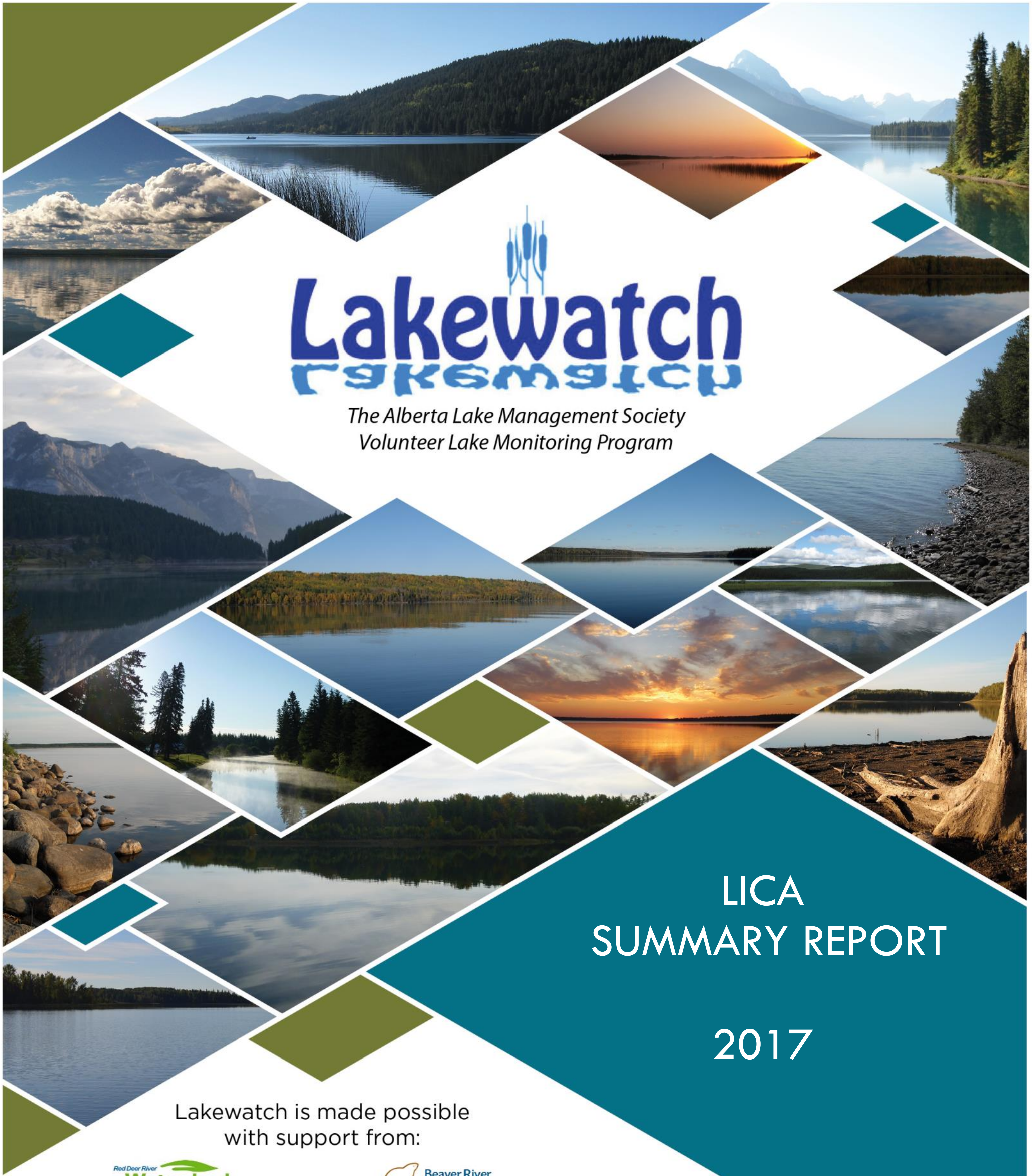

Lakewatch

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

LICA SUMMARY REPORT

2017

Lakewatch is made possible with support from:

Red Deer River Watershed Alliance
Beaver River Watershed Alliance
Cargill Helping the world thrive
Alberta Environment and Parks
Jackfish Lake Management Association
Pigeon Lake Watershed Association
LICA Lakeland Industry & Community Association

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 people prove that ecological apathy can be overcome and give us hope that our water resources will not be the limiting factor in the health of our environment.

This report has been prepared with un-validated data.

ACKNOWLEDGEMENTS

The LakeWatch program is made possible through the dedication of its volunteers. Thank you to Colin Hanusz who was integral in the organization of volunteers across the Beaver River Watershed. We would also like to thank Elashia Young and Melissa Risto who were summer technicians in 2017. Executive Director Bradley Peter and LakeWatch Coordinator Laura Redmond were instrumental in planning and organizing the field program. This report was prepared by Laura Redmond and Bradley Peter.

INTRODUCTION

In 2017, ALMS received funding from the Beaver River Watershed Alliance (BRWA) through the Lakeland Industry and Community Association (LICA), to conduct LakeWatch, a volunteer based water quality monitoring program. Data presented below has not completed its final validation process. This report highlights the variability that exists within select parameters among the 2017 lakes sponsored by LICA. 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 (Table 1), 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 this report.

In 2017, ALMS collected additional grab samples from Jessie Lake on two trips in 2017. Samples were taken from the culvert and the bridge on the east side of the lake. Results of grab samples are summarized in table 2 of the Appendix of this report.

Table 1– Drainage basin area (km^2), lake area (km^2), and the drainage basin to lake area ratio for the 2017 lakes.

Lake	Drainage Basin Area (km^2)	Lake Area (km^2)	Drainage Basin Area/Lake Area
Crane	44	10.3	4:1
Garner	26	6.2	4:1
Kehewin	156	7.4	21:1
Laurier	196	6.6	30:1
Minnie	4	0.7	7:1
Moose	808	40.5	20:1
Muriel	394	69	6:1
Skeleton	33	8.8	4:1
Touchwood	112	28.9	4:1

SAMPLE RECORD

Two summer field technicians (Elashia Young and Melissa Risto) and the LakeWatch Coordinator (Laura Redmond) conducted water quality sampling during the ice-off season of 2017. Each lake was to be visited five times throughout the summer, and in 2017, 44 of 50 scheduled trips were completed. This resulted in a completion rate of 88% (Table 2). Missed trips were a result of volunteer availability and unsafe weather. Data for Garner Lake should be observed with caution, as only two data collection points were available for analysis.

VOLUNTEERS

In 2017, ALMS worked with 17 volunteers for a total of 128 volunteer hours spent sampling 32 lakes. Each year, ALMS recognizes one volunteer who has shown outstanding dedication and commitment to the LakeWatch program. This year, Orest Kitt of Skeleton Lake North in the Beaver River Watershed was presented with the LakeWatch Volunteer of the Year Award.

Volunteer of the Year recipient, Orest Kitt, and LakeWatch Technician, Elashia Young at Skeleton Lake.

Table 2- The LakeWatch sample completion record for 2017. Missed trips due to unsafe weather or volunteer availability.

Lake	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5
Crane	15-Jun	26-Jul	10-Aug	29-Aug	11-Sep
Garner	Missed Trip	27-Jul	29-Aug	Missed Trip	Missed Trip
Kehewin	27-Jun	27-Jul	16-Aug	7-Sep	Missed Trip
Laurier	15-Jun	7-Jul	4-Aug	18-Aug	1-Sep
Minnie	12-Jun	10-Jul	8-Aug	21-Aug	25-Sep
Moose	29-Jun	18-Jul	9-Aug	27-Aug	20-Sep
Muriel	27-Jun	19-Jul	4-Aug	29-Aug	Missed Trip
Skeleton North	5-Jun	29-Jun	25-Jul	14-Aug	5-Sep
Skeleton South	23-Jun	12-Jul	14-Aug	28-Aug	13-Sep
Touchwood	28-Jun	27-Jul	17-Aug	Missed Trip	22-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. Results from 10 lakes have been summarized below.

Sunset on Crane Lake 2017- Photo by Elashia Young

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 depth across 2017 lakes ranged from a minimum of 1.00 m in Garner Lake to a maximum of 4.65 m in Touchwood Lake. Secchi depth was negatively correlated with chlorophyll-*a* indicating that on average, Secchi depth decreased with increasing algal biomass. However, this relationship is not always strong, and decreasing clarity can also be attributed to suspended sediments or dissolved organic compounds (which make the water brown), particularly in shallow areas.

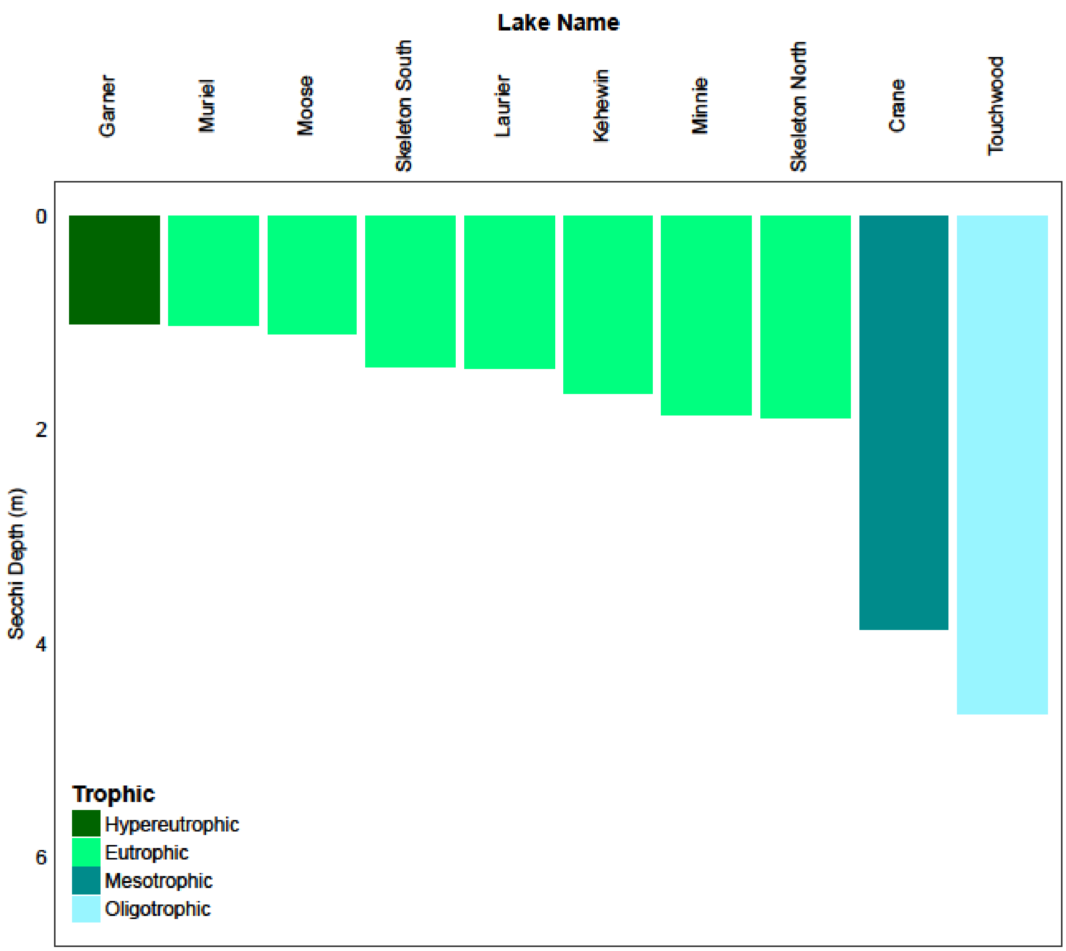

Figure 1: Average Secchi depth measurements (metres) across 10 LICA sponsored LakeWatch lakes sampled in 2017.

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.

In 2017, lakes sampled in the LICA area represented all major trophic levels except oligotrophic based on total phosphorus (TP) concentrations (Figure 2). Average TP ranged from 13.2 µg/L in Crane Lake to 121 µg/L in Kehewin Lake (Figure 2). LICA lakes fell into all major trophic classifications based on chlorophyll-*a* concentrations (Figure 3). Average chlorophyll-*a* concentrations ranged from a minimum of 3.48 µg/L in Touchwood lake to 88.35 µg/L in Garner Lake.

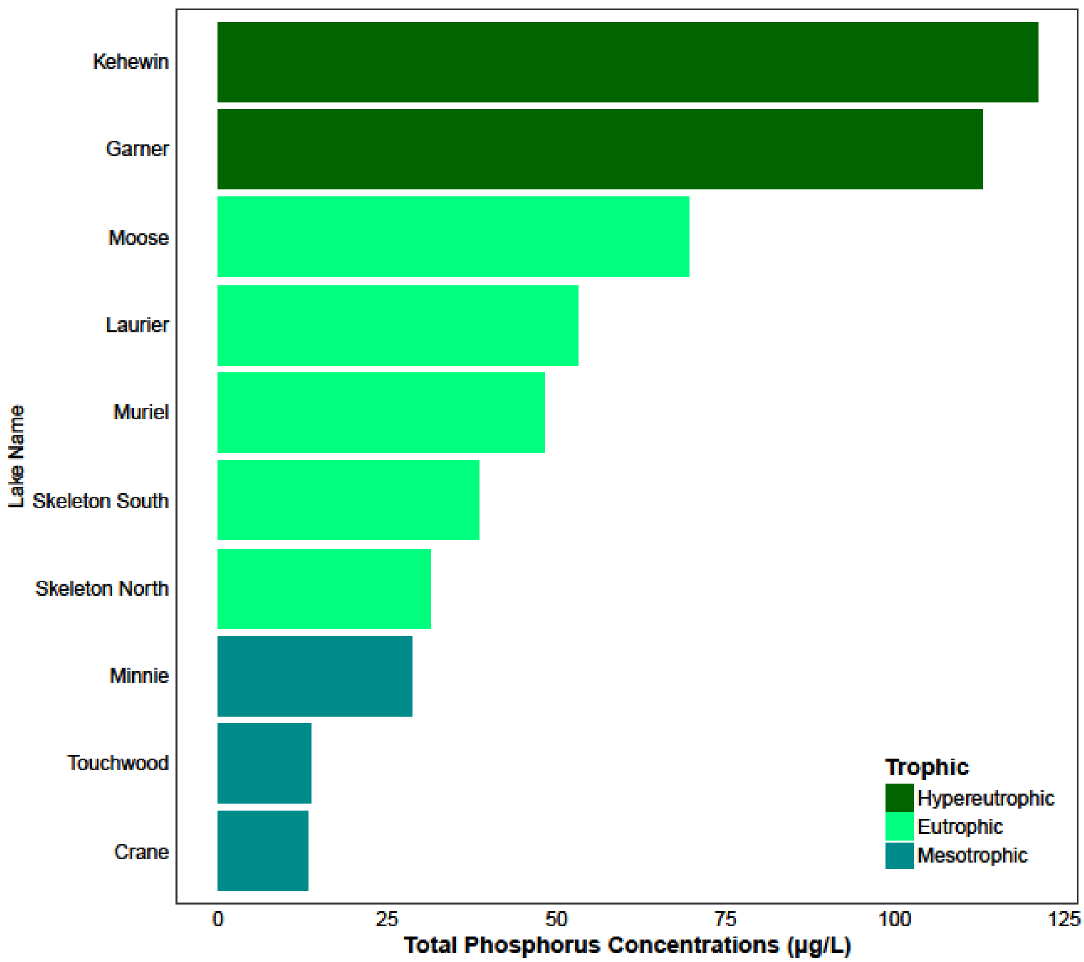

Figure 2: Average Total Phosphorus (TP) concentrations (µg/L) across 10 LICA sponsored LakeWatch lakes sampled in 2017.

Average total phosphorus (TP) and average chlorophyll-*a* were significantly correlated (r= 0.98, p-value= 1.45 x 10^{-7}) indicating that algal biomass was related to total phosphorus concentrations in the Beaver River Watershed.

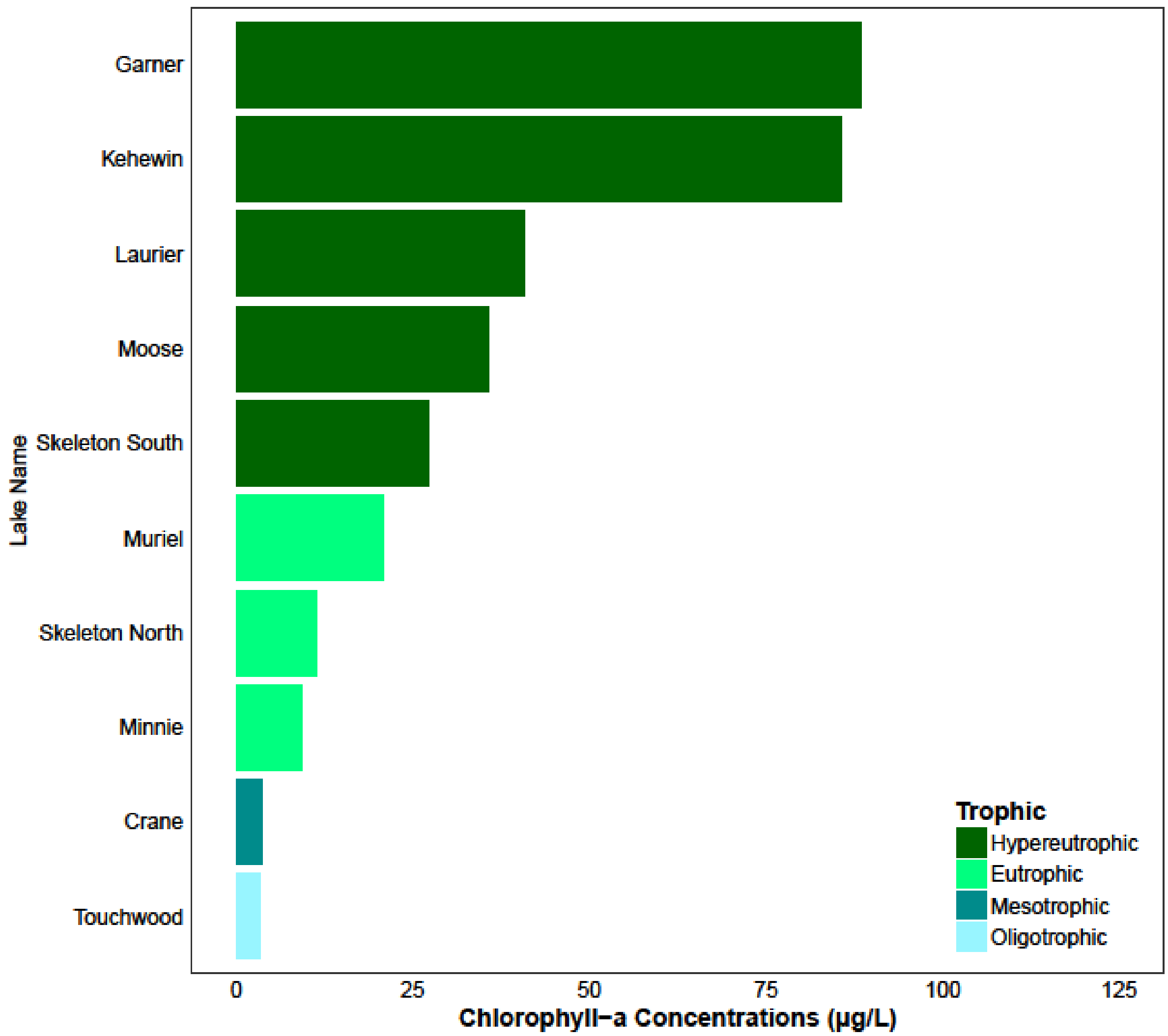

Figure 3: Average Chlorophyll-*a* concentrations (µg/L) across 10 LICA sponsored LakeWatch lakes sampled in 2017.

METALS

Samples were analyzed for metals twice throughout the summer (Table 3). In total, 27 metals were sampled for. 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 all fell above their recommended guidelines in the Beaver River Watershed.

2016 and 2017 were particularly wet years which resulted in increases in many lake's water levels. 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 2017, Crane, Garner, Minnie and Muriel exceeded the Canadian Council for Ministers of the Environment (CCME) recommended guidelines for the Protection of Aquatic Life (PAL; 5.0 µg/L) and Crane, Garner and Muriel exceeded the Health Canada Drinking Water Quality Guidelines (10.0 µg/L; Table 2).

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. Boron is not known to be elevated in the Beaver River Watershed, however in 2017, Crane and Muriel lakes exceeded guidelines for the Protection of Aquatic Life (1500 µg/L; Table 2).

Aluminum occurs naturally in the sediment and was slightly higher than CCME guideline in Garner Lake. This exceedance could be caused by sediment contamination during sampling.

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 agriculture. In the Beaver River Watershed, Crane, Garner and Muriel exceeded the CCME recommended guidelines for the Protection of Aquatic Life (1 µg/L; Table 2).

Moose Lake Island Bay. Photo by Elashia Young 2017.

Table 2 – Concentrations of arsenic, boron, aluminum and selenium measured in 2017. Concentrations have been compared to CCME Guidelines for the Protection of Aquatic Life. Values in red indicate measurements which have exceeded their guideline.

Lake	Arsenic[a] µg/L	Boron[b] µg/L	Aluminum[c] µg/L	Selenium[d] µg/L
Crane	21.9	1500	34.2	4.2
Garner	25.9	1130	122	4.5
Kehewin	2.38	93.2	9.2	0.4
Laurier	2.56	170	6.8	0.5
Minnie	9.65	194	3.9	0.5
Moose	1.83	181	19.4	0.5
Muriel	54.8	1760	85.7	12.8
Skeleton North	0.77	96.5	4.5	0.1
Skeleton South	1.04	105	21.5	0.1
Touchwood	0.63	34.7	3.9	0.1

[a]Guideline: 5.0 µg/L
[b]Guideline: 1500 µg/L
[c]Guideline: 100 µg/L
[d]Guideline: 1 µg/L

Invasive Species Monitoring

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 algae 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 two components: monitoring for juvenile mussel veligers using a plankton net and monitoring for attached adult mussels using substrates installed in each lake. In 2017, no mussels were detected in the 10 lakes sampled.

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.

Microcystin concentrations collected by ALMS are not suitable for advisory purposes: samples collected by ALMS are compiled from ten points around the lake and results may be diluted compared to a single grab sample collected at a recreational beach. Average microcystin levels remained below the recreational guideline of 20 μg/L. However, Garner Lake exceeded the guideline on August 29th, measuring 25 μg/L. Microcystin levels were minimal in Touchwood and Skeleton North, falling below the detection limit.

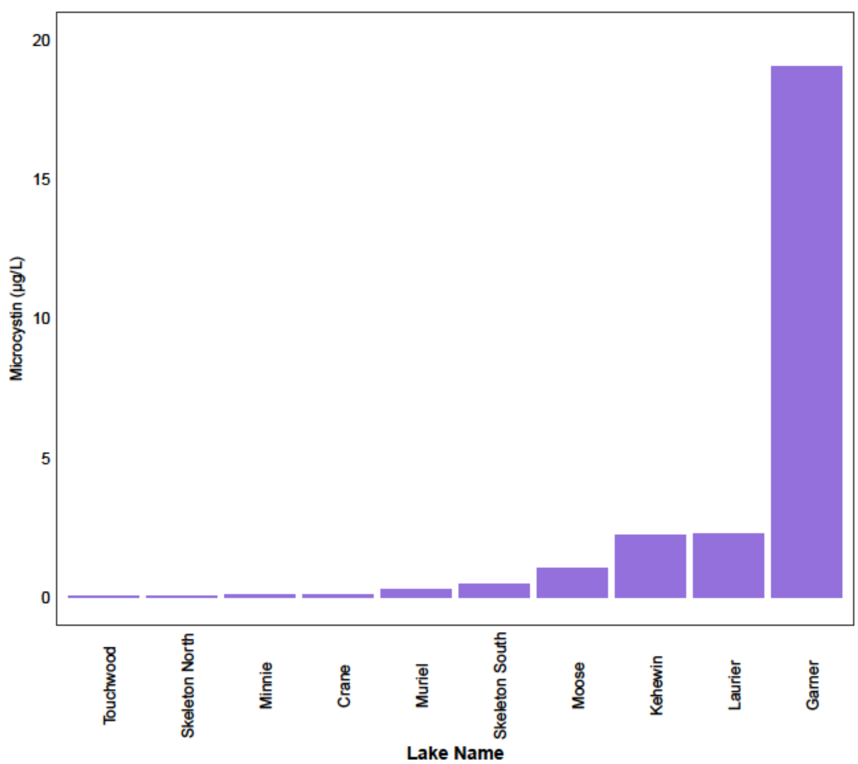

Figure 4: Average microcystin concentrations (μg/L) across 10 LICA sponsored LakeWatch lakes sampled in 2017.

APPENDIX

Table 1 – Average Secchi depth and water chemistry values for ten lakes sampled from June-September of 2017.

Lake	Total Phosphorus (µg/L)	Chlorophyll-*a* (µg/L)	Secchi Depth (m)	TKN (mg/L)	pH	Conductivity (µS/cm)	Alkalinity (mg/L $CaCO_3$)
Crane	13.2	3.7	3.86	0.90	8.93	906	446
Garner	113	88.4	1.00	3.15	9.21	1400	650
Kehewin	121	85.7	1.65	1.98	8.63	513	223
Laurier	53.2	39.6	1.42	2.5	8.86	966	458
Minnie	28.6	9.4	1.86	1.46	8.84	1320	344
Moose	69.4	40.7	1.10	2.1	8.75	934	322
Muriel	48.3	20.9	1.03	3.4	9.30	2200	998
Skeleton North	31.4	11.2	1.88	1.6	8.83	390	198
Skeleton South	38.6	27.3	1.40	1.5	8.79	422	222
Touchwood	13.7	3.5	4.65	0.59	8.42	270	150

Table 2—Water chemistry values for Jessie Lake sampled at culvert and east bridge in July and August of 2017.

Jessie Lake	Culvert		East Bridge	
	July 18	**August 9**	**July 18**	**August 9**
Total Phosphorus (µg/L)	490	500	550	710
Chlorophyll-*a* (µg/L)	65.9	46.5	116	64.5
TKN (mg/L)	3.7	4.0	4.3	5.7
pH	8.30	8.57	8.4	8.26
Conductivity (µS/cm)	2000	2000	2000	2100
Alkalinity (mg/L $CaCO_3$)	520	500	520	530
Microcystin (µg/L)	0.19	0.46	0.76	0.57