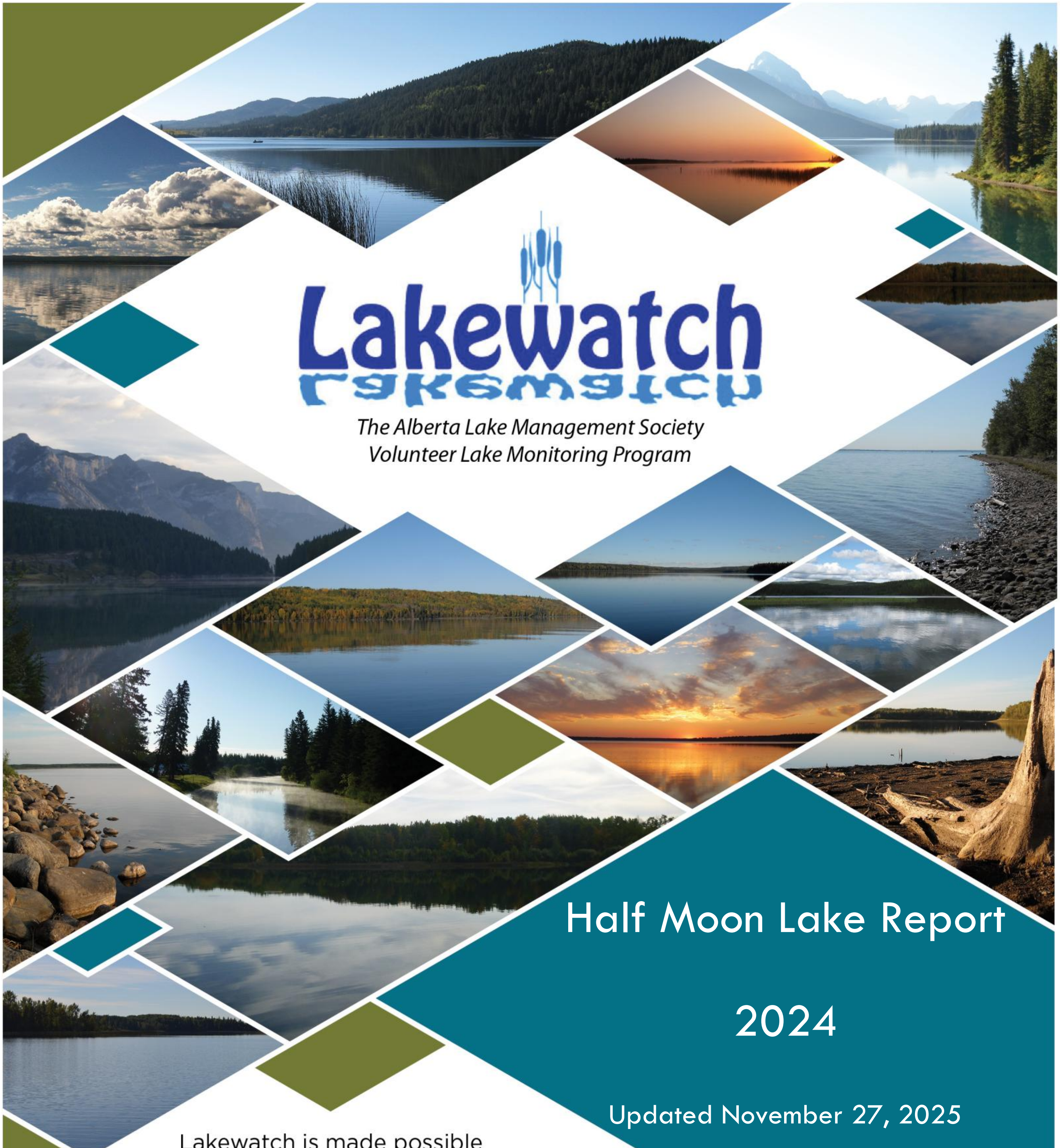


Lakewatch

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

Half Moon Lake Report

2024

Updated November 27, 2025

Lakewatch is made possible with support from:

Alberta

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.

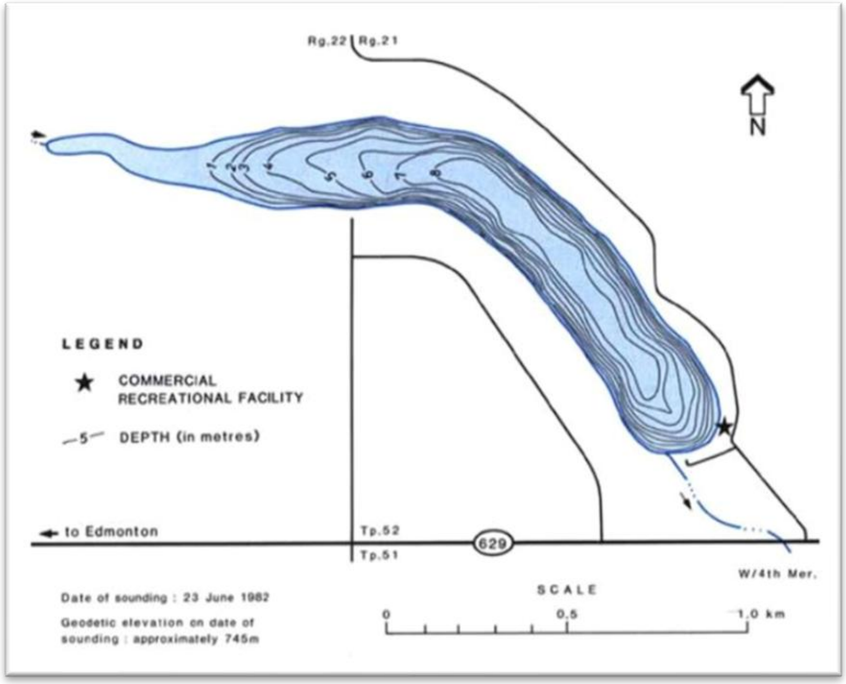
ACKNOWLEDGEMENTS

The LakeWatch program is made possible through the dedication of its volunteers. A special thanks to Richard Normandeau for their commitment to collecting data at Half Moon Lake. We would also like to thank Katherine Cundict and Jordyn Lajeunesse, 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.

BEFORE READING THIS REPORT, CHECK OUT A BRIEF INTRODUCTION TO LIMNOLOGY

HALF MOON LAKE

Half Moon Lake is located 20 km east of the City of Edmonton in the County of Strathcona. Half Moon Lake lies within the Beaverhill sub-basin of the North Saskatchewan River watershed.[1] The main land uses in this sub-basin are agriculture, oil and gas exploration, and municipal development.[1]



Bathymetric map of Half Moon Lake obtained from the Atlas of Alberta Lakes.

Half Moon Lake, named for its shape, is small, with a surface area of only 0.41 km^2, a mean depth of 4.8 m, and a maximum depth of 8.5 m.[2] The drainage basin is also small, measuring only 2.43 km^2, resulting in a drainage basin to surface area ratio of 6:1. Only one intermittent stream flows into the lake from the north.[2] Development in Half Moon Lake's watershed is extensive and includes residential units on the east and west shores, and one resort, the Half Moon Lake Resort, on the South shore.. Despite the lake's popularity as a recreational destination, sport fishing is absent as sport fish are unable to survive in the lake's low dissolved oxygen concentrations.[2] The lake has been considered very highly productive (hypereutrophic) for decades.[2] In addition, a sewage system for the lake was only completed in 1998; before that, residents recount that outhouses and septic systems discharged directly into the lake.[3]

Half Moon Lake has been the subject of several in-lake treatments for the control of nuisance algal/cyanobacterial blooms including herbicides and the addition of lime (calcium oxide and calcium carbonate).[2] In 1989, 58 tonnes of calcium carbonate and 49 tonnes of calcium oxide were added to the lake in effort to reduce the amounts of phosphorus and algae/cyanobacteria biomass.[4] In 1989, after positive results from the first additions, an extra 139 tonnes of calcium oxide was added to the lake. Although treating the lake with lime resulted in a reduction in the concentration of TP, Half Moon Lake has received cyanobacteria advisories for the past 5 years due to the occurrence and abundance of cyanobacteria in the lake. Therefore, the results of this treatment have been mixed, and this treatment is likely not a viable way to treat Half Moon Lake for cyanobacteria blooms.

Residents of Half Moon Lake are considering other treatment options for the lake, subject to better understanding of current and future conditions.[3]

Sampling at Half Moon Lake on August 6, 2024.

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[1] Amec Foster Wheeler Environment & Infrastructure. 2016. North Saskatchewan, Beaver, and Battle River Basins Study.
[2] Mitchell, P and E. Prepas. 1990. Atlas of Alberta Lakes.
[3] The Sherwood Park Strathcona Couty News. 2023. County to partner on Half Moon Lake's blue-green algae problem.
[4] Prepas, J. and Babin, J. 1990. Final Report on the 1989 Lime Treatment of Halfmoon Lake.

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. See Table 2 for a complete list of parameters.

The average total phosphorus (TP) concentration for Half Moon Lake was 68 µg/L (Table 2), falling into the eutrophic, or highly productive trophic classification. This value is consistent with the range of observed historical averages (Table 2). TP ranged from a minimum of 48 µg/L on July 9 to a maximum of 94 µg/L on September 3 (Figure 1).

Average chlorophyll-*a* concentration in 2024 was 43.4 µg/L (Table 2), falling into the hypereutrophic, or very highly productive trophic classification. Chlorophyll-*a* was lowest at 21.8 µg/L on June 17 and peaked at 87.3 µg/L on September 3 (Figure 1).

TP and chlorophyll-*a* followed a similar pattern over the summer, both increasing later in the season (Figure 1).

The average Total Kjeldahl Nitrogen (TKN) concentration in 2024 was 2 mg/L (Table 2). TKN increased slightly over the season (Figure 1).

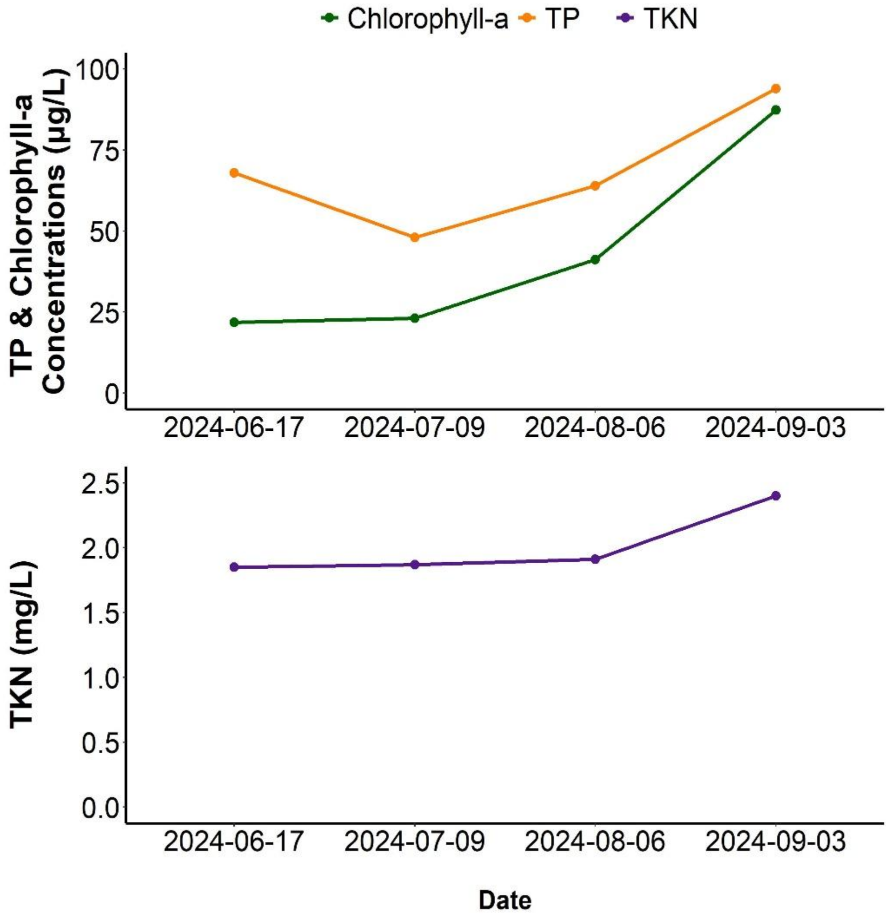
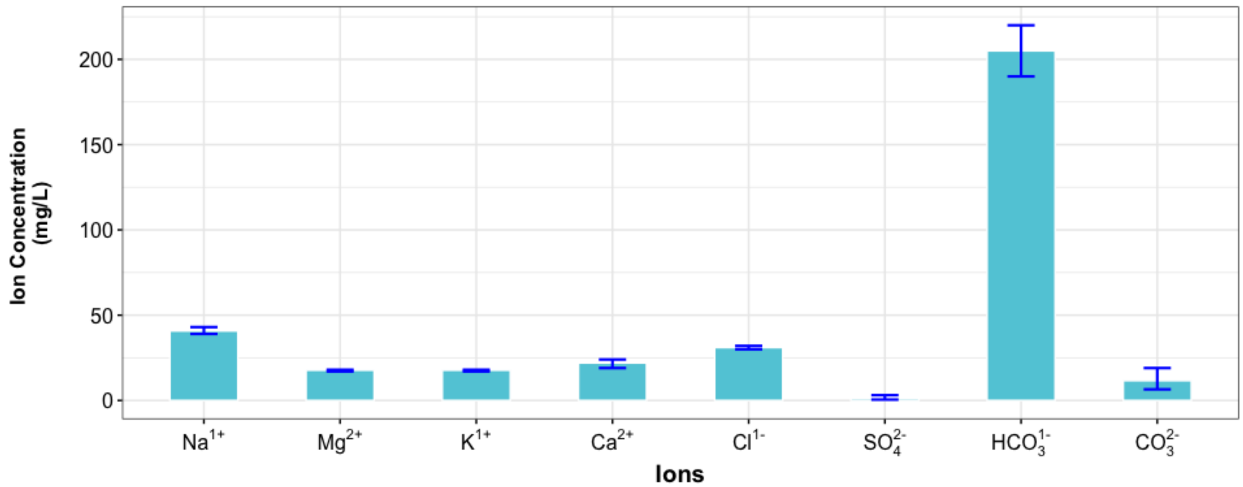


Figure 1. Total Phosphorus, Chlorophyll-*a*, and Total Kjeldahl Nitrogen concentrations measured over the course of the summer at Half Moon Lake in 2024.

Average pH was measured as 8.63 in 2024, buffered by moderate alkalinity (188 mg/L $CaCO_3$) and bicarbonate (205 mg/L HCO_3). Aside from bicarbonate, all ions with the exception of sulphate and carbonate had similar levels, and together contributed to a moderate conductivity of 448 µS/cm (Figure 2, top; Table 2). Half Moon Lake is in the average to low end range of ion levels, compared to other LakeWatch lakes sampled in 2024 (Figure 2, bottom).



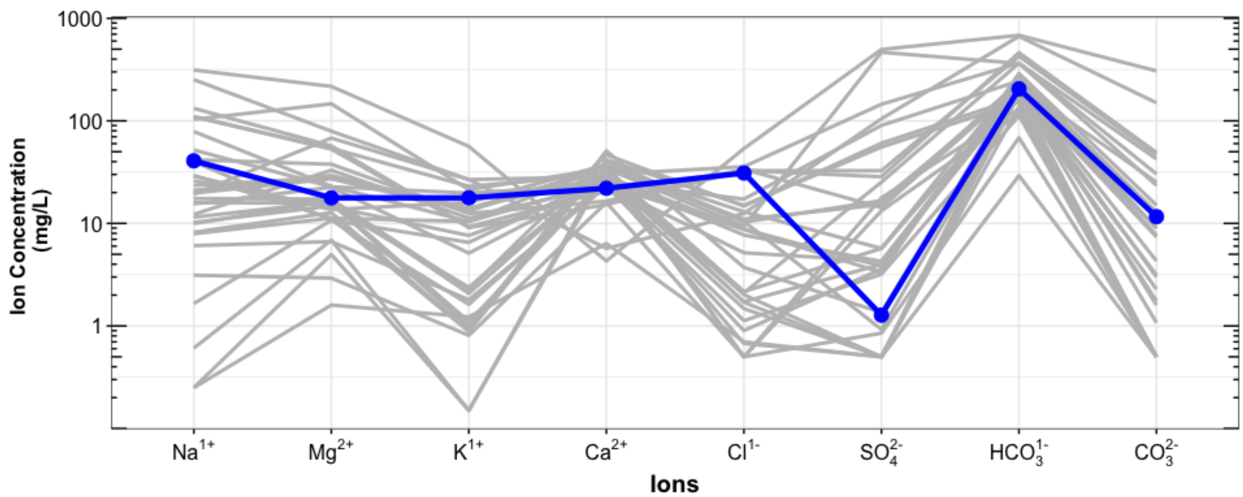


Figure 2. Average levels of cations (sodium = Na^{1+}, magnesium = Mg^{2+}, potassium = K^{1+}, calcium = Ca^{2+}) and anions (chloride = Cl^{1-}, sulphate = SO_4^{2-}, bicarbonate = HCO_3^{1-}, carbonate = CO_3^{2-}) measured over the course of the summer at Half Moon Lake. Top) bars indicate range of values measured, and bottom) Schoeller diagram of average ion levels at Half Moon Lake (blue line) compared to 26 lake basins (gray lines) sampled through the LakeWatch program in 2024 (note log10 scale on y-axis of bottom figure).

Metals

Metals will naturally be present in aquatic environments due to in-lake processes or the erosion of rocks, or introduced to the environment from human activities such as urban, agricultural, or industrial developments. Many metals have a unique guideline as they may become toxic at higher concentrations. Where current metal data are not available, historical concentrations for 27 metals have been provided (Table 3).

Metals were not measured at Half Moon Lake in 2024. Historical metals data is provided in Table 3.

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, 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 depth. Two times the Secchi depth equals the euphotic depth – the depth to which there is enough light for photosynthesis.

The average euphotic depth of Half Moon Lake in 2024 was 2.2 m, corresponding to an average Secchi depth of 1.1 m (Table 2). Euphotic depth varied over the season, ranging from as shallow as 1.2 m on September 3 to as deep as 3.4 m on July 9 (Figure 3). Secchi depth and euphotic depth were likely impacted by algal growth later in the summer during the August and September sampling trips, as TP and chlorophyll-*a* both increased during these months (Figure 1), indicating that algae and cyanobacteria abundance was responsible for the changes in water clarity through the summer.

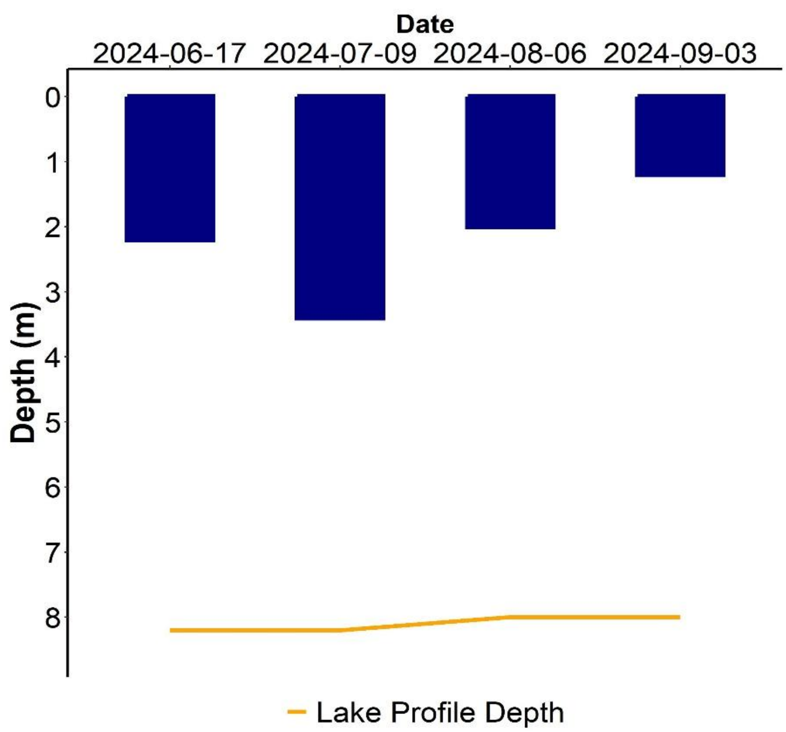


Figure 3. Euphotic depth values measured over the course of the summer at Half Moon Lake in 2024.

WATER TEMPERATURE AND DISSOLVED OXYGEN

Water temperature and dissolved oxygen (DO) profiles in the water column can provide information on water quality and fish habitat. The depth of the thermocline is important in determining the depth to which dissolved oxygen from the surface can be mixed. Please refer to the end of this report for descriptions of technical terms.

Surface temperatures of Half Moon Lake varied throughout the summer, with the July 9 sampling date having the warmest temperatures at 23.48°C (Figure 4). The lake displayed moderate and weak stratification during all sampling trips, with the exception of June, where the lake was primarily mixed.

Half Moon Lake was well oxygenated in the surface waters during all sampling events, measuring above the CCME guidelines of 6.5 mg/L dissolved oxygen[5] (Figure 4). Dissolved oxygen levels eventually became anoxic (<1.0 mg/L) during all sampling events, with anoxic levels being recorded shallower throughout the season (Figure 4).

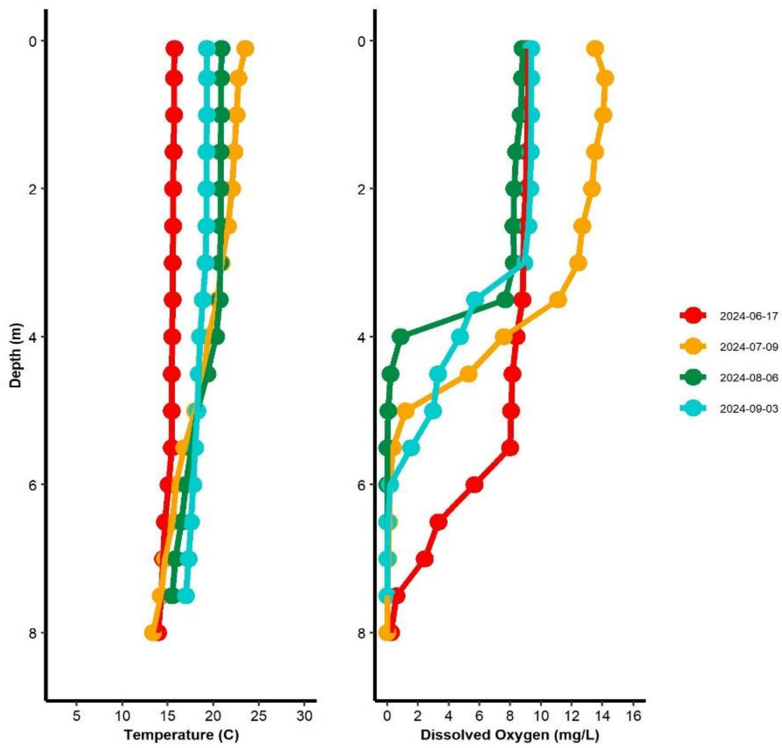


Figure 4. Temperature (°C) and dissolved oxygen (mg/L) profiles for Half Moon Lake measured over the course of the summer of 2024.

[5] Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life: Dissolved oxygen (freshwater).

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 one of the most common cyanobacteria toxins. In Alberta, recreational guidelines for microcystin are set at 10 μg/L. Blue-green algae advisories are managed by Alberta Health Services. Recreating in algal blooms, even if microcystin concentrations are not above guidelines, is not recommended.

Microcystin levels in Half Moon Lake fell below the recreational guideline of 10 μg/L[6] during every sampling event in 2024. Despite low levels of microcystin detected during the sampling events, caution should be observed in areas of the lake where significant cyanobacteria accumulation occurs.

Table 1. Microcystin concentrations measured four times at Half Moon Lake in 2024.

Date	Microcystin Concentration (μg/L)
06/17/2024	0.66
07/09/2024	0.57
08/06/2024	0.92
09/03/2024	2.87
Average	**1.25**

[6] Health Canada. 2022. Guidelines for Canadian Recreational Water Quality.

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 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.

Monitoring for aquatic invasive species involved sampling with a 63 µm plankton net. This monitoring is designed to detect juvenile Dreissenid mussel veligers and spiny water flea. No mussels or spiny water flea were detected at Half Moon Lake in 2024.

Eurasian watermilfoil is a 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. Eurasian watermilfoil can look similar to the native Northern watermilfoil, thus genetic analysis is ideal for suspect watermilfoil species identification.

Watermilfoil was collected from Half Moon Lake on August 16. The specimen was confirmed to be Northern Watermilfoil (*Myriophyllum sibiricum*).

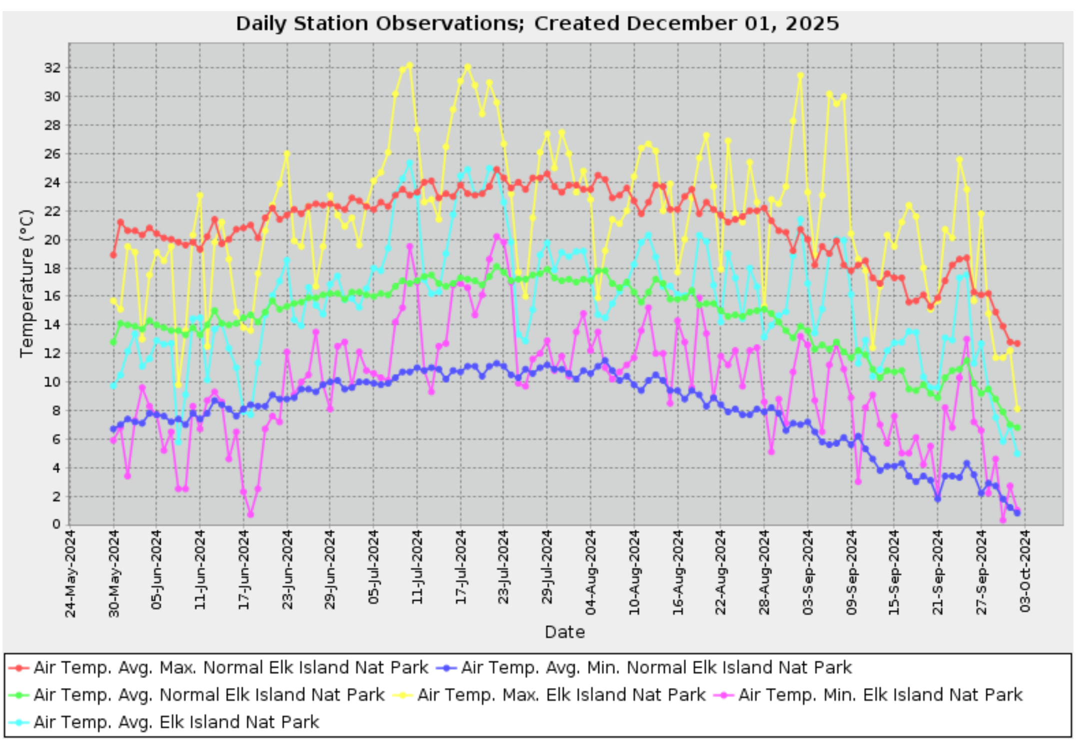
WEATHER AND LAKE STRATIFICATION

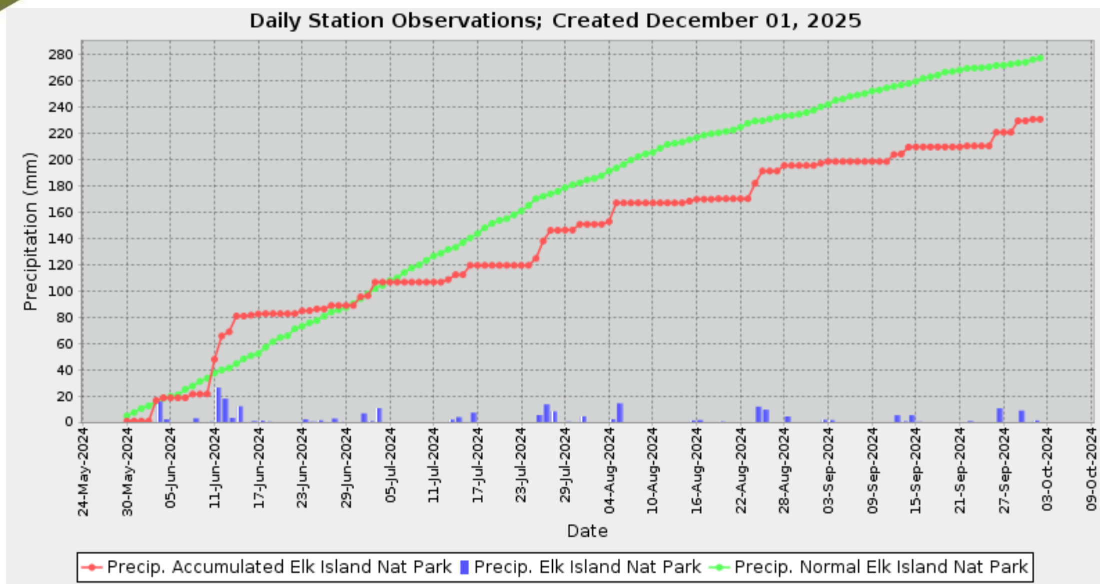
Air temperature will directly impact lake temperatures, and result in different temperature layers (stratification) throughout the lake, depending on its depth. Wind will also impact the degree to which a lake mixes, and how it will stratify. The amount of precipitation that falls within a lake's watershed will have important implications, depending on the context of the watershed and the amount of precipitation that has fallen. Solar radiation represents the amount of energy that reaches the earth's surface, and has implications for lake temperature & productivity.

In 2024, Half Moon Lake experienced a warmer and windier summer compared to normal, with less than normal accumulated precipitation (Figure 5). Although it was warmer overall, the beginning of the sampling season was unseasonably cool, with the month of June falling below average temperatures and breaking the lowest temperature record on June 18 at 0.7°C. July was the warmest month, with the average temperature being 19.7°C. 2024 also broke heat records on numerous days in July and September, including the hottest day recorded on July 10 at 32.2°C. August and September were warmer than average months, with the average temperature being 16.9°C and 13.6°C, respectfully.

Half Moon Lake received less precipitation than it normally receives throughout the summer months (230 mm total). Nearly 50% of the summer's precipitation fell by the 3rd day of July (Figure 5).

Strong winds were also observed throughout the sampling season.





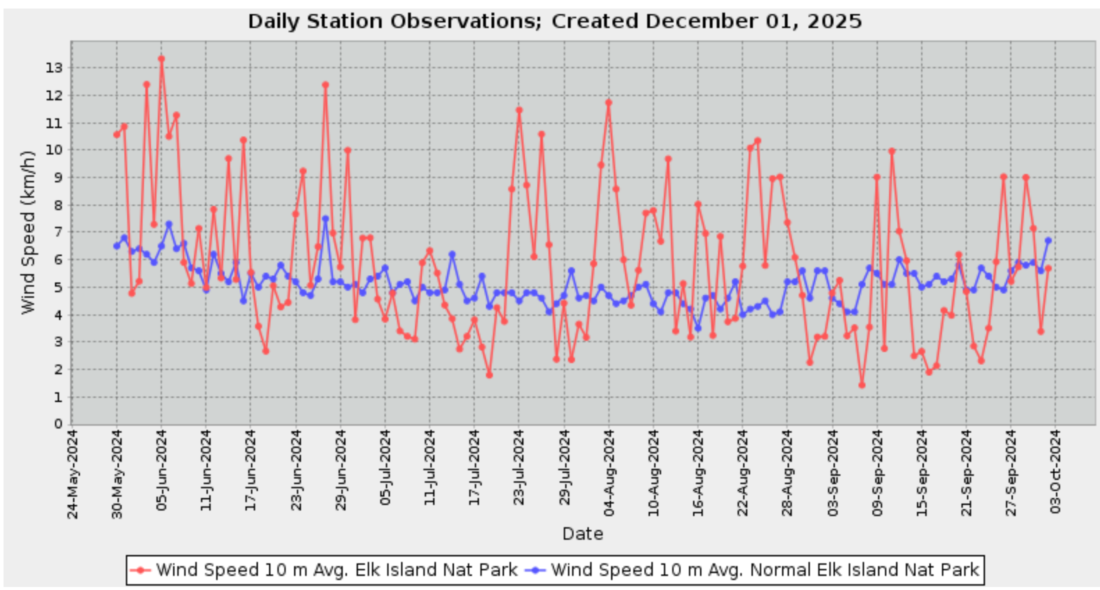


Figure 5. Air temperature (°C), wind speed (km/h), and precipitation (mm) measured from Elk Island Nat Park weather station northeast of Half Moon Lake. Weather data provided by Agriculture, Forestry and Rural Economic Development, Alberta Climate Information Service (ACIS) https://acis.alberta.ca.

WATER LEVELS

There are many factors influencing water quantity. Some of these factors include the size of the lake's drainage basin, precipitation, evaporation, water consumption, ground water influences, and the efficiency of the outlet channel structure at removing water from the lake. Requests for water quantity monitoring should go through Alberta Environment and Parks Monitoring and Science division.

In 2024, water levels at Half Moon Lake were lower than has been seen in the last five years (about 738.9 masl; Figure 6). Levels in 2024 were nearly the lowest on record, passed only in 2003 at 738.85 masl. There is a data gap in water levels from approximately 2001-2017.

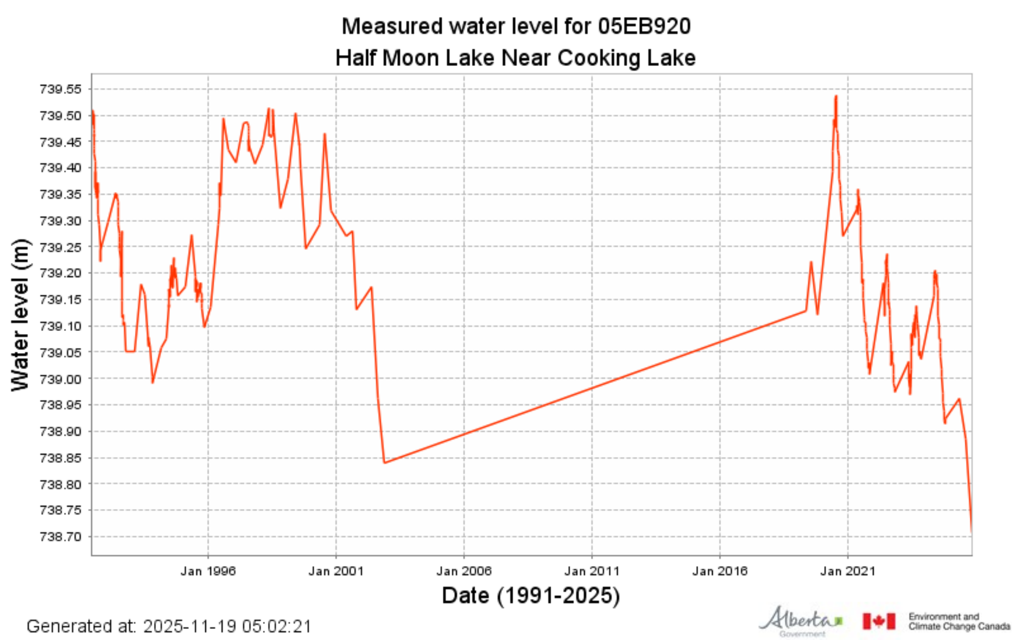


Figure 6. Water levels measured at Half Moon Lake in metres above sea level (masl) from 1991-2025. Obtained from Environment Canada and Alberta Environment and Parks Real-Time Hydrometric Data (https://wateroffice.ec.gc.ca/).

Table 2. Average Secchi depth and water chemistry values for Half Moon Lake.

Parameter	1983	1987	1988	1989	1990	2011	2017	2018	2019	2020	2022	2023	2024
TP (µg/L)	227	100	135	86	75	111	75	96	80	76	87	76	68
TDP (µg/L)	105	27	47	36	26	29	11	9	17	25	24	21	19
Chlorophyll-a (µg/L)	147.8	63.8	-	44.4	39.5	41.4	51.6	86.2	41.5	27.3	52.9	61.7	43.4
Secchi depth (m)	-	0.8	0.87	1.47	1	1.32	0.66	0.38	1.56	1.27	1.93	1.04	1.1
TKN (mg/L)	3.9	2.2	2.6	2.0	2.0	2.8	2.7	3.0	2.4	2.0	2.6	2.4	2.0
NO_2-N and NO_3-N (µg/L)	2	9	17	77	28	4	2	2	25	5	24	3	5
NH_3-N (µg/L)	85	-	127	-	64	-	38	80	173	107	82	157	30
DOC (mg/L)	-	19	20	19	18	22	22	24	21	19	21	20	22
Ca^{2+} (mg/L)	23	19	20	17	18	-	24	22	24	29	23	18	22
Mg^{2+}(mg/L)	10	10	14	11	12	-	18	18	17	16	17	18	18
Na^{+} (mg/L)	17	18	19	20	20	35	43	41	40	39	40	41	41
K^{+} (mg/L)	12	12	13	12	12	15	20	18	18	17	18	18	18
SO_4^{2-} (mg/L)	10	2	2	4	4	3	3	3	1	3	1	1	1
Cl^{-} (mg/L)	4	8	8	9	10	20	26	27	27	27	28	30	31
$CO\sim_3^{2-}$ (mg/L)	-	-	-	-	-	8.8	10.8	11.2	4.2	4	3.4	10.2	11.6
HCO_3^{2-} (mg/L)	-	-	-	-	-	195.75	205	207.5	217.5	215	220	210	205
pH	9.40	9.05	8.20	8.98	8.67	8.73	8.81	8.71	8.49	8.38	8.39	8.32	8.63
Conductivity (µS/cm)	283	287	304	291	294	397	430	430	435	442	445	422	448
Hardness (mg/L)	99	90	105	90	96	-	135	128	128	142	130	118	130
TDS (mg/L)	161	156	165	155	158	224	245	240	238	242	242	260	240
Microcystin (µg/L)	-	-	-	-	-	2.07	9.8	6.57	4.84	0.28	2.56	1.76	1.25
Total Alkalinity (mg/L CaCO3)	-	139	144	136	138	175	188	185	185	182	185	188	188

Table 3. Concentrations of metals measured in Half Moon Lake. The CCME heavy metal Guidelines for the Protection of Freshwater Aquatic Life (unless otherwise indicated) are presented for reference. Note that metal sample collection method changed in 2016 from composite to single surface grab at the profile location.

Metals	**2017**	**2023**	**Guidelines**
Aluminum (µg/L)	10.8	23.8	100[a]
Antimony (µg/L)	0.07	0.076	/
Arsenic (µg/L)	1.37	1.63	5
Barium (µg/L)	51.5	35	/
Beryllium (µg/L)	0.0015	0.0015	100[c,d]
Bismuth (µg/L)	0.0015	0.0015	/
Boron (µg/L)	76.2	79	1500
Cadmium (µg/L)	0.005	0.005	0.36[b]
Chromium (µg/L)	2.8	0.05	/
Cobalt (µg/L)	0.1015	0.087	500, 1000[c,d]
Copper (µg/L)	0.34	0.42	4[b]
Iron (µg/L)	55.35	49.3	300
Lead (µg/L)	0.073	0.057	7[b]
Lithium (µg/L)	27.2	26.6	2500[d]
Manganese (µg/L)	73.2	46.8	130[e]
Molybdenum (µg/L)	0.253	0.19	73
Nickel (µg/L)	1.59	0.52	150[b]
Selenium (µg/L)	0.25	0.2	1
Silver (µg/L)	5e-04	5e-04	0.25
Strontium (µg/L)	116.5	104	/
Thallium (µg/L)	0.001	0.001	0.8
Thorium (µg/L)	0.01	0.008	/
Tin (µg/L)	0.03	0.03	/
Titanium (µg/L)	0.555	0.71	/
Uranium (µg/L)	0.54	0.469	15
Vanadium (µg/L)	0.317	0.425	100[c,d]
Zinc (µg/L)	1.05	2.8	30[f]

Values represent means of total recoverable metal concentrations.
[a] Based on pH ≥ 6.5
[b] Based on 2016 avg. water hardness (as CaCO3) with CCME equation
[c] Based on CCME Guidelines for Agricultural use (Livestock).
[d] Based on CCME Guidelines for Agricultural Use (Irrigation).
[e] Based on CCME Manganese variable calculation (https://ccme.ca/en/chemical/129#_aql_fresh_concentration) using 2016 avg. water hardness (as CaCO3) and avg. pH
[f] Based on 2016 avg. water hardness (as CaCO3), avg. pH, and avg. DOC with CCME equation
A forward slash (/) indicates an absence of data or guidelines.