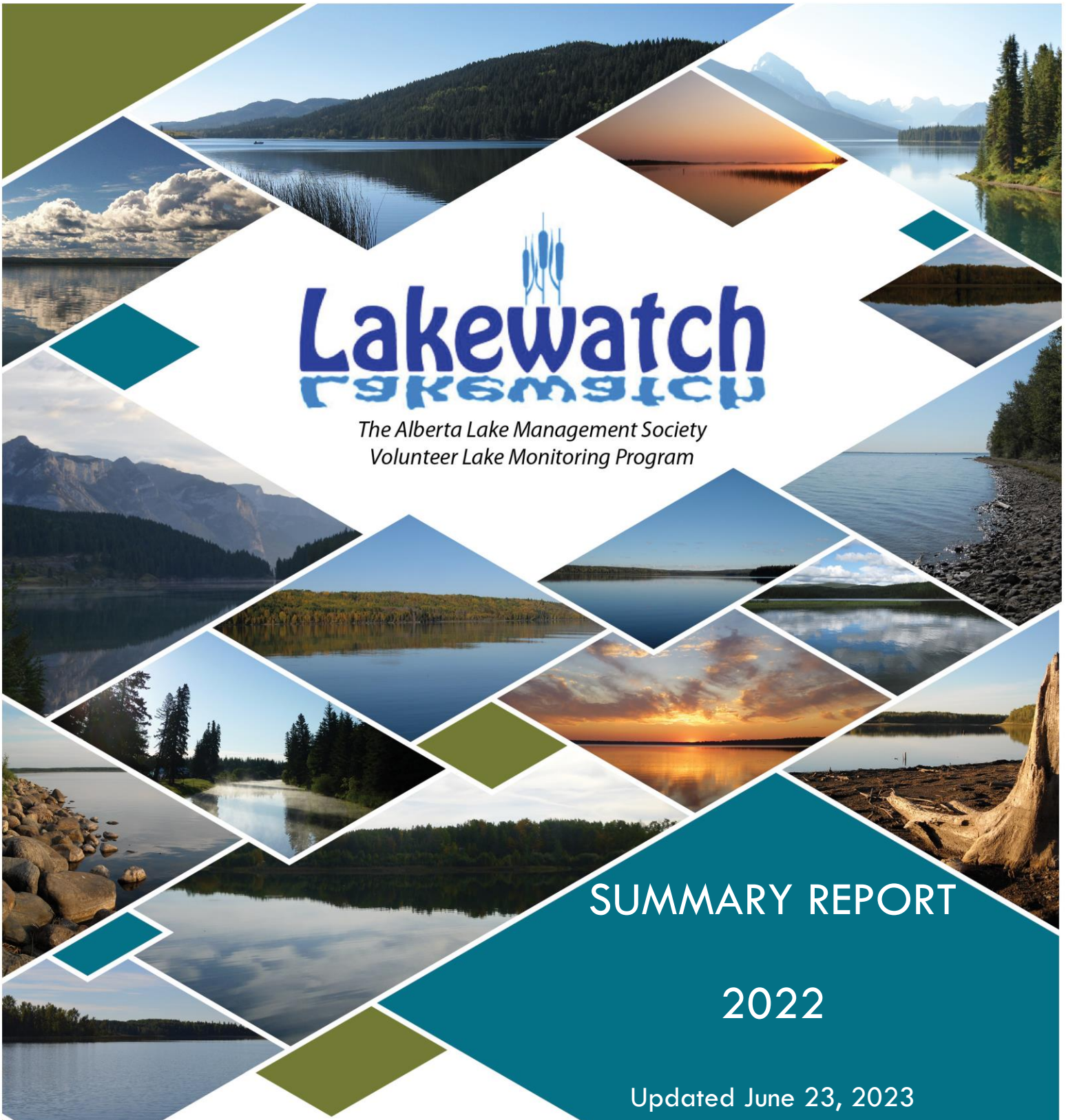


Lakewatch

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

SUMMARY REPORT

2022

Updated June 23, 2023

Lakewatch is made possible with support from:

Alberta

Lac La Biche County
welcoming by nature.

LICA
ENVIRONMENTAL STEWARDS

PIGEON LAKE
WATERSHED
ASSOCIATION

ALBERTA LAKE MANAGEMENT SOCIETY'S LAKEWATCH PROGRAM

LakeWatch has several important objectives, one of which is to collect and interpret water quality data from Alberta's Lakes. Equally important is educating lake users about aquatic environments, 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 the widest 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.

If you require data from this report, please contact ALMS for the raw data files.

ACKNOWLEDGEMENTS

The LakeWatch program is made possible through the dedication of its volunteers. We would also like to thank Kurstyn Perrin and Dominic Wong, who were summer technicians in 2022. Executive Director Bradley Peter and Program Manager Caleb Sinn were instrumental in planning and organizing the field program. This report was prepared by Caleb Sinn and Bradley Peter.

INTRODUCTION

In 2022, ALMS received funding from the Lakeland Industry and Community Association (LICA), the Pigeon Lake Watershed Association (PLWA), and Alberta Environment and Protected Areas, to conduct LakeWatch, a volunteer-based participatory water quality monitoring program. In addition, ALMS worked with staff from Lac La Biche County to sample two lakes; Touchwood Lake, and Pinehurst Lake.

SAMPLE RECORD

Two summer field technicians (Dominic Wong and Kurstyn Perrin) were hired in May 2022 to conduct water quality sampling. ALMS completed a provincial park monitoring program at 5 lakes and a standard monitoring program at 21 lakes. From June through October 2022, lakes were visited four times each, with the exception a few lakes where missed trips occurred. In 2022, 102 of 104 scheduled trips were completed. This resulted in a completion rate of 98% (Table 1). It is rare to have a LakeWatch season with no missed trips – minor issues with weather and volunteer coordination resulted in the two missed trips in 2022. However, the slightly lower number of lakes, requirement of four sampling events (down from five in past seasons), and the scheduling capability of the field technicians all cooperated to achieve a near-perfect sampling season.

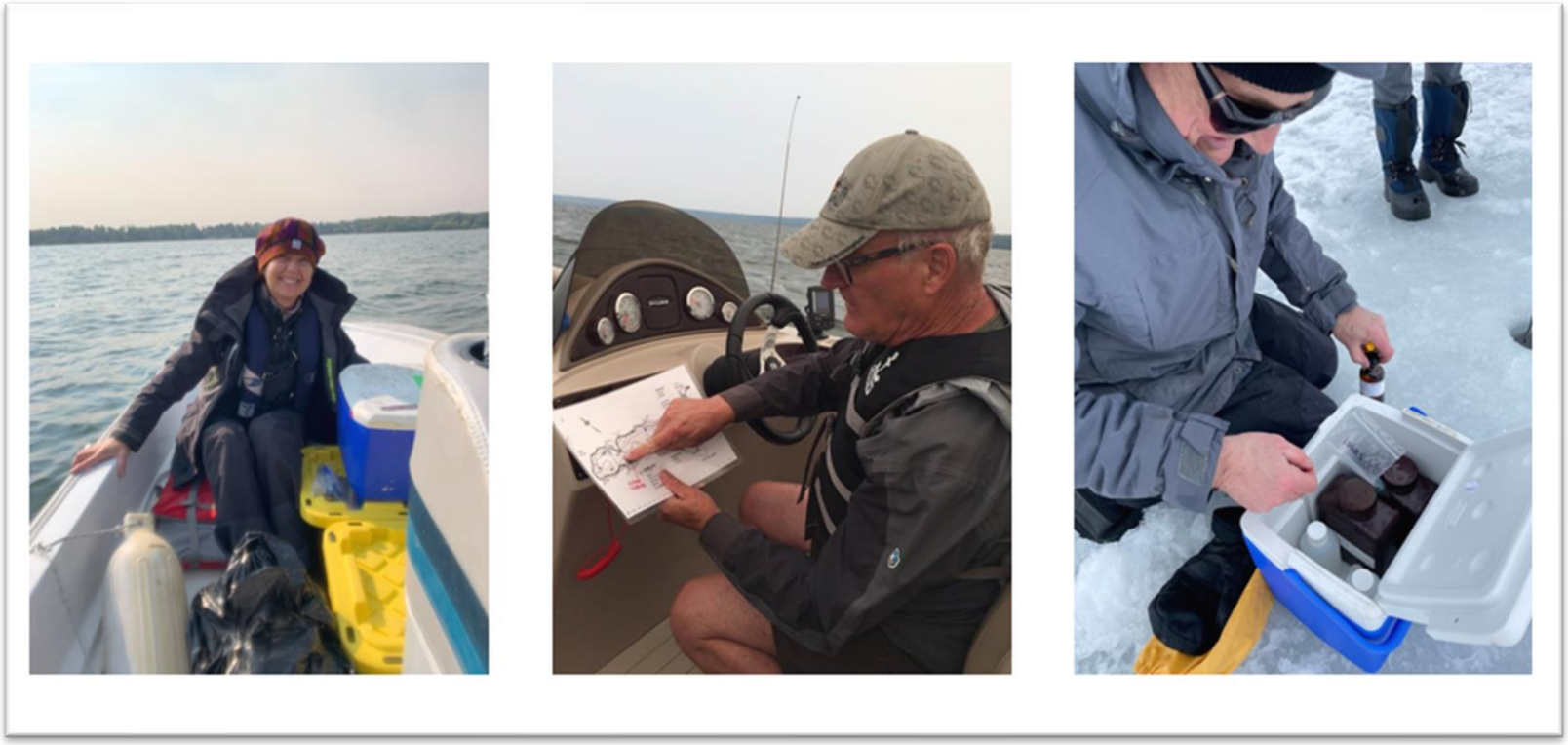
The 2022 LakeWatch Technicians - Dominic Wong (left), and Kurstyn Perrin (right).

Table 1. The LakeWatch sample completion record for 2022.

Program	Lakes	Trip 1	Trip 2	Trip 3	Trip 4
Base Lakes	Buffalo (near Bashaw)	27-Jun	MISSED	23-Aug	20-Sep
	Chestermere	27-Jun	19-Jul	22-Aug	20-Sep
	Half Moon	16-Jun	20-Jul	11-Aug	09-Sep
	Hastings	03-Jun	04-Jul	19-Aug	27-Sep
	Jackfish (near Carvel)	24-Jun	12-Jul	05-Aug	26-Sep
	Lac La Nonne	03-Jun	22-Jul	26-Aug	23-Sep
	Lacombe	25-Jun	14-Jul	11-Aug	22-Sep
	Wabamun	01-Jun	12-Jul	08-Aug	10-Sep
	Wizard	02-Jun	13-Jul	03-Aug	07-Sep
	Sylvan	30-Jun	19-Jul	24-Aug	20-Oct
Contract	Pigeon	21-Jun	21-Jul	10-Aug	09-Sep
LICA	Amisk	07-Jun	13-Jul	16-Aug	13-Sep
	Crane	18-Jun	15-Jul	10-Aug	12-Sep
	Laurier	28-Jun	22-Jul	17-Aug	15-Sep
	Minnie	MISSED	06-Jul	10-Aug	06-Oct
	Moose	21-Jun	15-Jul	06-Aug	14-Sep
	Muriel	29-Jun	23-Jul	17-Aug	16-Sep
	Pinehurst	09-Jun	06-Jul	09-Aug	06-Sep
	Skeleton North	07-Jun	12-Jul	16-Aug	13-Sep
	Skeleton South	18-Jun	12-Jul	15-Aug	03-Sep
	Touchwood	10-Jun	07-Jul	09-Aug	07-Sep
Parks	McLeod	06-Jun	08-Jul	19-Aug	12-Sep
	Moonshine	09-Jun	07-Jul	18-Aug	15-Sep
	Saskatoon	09-Jun	07-Jul	18-Aug	15-Sep
	Sturgeon	08-Jun	06-Jul	17-Aug	14-Sep
	Winagami	07-Jun	05-Jul	16-Aug	13-Sep

VOLUNTEERS

In 2022, ALMS worked with 45 unique volunteers, for a total of 532 volunteer hours spent sampling lakes. Volunteers also provided invaluable local knowledge about their lake that is used to contextualize lake conditions and inform safe lake sampling. Each year, ALMS volunteers show outstanding dedication and commitment to the LakeWatch program. Each year, ALMS will recognize a volunteer, or a group of volunteers, who have shown outstanding dedication and commitment to an ALMS program. This year, Sue Styles, Neil Fleming, and Stan Franklin from Wabamun Lake were presented with the ALMS Volunteer of the Year Award.



ALMS Volunteer of the Year (2022) recipients Sue Styles (left), Neil Fleming (centre), and Stan Franklin (right) participating in lake monitoring through ALMS LakeWatch and Winter LakeKeepers programs.

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 of our major parameters: Euphotic Depth, Total Phosphorus, Chlorophyll-a, and Microcystin. Please note that 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 lake depth, the size of the drainage basin, 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. Results are also presented as seasonal averages for comparability – seasonal trends (and in some cases, historical trends where enough data for a trend analysis is available) for the parameters presented below are available in each lake's individual 2022 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.

The 2022 LakeWatch season captured a range of lake types situated in the central, eastern, and northwest portions of the province. The lakes are located in boreal, parkland, grasslands, and foothills natural regions of the province. The 2022 season also included a lake system (Skeleton Lake) which has morphologically distinct basins that were sampled separately. This allows for the opportunity to investigate the differences between basins, which are unique from each other in morphology (depth, surface area). Interestingly, the basins of Skeleton Lake diverged primarily in water clarity and microcystin levels, indicating that algal and cyanobacteria communities differ.

Touchwood Lake, at the campground beach (Photo by Caleb Sinn, July 2022).

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 in 2022 ranged from a minimum of 1.15m at Skeleton Lake North to a maximum of 10.65m at Sylvan Lake (Figure 1). Lake profile depth, or the depth of the location where the Secchi depth measurement was taken, is also presented for context. Euphotic depth averages were significantly correlated with average chlorophyll-*a* concentrations across lakes (Kendalls' Tau-b, τ_b= -0.53, p = <0.001). This means that water turbidity appeared to be primarily associated with the growth of cyanobacteria and algae. Lacombe Lake, Moonshine Lake, and Chestermere Lake also displayed average euphotic depths that were almost as deep as the average lake profile depth (Figure 1). This means that light was likely reaching the bottom sediments across the majority of depths of the lake through the summer, likely having a large influence on the lake's aquatic plant distribution, and benthic (lake bottom) algae and cyanobacteria communities.

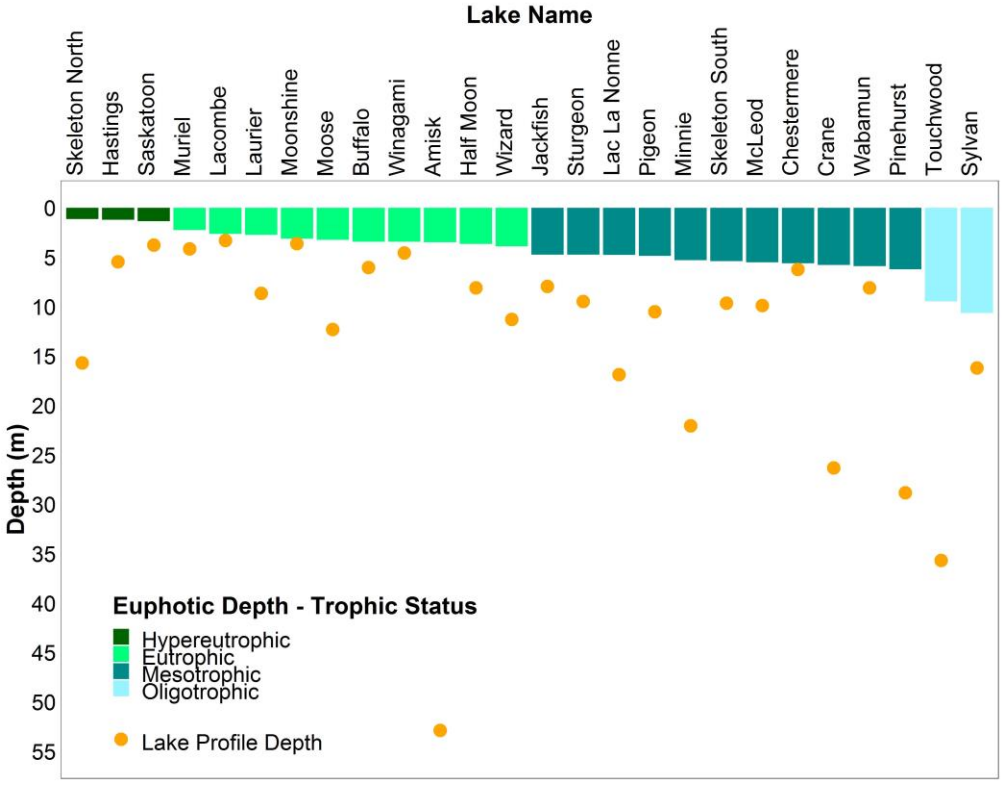


Figure 1. Average euphotic depth (m) values and lake profile depth measured at 26 lakes sampled as part of the LakeWatch program during the summer of 2022.

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 7.3 µg/L at Chestermere Lake to a maximum of 830.0 µg/L at Saskatoon Lake (Figure 2). Total phosphorus averages were significantly correlated with average chlorophyll-*a* concentrations across lakes (Kendalls' Tau-b, τ_b= 0.69, p = <0.001).

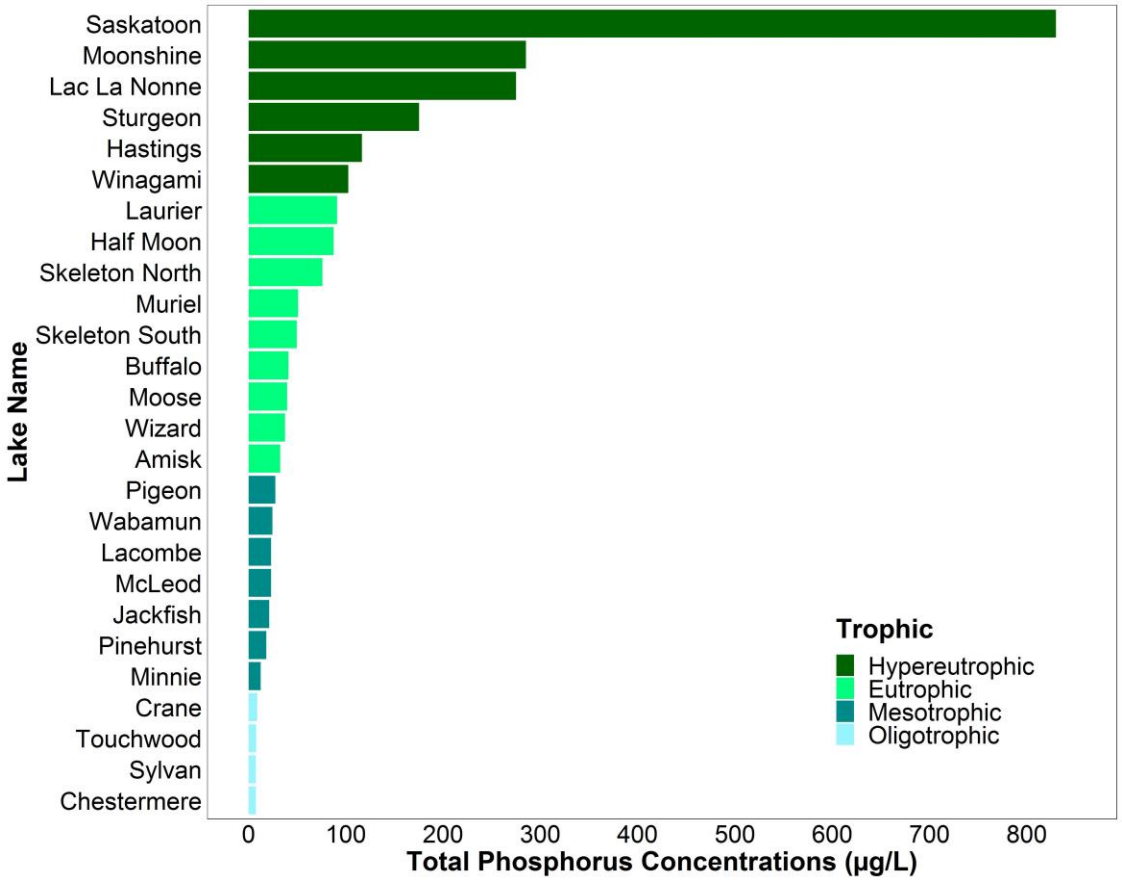


Figure 2. Average total phosphorus (TP) concentrations measured at 26 lakes sampled as part of the LakeWatch program during the summer of 2022.

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 3.05 µg/L at Touchwood Lake to a maximum of 66.65 µg/L at Laurier Lake (Figure 3). Chlorophyll-*a* and total Kjeldahl nitrogen averages were significantly correlated across lakes (Kendalls' Tau, τ= 0.57, p = <0.001).

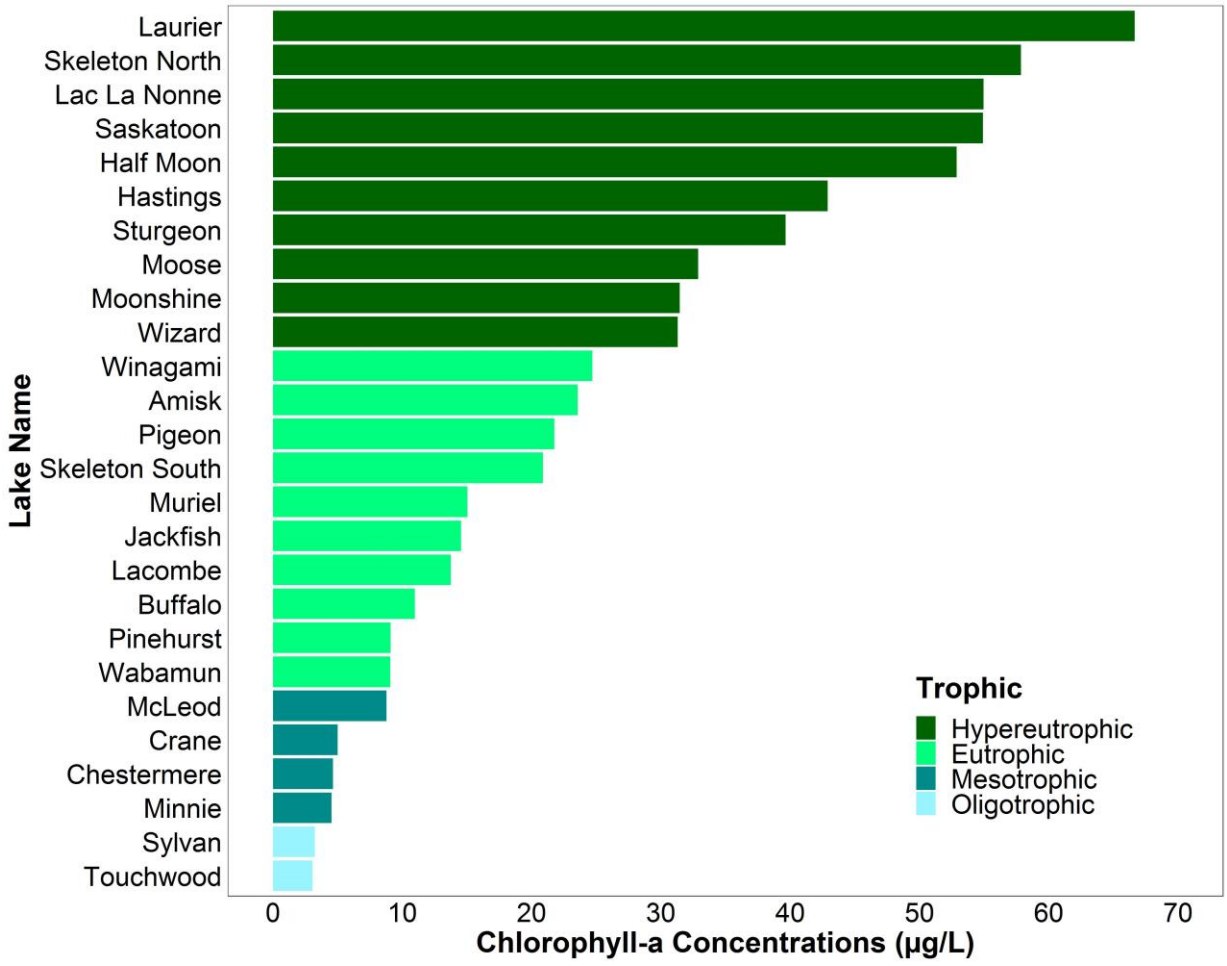


Figure 3. Average chlorophyll-*a* concentrations measured at 26 lakes sampled as part of the LakeWatch program during the summer of 2022.

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 2021, 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 fell below the minimum detection limit of 0.1 µg/L at Chestermere Lake, Crane Lake, Pinehurst Lake, Sylvan Lake, and Touchwood Lake (Figure 4). Microcystin was detected at every other lake, with the highest average concentration observed at Skeleton Lake North, measuring 9.48 µg /L. Skeleton Lake North was the only lake sampled in 2022 to measure higher than the recreational guideline of 10 µg /L, which occurred during the June and July sampling events. Samples from discrete locations such as a surface grab sample from a thick bloom, or from a beach, may have toxin concentrations higher than the recreational guidelines, and caution should be observed when recreating in or around cyanobacteria blooms.

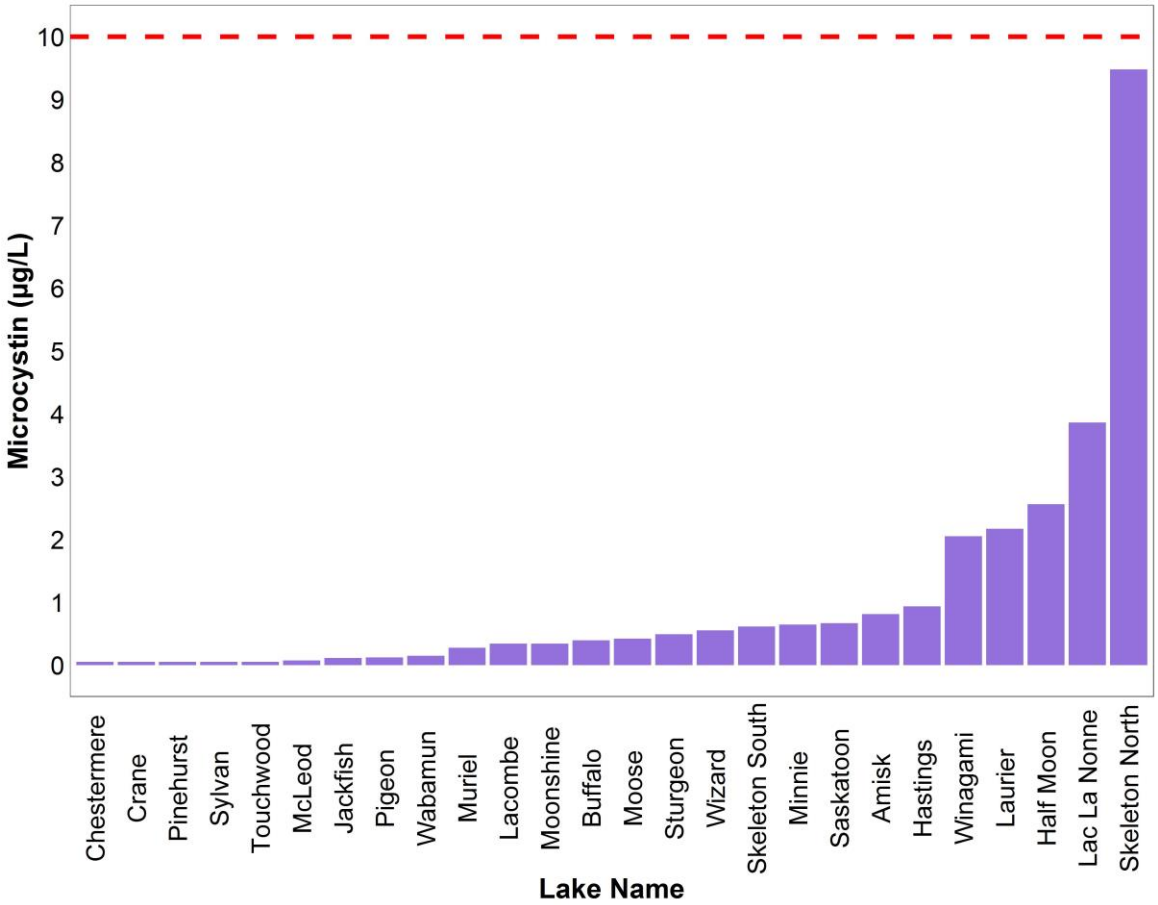


Figure 4. Average microcystin concentrations measured at 26 lakes sampled as part of the LakeWatch program during the summer of 2022. The dashed line indicates the recreational guideline of 10 µg/L.

WATER CHEMISTRY – Total Kjeldahl Nitrogen

As with phosphorus, nitrogen is a nutrient that primary producers 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 (TKN) concentrations ranged from a minimum of 0.25 mg/L at Chestermere Lake to a maximum of 4.58 mg/L at Hastings Lake (Figure 5). Total Kjeldahl nitrogen averages and total phosphorus averages were significantly correlated across lakes (Kendalls' Tau, τ= 0.62, p = <0.001).

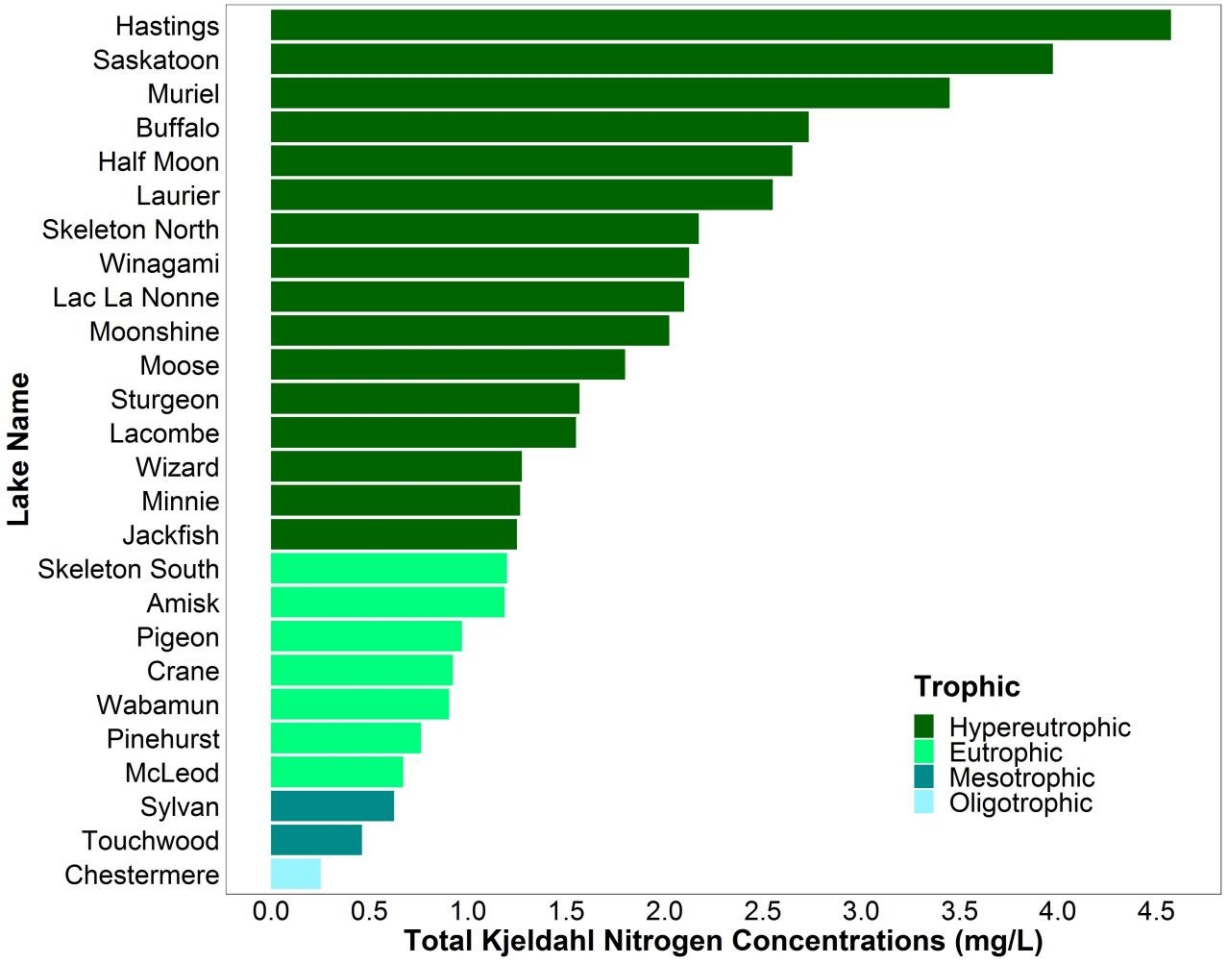


Figure 5. Average total Kjeldahl nitrogen (TKN) concentrations measured at 26 lakes sampled as part of the LakeWatch program during the summer of 2022.