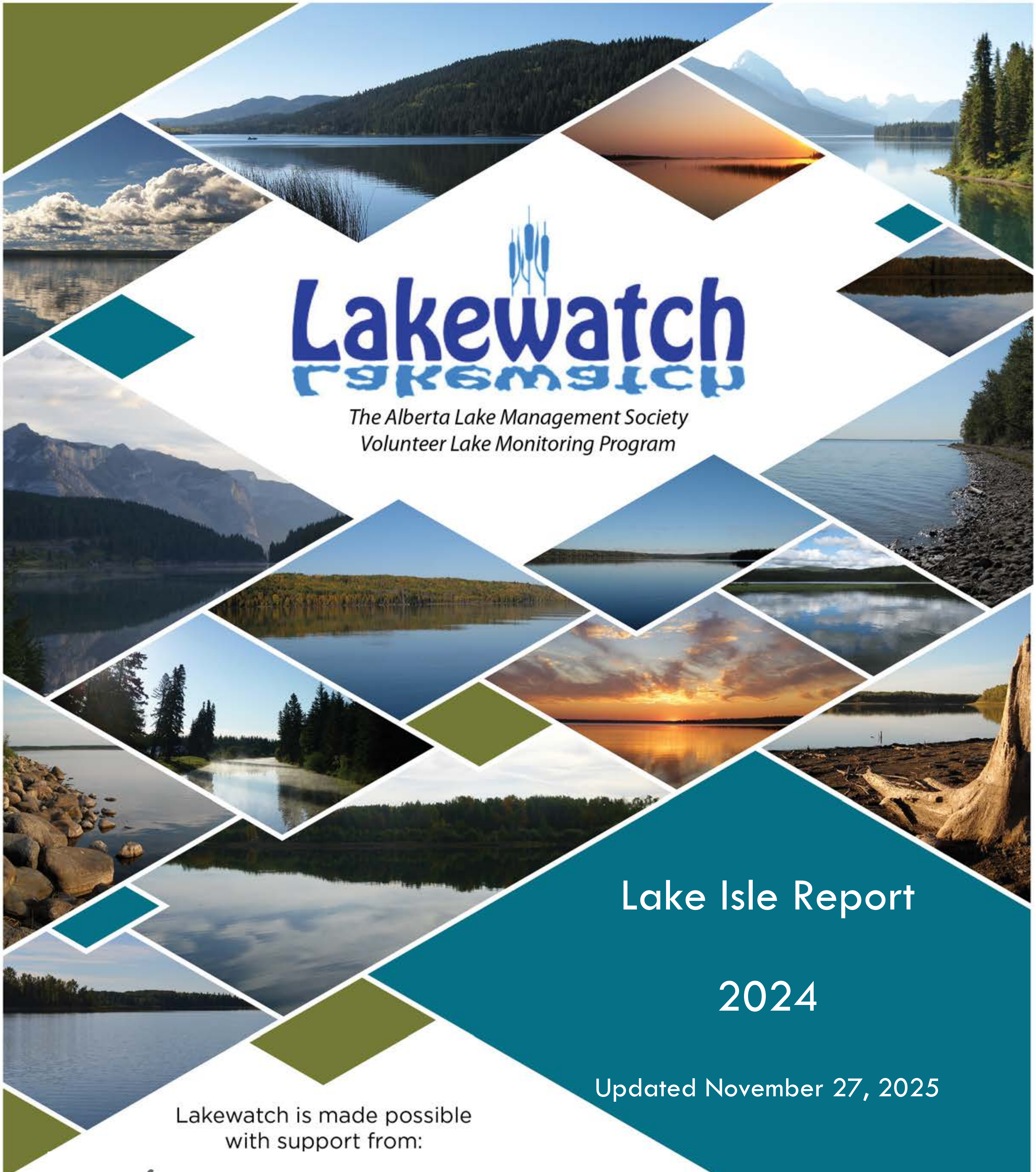


Lakewatch

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

Lake Isle 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 the Laidlaw family for their commitment to collecting data at Lake Isle. 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.

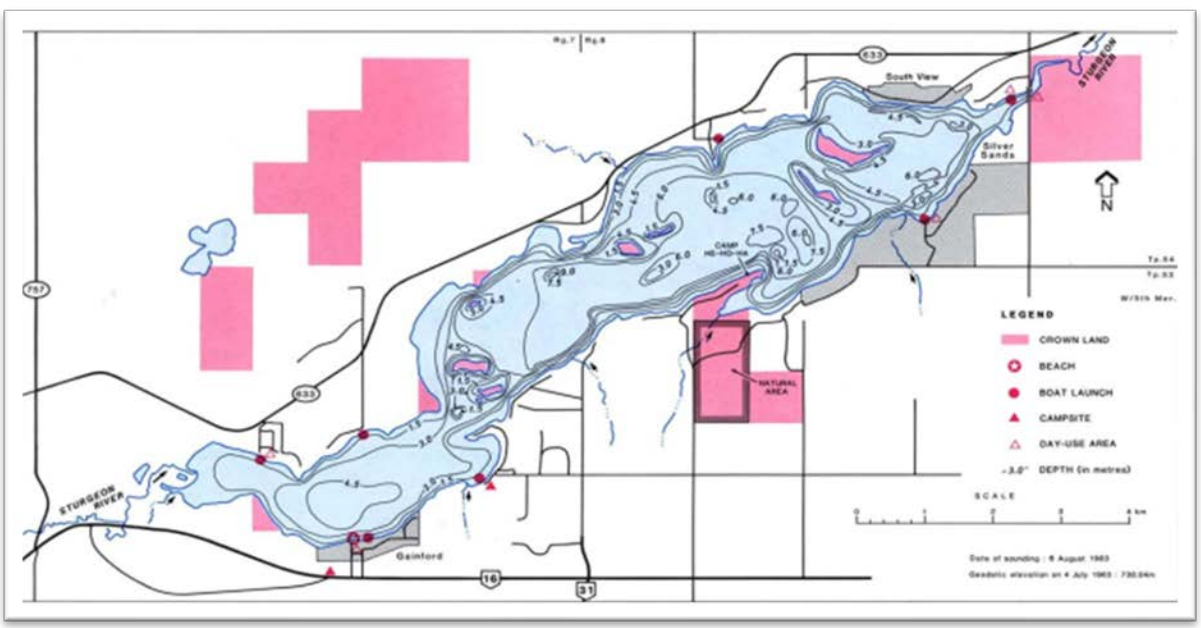
BEFORE READING THIS REPORT, CHECK OUT **A BRIEF INTRODUCTION TO LIMNOLOGY**

ISLE LAKE

Isle Lake is located in the counties of Lac Ste. Anne and Parkland, 80 km west of the City of Edmonton in the North Saskatchewan watershed. It's name originates from the many islands within the lake.[1] Isle Lake has a watershed that is approximately 253 km^2, and the lake itself has a surface area of 23 km^2, a mean depth of 4.1 m and the deepest spot being approximately 7.5 m deep.[1] The Sturgeon Lake runs into the west end of the lake, and continues to flow out of the northeast point of the lake, eventually leading to the North Saskatchewan River.[1]

Due to its close proximity to Edmonton, the lake is popular for camping and recreational water sports. Several subdivisions are registered along the shoreline. Sport fishing is popular, and species include northern pike, yellow perch, burbot, white suckers, and walleye.[1]

Isle Lake has experienced many stressors, including high phosphorus content which results in regular cyanobacteria blooms and a population of the invasive plant, Flowering Rush, which has the potential to reproduce and spread rapidly. Isle Lake is a very highly productive lake (hypereutrophic), and high algal growth has been reported at the lake for decades.[1,2]



Bathymetric map of Thunder Lake obtained from the Atlas of Alberta Lakes.

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[1] Mitchell, P. and E. Prepas. 1990. Atlas of Alberta Lakes.
[2] Government of Alberta. 1999. Water Quality Management in Lac Ste Anne and Lake Isle: A Diagnostic Study.

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 Isle Lake was 215 µg/L (Table 2), falling into the hypereutrophic, or very highly productive trophic classification. This value is on the higher end of previous historical averages (Table 2). TP was lowest on the July 20 sampling event at 120 µg/L to a maximum of 330 µg/L on August 17 (Figure 1).

Average chlorophyll-*a* concentration in 2024 was 57.3 µg/L (Table 2), similarly falling into the hypereutrophic classification. Chlorophyll-*a* was lowest earliest in the season, at 31.5 µg/L on June 15 and peaked at 86.8 µg/L on July 20 (Figure 1).

The average Total Kjeldahl Nitrogen (TKN) concentration in 2024 was 1.8 mg/L (Table 2), increasing slightly over the season (Figure 1).

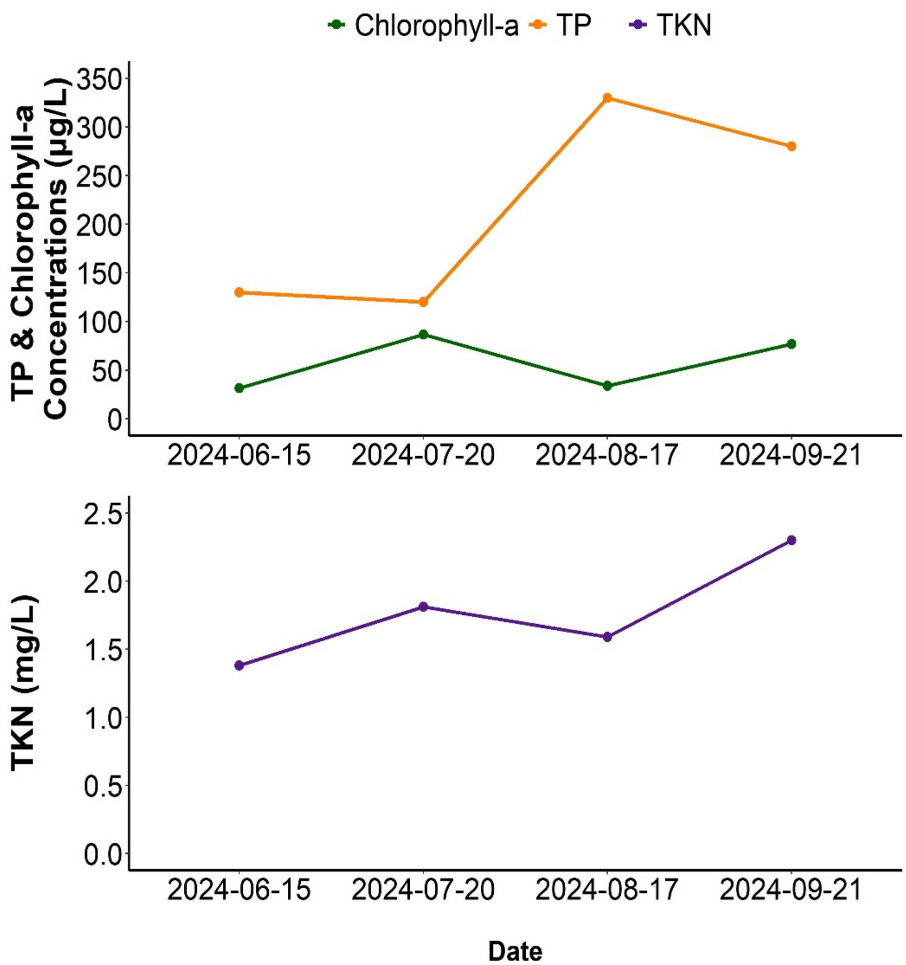

Figure 1. Total Phosphorus (TP), Chlorophyll-*a*, and Total Kjeldahl Nitrogen concentrations measured over the course of the summer at Isle Lake in 2024.

Average pH was measured as 8.32 in 2024, buffered by low alkalinity (175 mg/L $CaCO_3$) and bicarbonate (198 mg/L HCO_3). Aside from bicarbonate, calcium and sodium were slightly higher than other major ions and together contributed to a low conductivity of 380 µS/cm (Figure 2, top; Table 2). Isle Lake is in the moderate to low range of ion levels compared to other LakeWatch lakes sampled in 2024, with the exception of calcium, where it was higher than most of the other lakes (Figure 2, bottom).

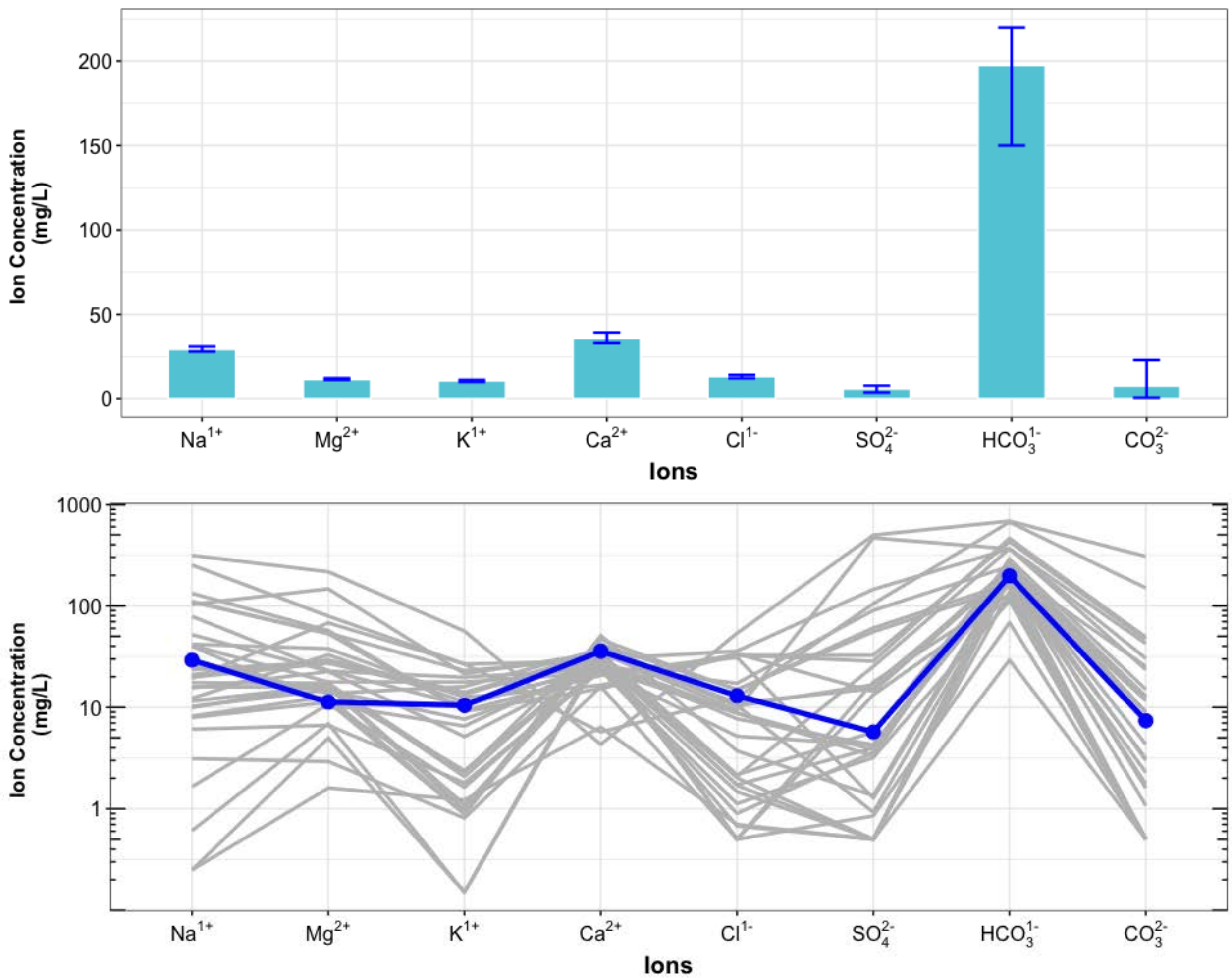

Figure 2. Average levels of cations (sodium = Na^{1+}, magnesium = Mg^{2+}, potassium = K^{1+}, calcium = Ca^{2+}) and anions (chloride = Cl^{1-}, sulphate = SO_4^{2-}, bicarbonate = HCO_3^{1-}, carbonate = CO_3^{2-}) from measurements over the course of the summer at Isle Lake. Top) bars indicate range of values measured, and bottom) Schoeller diagram of average ion levels at Isle 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).

Isle Lake also displayed high levels of ammonia (NH_3) during the August 17 and September 21 sampling events, exceeding the CCME guideline for the protection of aquatic life[3] (Figure 3).

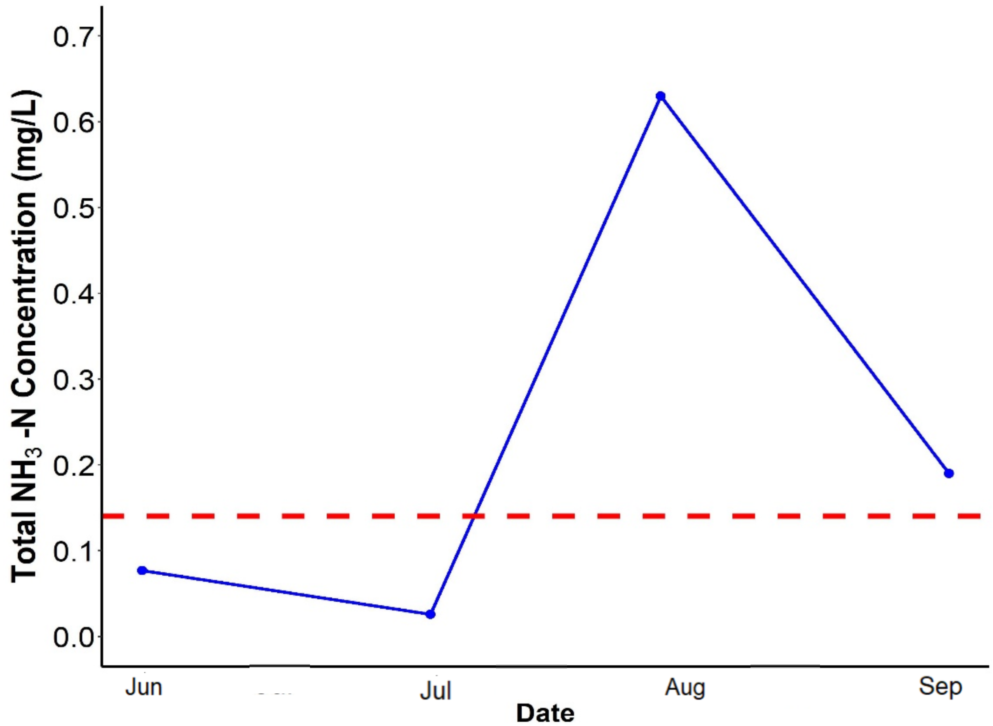

Figure 3. Total ammonia (NH3-N) concentrations measured over the course of the summer at Isle Lake, along with the CCME guideline for the protection of aquatic life, chronic exposure to Ammonia at pH=8.5, and water temperature at 20°C (0.141 mg/L). Note that the pH and water temperatures used are based on the average pH and water temperature at Isle Lake in 2024. Also note that the guideline is based on NH3 as N speciation, not NH3 as NH3 speciation.

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

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 Isle Lake in 2024. Historical information 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 Isle Lake in 2024 was 2.6 m, corresponding to an average Secchi depth of 1.3 m (Table 2). Euphotic depth varied over the season, ranging from as deep as 3.8 m on June 15 to 1.6 m on July 20 (Figure 4). The highest concentration of chlorophyll-*a* was also recorded on July 20 (Figure 1), indicating that an algal bloom was likely occurring and resulted in a decrease in water clarity.

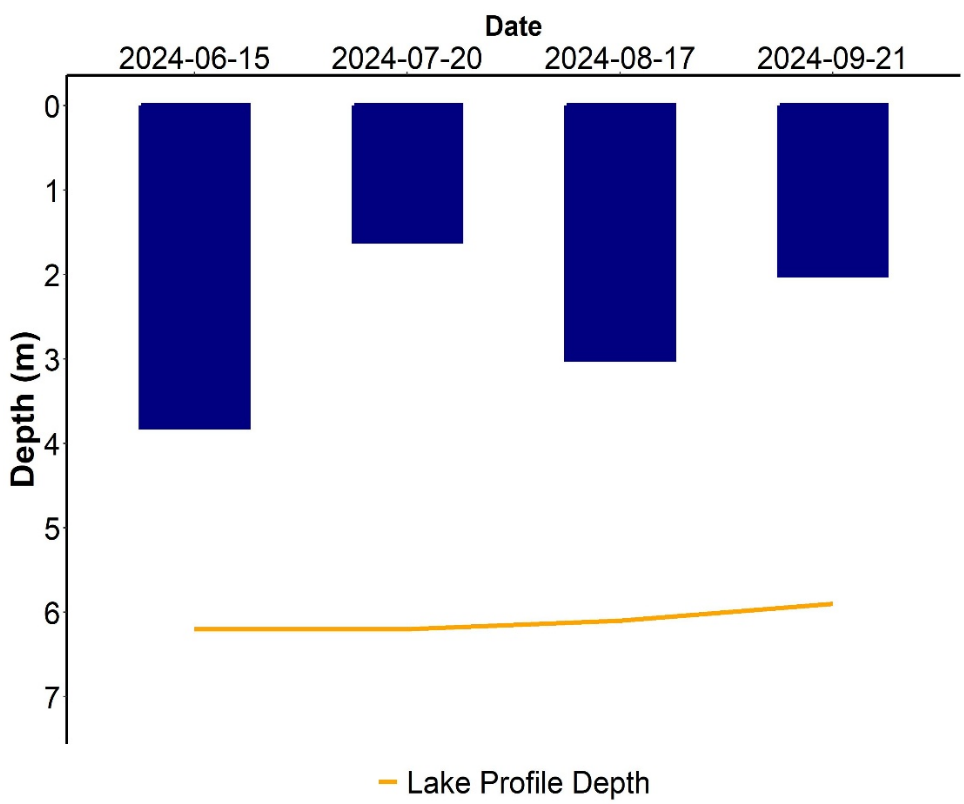

Figure 4. Euphotic depth values measured over the course of the summer at Isle Lake in 2024.

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 Isle Lake varied throughout the summer, with the July 20 sampling date having the warmest temperatures at 25.18°C (Figure 5). The lake showed weak thermal stratification during this sampling event at about m. For the remainder of the sampling season, Isle Lake did not experience thermal stratification, and remained well mixed during all other sampling trips (Figure 5).

Dissolved oxygen varied throughout the season at Isle Lake. Isle Lake was well oxygenated in the surface waters on the June 15 and September 21 sampling dates, measuring above the CCME guidelines of 6.5 mg/L dissolved oxygen[4] (Figure 5). On July 20, the surface waters were supersaturated. Supersaturation occurs when water holds more oxygen than it normally would, resulting in a level above 100%. The increase in oxygen was likely caused by extremely high algal growth, where photosynthesis processes created a large amount of oxygen. We can see this is what occurred on July 20 due to the increase in chlorophyll-*a* (Figure 1). Oxygen levels began to drop rapidly once beyond the surface waters during this sampling event, reaching anoxia at approximately 4 m (Figure 5).

Following the large bloom event, the August 17 sampling event saw oxygen levels that were below the CCME guidelines[4]. This dip in oxygen is likely due to the algal bloom dying off and decaying before and/or during this sampling event. The process of decomposition utilizes oxygen, removing it from lake water.

Oxygen levels were stable throughout the remaining sampling trips, due to the lack of thermal stratification and mixing (Figure 5).

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

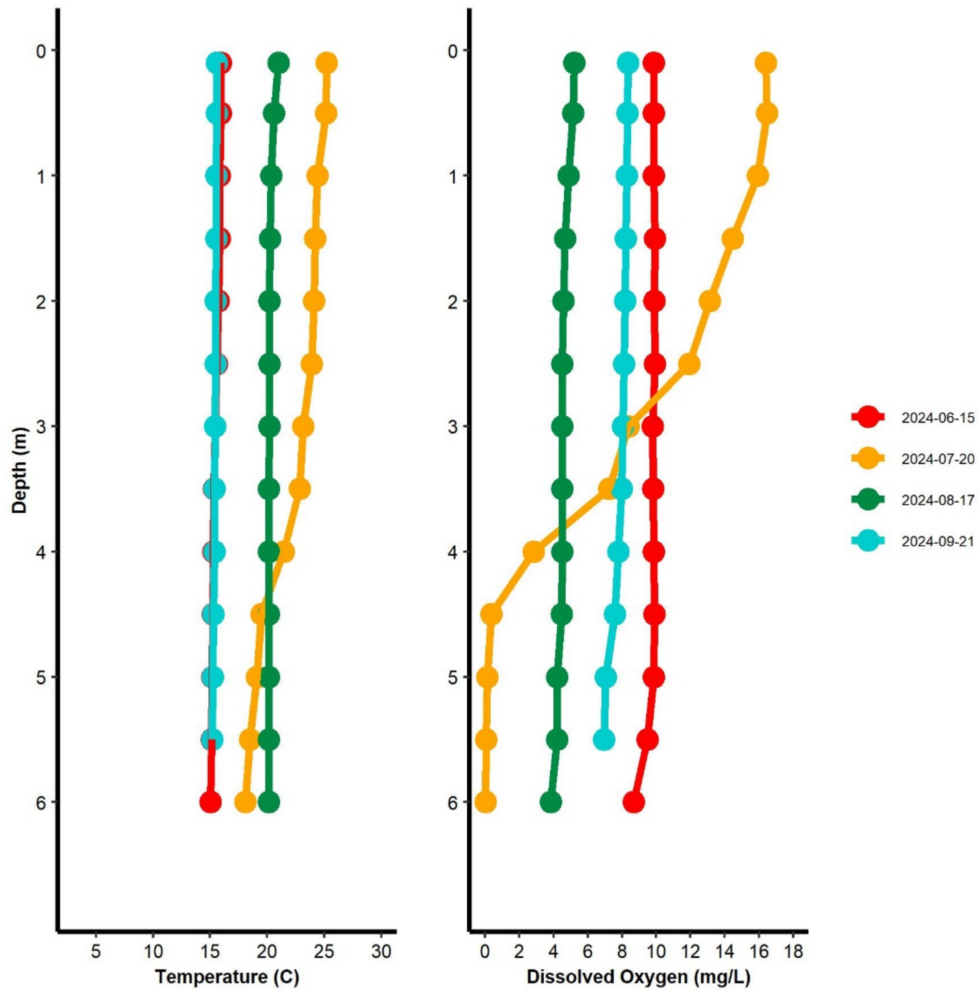


Figure 5. Temperature (°C) and dissolved oxygen (mg/L) profiles for Isle Lake measured over the course of the summer of 2024.

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 Isle Lake fell below the recreational guideline of 10 μg/L[5] during every sampling event in 2024. However, levels in August were elevated and suggest that areas of the lake may contain microcystin levels which could be harmful to human health. Recreating in or near cyanobacteria blooms should be avoided.

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

Date	Microcystin Concentration (μg/L)
06/15/2024	0.27
07/20/2024	1.18
08/17/2024	4.19
09/21/2024	6
Average	**2.91**

[5] 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 Isle 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 Isle Lake on June 6, 2024. The specimen was confirmed to be Northern Watermilfoil (*Myriophyllum sibiricum*).

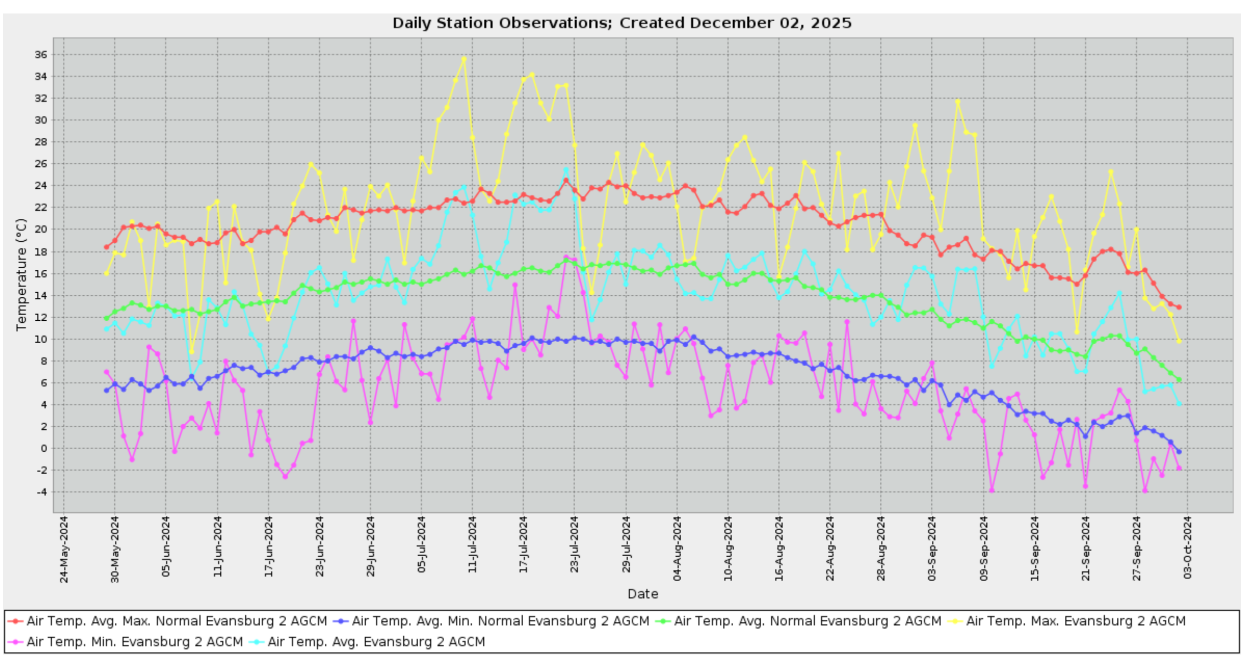
WEATHER AND LAKE STRATIFICATION

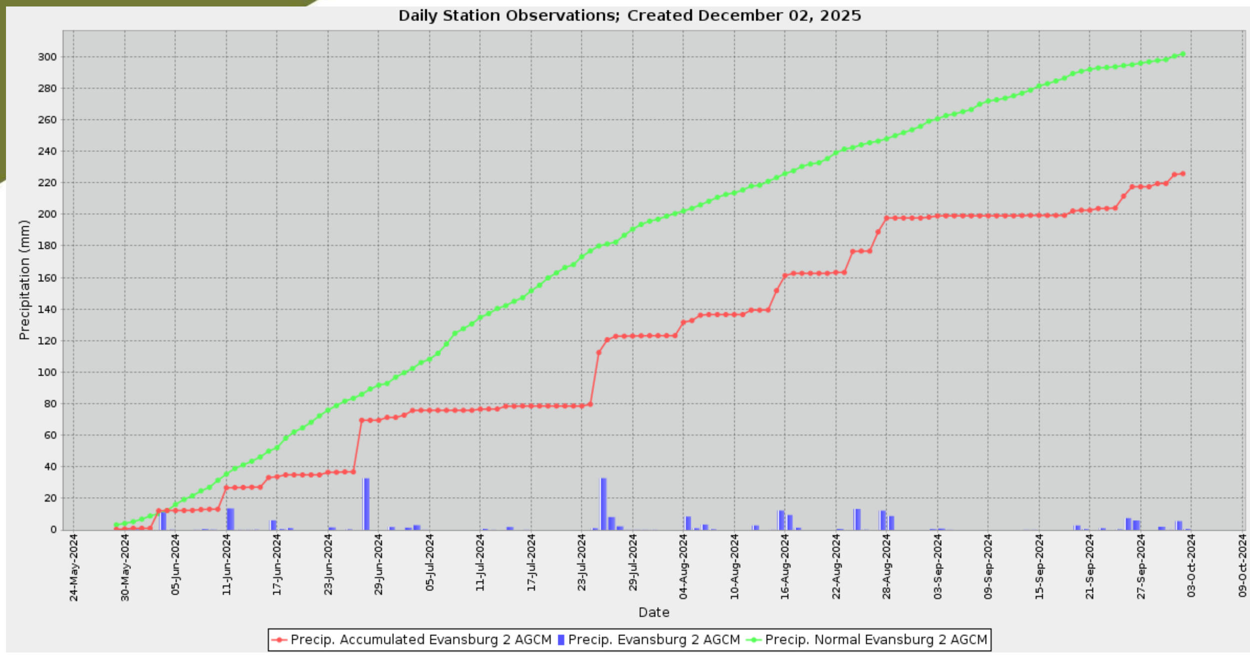
Air temperature will directly impact lake temperatures, and result in different temperature layers (stratification) throughout the lake, depending on its depth. Wind will also impact the degree to which a lake mixes, and how it will stratify. The amount of precipitation that falls within a lake's watershed 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, Isle Lake experienced a warmer and windier summer compared to normal, with less than normal accumulated precipitation (Figure 6). Although it was warmer overall, the beginning of the sampling season was unseasonably cold and wet, with the month of June falling below average temperatures and breaking the lowest temperature record on numerous days in June, including the coldest temperature recorded on June 19 at -2.6°C. July was the warmest month, with the average temperature being 18.8°C. 2024 also broke heat records on numerous days in July and September, including the hottest day recorded on July 10 at 35.6°C.

Isle Lake received less than normal precipitation in the summer of 2024 (222 mm total). Precipitation was sporadic over the summer months, and generally fell a bit at a time, with the exception of June 27 and July 25 when over 30 mm of precipitation fell (Figure 6).

Strong winds were also observed throughout the sampling season.





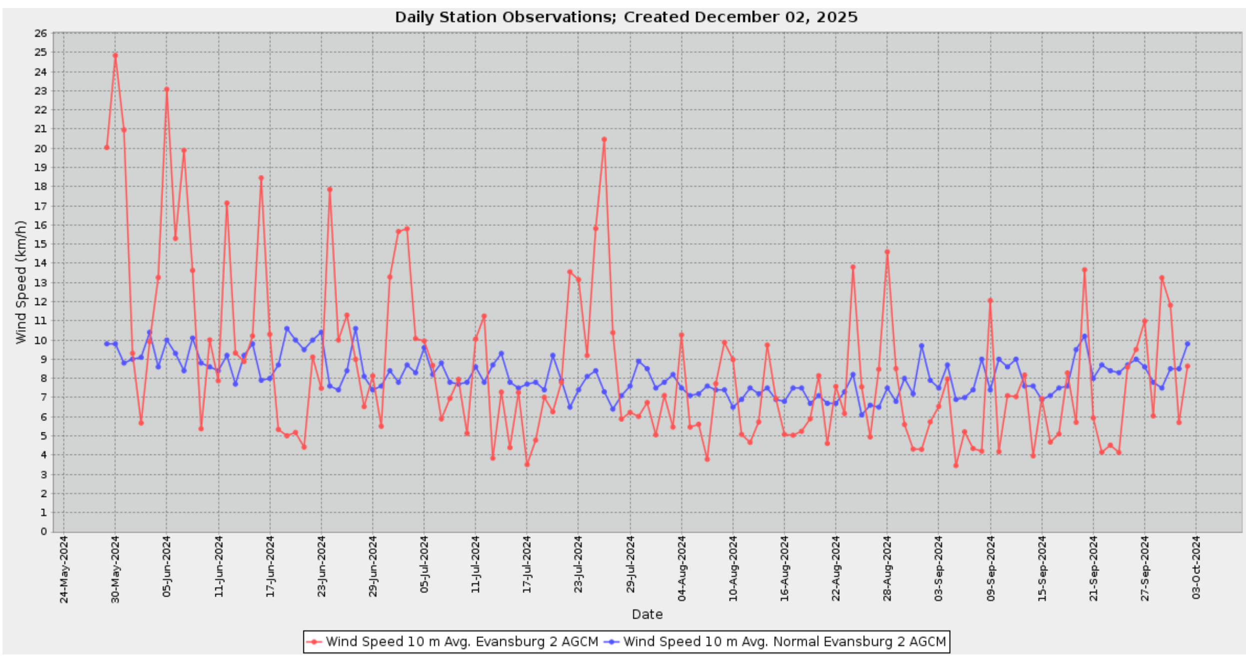


Figure 6. Air temperature (°C), wind speed (km/h), and precipitation (mm) measured from Evansburg 2 AGCM weather station west of Isle Lake. Weather data provided by Agriculture, Forestry and Rural Economic Development, Alberta Climate Information Service (ACIS) https://acis.alberta.ca.

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.

Water levels at Isle Lake have historically fluctuated between 730.8 masl and 729.2 masl (Figure 7). In 2024, water levels were at about 729.85 masl (Figure 8), which falls within the historical average (Figure 7).

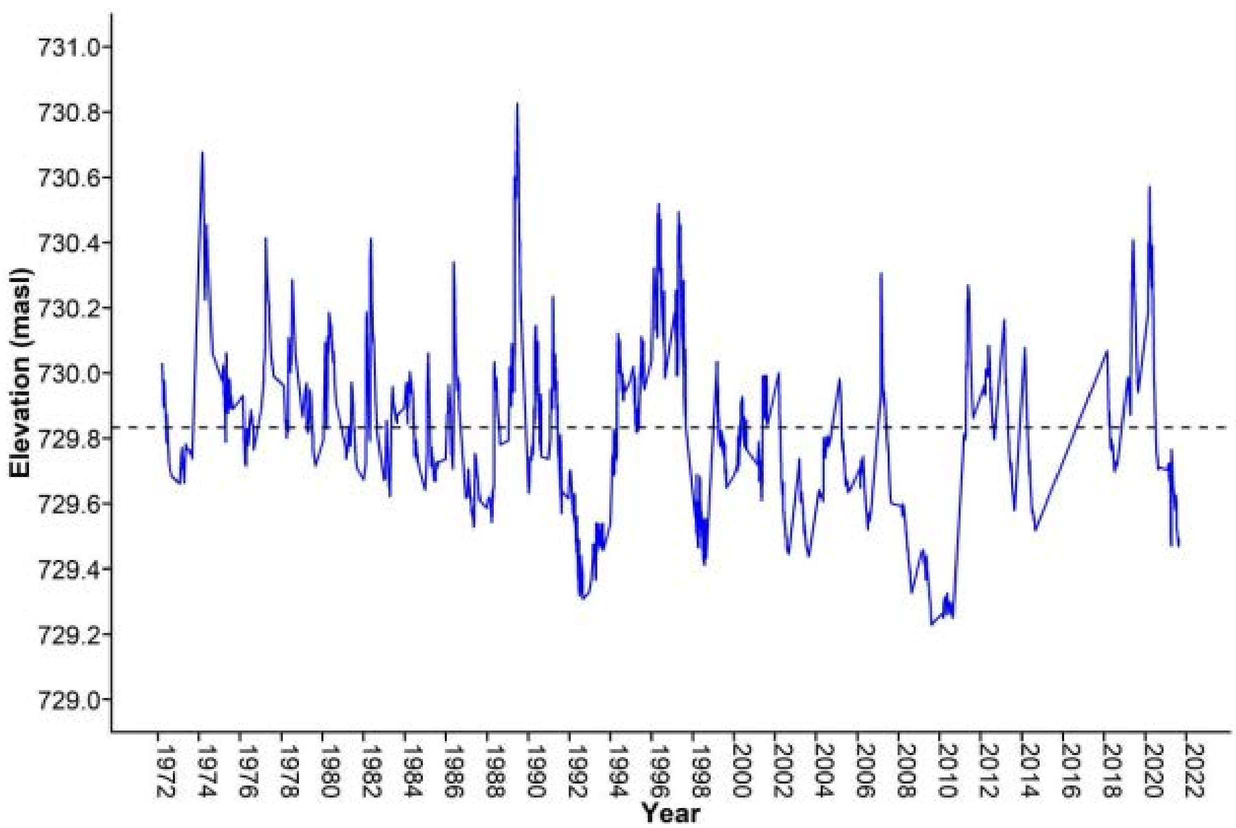


Figure 7. Historical water levels measured at Isle Lake in metres above sea level (masl) from 1972-2022. Obtained from 2013 Wabamun Lake State of the Watershed Report.

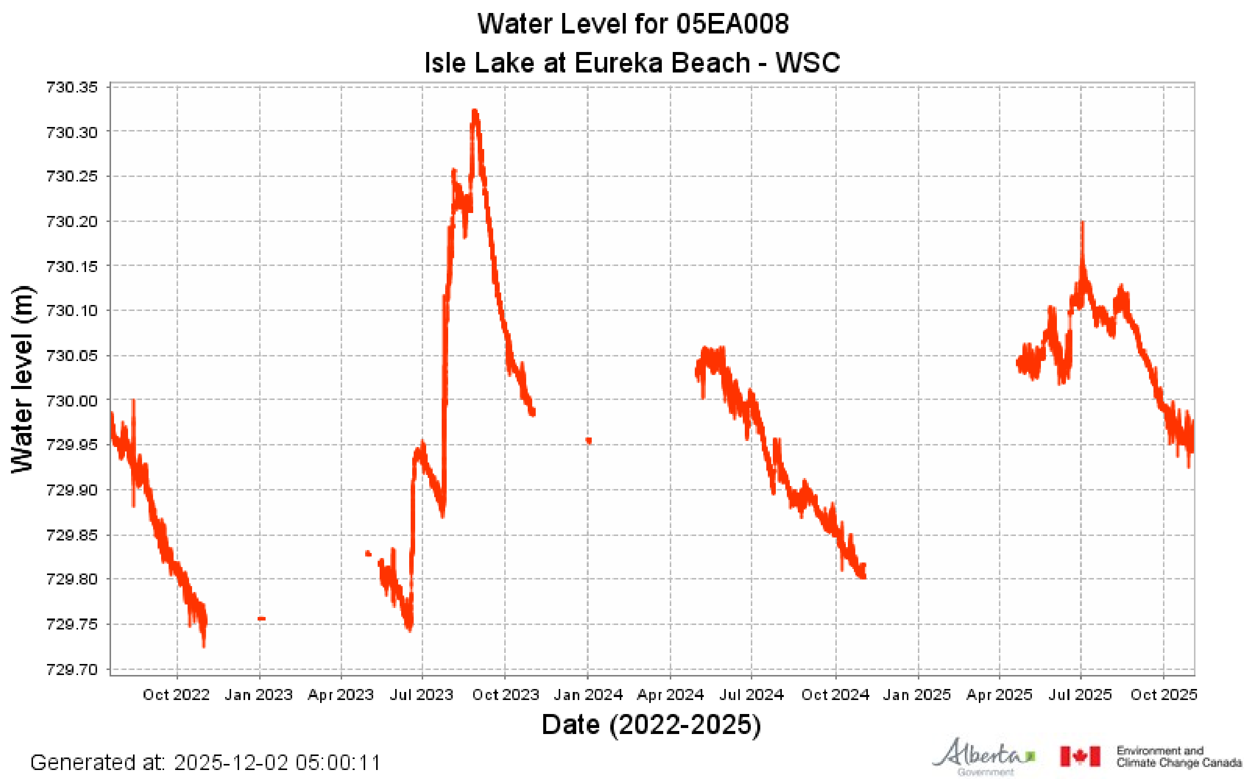


Figure 8. Water levels measured at Isle Lake in metres above sea level (masl) from 2022-2025. Obtained from Alberta Environment and Parks Real-Time Hydrometric Data (https://rivers.alberta.ca/).

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

Parameter	1983	1984	1985	1988	1996	1997	1998	2002
TP (µg/L)	107	109	-	146	74	135	367	95
TDP (µg/L)	54	65	-	-	32	82	285	43
Chlorophyll-a (µg/L)	33.8	39.3	3.5	47.5	32.6	45.3	67.0	13.0
Secchi depth (m)	2.08	1.88	-	2.05	3.13	2.43	2.08	2.5
TKN (mg/L)	1.2	1.4	1	-	1.3	1.3	2	2
NO_2-N and NO_3-N (µg/L)	13	14	131	10	31	8	18	3
NH_3-N (µg/L)	156	60	118	-	-	64	375	2
DOC (mg/L)	12	13	-	-	14	14	14	-
Ca^{2+} (mg/L)	28	27	25	31	-	31	32	-
Mg^{2+}(mg/L)	7	7	14	9	-	8	9	-
Na^{+} (mg/L)	17	18	21	22	20	18	21	-
K^{+} (mg/L)	6	6	7	6	-	7	7	-
SO_4^{2-} (mg/L)	8	7	2	9	10	8	5	-
Cl^{-} (mg/L)	2	3	4	3	5	5	5	-
CO~$_3^{2-}$ (mg/L)	-	-	-	-	4	7.1	11.5	-
HCO_3^{2-} (mg/L)	-	-	-	-	168	159.29	170	-
pH	8.46	8.63	8	8.2	8.28	8.67	8.78	-
Conductivity (µS/cm)	286	281	300	318	308	302	316	-
Hardness (mg/L)	101	97	120	114	-	-	-	-
TDS (mg/L)	154	155	166	172	164	151	175	-
Microcystin (µg/L)	-	-	-	-	-	-	-	-
Total Alkalinity (mg/L CaCO3)	142	144	150	154	142	143	158	-

Parameter	2011	2012	2014	2015	2018	2021	2024
TP (µg/L)	225	247	252	195	157	228	215
TDP (µg/L)	85	125	163	122	82	158	154
Chlorophyll-a (µg/L)	112.9	117.8	45.4	73.9	63.6	67.7	57.3
Secchi depth (m)	0.66	1.46	1.49	1.45	1.55	1.24	1.3
TKN (mg/L)	2.9	2.9	2.2	2.3	2.2	2	1.8
NO_2-N and NO_3-N (µg/L)	24	14	36	-	67	9	14
NH_3-N (µg/L)	78	-	207	-	118	52	231
DOC (mg/L)	18	-	20	18	18	18	18
Ca^{2+} (mg/L)	-	-	-	25	34	40	36
Mg^{2+}(mg/L)	-	-	-	11	11	11	11
Na^{+} (mg/L)	33	-	35	34	32	24	29
K^{+} (mg/L)	9	-	10	10	12	10	10
SO_4^{2-} (mg/L)	4	10	6	7	12	14	6
Cl^{-} (mg/L)	10	10	11	12	14	12	13
CO~$_3^{2-}$ (mg/L)	3.2	14.5	12.9	13.9	1.6	10.3	7.4
HCO_3^{2-} (mg/L)	202.6	177.75	183.2	170	205	187.5	197.5
pH	8.32	8.8	8.65	8.88	8.27	8.64	8.32
Conductivity (µS/cm)	364	365	370	354	370	382	380
Hardness (mg/L)	-	-	-	-	130	142	135
TDS (mg/L)	196	202	225	202	228	220	218
Microcystin (µg/L)	0.96	3.26	2.15	6.37	5.1	4.34	2.91
Total Alkalinity (mg/L CaCO3)	171	170	171	162	170	168	175

Table 3. Concentrations of metals measured in Isle 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	2012	2014	2015	Guidelines
Aluminum (μg/L)	19.7	10.65	41.83	100[a]
Antimony (μg/L)	0.065	0.058	0.058	/
Arsenic (μg/L)	1.76	2	1.65	5
Barium (μg/L)	78.2	83.6	72.2	/
Beryllium (μg/L)	0.0078	0.004	0.004	100[c,d]
Bismuth (μg/L)	0.0066	5e-04	0.0015	/
Boron (μg/L)	57.5	51.4	64.3	1500
Cadmium (μg/L)	0.005	0.002	0.001	0.36[b]
Chromium (μg/L)	0.253	0.385	0.3133	/
Cobalt (μg/L)	0.04645	0.0135	0.0353	500, 1000[c,d]
Copper (μg/L)	0.318	0.44	0.28	4[b]
Iron (μg/L)	36.45	40.1	68.17	300
Lead (μg/L)	0.053	0.07	0.035	7[b]
Lithium (μg/L)	16.7	14.4	18.2	2500[d]
Manganese (μg/L)	64.5	153.25	128	130[e]
Molybdenum (μg/L)	0.577	0.333	0.316	73
Nickel (μg/L)	0.109	0.004	0.245	150[b]
Selenium (μg/L)	0.078	0.23	0.067	1
Silver (μg/L)	0.0043	0.001	0.001	0.25
Strontium (μg/L)	182	210	190.3	/
Thallium (μg/L)	0.0026	0.0014	0.001	0.8
Thorium (μg/L)	0.025	0.012	0.003	/
Tin (μg/L)	0.05	0.01	0.02	/
Titanium (μg/L)	1.475	2.565	2.147	/
Uranium (μg/L)	0.361	0.248	0.264	15
Vanadium (μg/L)	0.514	0.36	0.39	100[c,d]
Zinc (μg/L)	1.62	0.5	0.38	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.

LONG TERM TRENDS

Trend analysis was conducted on the parameters total phosphorus (TP), chlorophyll-*a*, total dissolved solids (TDS), and Secchi depth to look for changes over time in Isle Lake. In sum, a significant increasing trend was detected in TP and TDS, while a significant decreasing trend was detected in Secchi depth. No significant trend was detected in chlorophyll-*a*. Data is presented below as both line and box-and-whisker plots. Detailed methods are available in the ALMS Guide to Trend Analysis on Alberta Lakes.

Table 4. Summary table of trend analysis on Isle Lake data from 1983 to 2024.

Parameter	Date Range	Direction of Significant Change
Total Phosphorus	1983-2024	Increasing
Chlorophyll-*a*	1983-2024	No Change
Total Dissolved Solids	1983-2024	Increasing
Secchi Depth	1983-2024	Decreasing

Definitions

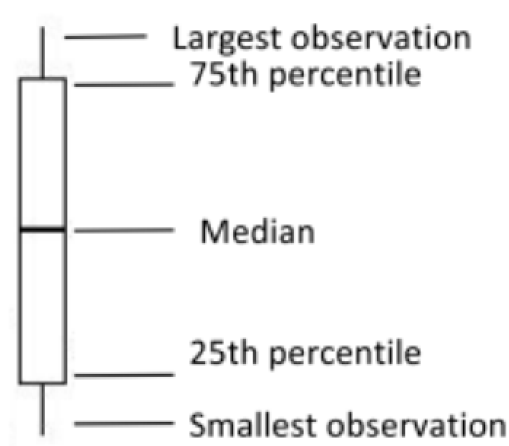
Median: the value in a range of ordered numbers that falls in the middle.

Trend: a general direction in which something is changing.

Monotonic trend: a gradual change in a single direction.

Statistically significant: The likelihood that a relationship between variables is caused by something other than random chance. This is indicated by a p-value of <0.05. Variability: the extent by which data is inconsistent or scattered.

Box and Whisker Plot: a box-and-whisker plot, or boxplot, is a way of displaying all of our annual data. The median splits the data in half. The 75th percentile is the upper quartile of the data, and the 25th percentile is the lower quartile of the data. The top and bottom points are the largest and smallest observations.



Total Phosphorus (TP)

Trend analysis of TP over time suggests TP has significantly increased in Isle Lake since 1983 (Tau = 0.2618, p = 0.0142).

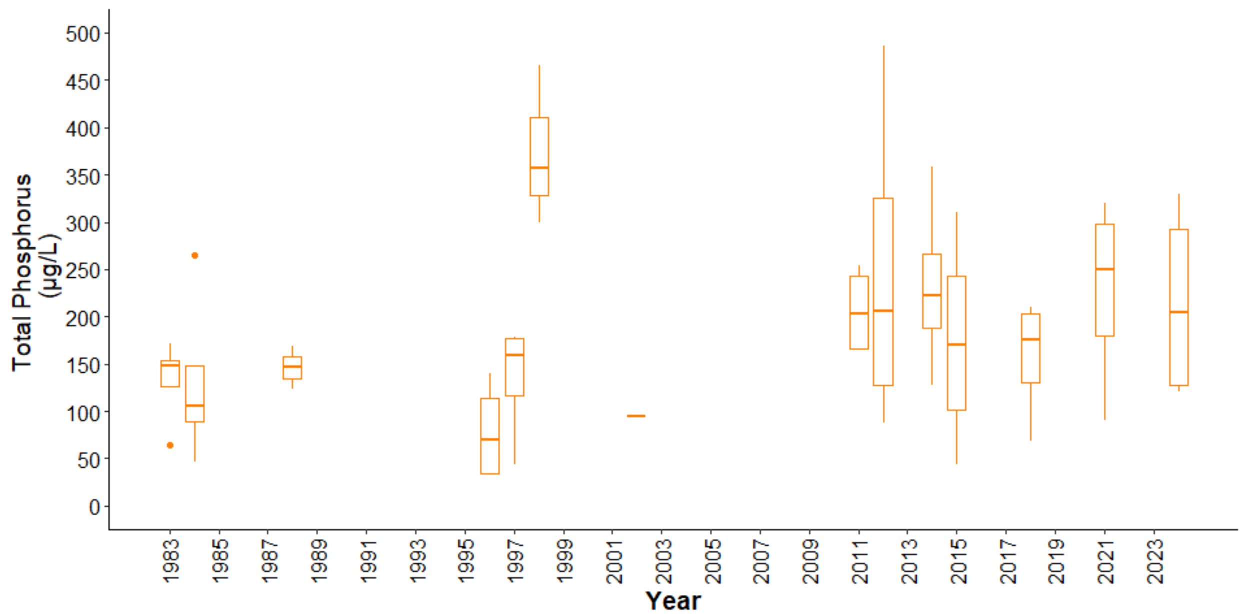


Figure 9. Monthly total phosphorus (TP) concentrations measured between June and September over the long term sampling dates between 1983 and 2024 (n = 50). The value closest to the 15th day of the month was chosen to represent the monthly value in cases with multiple monthly samples.

Chlorophyll-*a*

Trend analysis of chlorophyll-*a* suggests it has not significantly changed over time at Isle Lake from 1983-2024 (Tau = 0.1206, p = 0.2879).

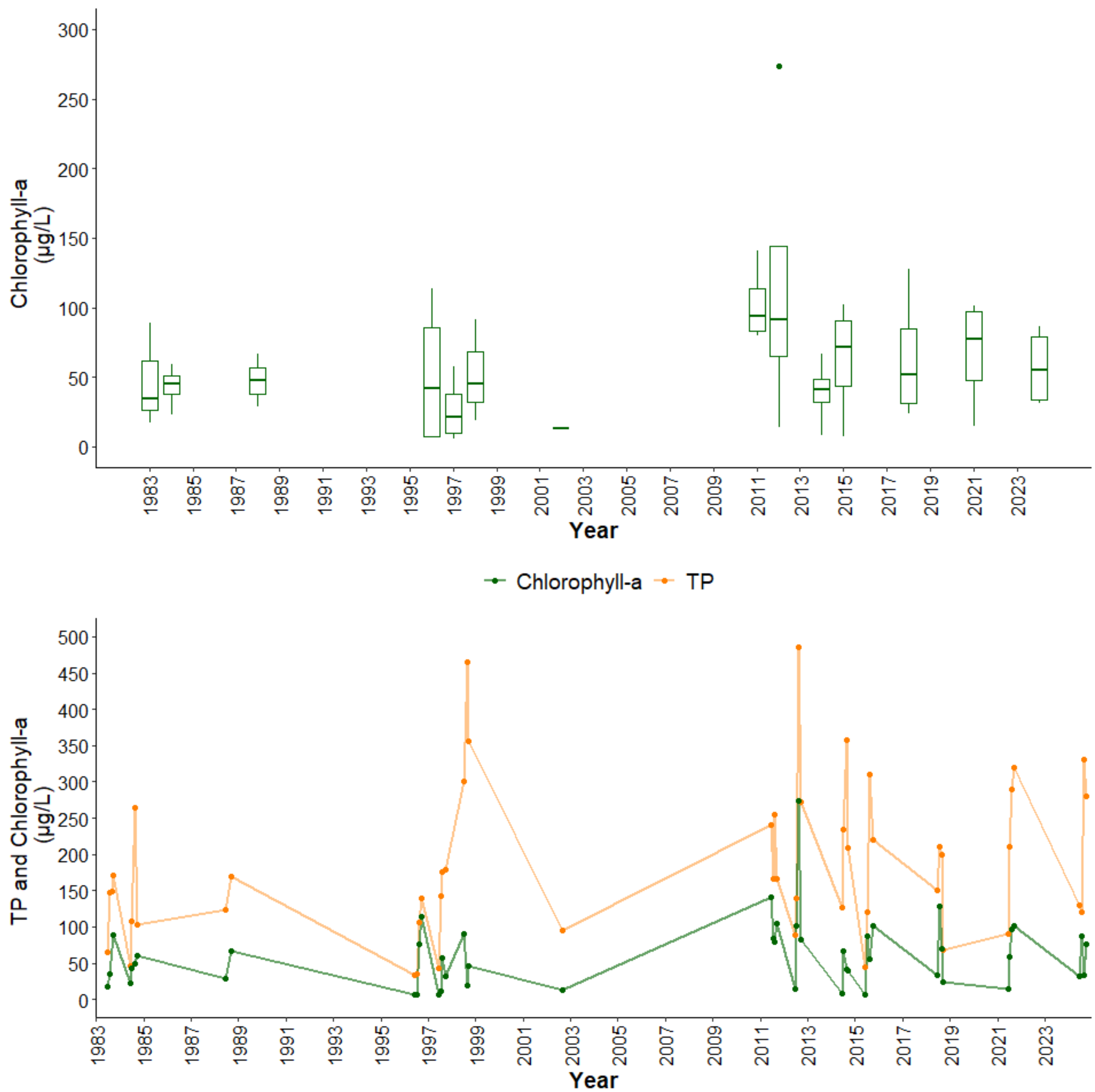


Figure 10. Monthly chlorophyll-*a* concentrations measured between June and September over the long term sampling dates between 1983 and 2024 (n = 49). The value closest to the 15th day of the month was chosen to represent the monthly value in cases with multiple monthly samples. Line graph is overlain by TP concentrations.

Total Dissolved Solids (TDS)

Trend analysis showed a significantly increasing trend in TDS in Isle Lake since 1983 (Tau = 0.7195, $p < 0.001$).

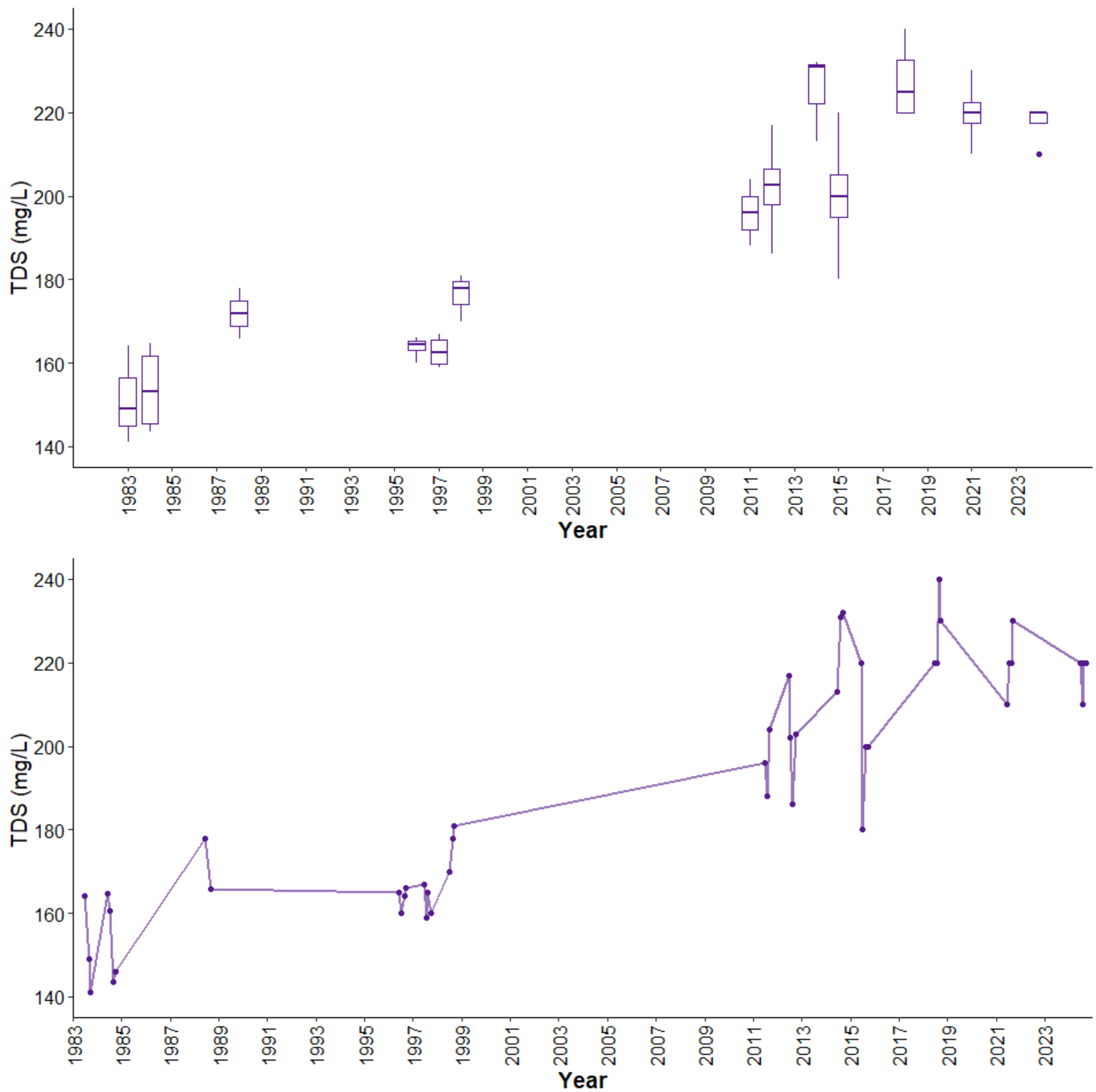


Figure 11. Monthly TDS values measured between June and September over the long term sampling dates between 1983 and 2024 (n = 46). The value closest to the 15^{th} day of the month was chosen to represent the monthly value in cases with multiple monthly samples.

Trend analysis of the major ions at Isle Lake indicates that many ions drove the historical increase in TDS, except for sulphate (Figure 12). Magnesium and calcium were not analyzed due to insufficient data. These ions appear to have had a step increase between the first half of the historical record compared to the second half.

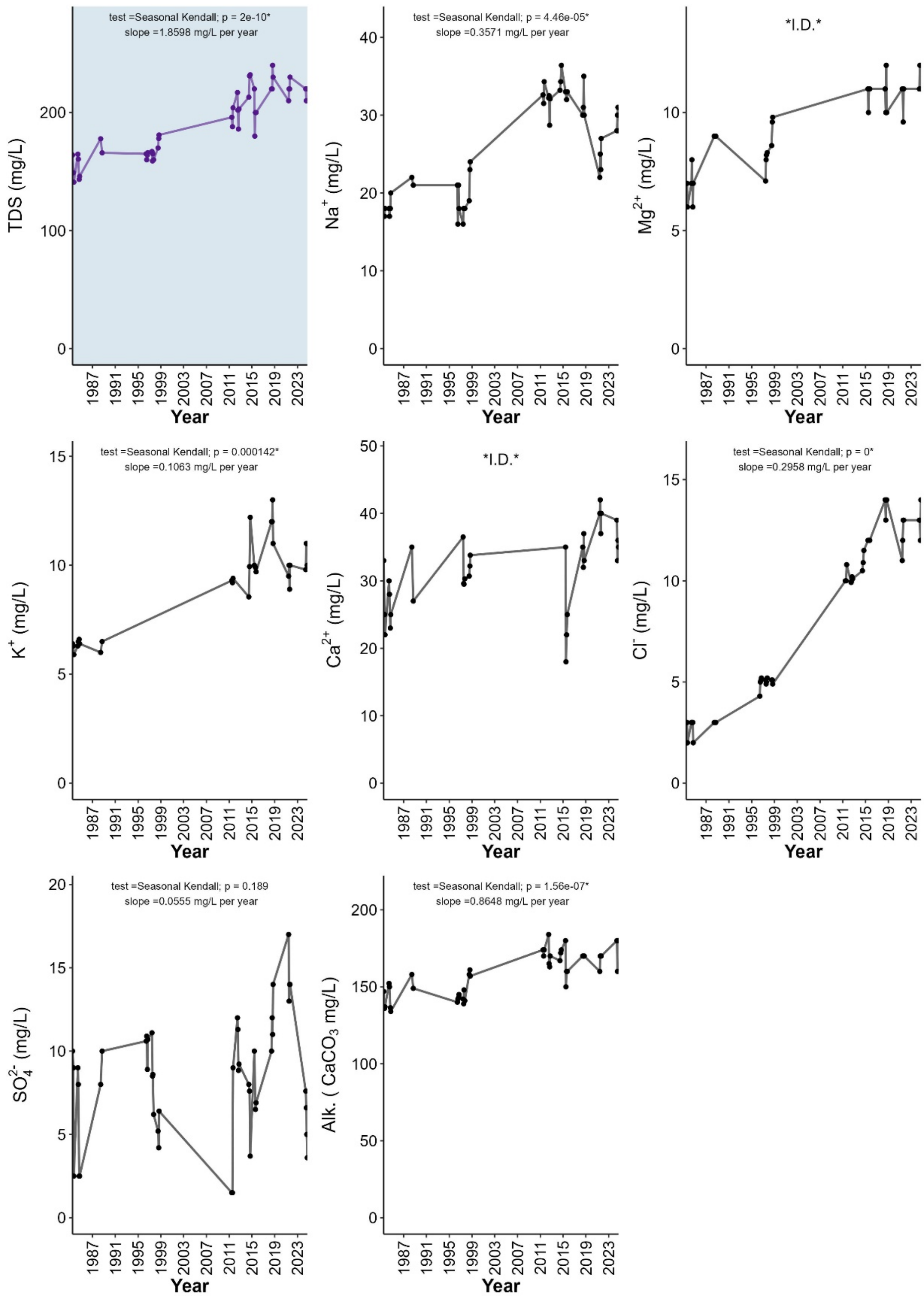
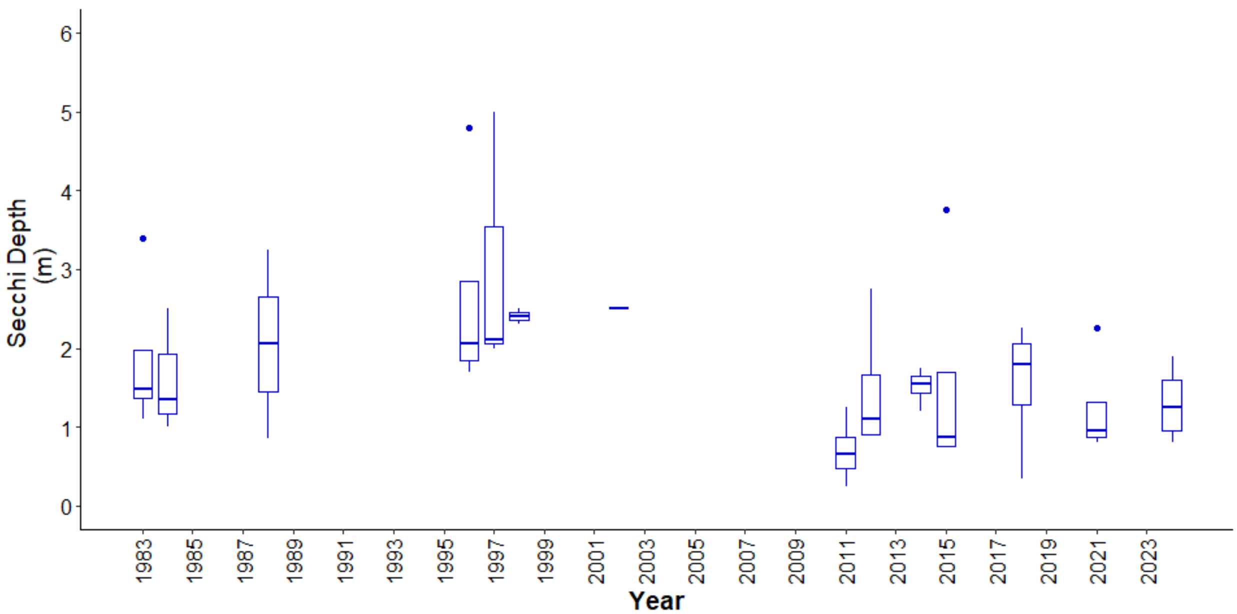


Figure 12. Concentrations of TDS (top left, blue panel), major ions (sodium = Na^+, magnesium = Mg^{2+}, potassium = K^+, calcium = Ca^{2+}, chloride = Cl^-, sulphate = SO_4^{2-}), and total alkalinity (Alk., as mg/L $CaCO_3$) measured monthly between June and September on sampling dates between 1983 and 2024. Also represented is the monotonic trend results for each parameter; test used (MK = Mann Kendall, SK = Seasonal Kendall), significance of test (*p*; assessed as significance when $p < 0.05$, marked with '*' if significant. A p=0* indicates significance <0.001), and the slope of the trend. Test selection follows method outline in the ALMS Guide to Trend Analysis on Alberta Lakes. Note that some ions had insufficient data (I.D.) therefore trends were not calculated. The value closest to the 15th day of the month was chosen to represent the monthly value in cases with multiple monthly samples.

Secchi Depth

Trend analysis of Secchi depth over time shows that it has significantly decreased in Isle Lake since 1983 (Tau = -0.2472, *p* = 0.0319).



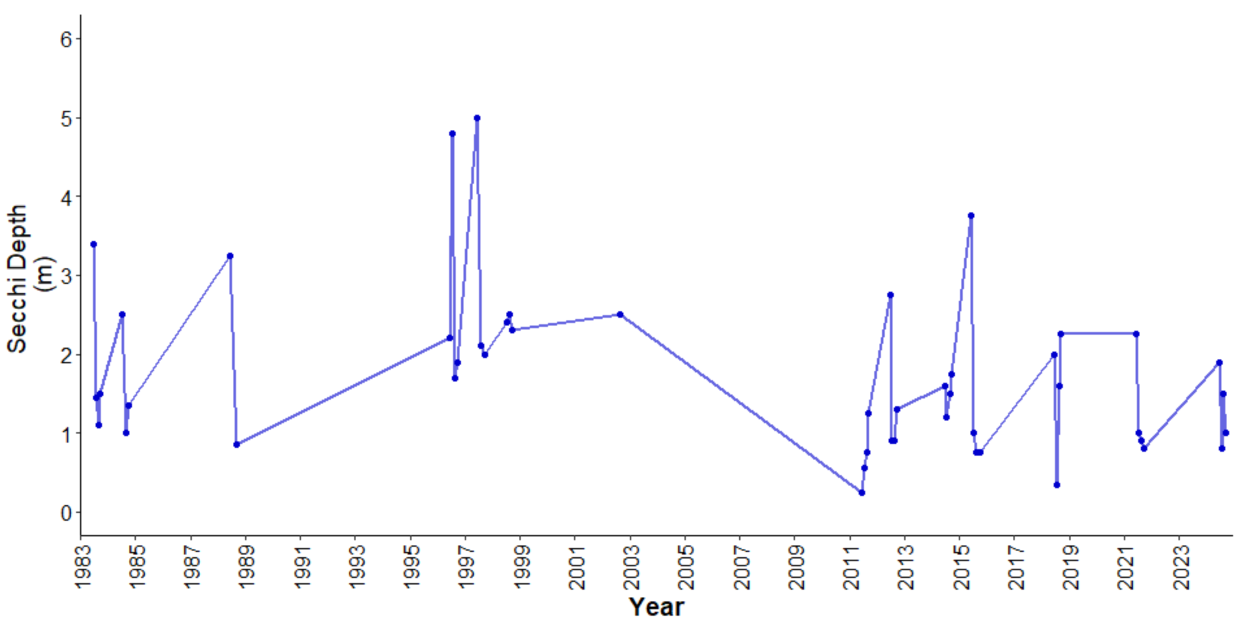


Figure 13. Monthly Secchi depth values measured between June and September over the long term sampling dates between 1983 and 2024 (n = 48). The value closest to the 15th day of the month was chosen to represent the monthly value in cases with multiple monthly samples.

Table 5. Results of trend tests using total phosphorus (TP), chlorophyll-*a*, total dissolved solids (TDS), and Secchi depth data from June to September for sampled years from 1983-2024 on Isle Lake data.

Definition	Unit	Total Phosphorus (TP)	Chlorophyll-*a*	Total Dissolved Solids (TDS)	Secchi Depth
Statistical Method	-	Seasonal Kendall	Seasonal Kendall	Seasonal Kendall	Seasonal Kendall
The strength and direction (+ or -) of the trend between -1 and 1	Tau	0.2618	0.1206	0.7195	-0.2472
The extent of the trend	Slope (units per Year)	2.0541	0.3499	1.8598	-0.0148
The statistic used to find significance of the trend	Z	2.452	1.0627	6.3761	-2.1454
Number of samples included	n	50	49	46	48
The significance of the trend	*p*	0.0142*	0.2879	2e-10*	0.0319*

*$p < 0.05$ is significant within 95%