From: LICA Reception <lica2@lica.ca>
Sent: Thursday, February 13, 2025 10:31:24 AM
Subject: LICA: ALMS 2024 LakeWatch Report

CAUTION: This email originated from outside the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

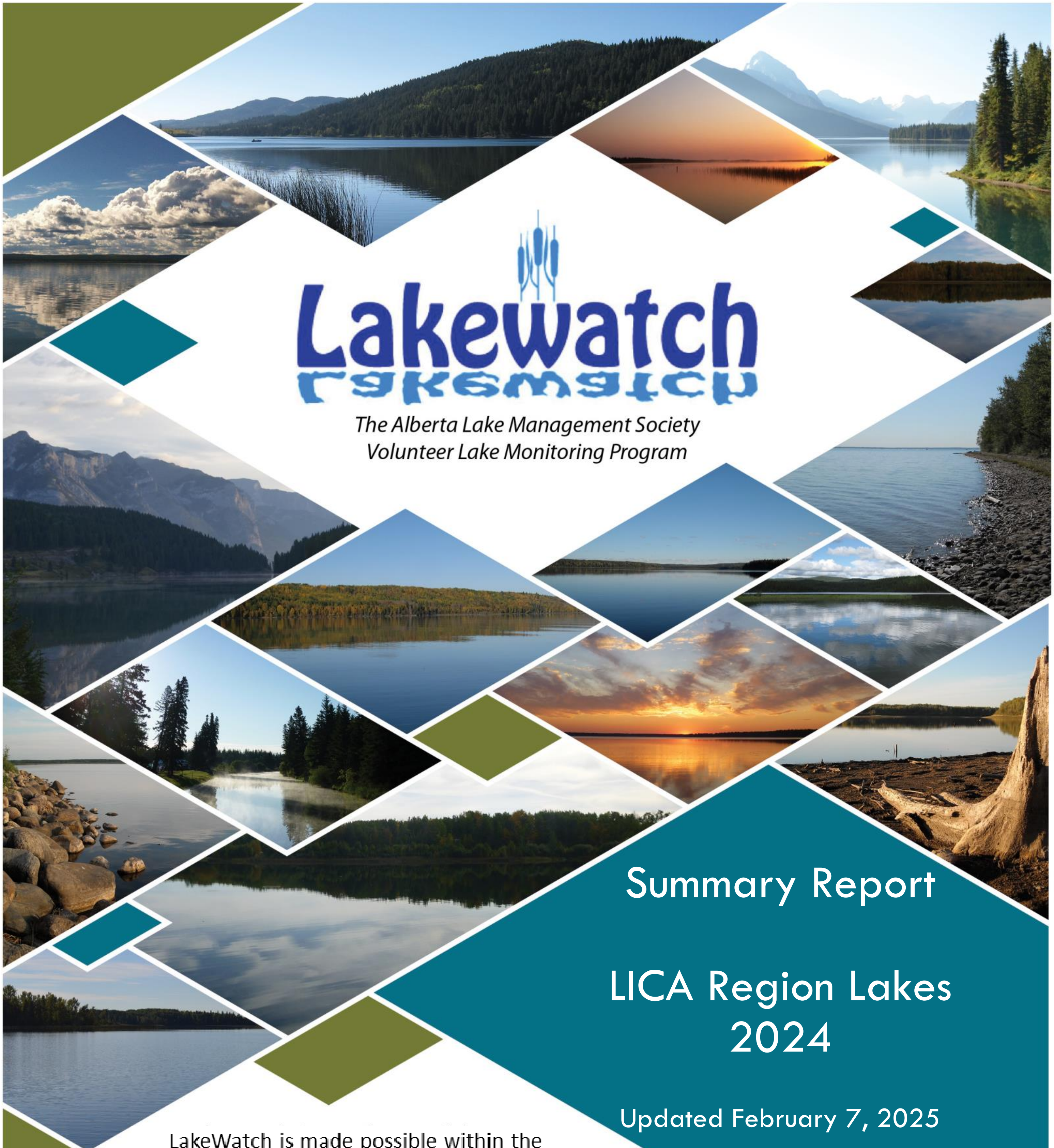
Hello LICA Members,

Please find attached the Alberta Lake Management Society 2024 LakeWatch Summary Report for the LICA region.

All past reports can be viewed on the LICA website. Click here to view them.

Thank you,

Lori Jodoin
Administrative Professional
LICA – Environmental Stewards
5107W – 50 Street, PO Box 8237
Bonnyville, AB T9N 2J5
(780) 812-2182



Lakewatch

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

Summary Report

LICA Region Lakes 2024

Updated February 7, 2025

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

Lac La Biche County welcoming by nature.

LICA Environmental Stewards

Alberta

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 Jordyn Lajeunesse and Katherine Cundict who were summer technicians in 2024. Executive Director Bradley Peter and Program Manager Brittany Onysyk were instrumental in planning and organizing the field program. This report was prepared by Brittany Onysyk and Bradley Peter.

INTRODUCTION

In 2024, ALMS received funding from the Lakeland Industry and Community Association (LICA), and Alberta Environment and Protected Areas to conduct LakeWatch, a participatory water quality monitoring program, for select lakes in the LICA region. This report presents a concise summary of key parameters from ten lakes which were sampled within the LICA region in the summer of 2024. More comprehensive water quality reports are available for each individual lake from data collected in the 2024 season, and can be accessed on the ALMS website (https://alms.ca/reports/), along with historical reports for those lakes. These individual LakeWatch reports may also present trend analysis results, where enough historical data exists, which is the best approach for evaluating lake water quality and health over time.

SAMPLE RECORD

From June through October 2024, lakes in the LICA region were sampled four times, with an exception of four lakes only sampled three times throughout the season (Table 1). This sampling record represents a 90% completion rate.

Table 1. The LICA region lakes LakeWatch sample completion record for 2024.

Lake	Trip 1	Trip 2	Trip 3	Trip 4
Elinor	25-Jun	22-Jul	9-Aug	missed
Hilda	missed	18-Jul	15-Aug	16-Sep
Lac Bellevue	14-Jun	16-Jul	13-Aug	16-Oct
Minnie	19-Jun	31-Jul	04-Sep	missed
Moore (Crane)	27-Jun	17-Jul	14-Aug	10-Sep
Moose	3-Jul	31-Jul	4-Sep	1-Oct
Muriel	20-Jun	missed	5-Sep	8-Oct
Skeleton North	10-Jun	4-Jul	8-Aug	22-Aug
Skeleton South	10-Jun	4-Jul	8-Aug	22-Aug
Wolf	26-Jun	18-Jul	15-Aug	16-Sep

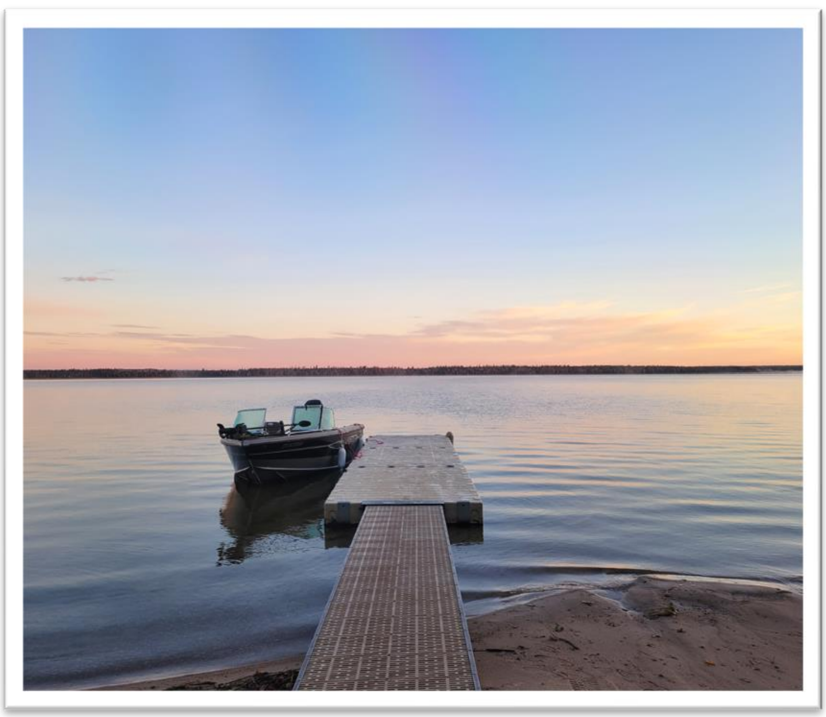
STAFF, VOLUNTEERS, PARTNERS

Two LakeWatch technicians were hired in May 2024 to conduct water quality sampling, and Katherine Cundict was assigned the LICA region lakes. ALMS worked with 14 volunteers the LICA region for a total of 121 volunteer hours spent lake sampling. Volunteers provided boats used for sampling, operated the boats, and assisted the LakeWatch technician with sampling procedures. Volunteers provided invaluable local knowledge about their lake that was used to contextualize lake conditions and improve lake sampling safety. Each year ALMS volunteers show outstanding dedication and commitment to the LakeWatch program.

LakeWatch Technician Katherine sampling with a volunteer at Crane Lake, August 2024.

RESULTS

While ALMS collects a large suite of water chemistry parameters, this report will highlight the variability which exists between lakes across only a few major parameters: euphotic depth, total phosphorus, total Kjeldahl nitrogen, chlorophyll-*a*, microcystin, major ions, and select metals. Please note that variation within these parameters does not necessarily reflect a degree of lake management. Many factors outside of human control can also impact lake water quality. The depth of the lake, the size of the drainage basin, lake order (position in hydrological network), and the composition of bedrock and sediment are some natural factors that affect lake water quality. These factors should be taken into consideration when interpreting these results. The results in this report are also presented as seasonal averages for comparability. Seasonal trends for some of the parameters presented below may be available in each lake's individual LakeWatch reports. Results are categorized into trophic status, or degree of lake productivity. More on trophic status, along with class criteria, can be found in 'A Brief Introduction to Limnology' on the ALMS website.



A scenic sunset after a day of sampling at Wolf Lake, September 2024.

WATER CLARITY AND EUPHOTIC 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, 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 – the depth to which a checkered disk disappears. Two times the Secchi disk depth equals the euphotic depth – the depth to which there is enough light for photosynthesis.

Average euphotic depths within the LICA region in 2024 ranged from a minimum of 1.04 m at Skeleton Lake North to a maximum of 8.70 m at Wolf Lake (Figure 1, Table 2). Muriel Lake also had an average euphotic depth that was relatively shallow (Figure 1). Lake profile depth, the location where the Secchi depth measurement was taken, is also presented for context. This shows how variable euphotic depth can be, even in waterbodies with similar depths. Euphotic depth averages were not significantly correlated with average chlorophyll-*a* concentrations across the lakes (*p-value* = 0.07).

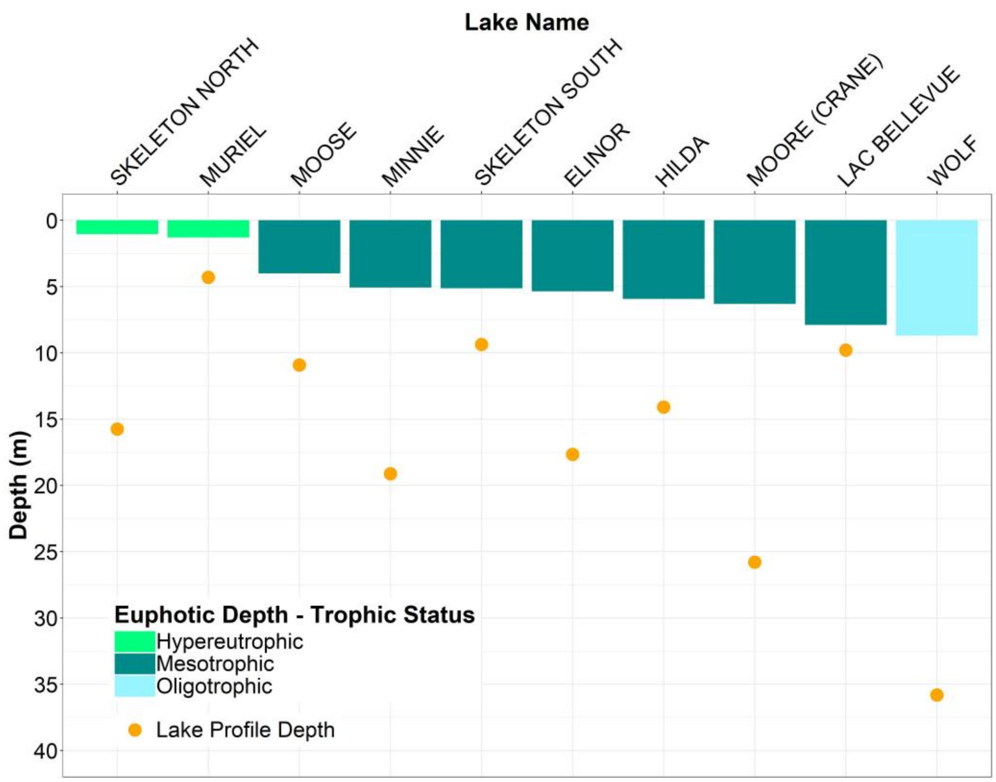


Figure 1. Average euphotic depth (m) and lake profile depth (m) values from 10 LICA region lakes sampled through the LakeWatch program during the summer of 2024.

WATER CHEMISTRY – Total Phosphorus

ALMS measures a suite of water chemistry parameters. Phosphorus 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. Some lakes in Alberta have naturally high levels of phosphorus due to nutrient-rich geology, while others experience eutrophication resulting from human-related activities. High levels of phosphorus promote cyanobacteria growth, which is measured by assessing chlorophyll-a concentrations. Absolute values of phosphorus and chlorophyll-a alone do not point to human-caused eutrophication or naturally elevated nutrients, however the trajectory of those parameters over time, coupled with other lake information, may indicate whether the nutrient and chlorophyll-a levels are natural or human-caused.

Average total phosphorus concentrations ranged from a minimum of 9.07 µg/L at Wolf Lake to a maximum of 74.0 µg/L at Skeleton Lake North (Figure 2, Table 2). Total phosphorus and total Kjeldahl nitrogen averages were significantly positively correlated across lakes (*p-value* = 0.03), meaning that for lakes sampled in the LICA region in 2024, increased levels of phosphorus were proportional to increased nitrogen levels.

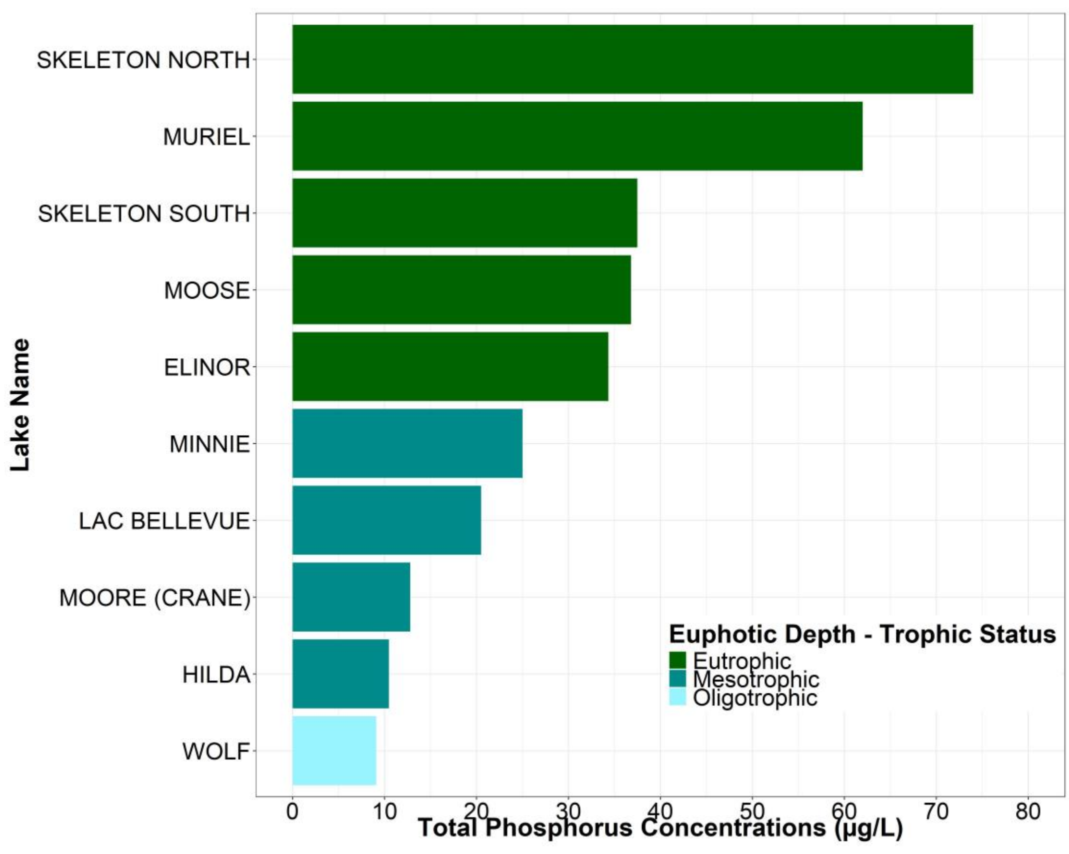


Figure 2. Average total phosphorus (TP) concentrations from 10 LICA region lakes sampled through the LakeWatch program during the summer of 2024.

WATER CHEMISTRY – Total Kjeldahl Nitrogen

As with phosphorus, nitrogen is a nutrient that primary producers (plants and algae) require in order to grow. Some lakes in Alberta have naturally high levels of nitrogen due to nutrient-rich geology, while others experience eutrophication resulting from human-related activities. High levels of nitrogen may promote excessive cyanobacteria growth, although generally only if phosphorus levels are not limiting. Total Kjeldahl nitrogen represents the sum of organic forms of nitrogen, along with ammonia and ammonium.

Average total Kjeldahl nitrogen concentrations ranged from a minimum of 0.63 mg/L at Wolf Lake to a maximum of 3.24 mg/L at Muriel Lake (Figure 3, Table 2). Chlorophyll-*a* and total Kjeldahl nitrogen averages were not significantly correlated across lakes (*p-value* = 0.15).

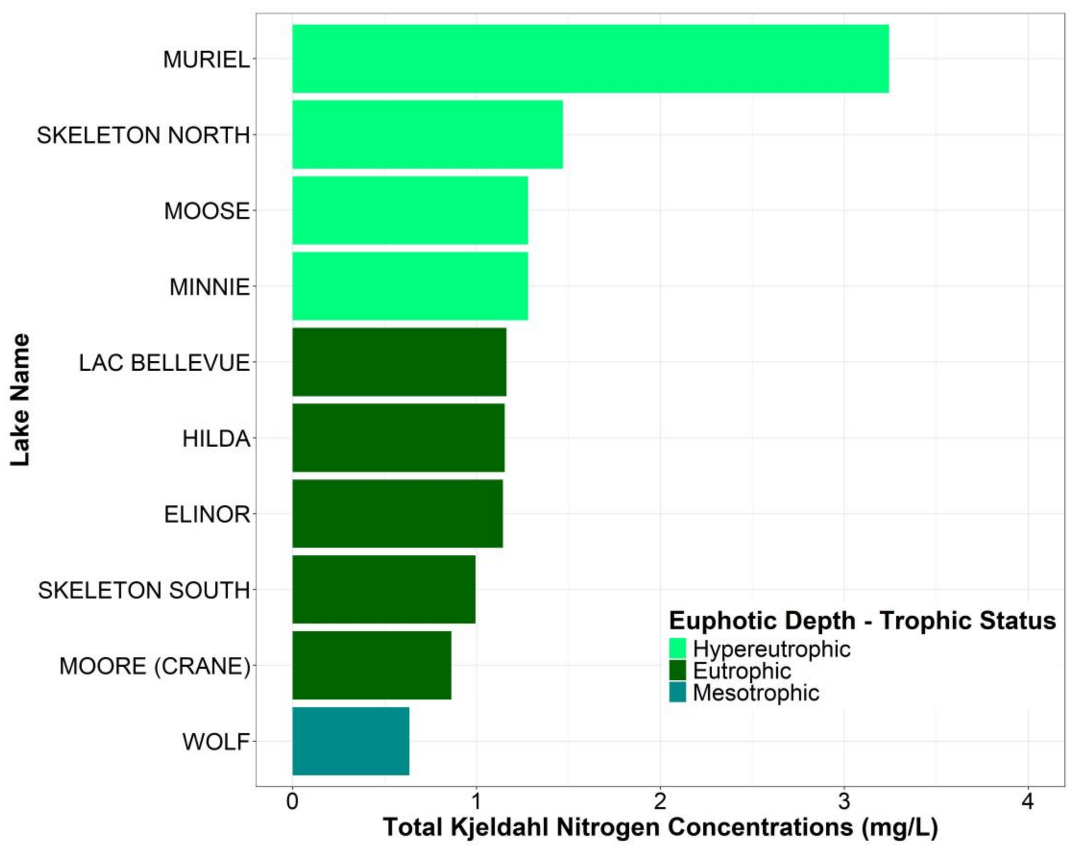


Figure 3. Average total Kjeldahl nitrogen concentrations from 10 LICA region lakes sampled through the LakeWatch program during the summer of 2024.

WATER CHEMISTRY – Chlorophyll-a

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

Average chlorophyll-*a* concentrations ranged from a minimum of 3.76 µg/L at Hilda Lake to a maximum of 57.95 µg /L at Skeleton Lake North (Figure 4, Table 2). Chlorophyll-*a* and total phosphorus averages were significantly positively correlated across lakes (*p-value* = 0.009), meaning that for lakes sampled in the LICA region in 2024, high levels of phosphorus were correlated with high levels of cyanobacteria and algae.

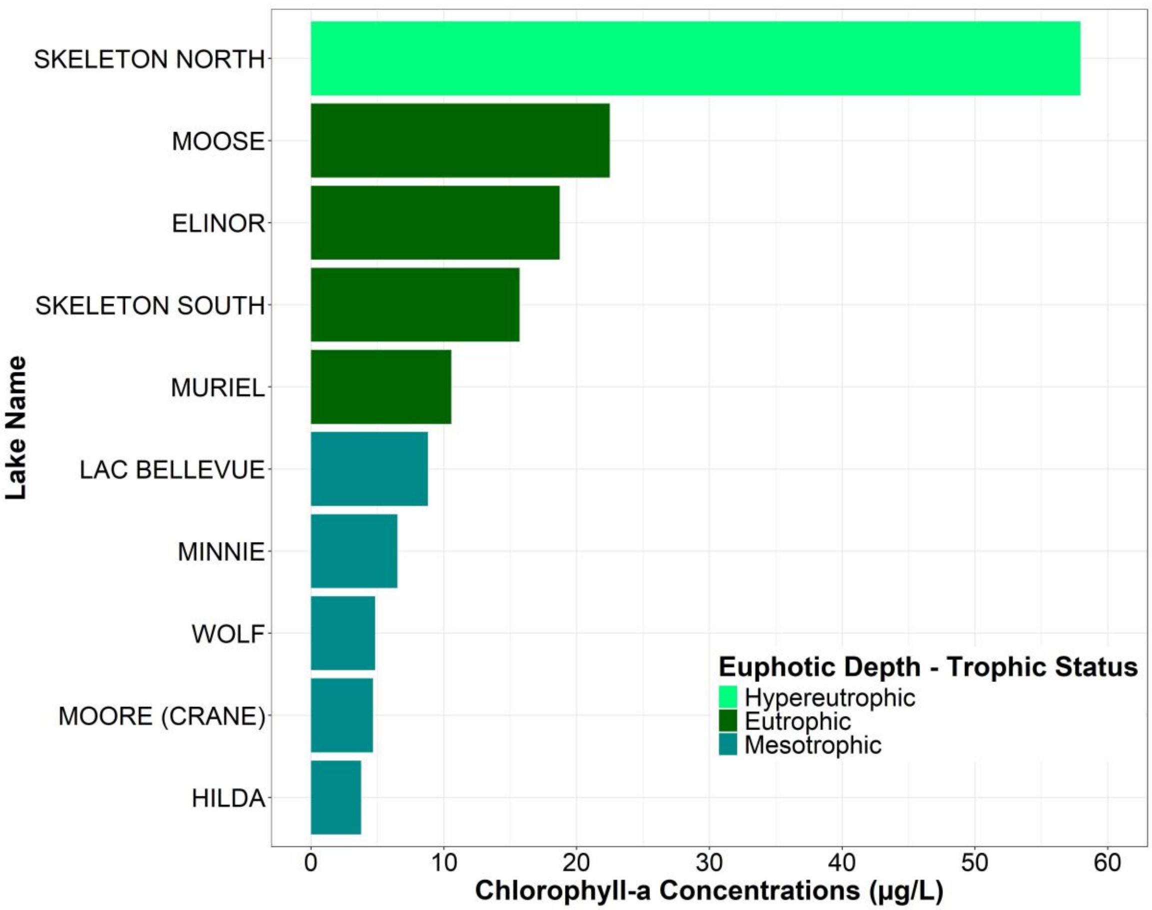


Figure 4. Average chlorophyll-*a* values from 10 LICA region lakes sampled through the LakeWatch program during the summer of 2024.

WATER CHEMISTRY – Microcystin

Microcystins are toxins produced by cyanobacteria (blue-green algae) which, when ingested by mammals, 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 one of the most common cyanobacteria toxins. In Alberta, recreational guidelines for microcystin are set at 10 µg/L, and as of 2024, the laboratory detection limit (the lowest level to which microcystin can be confidently detected by the analysis technique) is 0.1 µg/L.

Average microcystin concentrations ranged from <0.1 µg/L at multiple lakes, including Hilda, Crane, Wolf, Lac Bellevue, and Minnie, to 9.65 µg/L at Skeleton Lake North (Figure 5, Table 2). The only lake to measure higher than the recreational guideline of 10 µg/L during any sampling event was Skeleton Lake North during the June 10th and July 4th sampling events, with levels of 13.98 µg/L and 13.59 µg/L recorded, respectfully. Specific locations on the lakes 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 more information about recreating in lakes with cyanobacteria, refer to this document produced by Alberta Health Services about frequently asked questions regarding cyanobacteria.

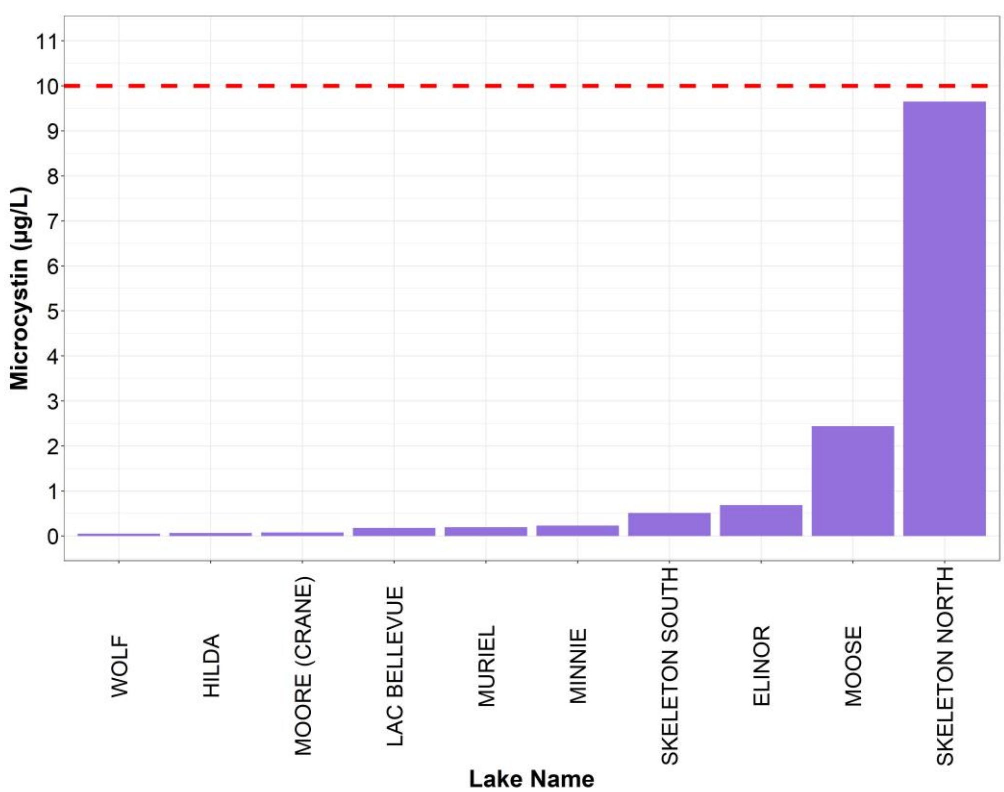


Figure 5. Average microcystin concentrations from 10 LICA region lakes sampled through the LakeWatch program during the summer of 2024. Alberta's recreational guideline of 10 µg/L is indicated by the red horizontal dashed line.

WATER CHEMISTRY – Ion Chemistry

Measuring specific ion abundances helps to better understand the nuances between lakes in terms of their water chemistry. Differences in the levels of these ions, or salts, may indicate a relatively high groundwater contribution, run-off of surrounding geology or road salts applications, or if levels are low, that surrounding geology contributes little salts, and instead dilutes levels present in the lake. Ion concentration may also increase in times of low rainfall or increased evaporation of lake water. Ion levels are important to monitor as certain organisms will have sensitivities to specific ions, and high levels of certain ions may aid to identify the source, whether natural or human-caused.

Average levels of different ions were quite variable between the lakes sampled in the LICA region within the 2024 LakeWatch season (Figure 6). Comparatively low variability in sodium was observed across the lakes, with the exception of Muriel Lake which had much higher sodium. Muriel Lake experienced the highest levels of all ions with the exception of calcium. In contrast, Wolf Lake displayed the lowest levels of all other ions. Looking at the connected basins of Skeleton Lake, ion levels were comparable for both Skeleton Lake North and South, with the exception of sulphate, where Skeleton Lake North had levels about four times higher than those at Skeleton Lake South.

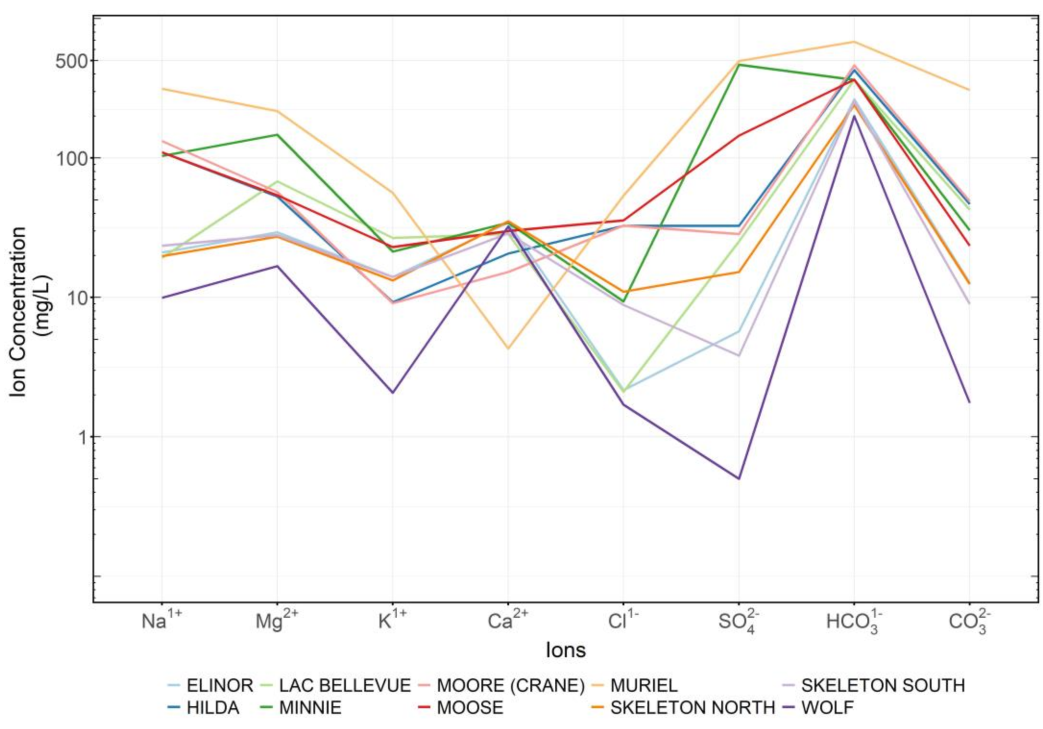


Figure 6. Average levels of cations (sodium = Na^{1+}, magnesium = Mg^{2+}, potassium = K^{1+}, calcium = Ca^{2+}) and anions (chloride = Cl^{1-}, sulphate = SO_4^{2-}, bicarbonate = HCO_3^{1-}, carbonate = CO_3^{2-}) from 10 LICA region lakes sampled through the LakeWatch program during the summer of 2024 (note $\log_{10}$ scale on y-axis).

SUMMARIZED PARAMETERS

Table 2. Average water chemistry (nutrients, chlorophyll-a, and microcystin), euphotic depth, and lake profile depth summaries for LICA region lakes sampled through the LakeWatch program during the summer of 2024.

Lake Name	Total Phosphorus (µg/L)	Total Kjeldahl Nitrogen (mg/L)	Chlorophyll-a (µg/L)	Microcystin (µg/L)	Euphotic Depth (m)	Lake Profile Depth (m)
Elinor	34.33	1.14	18.73	0.69	5.37	1.14
Hilda	10.47	1.15	3.77	0.07	5.93	1.15
Lac Bellevue	20.50	1.16	8.80	0.18	7.90	1.16
Minnie	25.00	1.28	6.50	0.23	5.07	1.28
Moore (Crane)	12.80	0.86	4.65	0.08	6.30	0.86
Moose	36.80	1.28	22.50	2.44	4.00	1.28
Muriel	62.00	3.24	10.57	0.20	1.30	3.24
Skeleton North	74.00	1.47	57.95	9.65	1.04	1.47
Skeleton South	37.50	1.00	15.70	0.51	5.13	1.00
Wolf	9.08	0.64	4.83	0.05	8.70	0.64

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 can change lake conditions which can then lead to toxic cyanobacteria blooms, decrease the amount of nutrients needed for fish and other native species, and cause millions of dollars in annual costs for repair and maintenance of water-operated infrastructure and facilities. Spiny water flea also pose a concern for Alberta because they alter the abundance and diversity of native zooplankton, as they are aggressive zooplankton predators. Through over-predation, they will impact higher trophic levels such as fish. They also disrupt fishing equipment by attaching in large numbers to fishing lines.

Invasive species monitoring involved sampling with a 63 µm plankton net at three sample sites to look for juvenile mussel veligers and spiny water flea in each lake. In 2024, no mussels or spiny water flea were detected in the 10 LICA region lakes sampled.

Eurasian watermilfoil is a non-native aquatic plant that poses a threat to aquatic habitats in Alberta because it outcompetes native aquatic plants, grows in dense mats preventing light penetration through the water column, and reduces oxygen levels in the lake when these plants decompose. Eurasian watermilfoil can look similar to the native Northern watermilfoil, thus genetic analysis is necessary for species identification.

Watermilfoil specimens were collected from Hilda Lake and Moose Lake in 2024. Reasons vary for why watermilfoil is not collected in a season, but it is likely due to watermilfoil not being observed during sampling events. All samples collected were identified as native Northern watermilfoil.

METALS

A surface sample was collected once at each lake in August to be used for metal analysis. In total, the abundance of 27 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 aluminum, arsenic, boron, and selenium as they have fallen above their recommended Canadian Council for Ministers of the Environment (CCME) guidelines in the LICA region in previous years. Individual LakeWatch reports will present the complete suite of metal results. In wet years, metals may be elevated as a result due to groundwater recharge and the weathering of rocks and sediments.

Samples for metal analysis were collected from all 10 lakes in the LICA region. Low levels of aluminum can be found in water naturally, however anthropogenic (human caused) sources of aluminum can include dust produced from agriculture, mining, and coal combustion. In 2024, none of the sampled lakes were in exceedance of the aluminum CCME guidelines for the Protection of Aquatic Life (100 µg/L; Table 3). Arsenic is found naturally elevated in the Beaver River Watershed. Arsenic can also be introduced into the aquatic environment through industrial or municipal discharges, or from the combustion of fossil fuels. In 2024, arsenic levels in Minnie Lake and Muriel Lake exceeded the CCME guidelines for the Protection of Aquatic Life (5 µg/L; Table 3). Boron is naturally occurring in many minerals, particularly in clay-rich sediments. Natural weathering often releases boron into the environment at rates comparable to or greater than anthropogenic sources. Anthropogenic sources include municipal wastewater, irrigation (fertilizer and pesticide run-off), coal power plants, and other industries that use boron. In 2024, none of the sampled LICA region lakes exceeded the CCME guidelines for boron concentrations (1500 µg/L; Table 3). Selenium is an essential micronutrient for human function, and can also be found naturally in water. Anthropogenic sources of selenium include the burning of coal and oil, industrial and municipal wastewater, and agricultural run-off. In 2024, Muriel Lake exceeded the CCME guidelines for the Protection of Aquatic Life (1 µg/L; Table 3).

Table 3. Values of select metals for LICA region lakes sampled through the LakeWatch program in 2024. The Canadian Council for Ministers of the Environment (CCME) recommended guidelines for the Protection of Aquatic Life is included at the top of the table.

Lake Name	Aluminum (µg/L)	Arsenic (µg/L)	Boron (µg/L)	Selenium (µg/L)
CCME PAL Guideline	100	5	1500	1
Elinor	11.1	0.94	54.8	0.1
Hilda	4.7	2.25	239.0	0.7
Lac Bellevue	17.6	3.43	89.9	0.1
Minnie	7.4	7.59	175.0	0.5
Moore (Crane)	3.4	4.40	292.0	0.7
Moose	5.4	2.03	162.0	0.5
Muriel	14.2	11.20	419.0	1.0
Skeleton North	4.4	0.92	90.6	0.3
Skeleton South	7.2	1.26	102.0	0.2
Wolf	2.1	0.96	35.6	0.1