Benthic Monitoring Report

Seguin Township Lakes

Author

generations effect

November 2024

Prepared For

Seguin Township

generations effect

Sustainable Solutions
Practical Results

TABLE OF CONTENTS

INTRODUCTION

In 2019, Seguin residents requested that Seguin Township staff and Council consider initiating a benthic monitoring program to complement the township's existing water quality monitoring program focused on chemical parameters of water quality (e.g. total phosphorus, dissolved organic carbon). The resulting benthic monitoring program created by Seguin Township, in partnership with Generations Effect (a social enterprise of the Georgian Bay Mnidoo Gamii Biosphere), aims to determine the ecological condition of 10 lakes, monitor them over time, and compare them to similar lakes in the Parry Sound-Muskoka District. Monitoring began in 2020 and has continued each summer (monitoring locations shown in Figure 1, monitoring dates listed in Appendix A).

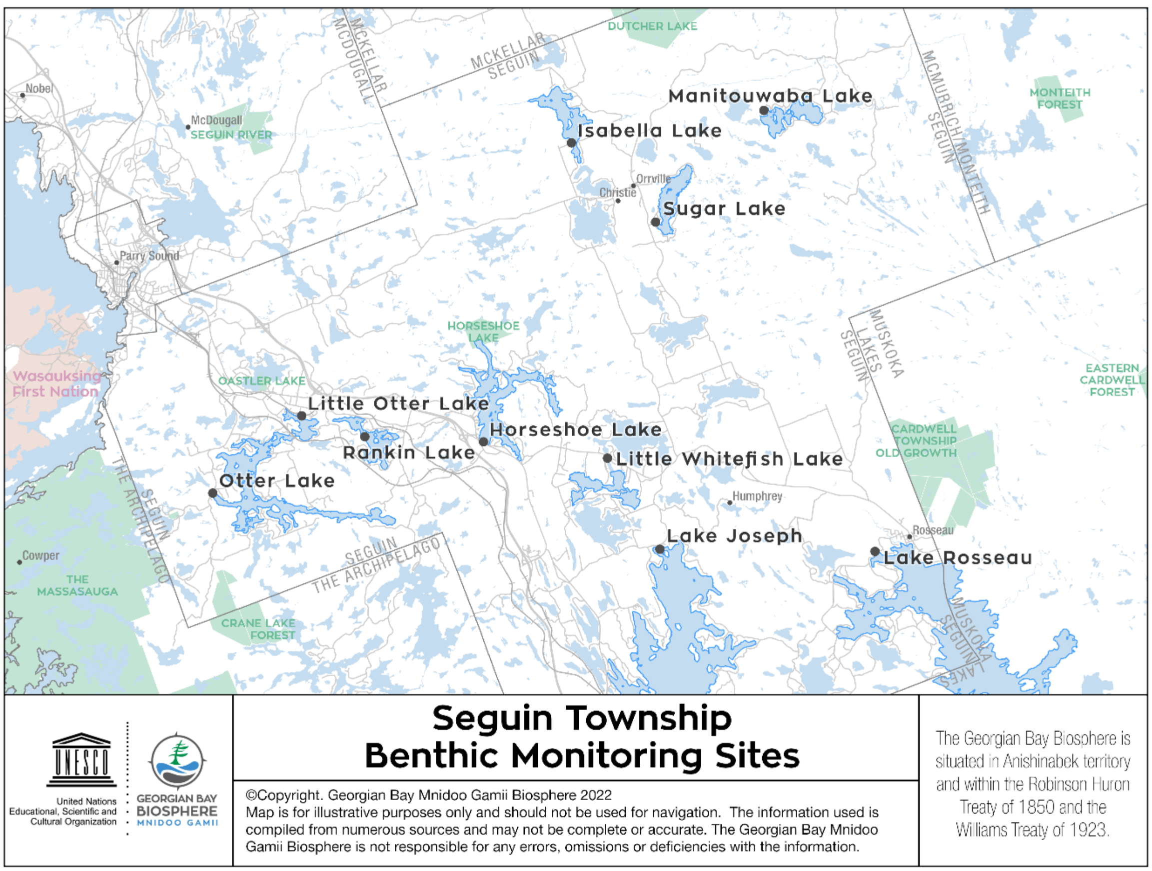


Figure 1. Benthic macroinvertebrate monitoring locations on 10 lakes across Seguin Township.

BENTHIC MONITORING

OVERVIEW

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 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, Seguin Township monitors 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. What must then be understood is the impact of 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 nonpoint 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 2 shows examples of benthic macroinvertebrates found in lakes in this area with their accompanying pollution tolerances.

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).

Finally, benthic macroinvertebrates are 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.

Figure 2. Benthic macroinvertebrates found in Seguin Township lakes and their pollution sensitivities.

MONITORING PROTOCOL

Certified Generations Effect staff oversee benthic macroinvertebrate sampling alongside Seguin Township staff using the standardized Ontario Benthos

Biomonitoring Network (OBBN) protocol for lakes. Three shallow, nearshore areas representative of each lake are selected as test sites (referred to as "lake segments" in the protocol) and sampled each year 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. Using a net, the dislodged material is collected and placed in a bucket. Subsamples from the collected material are then processed with individual benthos counted and identified (video available here). Benthos are identified as belonging to one of 27 different groups, ranging in sensitivity to water pollutants.

INTERPRETING RESULTS

The objectives of the benthic monitoring are to characterize the benthic community of each lake and compare it to lakes in the Parry Sound-Muskoka District to determine whether the benthic community 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 Dorset Environmental Science Centre 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 3 and is used for analysis in this report.

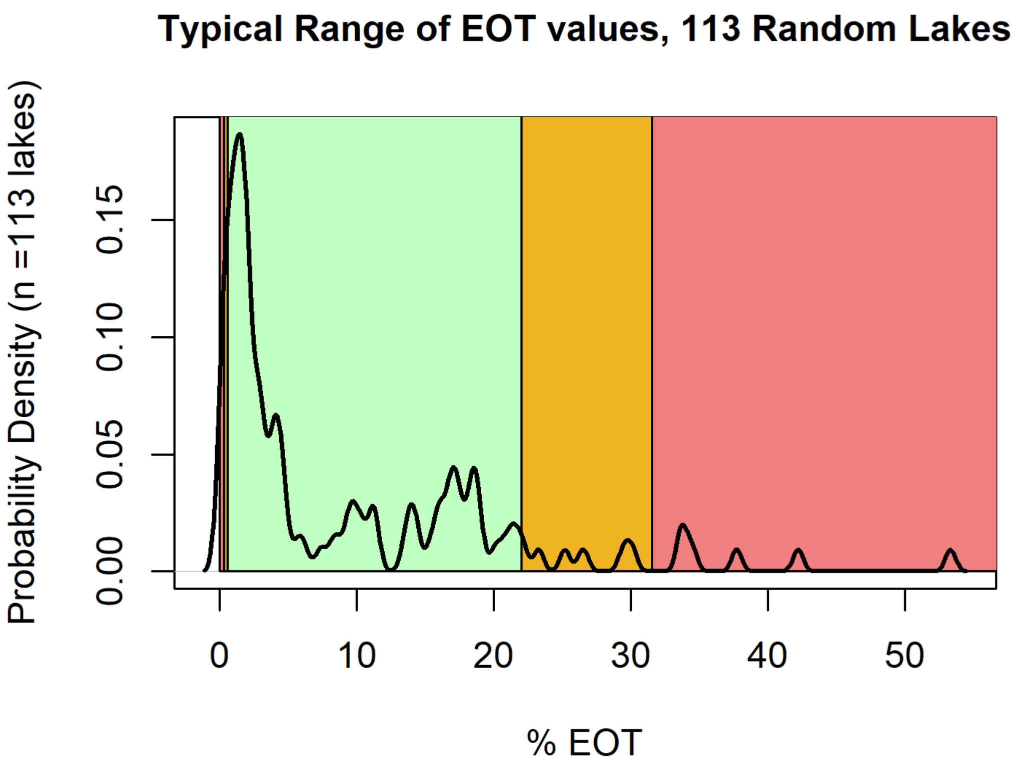


Figure 3. Range of %EOT values of sampled lakes in the region from 2012 to 2017. Typical is shown in green which is between the 10th and 90th percentile (%EOT between 0.55 and 20.99). Atypical is shown in orange which is between the 5th and 10th percentile (%EOT between 0.3 and 0.54) and 90th and 95th 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).

Following the methodology used by MWC (2018), the average %EOT was calculated for each of the lakes sampled in the township. The average %EOT for each lake was then compared to the normal range (Figure 3) to determine whether a 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.

RESULTS

Each lake has one site (three lake segments) that has been sampled annually since 2020, with the exception of Little Otter Lake and Otter Lake. Little Otter Lake has had one site sampled annually since 2019. Otter Lake has had two sites sampled annually since 2019. Sampling in 2019 was completed on behalf of the Otter Lake Ratepayers' Association (OLRA). OLRA supports the sampling of the second site on Otter Lake each year.

The benthic communities in the 10 monitored Seguin Township lakes are considered typical for this region. Results for each individual lake are presented here, including figures depicting annual %EOT values and annual taxa counts. Raw data is available upon request. Please contact Katrina Krievins at kkrievins@generationseffect.com.

HORSESHOE LAKE

The %EOT for Horseshoe Lake falls within the normal range of what is expected for lakes in the region (Figure 4).

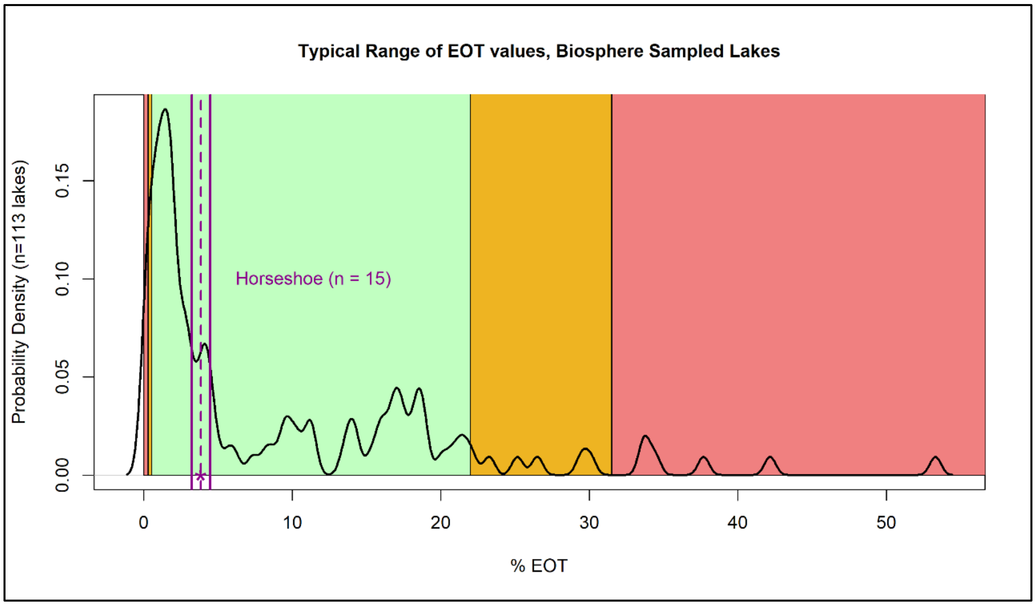


Figure 4. Horseshoe Lake average %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 5 years (n = 15) fall within the "typical" category (green area) on the typical %EOT range plot (based on 113 sampled lakes). This indicates that the Horseshoe Lake benthic community is typical of what is expected for a lake in this region.

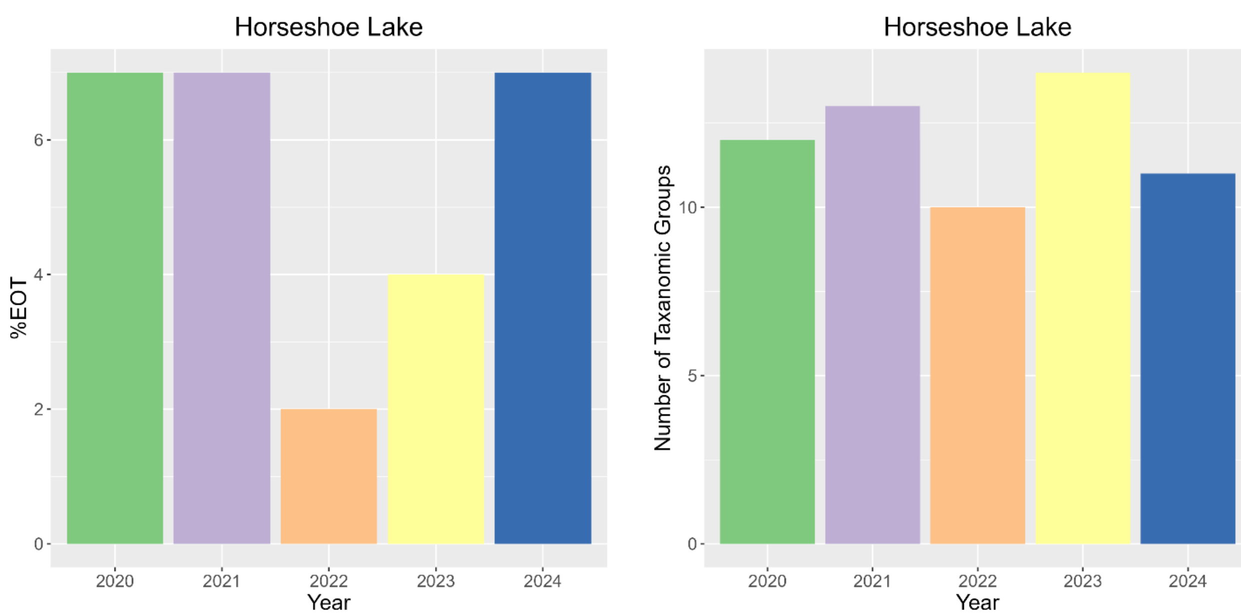


Figure 5. % EOT and the number of taxonomic groups in Horseshoe Lake from 2020 to 2024.

ISABELLA LAKE

The %EOT for Isabella Lake falls within the normal range of what is expected for lakes in the region (Figure 6).

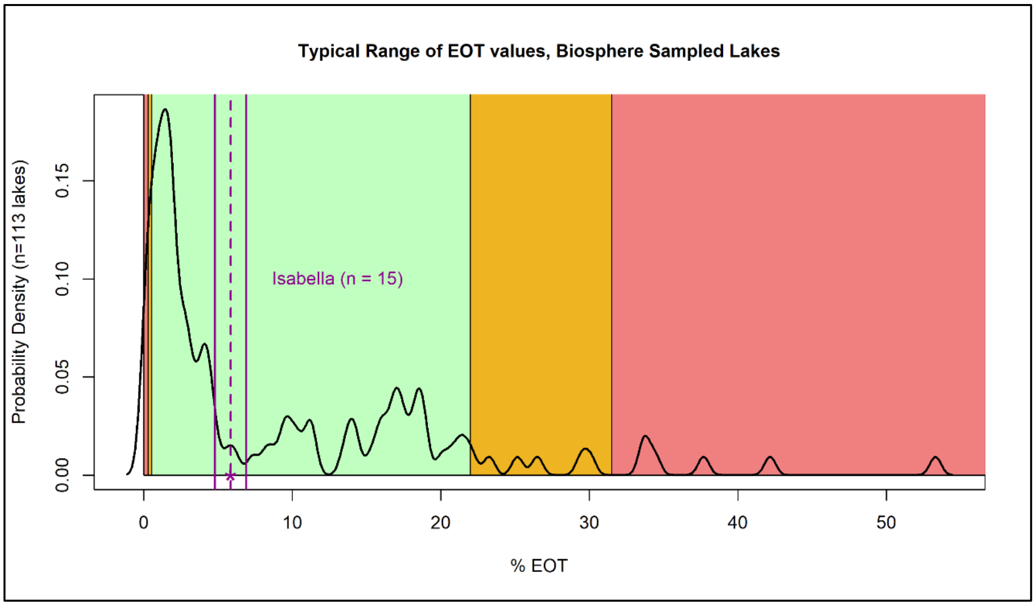


Figure 6. Isabella Lake average %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 5 years (n = 15) fall within the “typical” category (green area) on the typical %EOT range plot (based on 113 sampled lakes). This indicates that the Isabella Lake benthic community is typical of what is expected for a lake in this region.

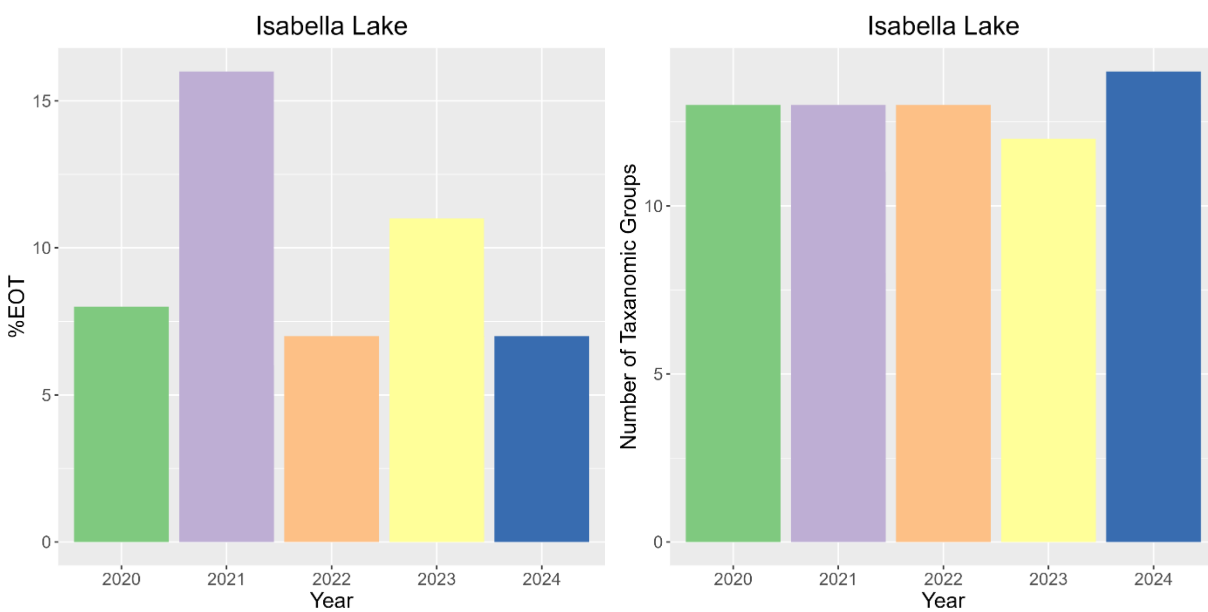


Figure 7. % EOT and the number of taxonomic groups in Isabella Lake from 2020 to 2024.

LAKE JOSEPH

The %EOT for Lake Joseph falls within the normal range of what is expected for lakes in the region (Figure 8).

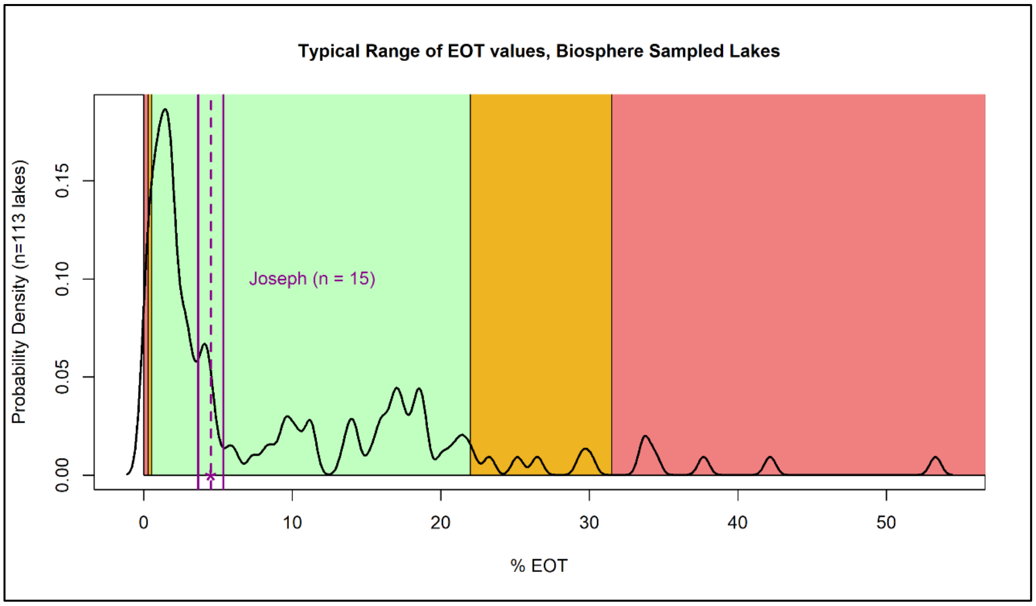


Figure 8. Lake Joseph average %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 5 years (n = 15) fall within the "typical" category (green area) on the typical %EOT range plot (based on 113 sampled lakes). This indicates that the Lake Joseph benthic community is typical of what is expected for a lake in this region.

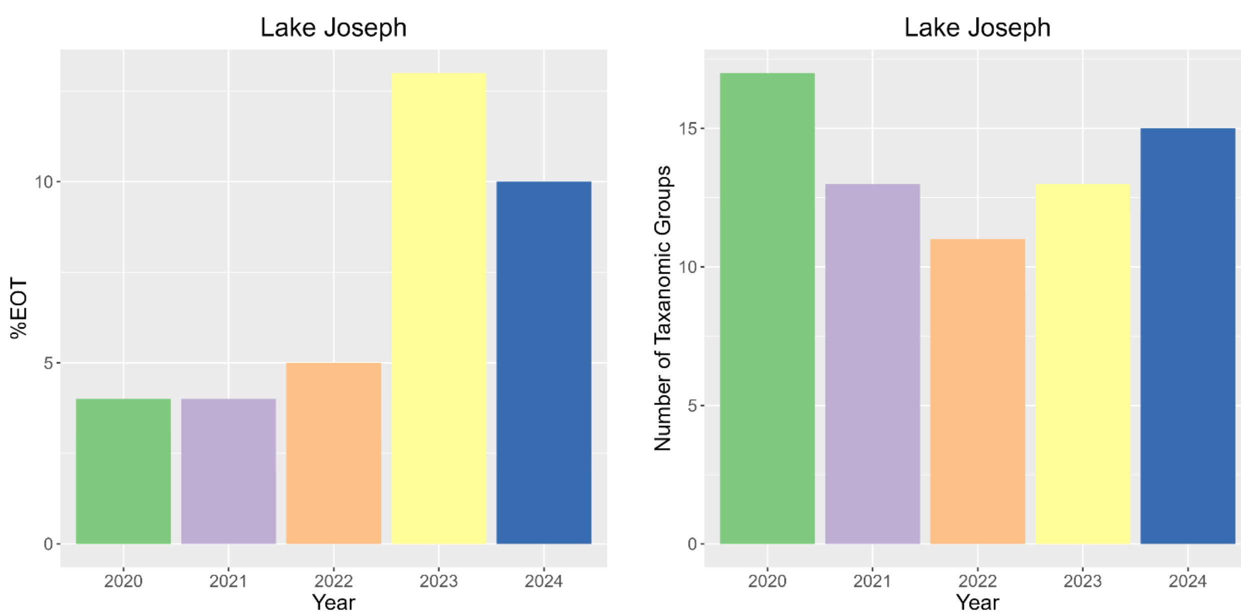


Figure 9. % EOT and the number of taxonomic groups in Lake Joseph from 2020 to 2024.

LAKE ROSSEAU

The %EOT for Lake Rosseau falls within the normal range of what is expected for lakes in the region (Figure 10).

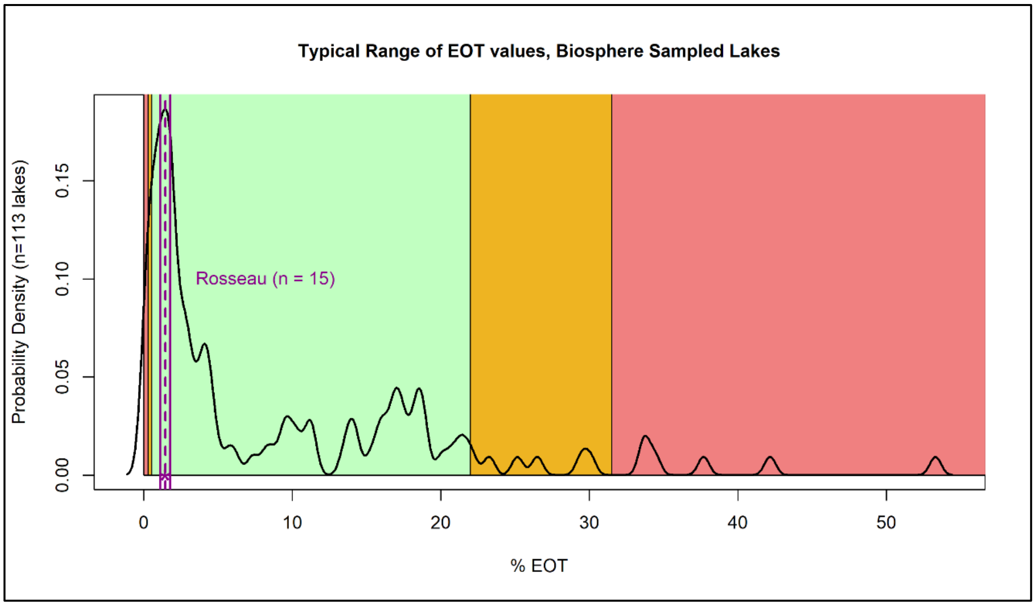


Figure 10. Lake Rosseau average %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 5 years (n = 15) fall within the "typical" category (green area) on the typical %EOT range plot (based on 113 sampled lakes). This indicates that the Lake Rosseau benthic community is typical of what is expected for a lake in this region.

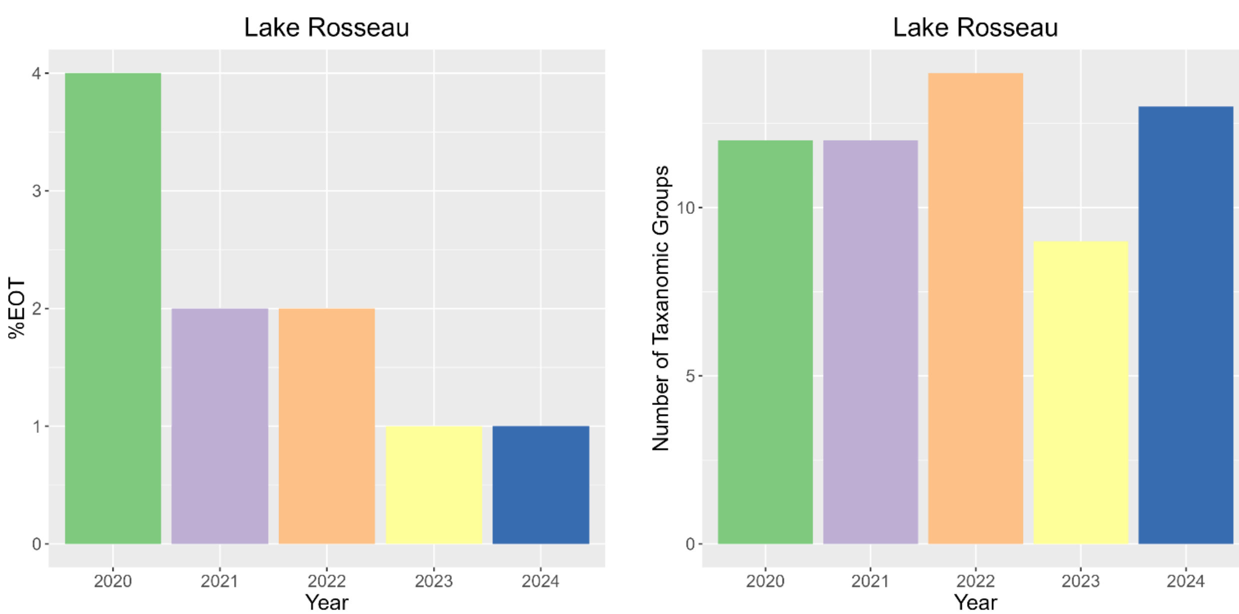


Figure 11. % EOT and the number of taxonomic groups in Lake Rosseau from 2020 to 2024.

LITTLE OTTER LAKE

The %EOT for Little Otter Lake falls within the normal range of what is expected for lakes in the region (Figure 12).

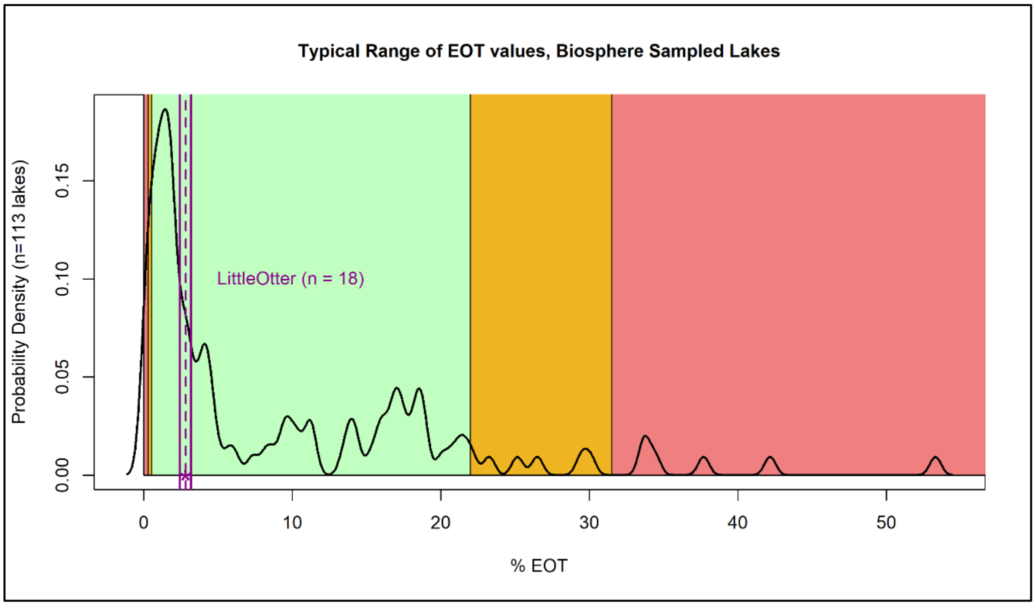
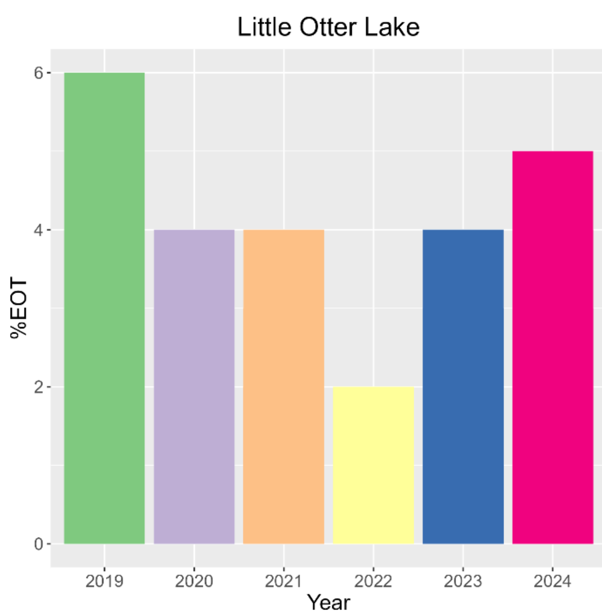


Figure 12. Little Otter Lake average %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 6 years (n = 18) fall within the "typical" category (green area) on the typical %EOT range plot (based on 113 sampled lakes). This indicates that the Little Otter Lake benthic community is typical of what is expected for a lake in this region.



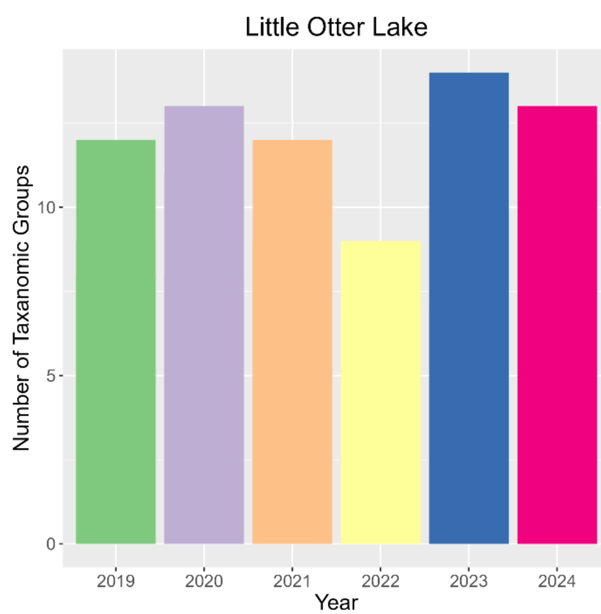


Figure 13. % EOT and the number of taxonomic groups in Little Otter Lake from 2019 to 2024.

LITTLE WHITEFISH LAKE

The %EOT for Little Whitefish Lake falls within the normal range of what is expected for lakes in the region (Figure 14).

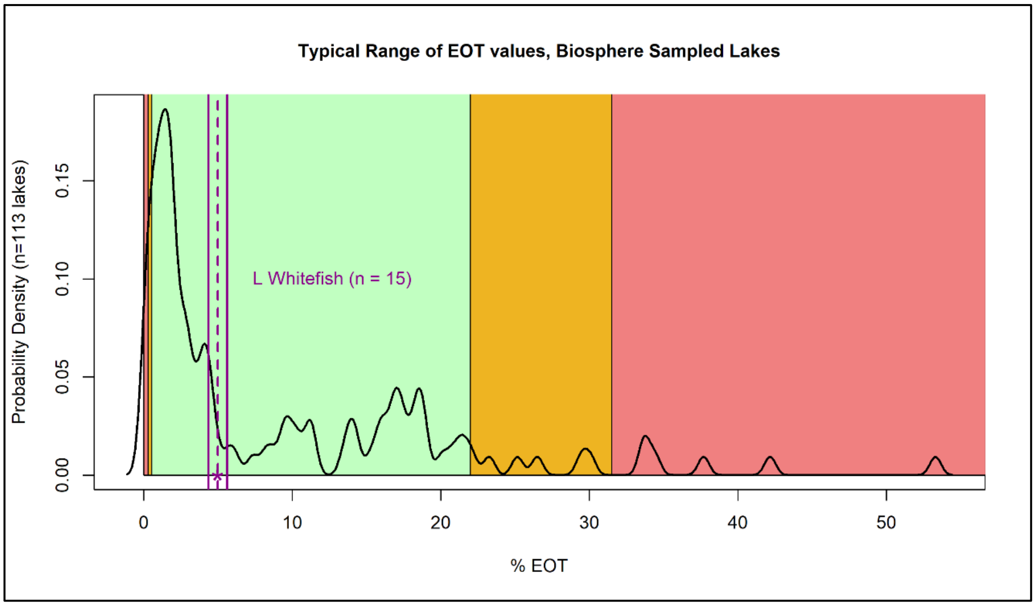


Figure 14. Little Whitefish Lake %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 5 years (n = 15) fall within the "typical" category (green area) on the typical %EOT range plot (based on 113 sampled lakes). This indicates that the Little Whitefish Lake benthic community is typical of what is expected for a lake in this region.

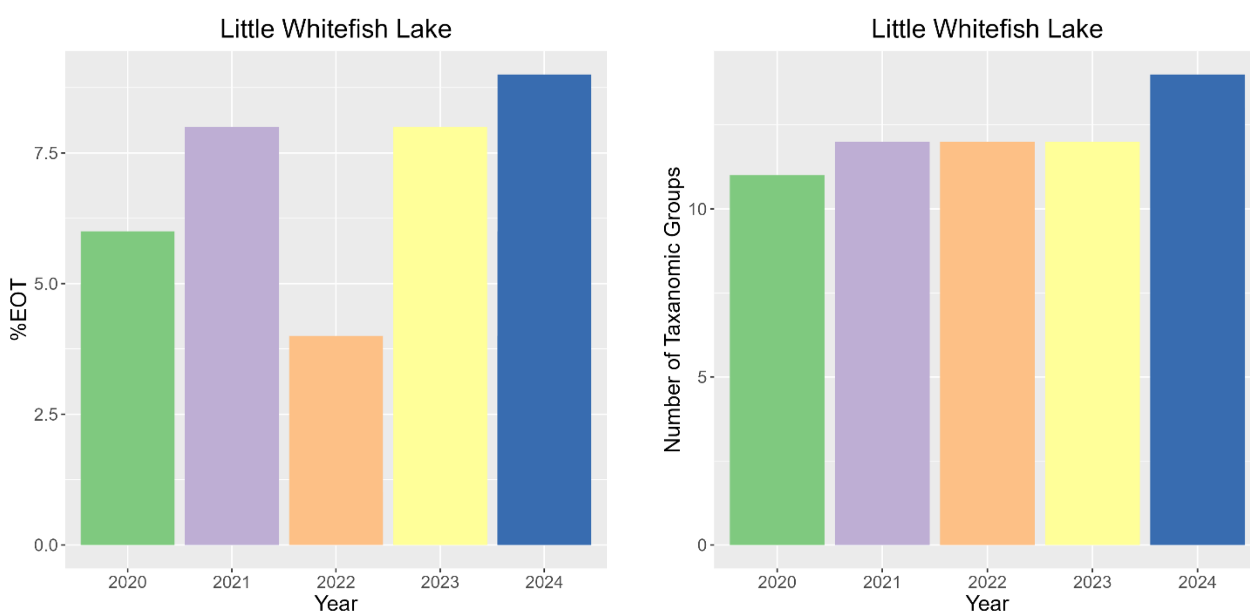


Figure 15. % EOT and the number of taxonomic groups in Little Whitefish Lake from 2020 to 2024.

MANITOUWABA LAKE

The %EOT for Manitouwaba Lake falls within the normal range of what is expected for lakes in the region (Figure 16).

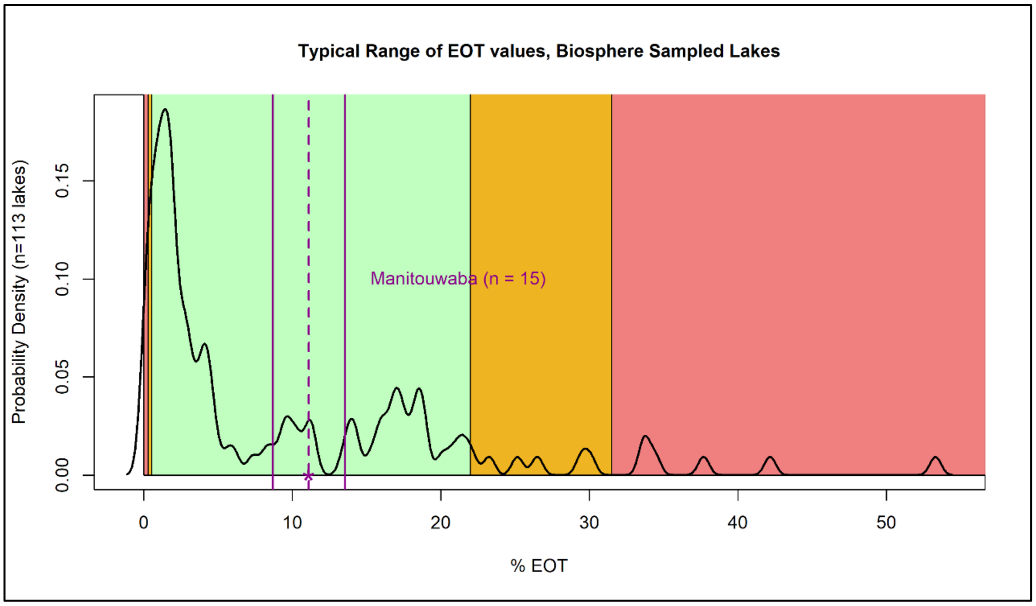


Figure 16. Manitouwaba Lake %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 5 years (n = 15) fall within the "typical" category (green area) on the typical %EOT range plot (based on 113 sampled lakes). This indicates that the Manitouwaba Lake benthic community is typical of what is expected for a lake in this region.

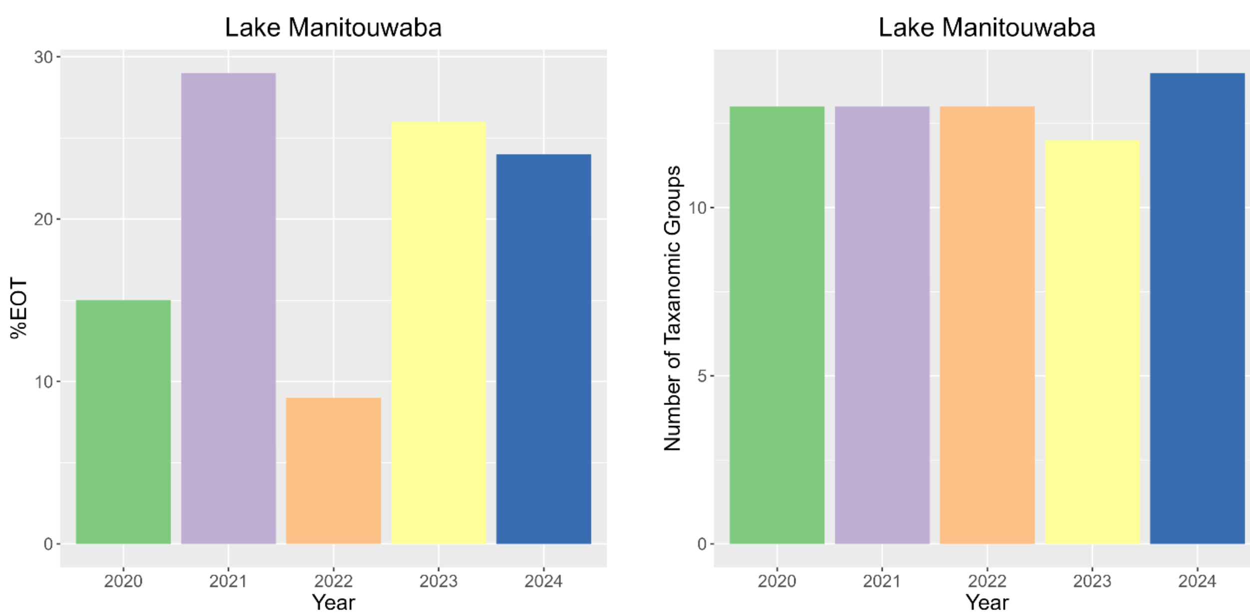


Figure 17. % EOT and the number of taxonomic groups in Lake Manitouwaba from 2020 to 2024.

OTTER LAKE

As shown in Figure 18 and Figure 20, the %EOT for site 1 and site 2 on Otter Lake falls within the normal range of what is expected for lakes in the region.

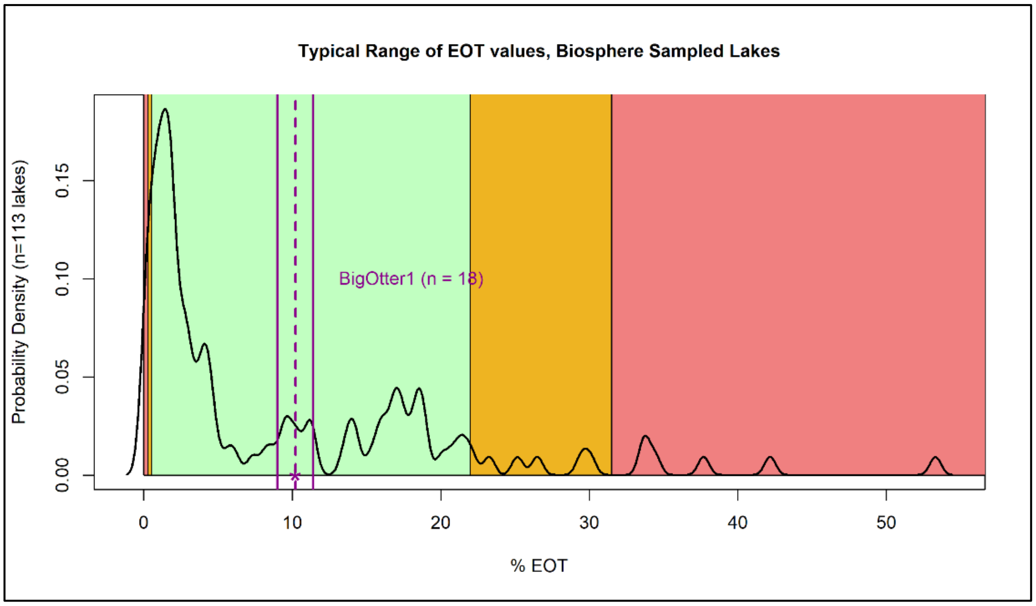


Figure 18. Otter Lake site 1 average %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 6 years (n = 18) fall within the "typical" category (green area) on the typical %EOT range plot (based on 113 sampled lakes). This indicates that the Otter Lake benthic community at site 1 is typical of what is expected for a lake in this region.

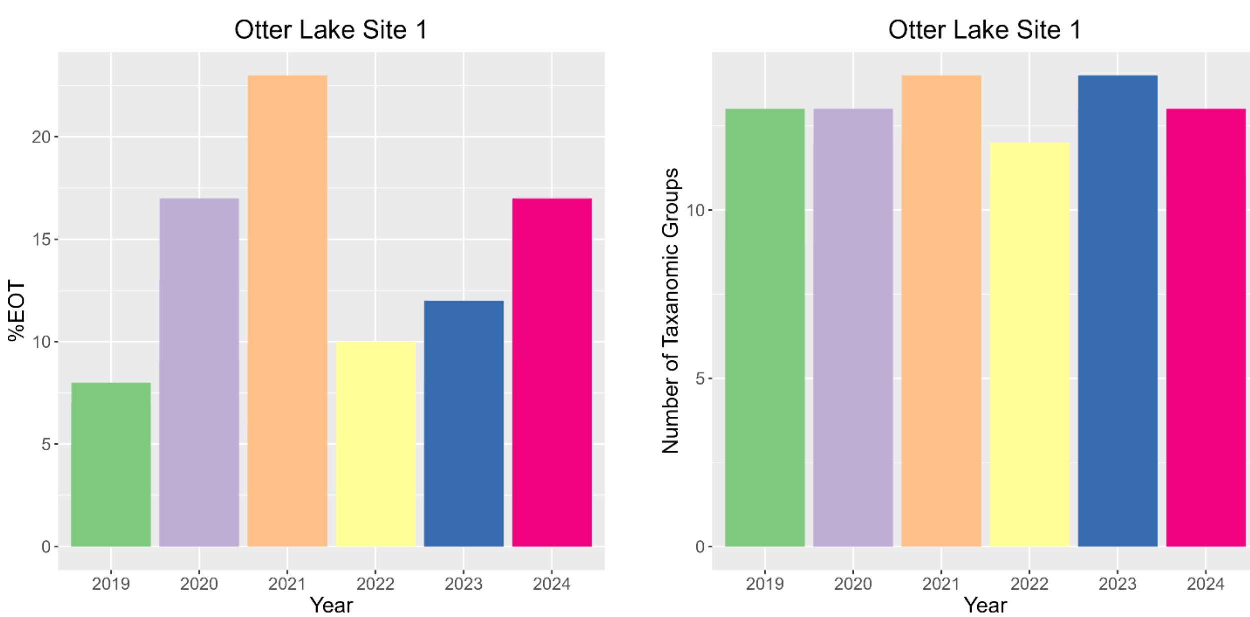


Figure 19. % EOT and the number of taxonomic groups at Site 1 on Otter Lake from 2019 to 2024.

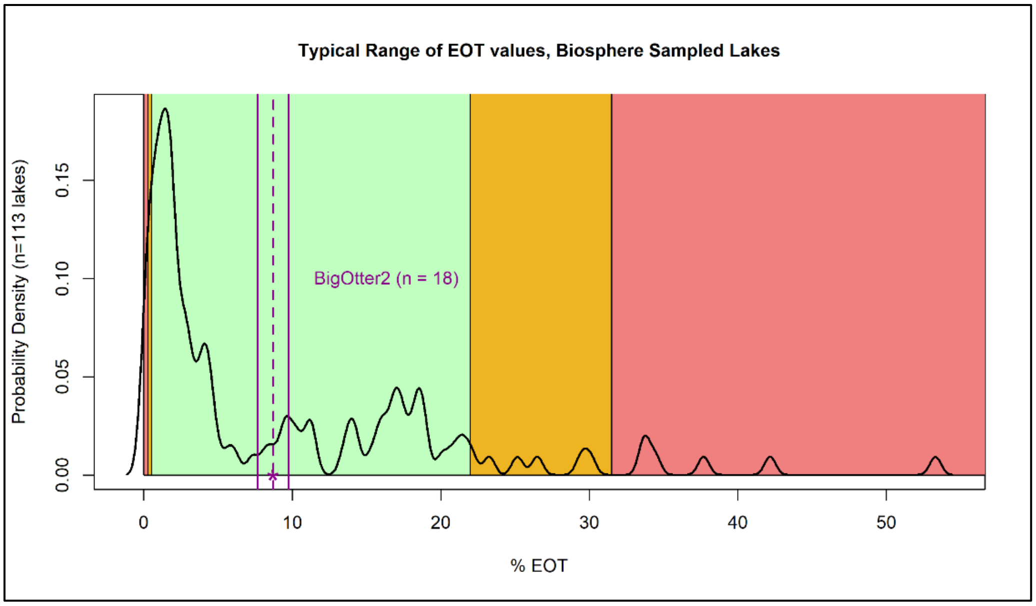


Figure 20. Otter Lake site 2 average %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 6 years (n = 18) fall within the "typical" category (green area) on the typical %EOT range plot (based on 113 sampled lakes). This indicates that the Otter Lake benthic community at site 2 is typical of what is expected for a lake in this region.

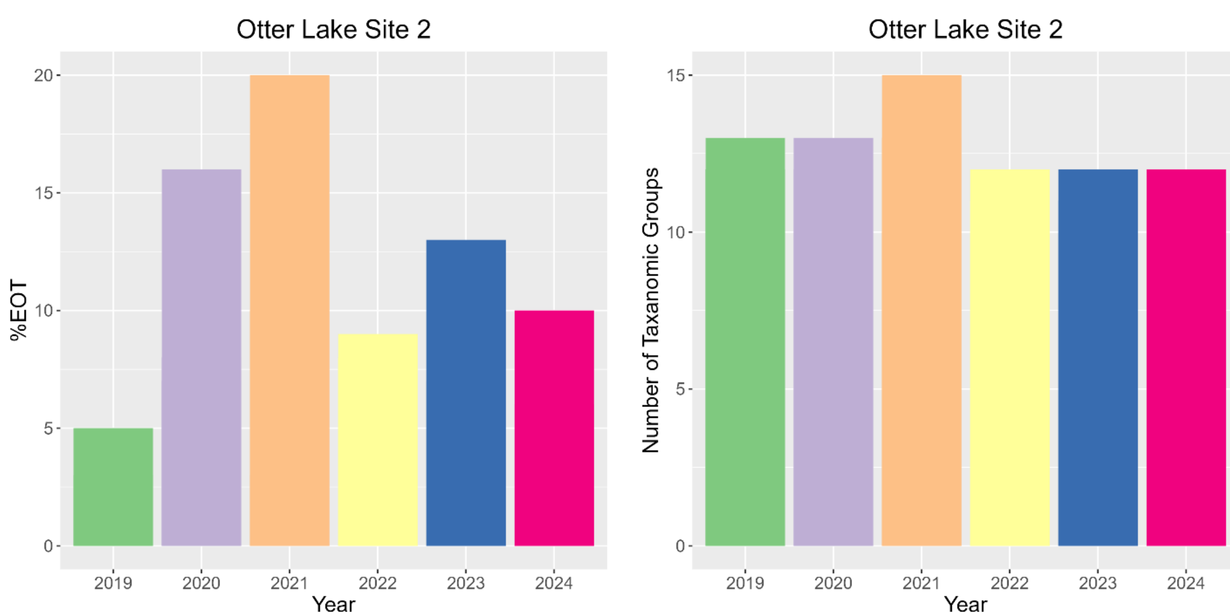


Figure 21. % EOT and the number of taxonomic groups at Site 2 on Otter Lake from 2019 to 2024.

RANKIN LAKE

The %EOT for Rankin Lake falls within the normal range of what is expected for lakes in the region (Figure 22).

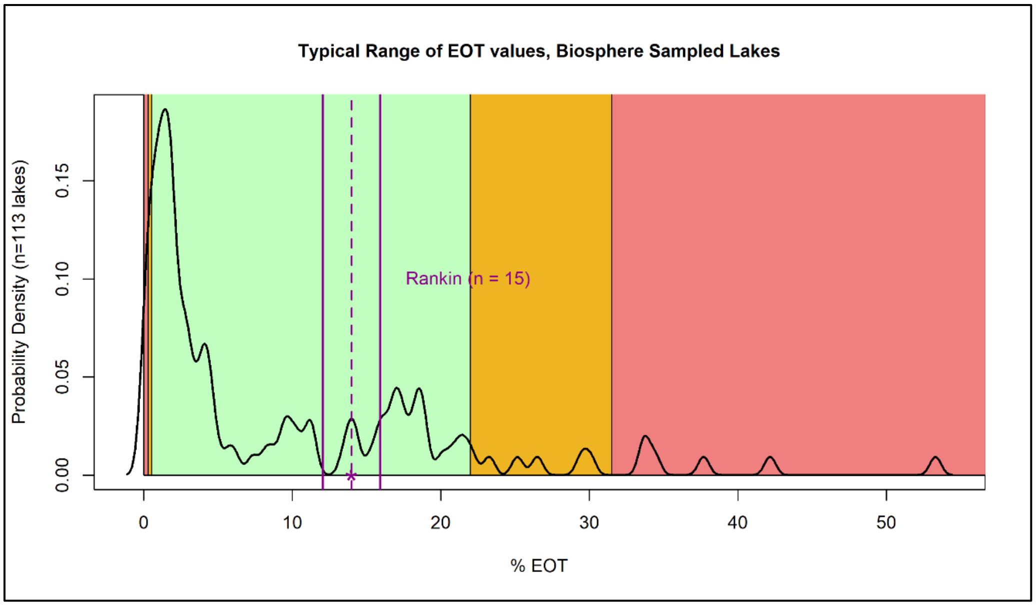


Figure 22. Rankin Lake average %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 5 years (n = 15) fall within the "typical" category (green area) on the typical %EOT range plot (based on 113 sampled lakes). This indicates that the Rankin Lake benthic community is typical of what is expected for a lake in this region.

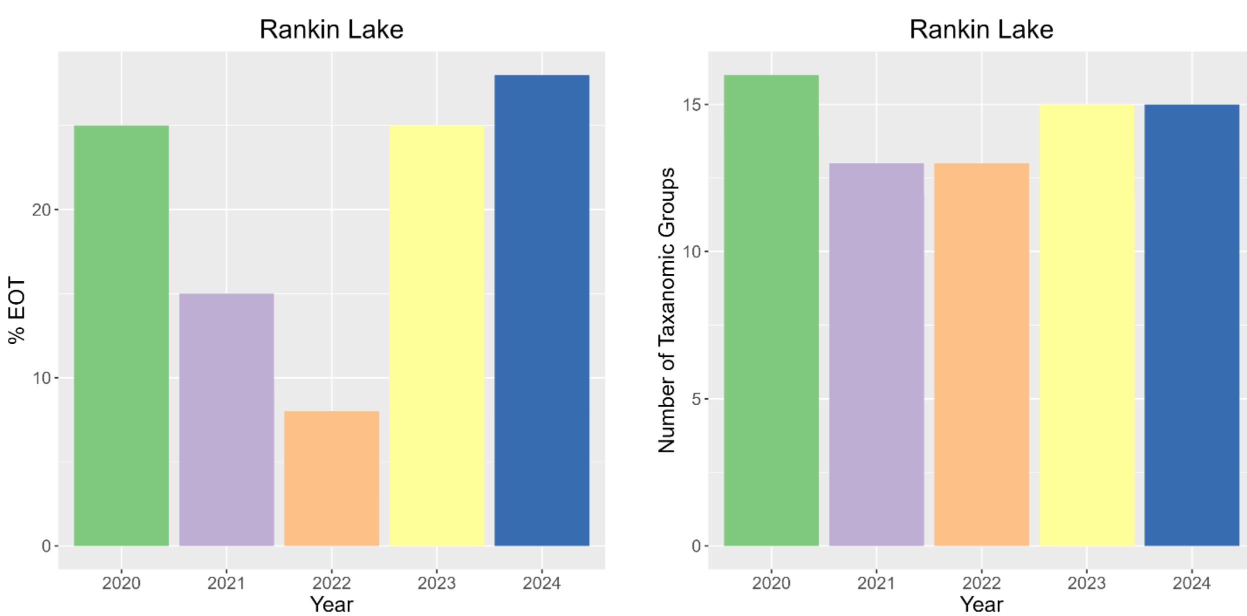


Figure 23. % EOT and the number of taxonomic groups in Rankin Lake from 2020 to 2024.

SUGAR LAKE

The %EOT for Sugar Lake falls within the normal range of what is expected for lakes in the region (Figure 24). While the average %EOT falls within the normal range, one standard deviation above average straddles the typical and atypical range. Some Sugar Lake samples may fall within the upper atypical range meaning some sites over some years may have a higher than normal %EOT. This will continue to be monitored in coming years.

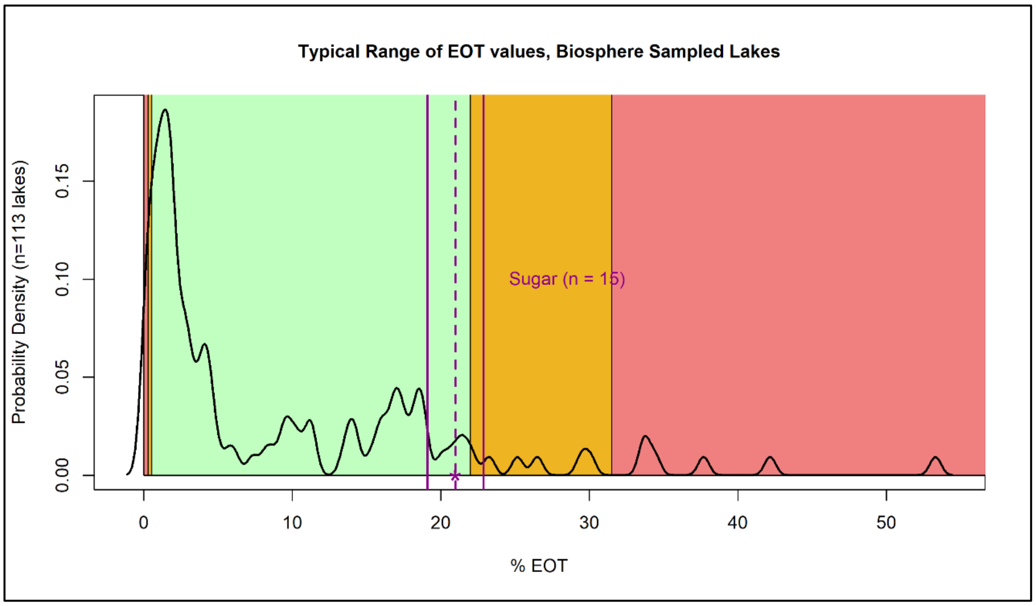


Figure 24. Sugar Lake average %EOT (dashed purple line) and standard deviation (solid purple line) sampled from 3 lake segments over 5 years (n = 15) fall within the "typical" category (green area) on the typical %EOT range plot (based on 113 sampled lakes). This indicates that the Sugar Lake benthic community is typical of what is expected for a lake in this region.

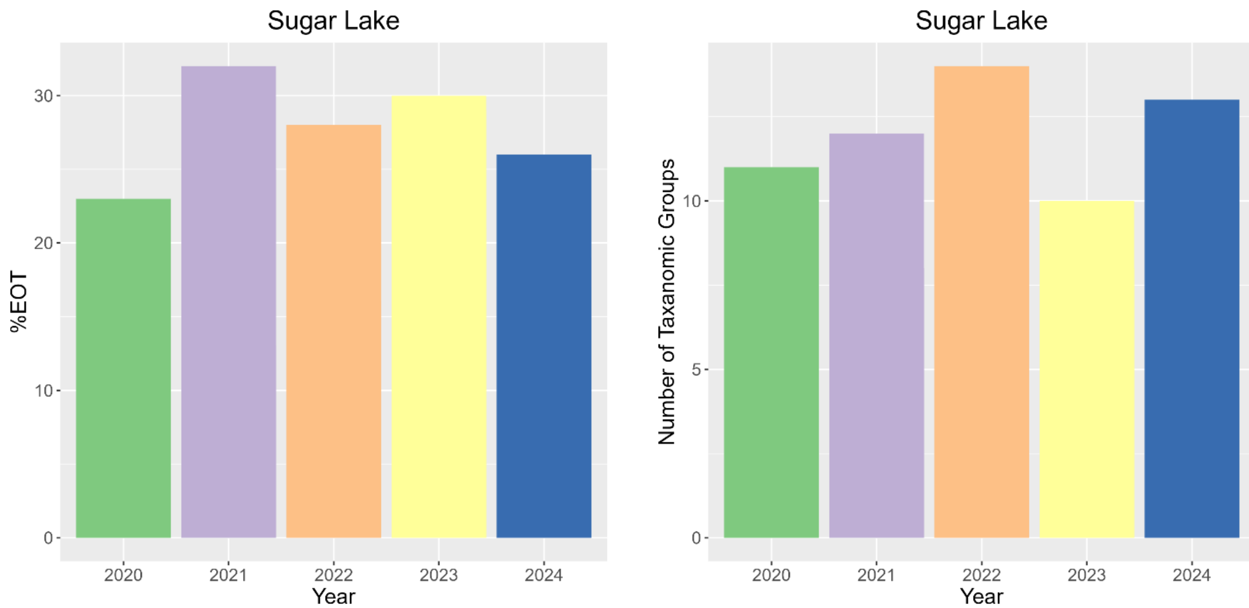


Figure 25. % EOT and the number of taxonomic groups in Sugar Lake from 2020 to 2024.

RECOMMENDATIONS

For all monitored lakes within Seguin Township, the recommendation is to continue with annual sampling to track trends over time and observe any notable shifts in the benthic community away from typical conditions.

While all of the 10 monitored lakes are currently considered to have 'typical' benthic communities, 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.

Finally, maintaining a benthic monitoring program is in direct alignment with the township's vision of prioritizing the environment, set out in the Strategic Plan: 2026 & Beyond. Seguin Township is one of a few townships in the province with a dedicated lake benthic monitoring program. This fact speaks to the township's commitment to the goal of maintaining and improving environmental quality in the region.

APPENDIX A

Monitoring Schedule

Lake	2020	2021	2022	2023	2024
Otter	05-Jul	05-Jul	03-Jul	03-Jul	03-Jul
Little Otter	06-Jul	06-Jul	05-Jul	05-Jul	04-Jul
Rankin	07-Jul	07-Jul	06-Jul	06-Jul	05-Jul
Little Whitefish	08-Jul	08-Jul	07-Jul	07-Jul	08-Jul
Joseph	09-Jul	09-Jul	08-Jul	10-Jul	09-Jul
Rosseau	10-Jul	12-Jul	11-Jul	11-Jul	10-Jul
Horseshoe	13-Jul	13-Jul	12-Jul	12-Jul	11-Jul
Manitouwaba	14-Jul	14-Jul	13-Jul	13-Jul	12-Jul
Isabella	16-Jul	15-Jul	14-Jul	14-Jul	15-Jul
Sugar	17-Jul	16-Jul	15-Jul	17-Jul	16-Jul

Thank You
Miigwech

generations effect
is a social enterprise rooted in the
Georgian Bay Mnidoo Gamii Biosphere.

We provide consulting services that advance ecological, social & economic well-being.

We give back to the communities in which we work, in support of the United Nations Sustainable Development Goals & Declaration on the Rights of Indigenous Peoples.

We know decisions made today
have an effect on generations to come.

For more information, please visit:
generationseffect.com

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