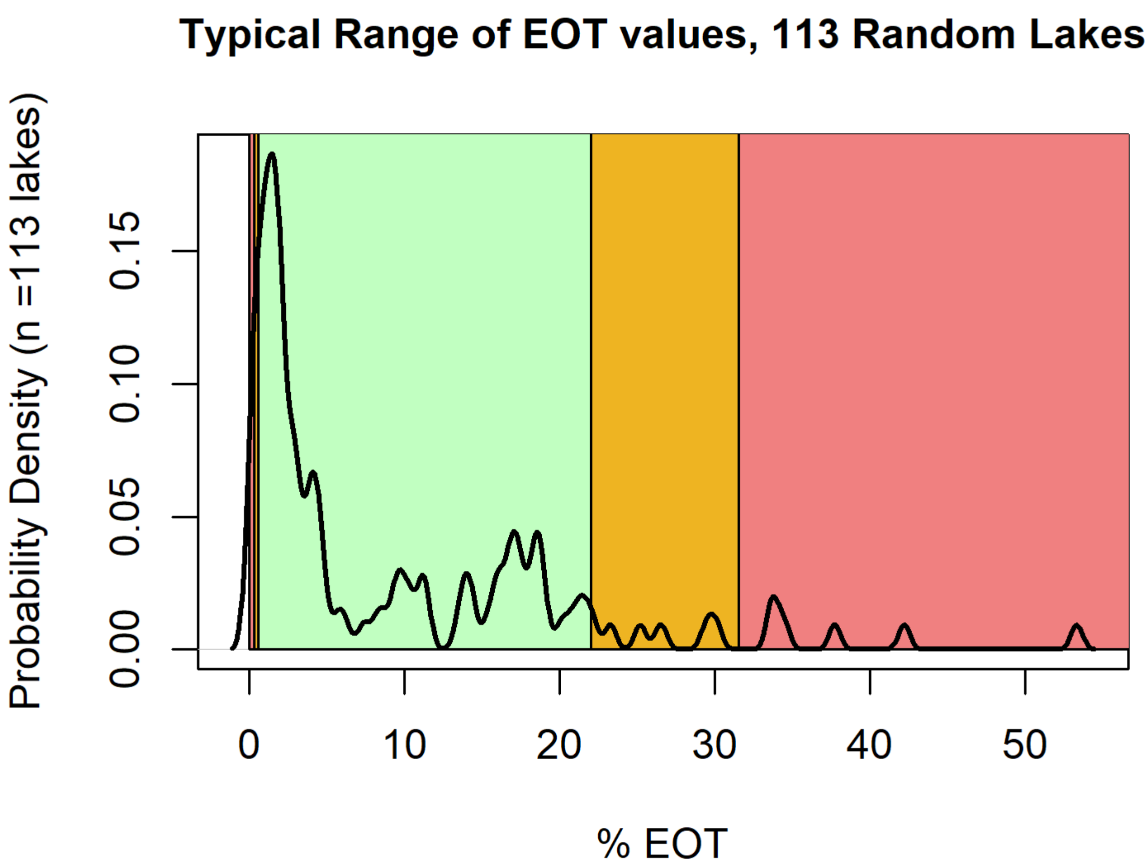

Figure 15. Range of %EOT values of sampled lakes in the region from 2012 to 2017. Typical is shown in green which is between the 10th and 90th percentile (%EOT between 0.55 and 20.99). Atypical is shown in orange which is between the 5th and 10th percentile (%EOT between 0.3 and 0.54) and 90th and 95th percentile (%EOT between 22.1 and 28.01). Extremely atypical is shown in red which is less than the 5th percentile (%EOT less than 0.29) or greater than the 95th percentile (%EOT greater than 31.5).

2.2.3 Results

Three sites (three lake segments each) were sampled in Manitouwabing Lake from 2020-2025 (MWABING01, MWABING02, MWABING04) (Figure 16). One site, MWABING03, was sampled from 2020-2023. This site will not be sampled going forward. Raw data is available upon request, please contact Katrina Krievins at kkrievins@generationseffect.com.

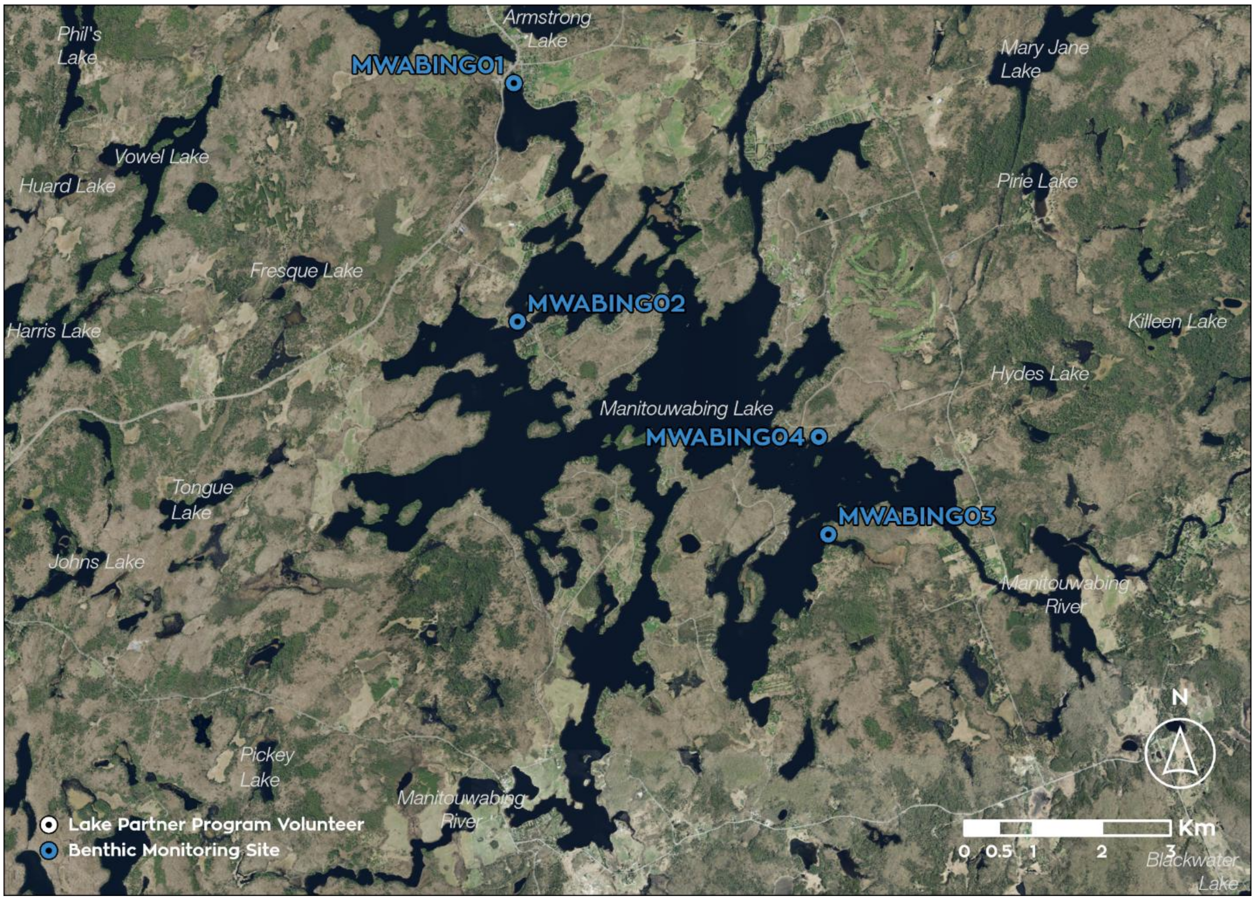

Figure 16. Benthic sampling locations on Manitouwabing Lake.

Site 1 – Manitouwabing Lake

As shown in Figure 17, the %EOT for site 1 on Manitouwabing Lake falls within the normal range of what is expected for lakes in the region.

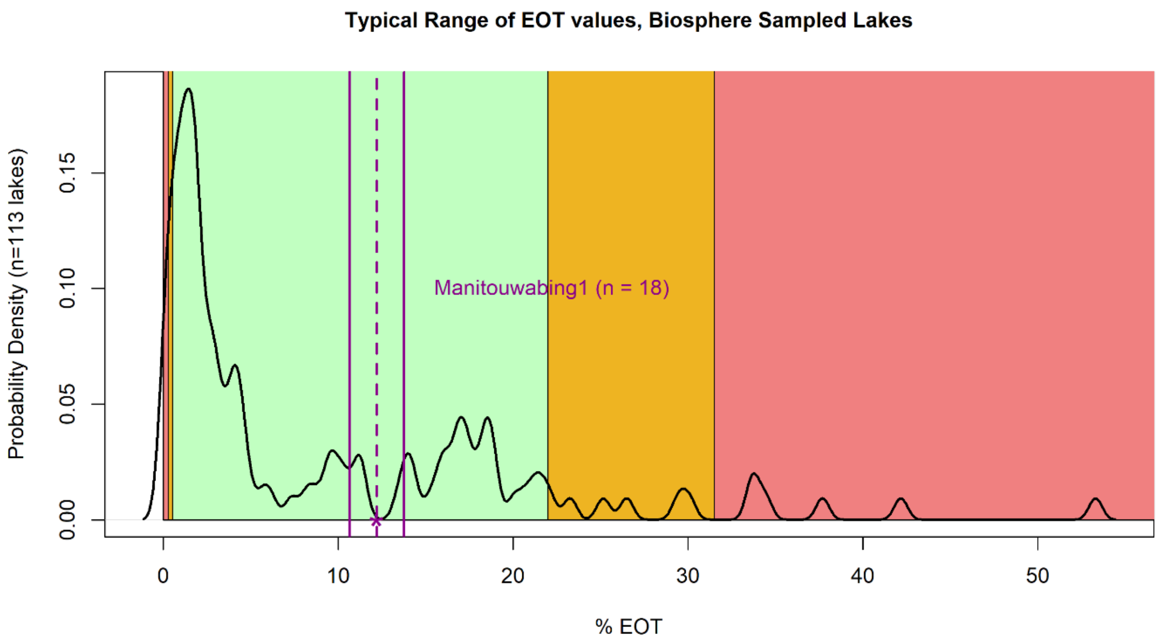

Figure 17. Manitouwabing Lake site 1 average %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 6 years (n=18) fall within the "typical" category (green area) on the typical %EOT range plot (based on 113 sampled lakes).

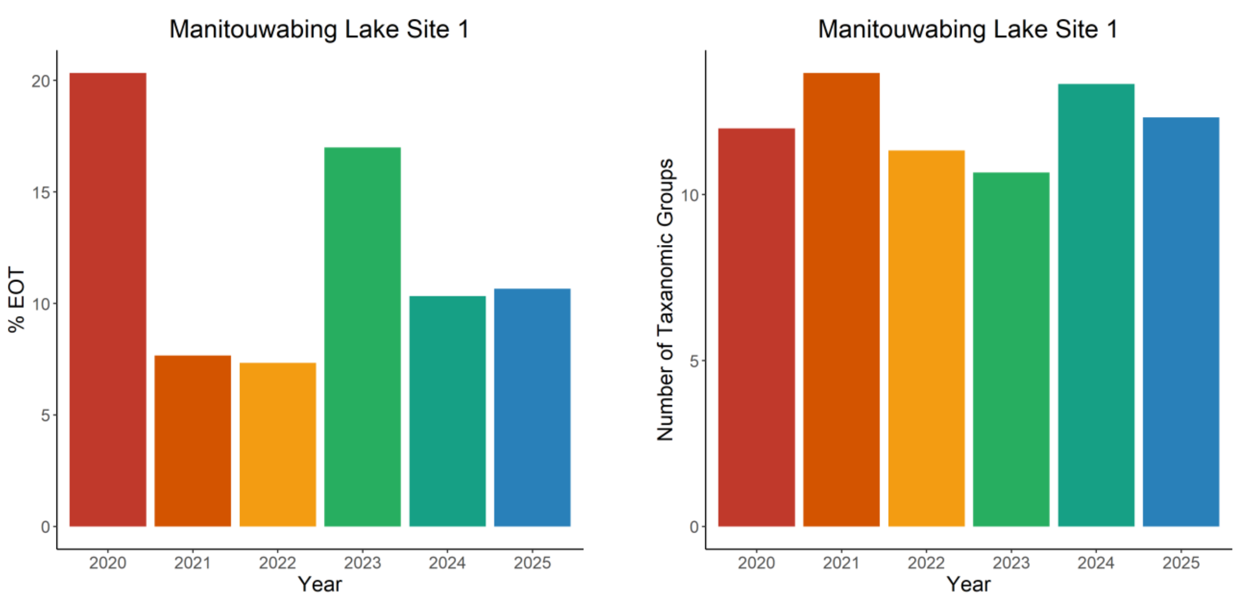

Figure 18. %EOT and the number of taxonomic groups for Site 1 on Manitouwabing Lake from 2020 to 2025.

Site 2 – Manitouwabing Lake

As shown in Figure 19, the %EOT for site 2 on Manitouwabing Lake falls within the normal range of what is expected for lakes in the region.

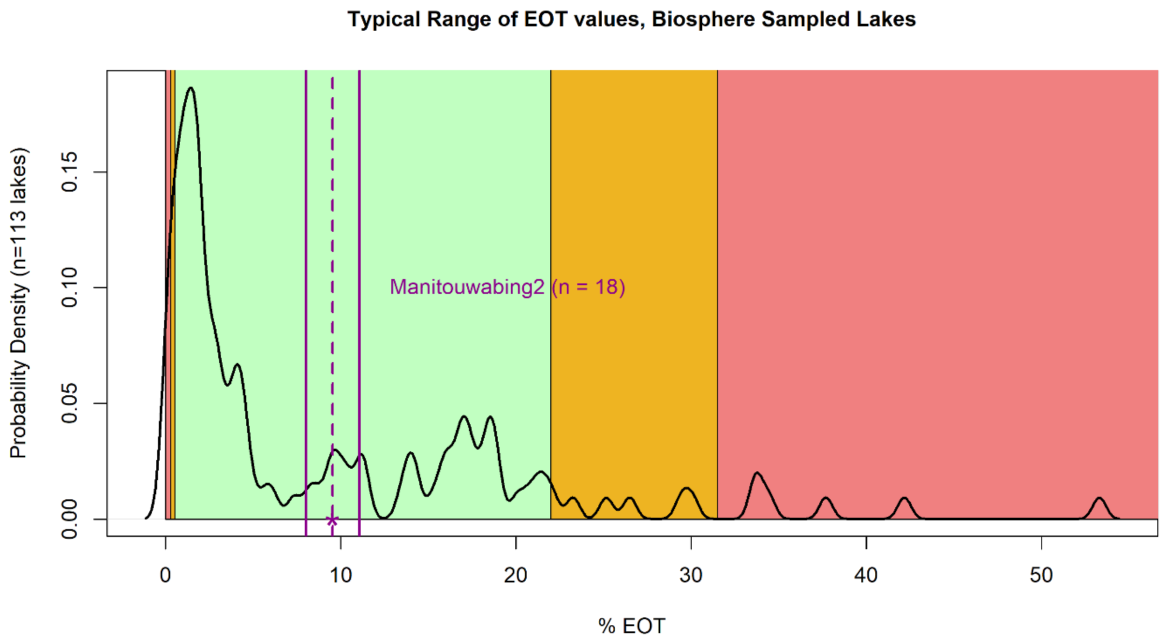

Figure 19. Manitouwabing Lake site 2 average %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 6 years (n=18) fall within the "typical" category (green area) on the typical %EOT range plot (based on 113 sampled lakes).

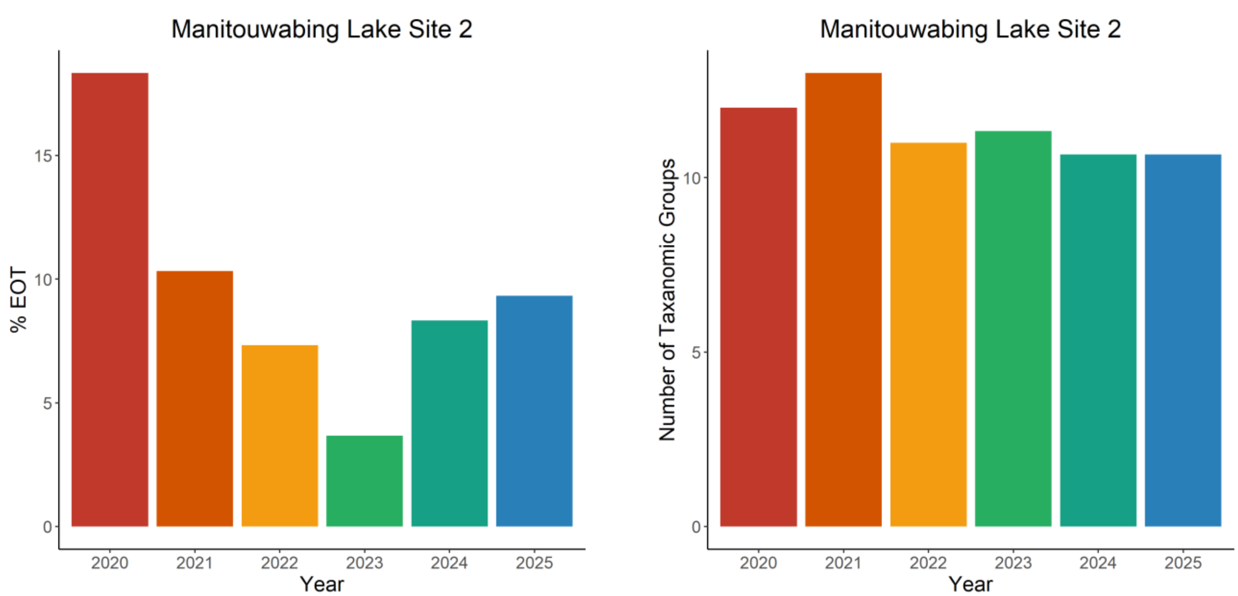

Figure 20. %EOT and the number of taxonomic groups for Site 2 on Manitouwabing Lake from 2020 to 2025.

Site 3 – Manitouwabing Lake

As shown in Figure 21, the %EOT for site 3 on Manitouwabing Lake falls within the normal range of what is expected for lakes in the region.

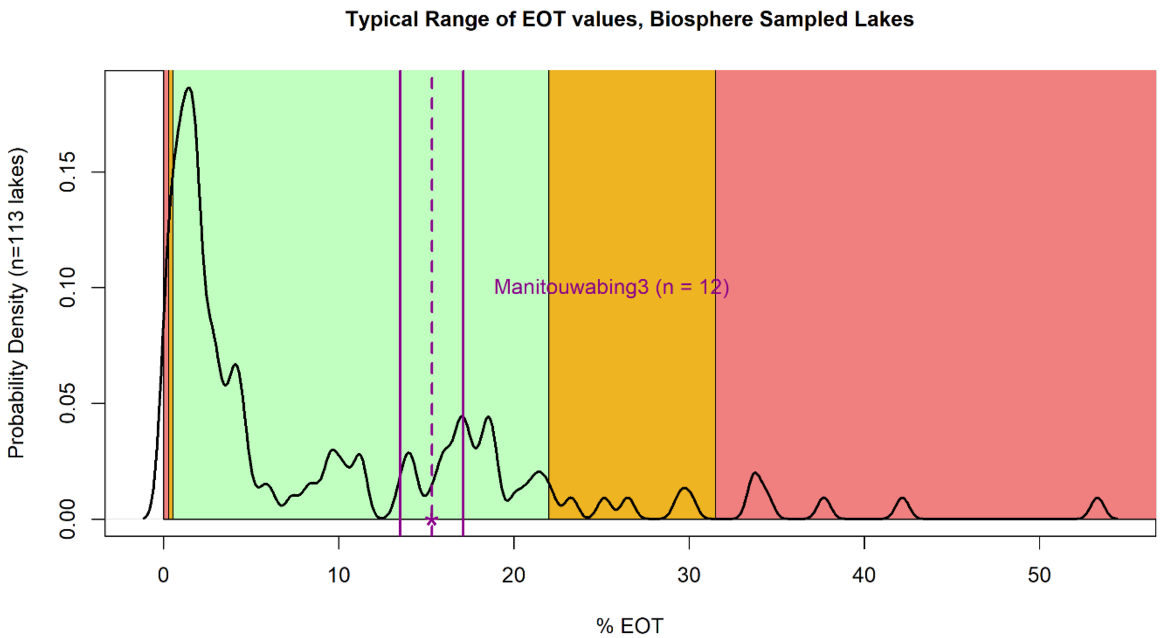

Figure 21. Manitouwabing Lake site 3 average %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 4 years (n=12) fall within the "typical" category (green area) on the typical %EOT range plot (based on 113 sampled lakes).

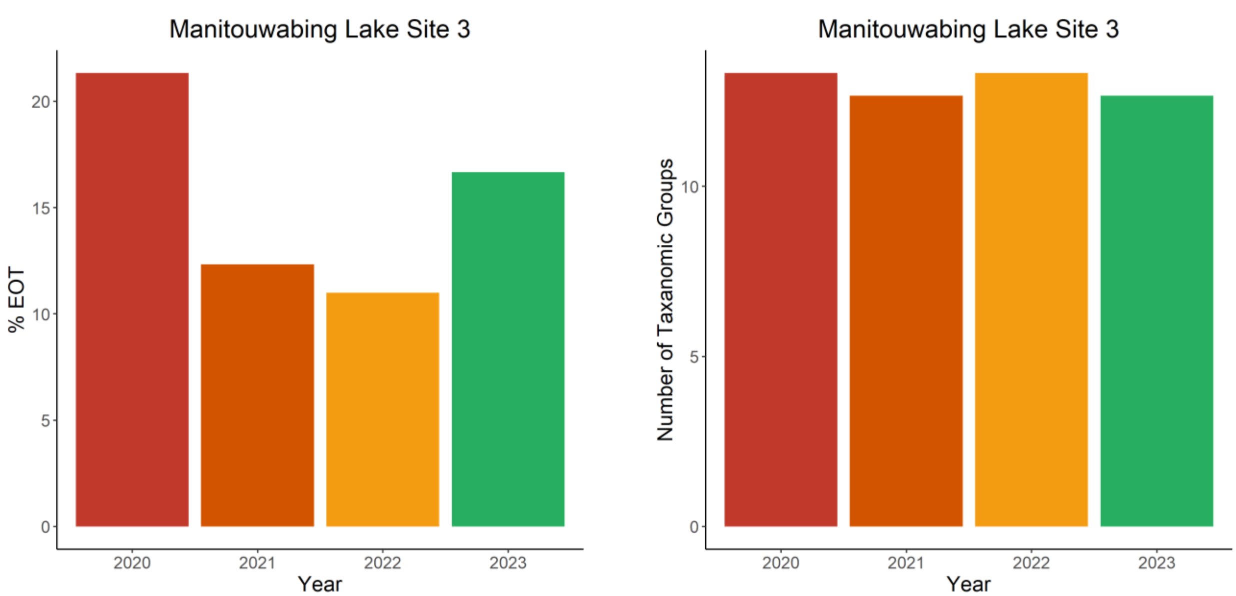

Figure 22. %EOT and the number of taxonomic groups for Site 3 on Manitouwabing Lake from 2020 to 2023.

Site 4 – Manitouwabing Lake

As shown in Figure 23, the %EOT for site 4 on Manitouwabing Lake falls within the normal range of what is expected for lakes in the region.

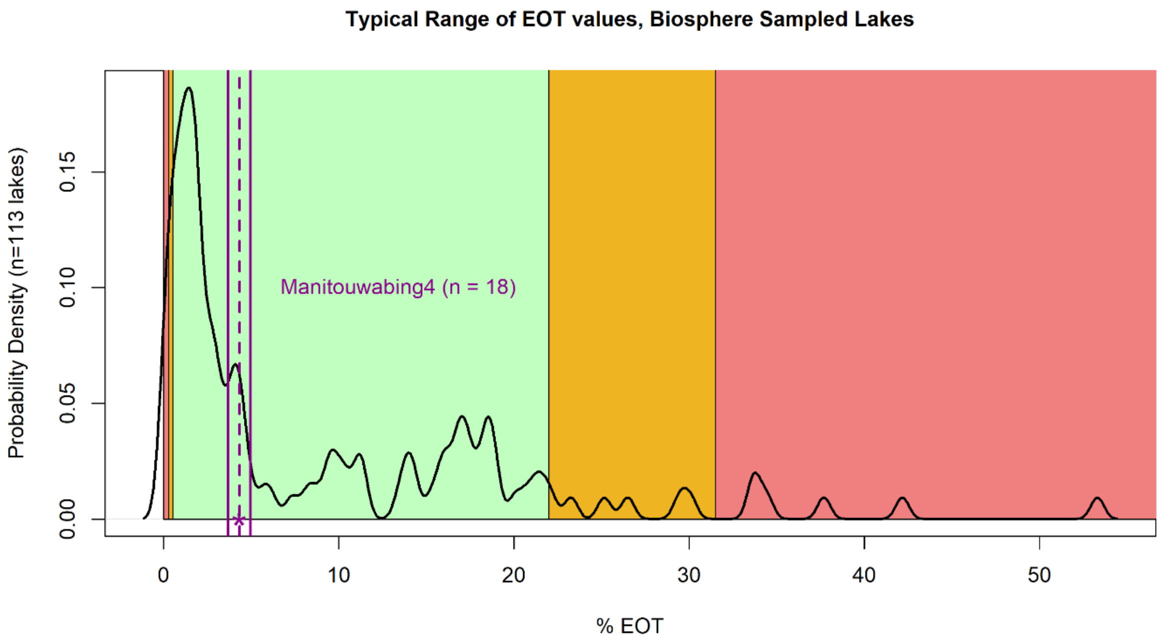

Figure 23. Manitouwabing Lake site 2 average %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 6 years (n=18) fall within the "typical" category (green area) on the typical %EOT range plot (based on 113 sampled lakes).

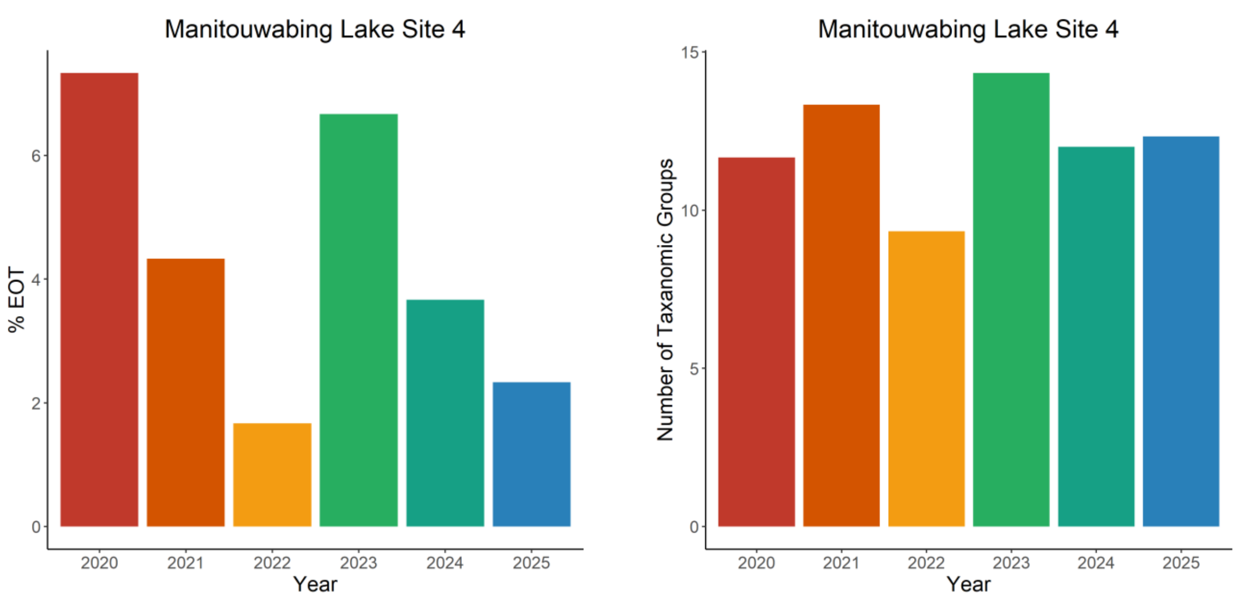

Figure 24. %EOT and the number of taxonomic groups for Site 4 on Manitouwabing Lake from 2020 to 2025.

2.2.4 Recommendations

With lakes in the region facing many threats (e.g., climate change, biodiversity loss, development, pollution), benthic communities act as a barometer of ecological change and impacts. Continuing to monitor the benthic community in Manitouwabing Lake will allow for trends to be tracked over time and the observation of any notable shifts (statistically significant changes) that would be cause for further investigation and potentially require remedial actions.

2.3 Manitouwabing Lake State of the Basin Review 2018

Bev Clark, Aquatic Scientist, was hired by the MLCA to conduct a thorough review of existing Manitouwabing Lake water quality data and provide recommendations for future water quality monitoring activities. Clark's report was published in 2018 and is available for download on the MLCA's website. The key conclusion and recommendations from the report are provided in full below.

The following conclusions were drawn in Clark's (2018) report:

- The bottom line with respect to phosphorus is that concentrations are similar throughout the lake and consistent between years.
- The phosphorus values indicate a lake that is highly influenced by its watershed with no sign of deterioration in water quality (with respect to phosphorus) over the years.
- Manitouwabing Lake's mesotrophic status is not likely the result of human activity in the watershed but rather the result of export of dissolved organic carbon (DOC) from wetlands. Most of the 11.5 μg/L TP in Manitouwabing Lake has its origins as DOC in the watershed's wetland complexes.
- DOC concentrations throughout the lake are relatively similar (4.2-6.0 mg/L) with slightly more tea stained water in the south east areas of the lake. This relatively narrow range in DOC values throughout the lake indicates similar wetland conditions throughout the different subwatersheds.
- Manitouwabing Lake is not expected to support algal blooms.
- Bacteria data are difficult to interpret. There are conclusions that can be drawn by examination of the data, but there are also many aspects of bacteria in lake water that cannot be deduced from these data. Generally, the Manitouwabing Lake bacteria data show that about 5% of the samples are over 100 counts which is the guideline for recreational use. This indicates that the water is swimmable in most areas 95% of the time.

2.3.1 Recommendations

The following recommendations are made in Clark's (2018) report:

1. Several central locations (LPP Site #11, 1 and 3) and possibly one new location near the outflow be monitored by LPP volunteers with an effort to maintain a long-term monitoring record. Some of these sites may or may not be currently sampled. Long-term monitoring records are important to assess the effect of external drivers on the nutrient status of the lake.
2. The efforts used to collect bacteria data could be directed at other issues such as:
    - Education towards aspects of nearshore (shoreline) management.
    - Useful inventories such as areas where aquatic plants grow to assess whether the extent of plant beds are changing.
    - Long-term records of water levels and/or temperature.
3. Late summer monitoring of dissolved oxygen in the deepest location and in isolated bays where the depths are greater than 7-8 m (see page 11 of Clark (2018) report for a map) may provide additional information to address the potential for algal blooms. After areas are identified as having the oxygen depleted at the bottom (with measured oxygen profiles) in year one, there can be samples taken 1 meter from the bottom in subsequent years to assess whether or not there are elevated phosphorus concentrations in the bottom water.
4. All efforts should be made to ensure that invasive species do not enter the watershed. There are many organizations that provide guidance on invading species, e.g. The Federation of Ontario Cottagers' Associations. https://foca.on.ca/aquatic-invasive-species-program/

Additional years of LPP results have become available since Clark's report was published in 2018. These additional data are available through the Lake Partner Program open data website.

3. Fish Communities

3.1 Overview

Table 4 provides a high-level overview of the fish communities in Manitouwabing Lake.

Table 4. Summary of Manitouwabing Lake fish communities and their management (see link).

Major fish species	Largemouth bass (introduced), smallmouth bass (introduced), walleye (introduced), black crappie (introduced), northern pike (introduced)
Other fish species	Lake whitefish, creek chub, brown bullhead, yellow perch, bluntnose minnow, eastern blacknose dace, cisco, pumpkinseed, rock bass, common carp, white sucker
Lake trout management	Not designated
Current stocking	None
Historic stocking	Walleye (1938, 1950-2010), smallmouth bass (1941, 1950-1966)
Contaminants (species tested)	Northern pike, walleye, black crappie

The first documentation of a Ministry-led fish community study on Manitouwabing Lake is from 1959. A cursory survey documented the presence of walleye, smallmouth bass, largemouth bass, yellow perch, lake whitefish, and common carp. Northern pike, however, were not found to be present at that time. A historical note on the Ministry's lake file indicates that northern pike were introduced to the lake via unauthorized introduction in the 1960s. Interestingly, Manitouwabing Lake is the only lake known to contain common carp in the Parry Sound area. Another unreferenced historical note on the Manitouwabing Lake file states that carp were introduced to the lake at the turn of the century (1900) or earlier. Stocking of walleye began in 1938 and in 1941 for smallmouth bass (McIntrye, 2005).

During a 1974 Aquatic Habitat Inventory Survey, northern pike were documented in the lake for the first time. At this time, walleye, smallmouth bass, and brown bullhead were all captured in low numbers. On the other hand, northern pike, common white sucker, rock bass, yellow perch, and cisco were captured in high numbers (OMNR, 1974).

In 1982 a trap net and gill net survey was conducted on Manitouwabing Lake to assess the health of the fish population. Results of the survey indicated a well-balanced fish community with good recruitment, although productivity appeared low and there were indications of over-exploitation of game fish (McIntyre, 1983). When this survey was repeated in 1988, the results showed a drastic change to a coarse fish dominated community (i.e., dominated by fish other than game fish) (Sober, 1989). The brown bullhead population saw a dramatic increase between these two surveys. Weight and number of fish caught in 1988 were much higher than in 1982, attributable primarily to the growing brown bullhead population. Walleye, northern pike, and smallmouth bass populations were essentially unchanged.

Intensive creel surveys were conducted in the summer of 1983 and the winter of 1984. Together these surveys revealed high fishing pressure on Manitouwabing Lake and modest harvest of game fish (MacMillan, 1985a; 1985b). Fishing effort exceeded 30 rod hours per hectare with fishing for northern pike described as very good, but only fair for walleye and smallmouth bass. Comparing this information to volunteer creel data pooled from 1973-1979, it appears that fishing quality has not changed much on the lake over time.

In an effort to rebuild walleye stocks and promote natural rehabilitation in Manitouwabing Lake, several habitat enhancement projects were carried out over the decades. Details on some of these efforts are quite sparse. For example, in a note on the lake file in 1985, a walleye spawning bed enhancement project at Broadbent Rapids is mentioned (MNRF, 2010). A separate note added in 1988 states that spawning bed rehabilitation work was completed below the Hurdville Dam (limestone rock placement and sand removal) and spawning bed rubble was cleaned at a set of rapids on Middle River (MNRF, 2010). No other details are provided.

In addition to spawning bed enhancement work, lake-specific fishing regulations were changed in 1998. The walleye daily catch limit was reduced to two fish per day and a maximum size catch limit of 35.6 cm (14") was imposed (this regulation was later revoked in 2008). Furthermore, in 2000, the Manitou-Seguin Game and Fish Club commenced rehabilitative stocking of walleye fry, in partnership with the Ministry of Natural Resources (MNR). In 2000 and 2001 alone, over 638,000 walleye fry were stocked at various sites in Manitouwabing Lake (McIntyre, 2000; 2001).

An End of Spring Trapnet (ESTN) survey was conducted in 2004, shortly after walleye stocking began. The purpose of the survey was three-fold. First, to assess the status of the nearshore fish community, particularly the walleye population. Second, to evaluate the impact of previous walleye fry stocking, and third, to evaluate the impact of regulations for walleye implemented in 1998.

ESTN surveys use live capture, 6' trap nets set overnight for approximately 24 hours. A total of 30 net sets were completed from May 17-June 10 resulting in the capture of 2,820 fish weighing over 1,400 kg. As summarized by McIntyre (2005), productivity was found to be exceptionally high, but over 70% of the catch weight was comprised of brown bullhead (Figure 25). Abundance indices for walleye, smallmouth bass, and largemouth bass were somewhat low relative to provincial and Parry Sound area lakes. These figures were similar to those observed on the lake in the 1980s (Figure 26). Northern pike abundance was slightly higher than the provincial and Parry Sound average and similar to abundance measured in the 1980s. Other nearshore species including yellow perch, rock bass, and pumpkinseed were caught in very low abundance.

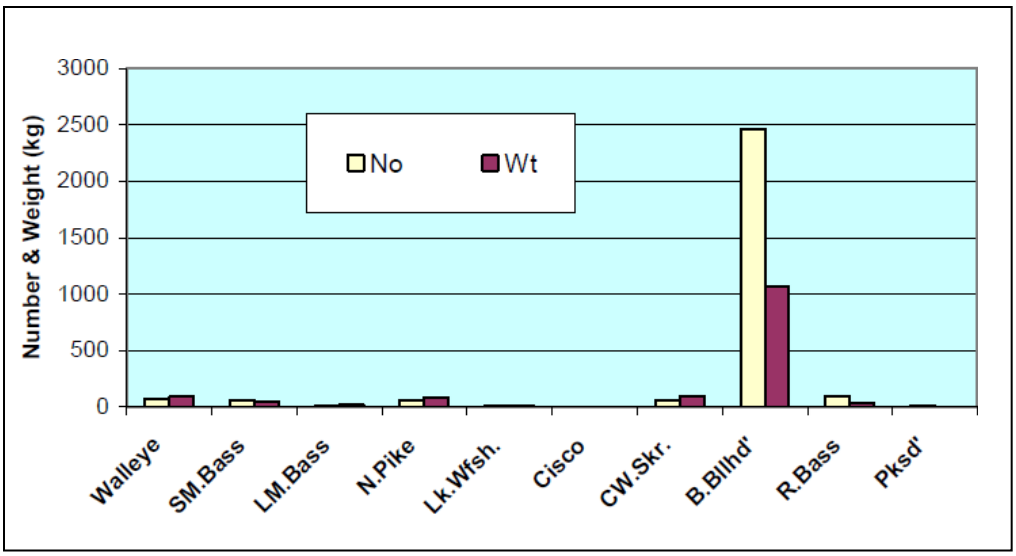

Figure 25. Catch composition for the 2004 ESTN survey on Manitouwabing Lake (McIntyre, 2005).

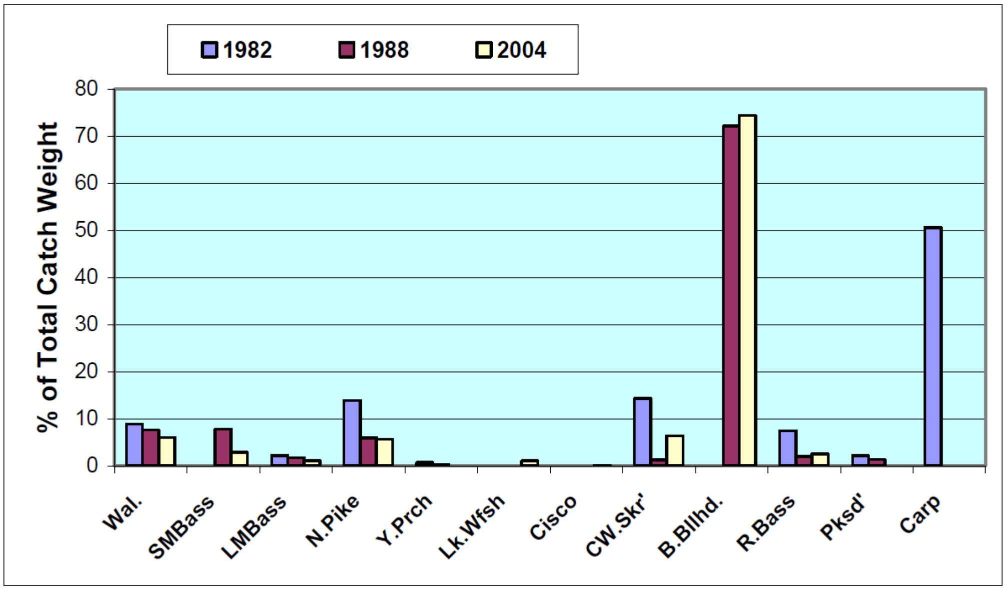

Figure 26. Catch composition by species for the 1982, 1988, and 2004 trapnet surveys on Manitouwabing Lake (McIntyre, 2005).

3.2 Nearshore Community Index Netting Project

Manitouwabing Lake was most recently surveyed by the MNR in 2014 and 2015 (Figure 27). A Nearshore Community Index Netting (NSCIN) project was conducted over the two years. The purpose of the survey was to obtain information on the composition of the fish community and the abundance and population of primary game fish species (Scholten, 2020).

NSCIN surveys use live capture, 6' trap nets set overnight for approximately 24 hours. Netting is conducted in late summer from August 1 until the surface temperature cools to 13°C. Net set locations are typically randomly selected, however in this case the same sites used in the 2004 ESTN (McIntyre, 2005) were used again. Captured fish are enumerated by species and major game fish species are sampled in greater detail including length, weight, and the collection of calcified structures for age determination.

A total of 16 net sets were completed from September 8-13, 2014 and 15 net sets completed from September 28-October 2, 2015. Most of the results presented in the NSCIN report are reported by combining results from both years.

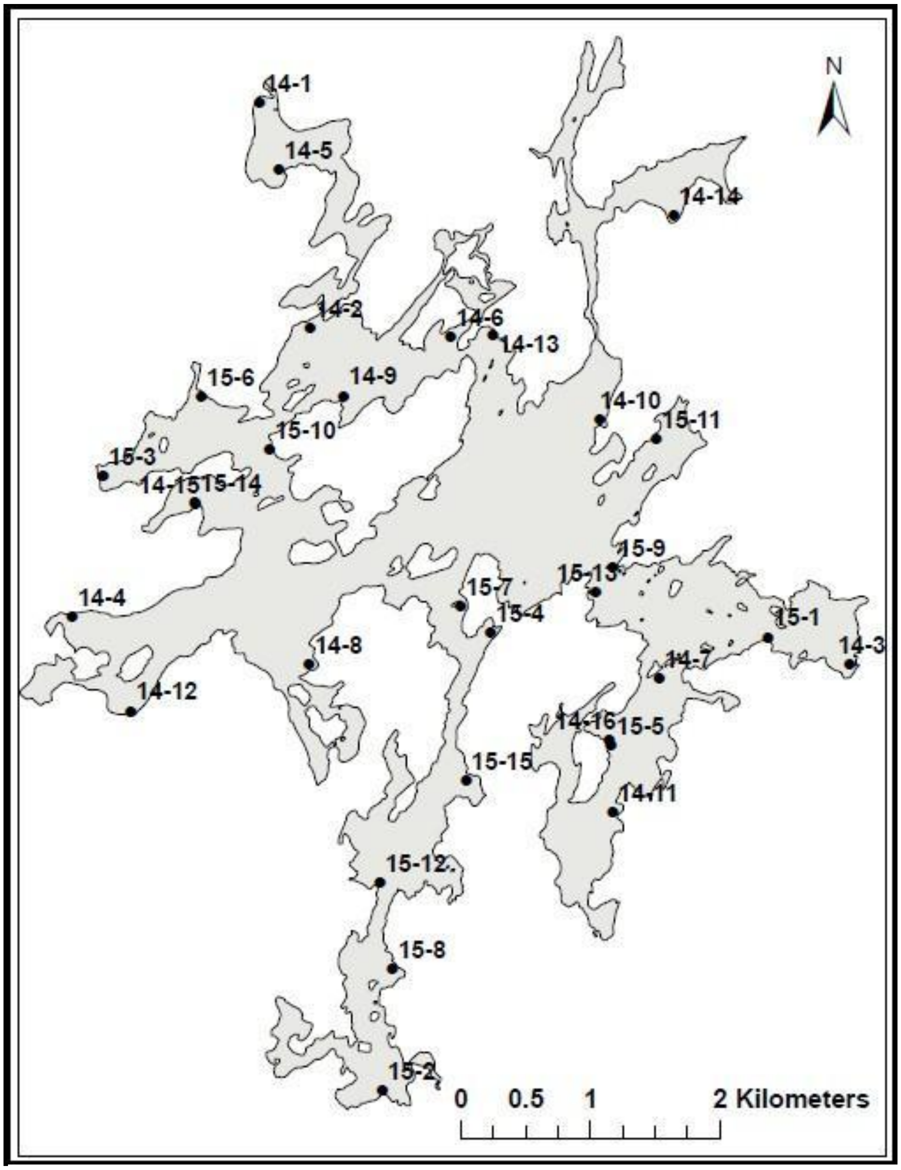

Figure 27. Manitouwabing Lake trap net set locations, NSCIN 2014-2015.

By both number and weight, brown bullhead was the most abundant species (average 16.4/net, 7.4kg/net). Of the large game fish, smallmouth bass were the most abundant by number and weight (3.0/net, 2.0kg/net). Northern pike (0.8/net, 1.1kg/net), largemouth bass (1.0/net, 0.8kg/net), and walleye (1.1/net, 1.6kg/net) were all caught at similar rates but varied more in their total weights due to differences in average size of each species. Black crappie were the most numerous game fish overall (4.9/net), but accounted for less weight (1.2kg/net). Finally, white sucker, rock bass, and pumpkinseed made up the remainder of the catch (Figure 28). Table 5 presents a summary of size and age ranges for each game fish species as well as an indication of growth rate.

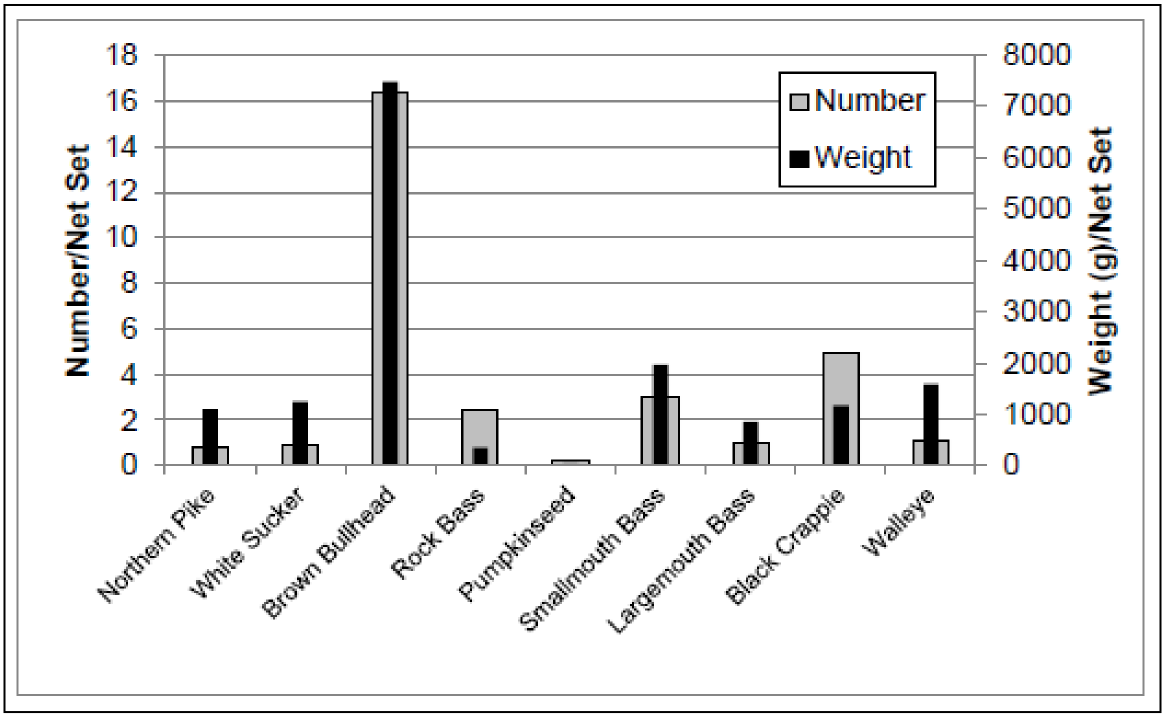

Figure 28. Catch summary by number (wide bars, left vertical axis) and weight (narrow bars, right vertical axis) for Manitouwabing Lake NSCIN 2014-2015 (Scholten, 2020).

Table 5. Summary of game fish species' lengths, ages, and growth rates (Scholten, 2020).

	Walleye	Northern pike	Smallmouth bass	Largemouth bass	Black crappie
Min fork length (mm)	249	337	160	180	115
Max fork length (mm)	672	840	444	431	315
Mean fork length (mm)	487	559	325	347	232
Min age (years)	2	1	1	1	1
Max age (years)	19	8	12	9	5
Mean age (years)	7.7	4.3	6.1	3.1	2.7
Growth rate	Above average	Below average	Above average	Above average*	Above average

*The observed growth rate of largemouth bass was very rapid; above maximum values observed elsewhere in the province.

The 2014-2015 NSCIN report (Scholten, 2020) summarizes that overall, catch composition and abundance of the major game fish species caught were similar to previous surveys, other than the appearance of black crappie (Figure 29). While black crappie had been reported to occur in the lake previously, they did not occur when the last MNR survey was conducted in 2004. Since being illegally introduced to the lake, back crappie have become a major component of the fish community as evidenced by the fact that they were the second most commonly caught species by number. Several species previously documented were not caught during the 2014-2015 sampling including yellow perch, lake whitefish, cisco, and common carp.

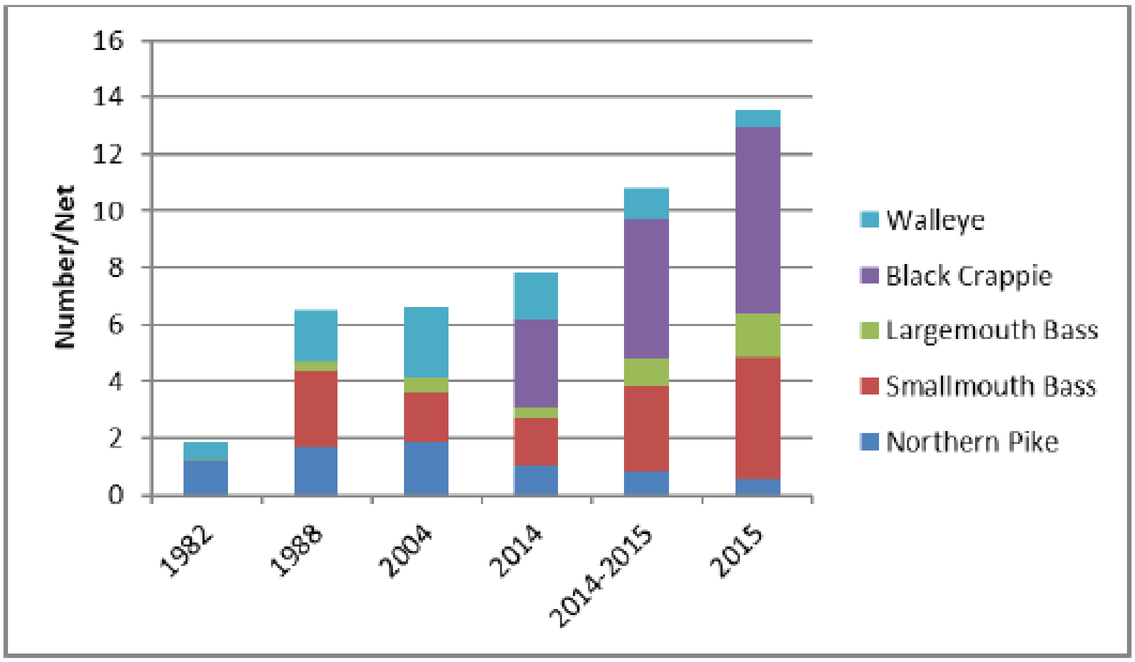

Figure 29. Catch rate (number/net) of major game fish species from 6' trap nets in Manitouwabing Lake, by year (Scholten, 2020).

The overall catch rates of northern pike and walleye in 2014-2015 were somewhat lower than in the past. Smallmouth bass, on the other hand, had a higher catch rate than observed in 1988 and 2004, but not to the point of concluding that a long-term trend has occurred. Largemouth bass catch rate has increased with each successive survey reflecting a real long-term increase in abundance. Brown bullhead catch has shown the greatest variation over surveys; none were caught in 6' trap nets in 1982, extremely large numbers were caught in 1988 and 2004, and a decrease occurred in 2014-2015 (Figure 30). Scholten (2020) states that the implications of changing bullhead abundance on other members of the fish community is unclear but that a real decline in abundance more recently may ease competitive interactions with other species.

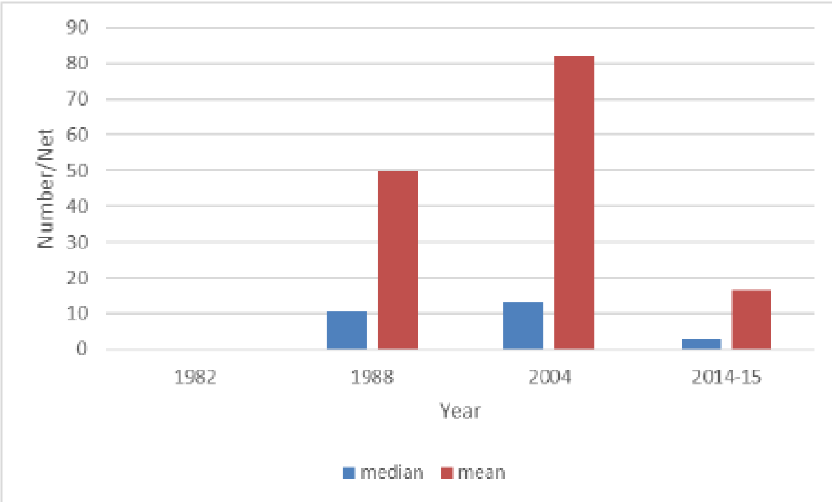

Figure 30. Mean and median catch of brown bullhead from 6′ trap nets in Manitouwabing Lake, by year (Scholten, 2020).

Based on the findings from the 2014-2015 NSCIN project, it was determined that Manitouwabing Lake should be "managed as a natural walleye lake and supplemental stocking should not be done" (Scholten, 2020, p. 15). Provincial guidelines recommend that stocking of a species not occur when a viable self-sustaining population is present (OMNR, 2002). Furthermore, the report recommends that "no lake-specific management actions take place at this time" (Scholten, 2020, p. 15).

3.3 Consumption Advisories

Consumption advisories or restrictions on fish are commonplace across jurisdictions in North America. Fish are exposed to, and absorb, contaminants in the water in a variety of ways (e.g., consuming contaminated food, absorption from the water as it passes over their gills). Contaminants found in fish can come from local sources, as well as sources from thousands of kilometers away (e.g., airborne contaminants that end up in the water via rain or snowfall). Examples of contaminants that are known to be transported long distances include mercury, polychlorinated biphenyls (PCBs), and toxaphene.

Based on species, size, and location, certain fish are more or less suitable to eat than others. Smaller fish tend to be less contaminated than larger fish of the same species. In the Great Lakes, leaner fish (e.g., bass, pike, walleye, perch, panfish) tend to have much lower contaminants than fatty species like trout and salmon. In inland lakes, top-predatory fish such as pike and walleye generally have greater contaminants than panfish or whitefish.

Advisories provide consumption advice for the general population and sensitive populations. The sensitive population includes women of child-bearing age (women who intend to become pregnant or are pregnant) and children younger than 15 years of age. These groups are considered sensitive because pregnant women and nursing mothers can affect the health or their baby through a diet elevated in contaminants, and young children are affected by contaminants at lower levels than the general population.

In terms of advisories for eating fish from Manitouwabing Lake, mercury is the contaminant of concern (Table 6). Specifically, advisories exist for black crappie, northern pike, and walleye due to concerns around mercury. To learn more about fish consumption advisories and how to reduce the risk from contaminants in fish, please visit the MECP website on eating Ontario fish.

Table 6. Fish consumption advisories for Manitouwabing Lake (see link).

Species	General Population	Sensitive Population*
Black crappie[1]	• max 32 meals/month of fish 20-25cm • max 12 meals/month of fish 25-30cm	• max 12 meals/month of fish 20-25cm • max 4 meals/month of fish 25-30cm
Northern pike[1]	• max 16 meals/month of fish 30-35cm, 35-40cm, and 40-45cm • max 12 meals/month of fish 45-50cm • max 8 meals/month of fish 50-55cm, 55-60cm, and 60-65cm • max 4 meals/month of fish 65-70cm, 70-75cm, and >75cm	• max 8 meals/month of fish 30-35cm and 35-40cm • max 4 meals/month of fish 40-45cm, 45-50cm, 50-55cm, and 55-60cm • no meals of fish >60cm
Walleye[1]	• max 8 meals/month of fish 25-30cm and 30-35cm • max 4 meals/month of fish 35-40cm, 40-45cm, and 45-50cm • max 2 meals/month of fish 50-55cm, 55-60cm, and 60-65cm • no meals of fish >65cm	• max 4 meals/month of fish 25-30cm • no meals of fish >30cm

* People who are pregnant or may become pregnant and children under 15; [1] Mercury

4. Summary of Recommendations

4.1 Water Quality

Continue annual LPP sampling. If capacity is limited, preference should be given to sites that are spread across different areas of the lake and that have the longest datasets. Long-term datasets are important to assess the effect of external drivers on the nutrient status of the lake (Clark, 2018). Suggested sites are Station 2973, Site IDs 8, 9, 13, and 18.

Continue with annual benthic sampling to accurately characterize and track trends in the benthic community in the lake. Lakes in the region are experiencing increasing pressures, such as climate change, invasive species, and development. It is important to continue monitoring water quality even in lakes considered to be healthy so that if/when changes start to occur, those changes are noted and appropriate actions can be taken swiftly (e.g., stewardship actions, enhanced monitoring or studies). Without long-term, continuous monitoring, changes in the benthic community and water quality more broadly may go unnoticed until there is a significant problem.

Continue with the additional water quality monitoring that was started on Manitouwabing Lake in the fall of 2022. Reporting out to the public on results of the monitoring in a way that is understandable and meaningful for a general audience is very important. Continue providing water quality testing reports to Council and consider using the Lake Stewardship and Environmental Committee Facebook page as another means of sharing results with the general public for increased engagement.

Should the MLCA wish to continue with bacteria monitoring, it should happen in the framework of a scientific investigation focused on testing specific hypotheses on potential sources of contamination through a focused sampling program. For example, recreational sites (e.g., beaches) could be considered for bacteria monitoring as per the province's Beach Management Guidance Document.

4.2 Fish Communities

The MLCA has joined the "Let's Get the Lead Out Campaign" to raise awareness and encourage anglers to make the switch to non-toxic tackle.

As part of their efforts, the MLCA has launched a local exchange program where anglers can bring old lead tackle to one of two drop off locations for proper disposal. Drop off locations are the MLCA booth at the McKellar Market and the McKellar Public Library. In return, participants receive:

- A $10 voucher to be used on a purchase of lead-free tackle products at Canadian Tire in Parry Sound;
- A draw ticket for fishing gear and a loon painting; and
- All kids receive a loot bag.

This campaign is a practical, positive way to remove toxic fishing gear from circulation and reward anglers who choose conservation-minded alternatives.

The province of Ontario released new regulations for the sale and possession of live bait in July 2020, anglers should familiarize themselves with these changes to remain in compliance with the new regulations at all times. Highlights include:

- A valid fishing license is required to catch your own live baitfish, leeches, crayfish, and northern leopard frogs.
- There are specific fish species that can and cannot be used as bait in Ontario (see permitted list of baitfish here).
- Bait can only be caught in your home Bait Management Zone (BMZ) and cannot leave your BMZ.
- Baitfish and leeches you catch cannot be sold unless you are a licensed dealer.
- If you fish outside your home BMZ, you must buy your baitfish and leeches locally, keep a receipt, and use or dispose of your bait within two weeks of the purchase date.

The app MyCatch by Angler's Atlas can be used by people fishing on the lake to log fishing trips and share fishing data confidentially with biologists. Use of the app can help supplement fisheries data between MNR population surveys.

4.3 Stewardship Activities

MLCA should continue to encourage Manitouwabing Lake property owners to maintain and/or restore natural shorelines. GBB's Planting for Pollinators guide offers property owners assistance in choosing plants for their property that are native to eastern Georgian Bay and that help to enhance the property and conserve important natural habitats. Native plants can be sourced from the MLCA Native Plant Seedling Sale and the annual GBB Native Plant Fundraiser (check the GBB events page in the spring).

Property owners interested in decreasing their ecological footprint can also utilize GBB's Life on the Bay Stewardship Guide. The guide covers a range of topics including how to live with wildlife, how to use landscaping to improve water quality, best practices during construction, how to store chemicals and garbage, and many more. The Life on the Bay guide is designed to be used by waterfront property owners on Georgian Bay and inland lakes.

There are many citizen science programs for interested cottagers and residents to get involved in. Examples include invasive species reporting, IceWatch, FrogWatch, Canadian Lakes Loon Survey, and many others.

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For more information, please visit:
generationseffect.com

info@generationseffect.com
705-773-2286
PO Box 662
Parry Sound ON,
P2A 2Z1