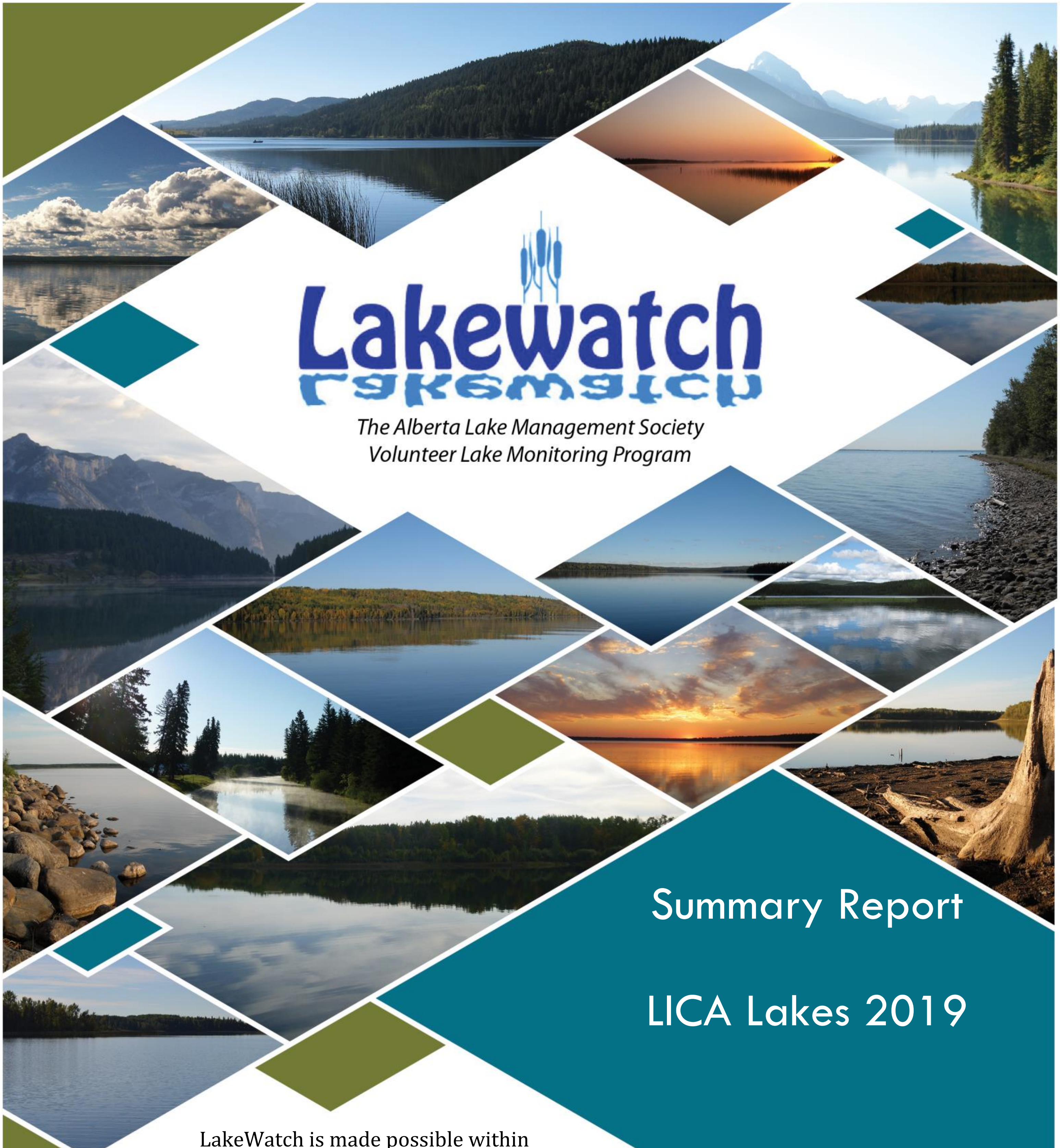


Lakewatch

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

Summary Report

LICA Lakes 2019

LakeWatch is made possible within the LICA region with support from:

Alberta

LICA ENVIRONMENTAL STEWARDS

ALBERTA LAKE MANAGEMENT SOCIETY'S LAKEWATCH PROGRAM

LakeWatch has several important objectives, one of which is to collect and interpret water quality data on Alberta Lakes. Equally important is educating lake users about their aquatic environment, encouraging public involvement in lake management, and facilitating cooperation and partnerships between government, industry, the scientific community and lake users. LakeWatch Reports are designed to summarize basic lake data in understandable terms for a lay audience and are not meant to be a complete synopsis of information about specific lakes. Additional information is available for many lakes that have been included in LakeWatch and readers requiring more information are encouraged to seek those sources.

ALMS would like to thank all who express interest in Alberta's aquatic environments and particularly those who have participated in the LakeWatch program. These leaders in stewardship give us hope that our water resources will not be the limiting factor in the health of our environment.

ACKNOWLEDGEMENTS

The LakeWatch program is made possible through the dedication of its volunteers. We would also like to thank Sarah Davis Cornet, Caleb Sinn, and Pat Heney, who were summer technicians in 2019. Executive Director Bradley Peter and Program Coordinator Caitlin Mader were instrumental in planning and organizing the field program. This report was prepared by Pat Heney, Bradley Peter, and Caleb Sinn.

INTRODUCTION

In 2019, ALMS received funding from through the Lakeland Industry and Community Association (LICA) and Alberta Environment and Parks, to conduct LakeWatch, a volunteer based water quality monitoring program, in the LICA region. Lakes sampled within the LICA region are part of the larger province-wide LakeWatch program, which included 26 lakes in 2019. This report presents data on only ten of these lakes within the LICA region.

SAMPLE RECORD

Three summer field technicians (Sarah Davis Cornet, Caleb Sinn, and Pat Heney) were hired in May of 2019 to conduct water quality sampling. ALMS completed a standard monitoring program at 10 lakes in the LICA region. From June through early October 2019, lakes were visited up to four times each. In 2019, 36 of 40 scheduled trips were completed. This resulted in a completion rate of 90% (Table 1). Missed trips were a result of volunteer unavailability, boat mechanical issues, and unsafe weather.

VOLUNTEERS

In 2019, across all 10 LICA lakes included in the LakeWatch program, ALMS worked with 20 unique volunteers for a total of 181 volunteer hours spent sampling lakes. Each year ALMS volunteers show outstanding dedication and commitment to the LakeWatch program.

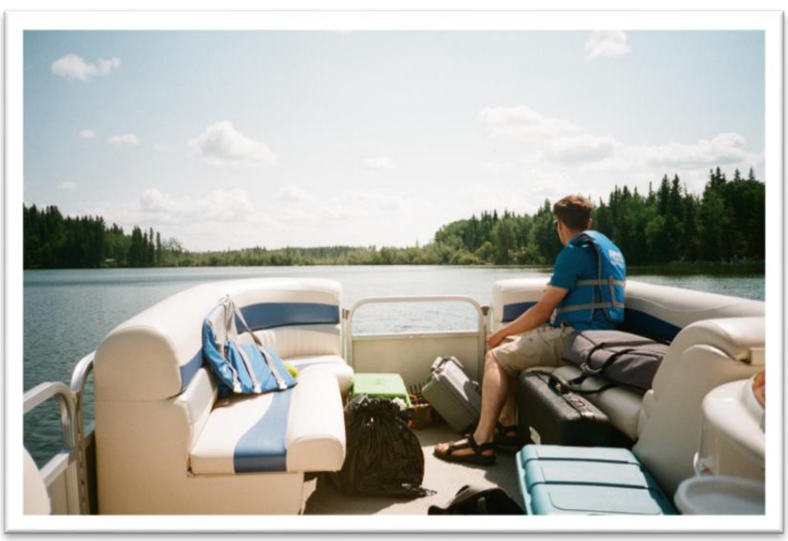
Kehewin Lake Volunteer Paul and his assistant Trapper

Table 1- The LICA LakeWatch sample completion record for 2019.

Lake	Trip 1	Trip 2	Trip 3	Trip 4
Crane	14-Jun	13-Jul	14-Aug	24-Sep
Kehewin	23-Jun	20-Aug	11-Sep	24-Sep
Laurier	21-Jun	17-Jul	4-Sep	-
Marie	13-Jun	12-Jul	13-Aug	4-Oct
Minnie	25-Jun	16-Jul	14-Aug	-
Moose	12-Jun	9-Jul	2-Aug	16-Sep
Muriel	3-Jun	3-Jul	6-Aug	5-Sep
Skeleton North	17-Jun	23-Jul	22-Aug	24-Sep
Skeleton South	17-Jun	23-Jul	-	-
Vincent	20-Jun	23-Jul	15-Aug	20-Sep

RESULTS

While ALMS collects a large suite of water chemistry parameters, this report will highlight the variability which exists across only a few of our major parameters: Secchi Depth, Total Phosphorus, Chlorophyll-a, and Microcystin. The variation within these parameters does not necessarily reflect a degree of lake management, for many factors outside of human control also impact lake water quality. The depth of the lake, the size of the drainage basin, lake order, and the composition of bedrock and sediment are just some of the factors which affect lake water quality and should be taken into consideration when reading these results.



Technician Caleb Sinn sampling Marie Lake in 2019

WATER CLARITY AND SECCHI DEPTH

Water clarity is influenced by suspended materials both living and dead, as well as dissolved colored compounds in the water column. During the melting of snow and ice in spring, lake water can become turbid (cloudy) from silt transported into the lake. Lake water usually clears in late spring but then becomes more turbid with increased algal growth as the summer progresses. The easiest and most widely used measure of lake water clarity is the Secchi disk depth. Two times the Secchi disk depth equals the euphotic depth – the depth to which there is enough light for photosynthesis.

Average Secchi depths within the LICA region in 2019 ranged from a minimum of 0.90 m at Skeleton Lake North to a maximum of 4.01 m at Crane Lake (Figure 1). Secchi depth averages were significantly negatively correlated with average chlorophyll-*a* concentrations across lakes (Kendalls' Tau-b, τ_b= -0.65, *p-value* = 0.04). This means that across all lakes, water turbidity was largely associated with algal blooms.

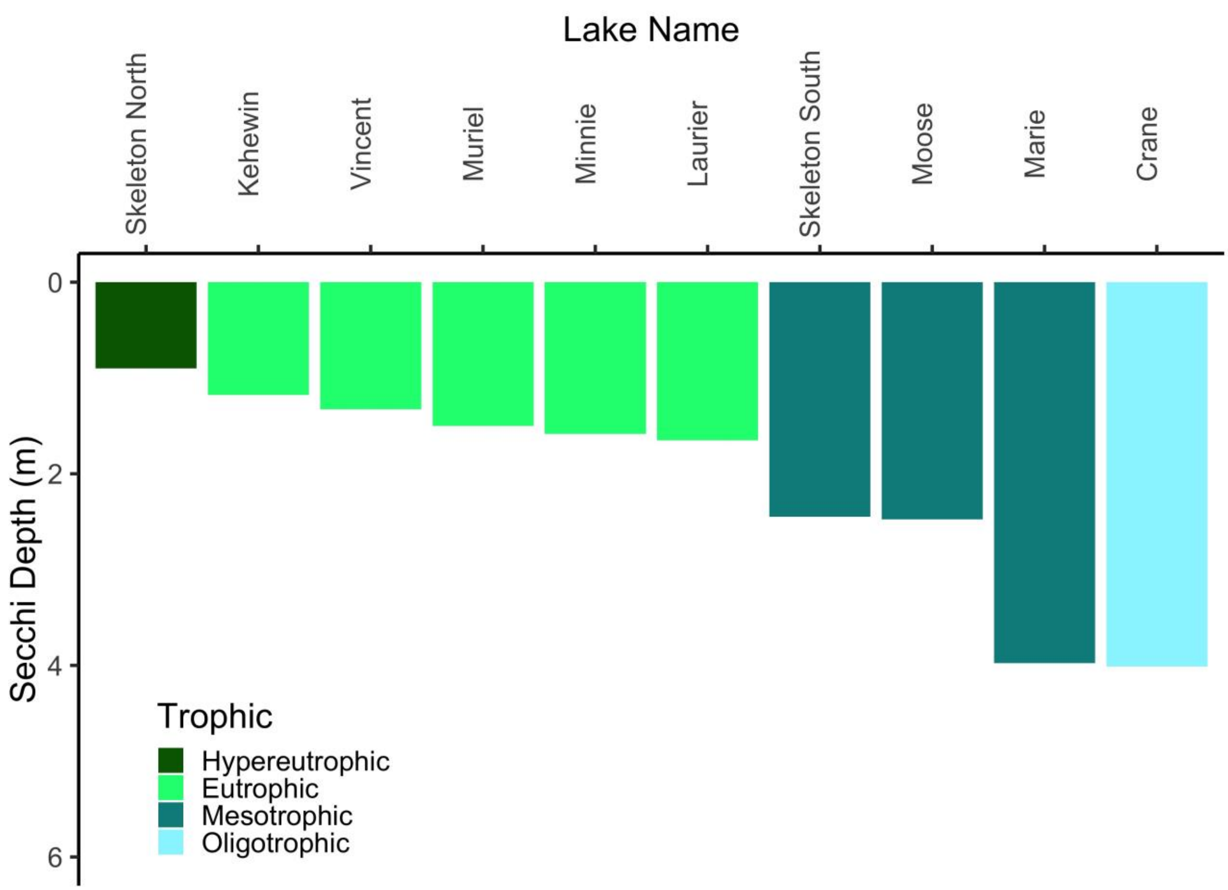


Figure 1*:* Average Secchi disk depth (m) values measured at 10 LICA lakes during the summer of 2019.

WATER CHEMISTRY

ALMS measures a suite of water chemistry parameters. Phosphorus, nitrogen, and chlorophyll-a are important because they are indicators of eutrophication, or excess nutrients, which can lead to harmful algal/cyanobacteria blooms. One direct measure of harmful cyanobacteria blooms are Microcystins, a common group of toxins produced by cyanobacteria.

Average total phosphorus concentrations ranged from a minimum of 10.9 μg/L at Marie Lake to a maximum of 121 μg/L at Vincent Lake (Figure 2, Table 3).

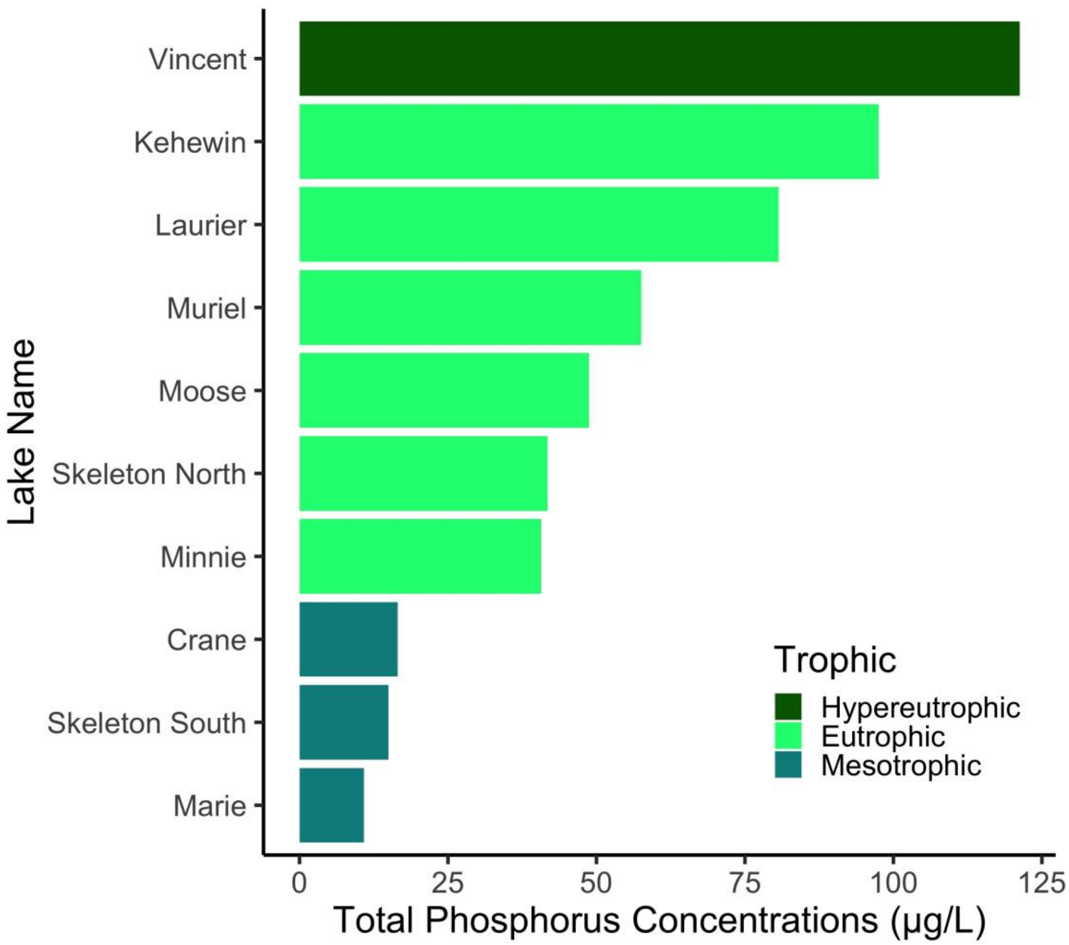


Figure 2: Average total phosphorus (TP) concentrations measured at 10 LICA lakes during the summer of 2019.

CHLOROPHYLL-A

Chlorophyll-a is the green pigment found in plants and algae that allows them to photosynthesize. Measuring the concentration of chlorophyll-a is a proxy for how much algae is present in lake water, because all algae will contain it.

Average chlorophyll-*a* concentrations ranged from a minimum of 3.95 μg/L at Marie Lake to a maximum of 73.3 μg /L at Vincent Lake (Figure 3, Table 3). Chlorophyll-*a* and TP averages were significantly positively correlated across lakes (Kendalls' Tau, τ= 0.97, *p-value* < 0.001).

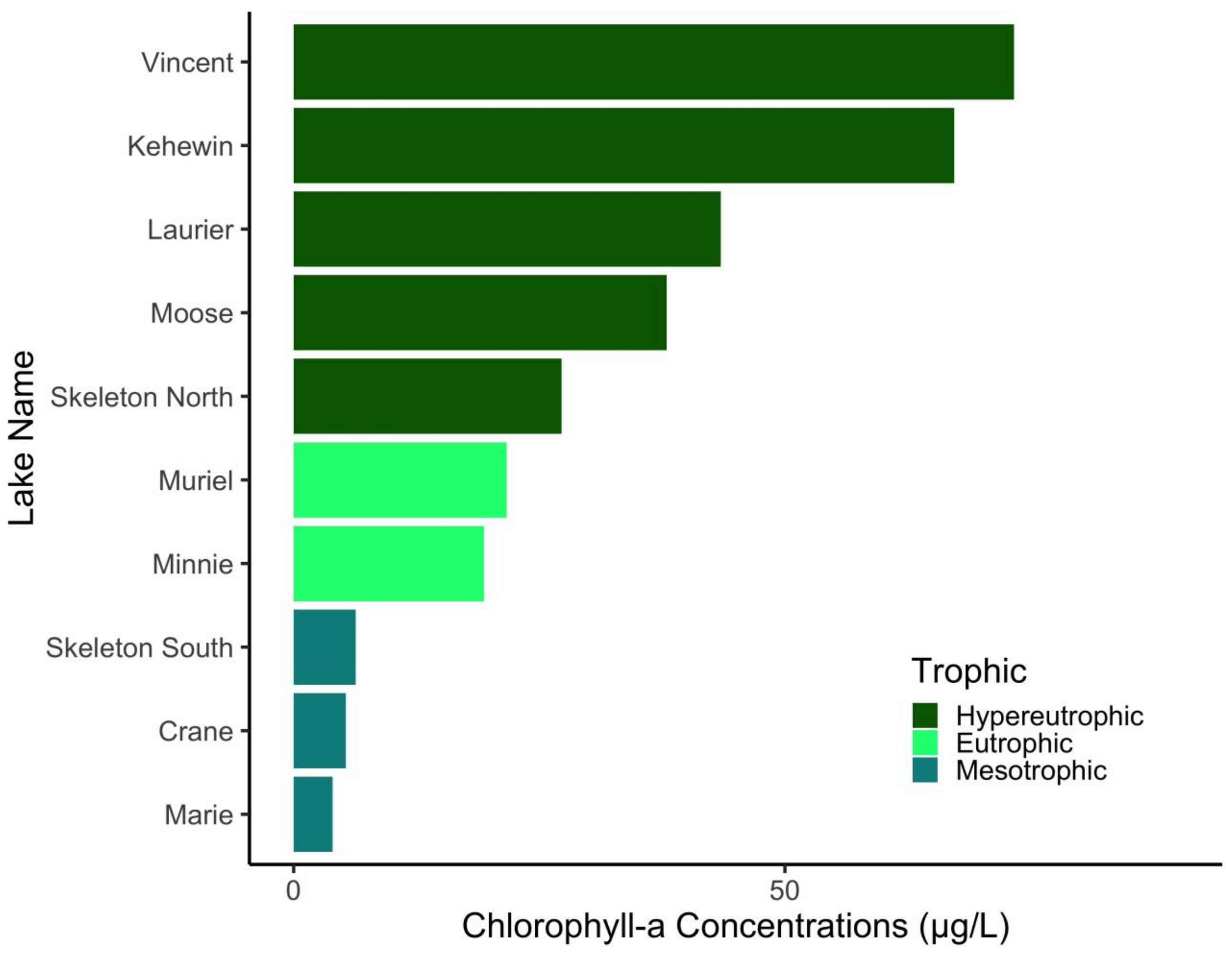


Figure 4: Average chlorophyll-*a* values measured at 10 LICA lakes during the summer of 2019.

MICROCYSTIN

Microcystins are toxins produced by cyanobacteria (blue-green algae) which, when ingested, can cause severe liver damage. Microcystins are produced by many species of cyanobacteria which are common to Alberta's Lakes, and are thought to be the one of the most common cyanobacteria toxins. In Alberta, recreational guidelines for microcystin are set at 20 µg/L.

Average microcystin concentrations fell below the minimum detection limit of 0.1 µg/L at Marie Lake in the LICA region, but was detected at all other lakes in the region (Figure 4), with the highest average concentration observed at Skeleton Lake North, measuring 2.63 µg /L (Table 3). None of the lakes sampled measured higher than the recreational guideline of 20 µg /L at any time throughout the summer of 2019. However, individual locations not sampled by ALMS may display toxin concentrations higher than the recreational guidelines, and caution should be observed when recreating in or around cyanobacteria.

For example, a surface scum observed at Skeleton Lake North on July 23rd, 2019 prompted ALMS staff to collect a grab sample. Results from this sample had microcystin toxin concentrations of 359.55 ug/L – well in exceedance of the recreational guideline. Poor water clarity issues identified by the ALMS LakeWatch volunteer appear to be caused by a bloom of cyanobacteria, which live part-way down the water column (Figure 5).

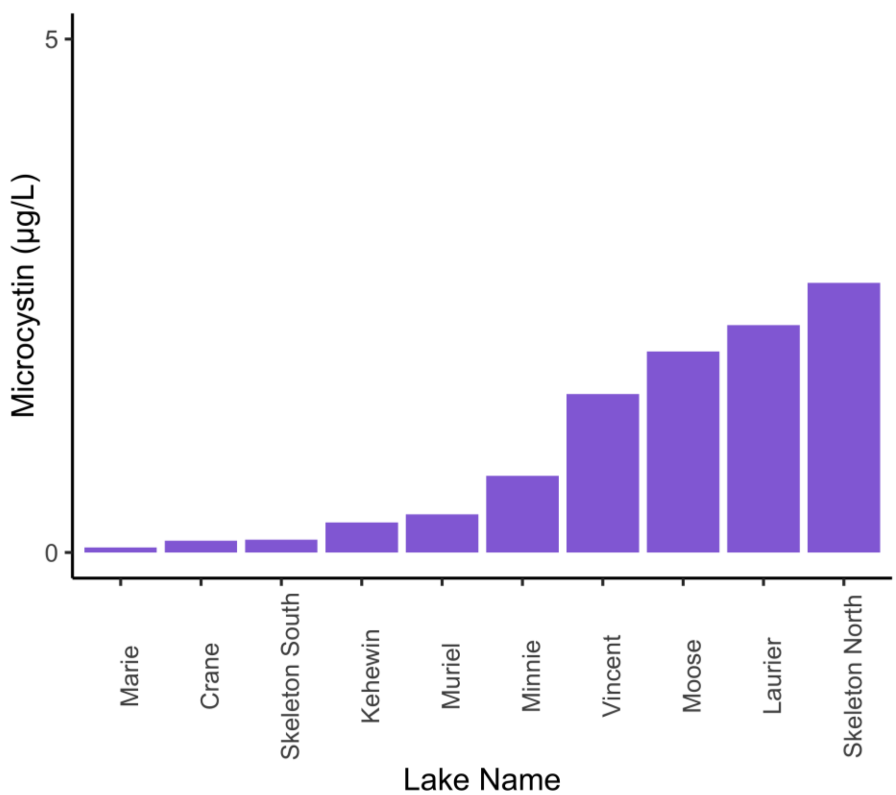


Figure 4: Average microcystin concentrations measured at the 10 LICA lakes during the summer of 2019.

Figure 5. A microscope image of a surface scum grabbed at Skeleton Lake North on July 23, 2019. These bacteria are likely in the genus *Planktothrix*.

Summarized Parameters

Table 3- Average water chemistry and secchi depth summaries for LICA lakes in the 2019 season.

Lake Name	Total Phosphorus (µg/L)	Total Dissolved Phosphorus (µg/L)	Chlorophyll-a (µg/L)	Microcystin (µg/L)	Secchi depth (m)
Crane Lake	16.5	5.75	5.33	0.12	4.01
Kehiwin Lake	97.5	36.2	67.2	0.29	1.18
Laurier Lake	80.7	14.0	43.5	2.21	1.65
Marie Lake	10.9	3.95	3.95	0.05	3.98
Minnie Lake	40.7	11.4	19.4	0.75	1.58
Moose Lake	48.8	15.3	38	1.96	2.48
Muriel Lake	57.5	14.1	21.7	0.37	1.5
Skeleton Lake North	41.8	4.95	27.3	2.63	0.9
Skeleton Lake South	15	6.20	6.3	0.13	2.45
Vincent Lake	121	41.8	73.3	1.54	1.33

Invasive Species

Dreissenid mussels pose a significant concern for Alberta because they impair the function of water conveyance infrastructure and adversely impact the aquatic environment. These invasive mussels have been linked to creating toxic cyanobacteria blooms, decreasing the amount of nutrients needed for fish and other native species, and causing millions of dollars in annual costs for repair and maintenance of water-operated infrastructure and facilities.

Monitoring involved using a 63 µm plankton net at three sample sites to look for juvenile mussel veligers in each lake sampled. In 2019, no mussels were detected in the 10 LICA lakes sampled.

Eurasian watermilfoil is non-native aquatic plant that poses a threat to aquatic habitats in Alberta because it grows in dense mats preventing light penetration through the water column, reduces oxygen levels when the dense mats decompose, and outcompetes native aquatic plants.

All suspect samples collected from the 10 LICA lakes from 2019 were confirmed to be the native Northern watermilfoil (*Myriophyllum sibiricum)*.

METALS

Samples were analyzed for metals once throughout the summer (Table 3). In total, the abundance of 29 metals were investigated. It should be noted that many metals are naturally present in aquatic environments due to the weathering of rocks and may only become toxic at higher levels. In this report we highlight the results of arsenic, boron, aluminum and selenium as they have fallen above their recommended guidelines in the LICA region in previous years. Individual LakeWatch reports will present the complete suite of metal results.

In wet years, metals in LICA region lakes may be elevated as a result due to groundwater recharge and the weathering of rocks and sediments.

Arsenic may be introduced to aquatic environments through industrial or municipal discharges or from the combustion of fossil fuels. Arsenic is known to be naturally elevated in the Beaver River Watershed, and in 2018, Minnie Lake exceeded the Canadian Council for Ministers of the Environment (CCME) recommended guidelines for the Protection of Aquatic Life (PAL; 5.0 µg/L). This is not an unusual occurrence at lakes in the LICA region. Boron is naturally occurring in many minerals, particularly in clay-rich sediments. Natural weathering can release boron into the environment at a higher rate than industrial sources. Following the results of 2018, none of the sampled LICA lakes exceeded the CCME PAL guidelines for Boron concentrations (1500 µg/L) in 2019. Aluminum occurs naturally in the sediment and was not in exceedance of CCME PAL guielines (100 ug/L) in the 2019 LICA lakes. Selenium can be found in water from both natural and anthropogenic sources. Examples of anthropogenic sources of selenium are the burning of coal and oil, and from agriculture. In 2019, no lakes were in exceedance of the CCME recommended guidelines for the Protection of Aquatic Life (1 µg/L; Table 2).

Unfortunately, due to scheduling issues, a metals sample was not taken at Skeleton Lake South in the summer of 2019. Although metals samples were taken at Muriel Lake and Moose Lake in the summer of 2019, due to laboratory issues, metals data is not available for those two lakes.

Table 3- Average metal summaries for LICA lakes in the 2019 season. Metal samples for Muriel, Skeleton South, and Moose are unavailable.

Lake	Aluminum[a] (µg/L)	Arsenic[b] (µg/L)	Boron[c] (µg/L)	Selenium[d] (µg/L)
Kehewin Lake	8.4	2.28	95	0.3
Laurier Lake	28.8	2.14	129	0.4
Marie Lake	6.7	0.56	18.8	0.1
Minnie Lake	6.1	8.91	184	0.7
Crane Lake	3.7	4.61	288	0.4
Skeleton Lake North	7.9	0.85	93	0.4
Vincent Lake	3.1	2.11	64.2	0.2

[a]Guideline: 100 µg/L
[b]Guideline: 5 µg/L
[c]Guideline: 1500 µg/L
[d]Guideline: 1 µg/L