



Lakewatch

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

Lacombe Lake Report

2024

Updated November 27, 2025

Lakewatch is made possible
with support from:



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 Anto Davis for their commitment to collecting data at Lacombe 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 Onsyk were instrumental in planning and organizing the field program. This report was prepared by Brittany Onsyk and Bradley Peter.

BEFORE READING THIS REPORT,
CHECK OUT [A BRIEF
INTRODUCTION TO LIMNOLOGY](#)

LACOMBE LAKE

Lacombe Lake is a small pothole lake found in Lacombe County in central Alberta. It is located 5 km north of the town of Blackfalds and 15 km north of Red Deer. Much of the shoreline is intact, consisting of private farms and homesteads, as well as public land and reserves. Lacombe Lake falls within Treaty 6, the ancestral land where the Samson and Ermineskin Cree Nations hunted and travelled.¹

Lacombe Lake lies within the Battle River sub-basin of the North Saskatchewan River watershed. Much of the

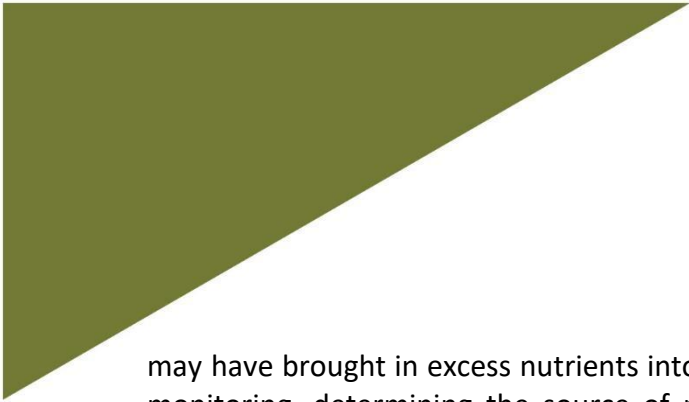
watershed has been developed as agricultural land. The lake is narrow, with an approximate length of 3 km, a maximum depth of about 3.0 m, and a maximum width of around 500 m. Lacombe Lake has numerous bays and points which give it a distinct shape. The lake is a popular recreational site for canoeing, kayaking, rowing, birdwatching and swimming. Lacombe Lake is also home to the Central Alberta Rowing Club.

Lacombe Lake has a large population of macrophytes, including yellow pond lily, various pondweeds, chara, cattail, bulrushes, and bladderwort. Due to its small size, dense macrophytes, and limited recreational activity, the lake provides important habitat for waterfowl, including the common loon, mallard, common grebe, goldeneye, scaup, and ruddy duck. Larger vertebrates that are found around the lake are deer, muskrat, lynx, and beavers.

In the 1960s, a weir was constructed on the north side of the lake redirecting Whelp Creek to stabilize the level of Lacombe Lake, mitigate flooding, and/or provide storage for irrigation.² The diversion of water from Whelp Creek was minimal over its lifespan (most recently in 2001 and 2002), however, residents often voiced concerns over the quality of the water entering the lake via the weir.² Before 2008, residents observed deteriorations in water quality as well as dense macrophyte growth. In 2008, the diversion of Whelp Creek was stopped. Golder Associates Ltd. assessed the water quality of Lacombe Lake over the next 4 years, concluding that the diversion



Sampling at Lacombe Lake on June 14, 2024.



may have brought in excess nutrients into Lacombe Lake.² The report recommended enhanced monitoring, determining the source of nutrients, and improving water quality through best management practices, including fertilizer restrictions, restoration of riparian vegetation along shorelines, and nutrient management planning within the watershed.

Water levels have been a contentious issue at the lake over the last few years, with some residents concerned that the lake levels have gotten too high and are causing damage to property, and others concerned that water levels are too low and impacting lake health and recreation potential. Additionally, in 2016 the Town of Blackfalds developed a stormwater management plan that would ultimately see wastewater diverted from the town's treatment plant released into Lacombe Lake.³ Although the project faced appeals, the project was approved by Alberta Environment and Parks in 2025.

¹ The Alberta Teacher's Association. Treaty map (<https://www.albertaschoolcouncils.ca/public/download/documents/57314>).

² Lacombe County. Whelp Creek Water Diversion Project. (https://www.lacombecounty.com/media/2fvp24v3/whelp-creek-water-diversion_website-1.pdf).

³ Rimbey Review. 2025. Lacombe Lake management plan funding sought (<https://rimbeyreview.com/2025/05/14/lacombe-lake-management-plan-funding-sought/>).

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 Lacombe Lake was 19 µg/L (Table 2), falling into the mesotrophic, or moderately productive trophic classification. TP ranged from a minimum of 15 µg/L on the June 14 to a maximum of 22 µg/L on September 13 (Figure 1).

The average chlorophyll-*a* concentration in 2024 was 8.22 µg/L (Table 2), similarly falling into the mesotrophic classification. Chlorophyll-*a* was lowest at 5.6 µg/L on June 14 and peaked at 10.4 µg/L on September 13, 2024 (Figure 1).

The average Total Kjeldahl Nitrogen (TKN) concentration in 2024 was 1.3 mg/L (Table 2). TKN increased slightly over the season (Figure 1).

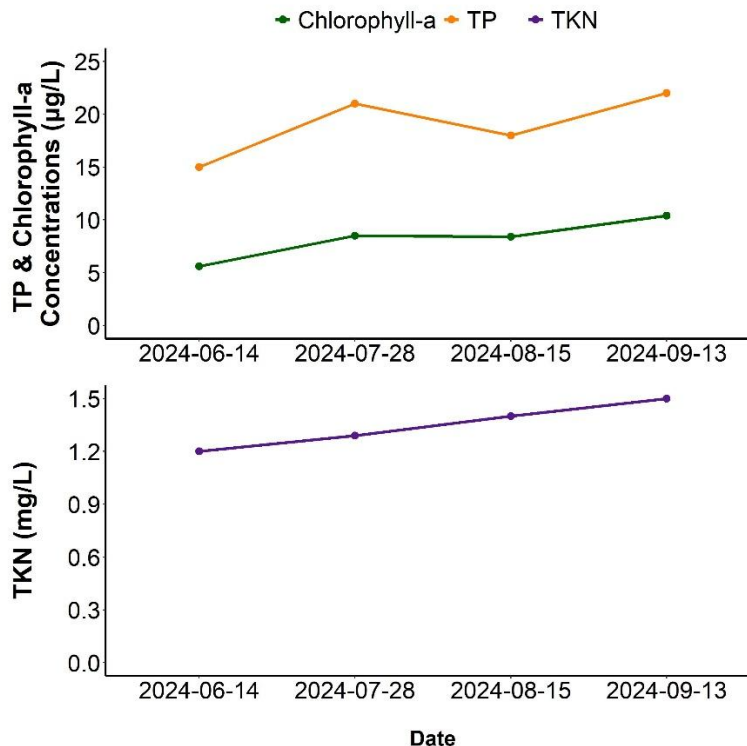


Figure 1. Total Phosphorus, Chlorophyll-*a*, and Total Kjeldahl Nitrogen concentrations measured over the course of the summer at Lacombe Lake in 2024.

Average pH was measured as 8.87 in 2024, buffered by moderate alkalinity (222 mg/L CaCO₃) and bicarbonate (220 mg/L HCO₃⁻). Aside from bicarbonate, sodium, magnesium, and chloride were higher than all other major ions, contributing to a moderate conductivity of 525 μS/cm (Figure 2, top; Table 2). Lacombe Lake is in the middle of the range of ion levels when compared to other LakeWatch lakes sampled in 2024 (Figure 2, bottom).

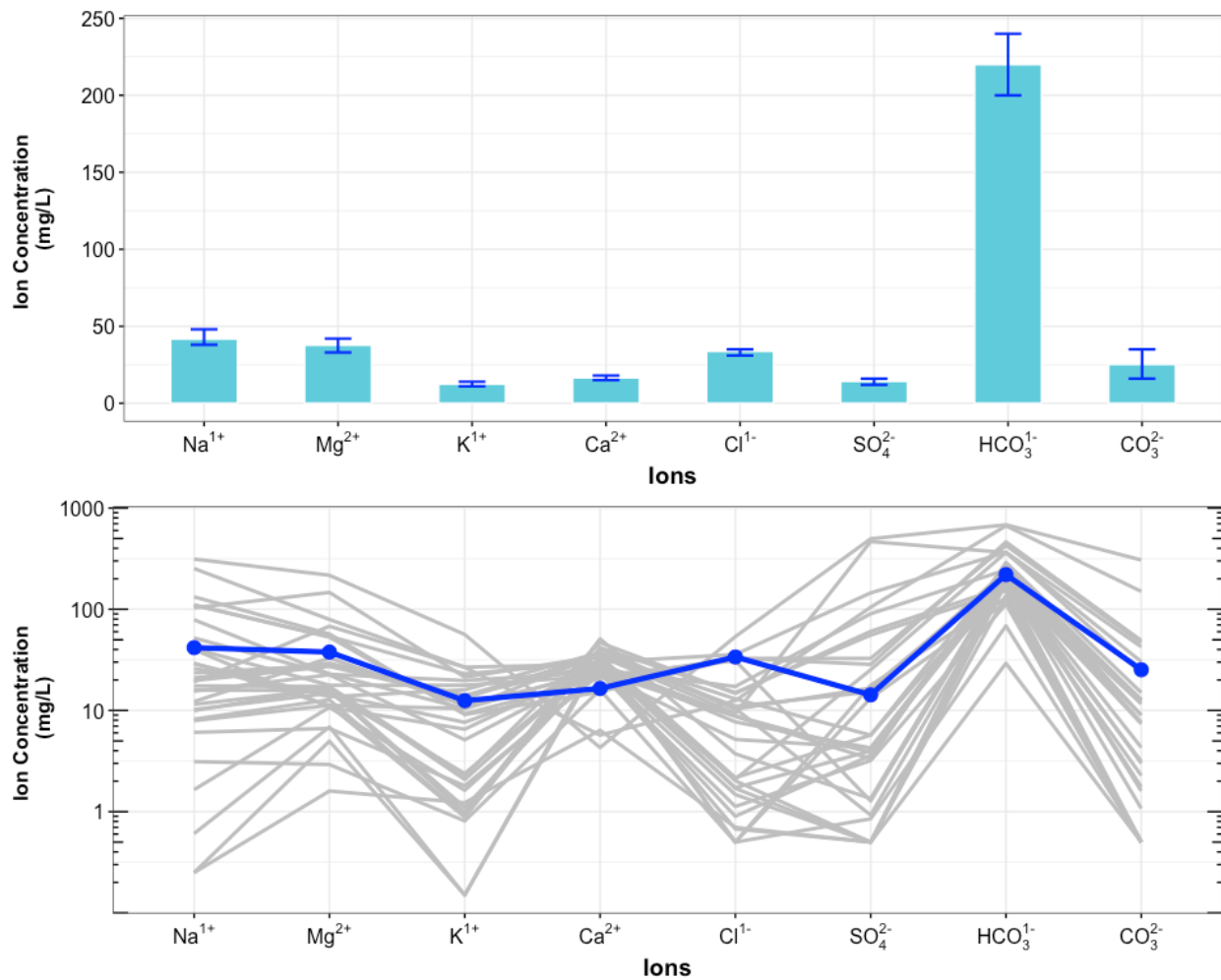


Figure 2. Average levels of cations (sodium = Na¹⁺, magnesium = Mg²⁺, potassium = K¹⁺, calcium = Ca²⁺) and anions (chloride = Cl¹⁻, sulphate = SO₄²⁻, bicarbonate = HCO₃¹⁻, carbonate = CO₃²⁻) from 4 measurements over the course of the summer at Lacombe Lake. Top) bars indicate range of values measured, and bottom) Schoeller diagram of average ion levels at Lacombe 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 Lacombe 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 Lacombe Lake in 2024 was 2.7 m (lake bottom), corresponding to an average Secchi depth of 1.35 m (Table 2). Euphotic depth showed little variation over the season, fluctuating by only 0.2 m throughout the summer (Figure 3). Euphotic depth cannot be greater than the lake bottom, so although Secchi depth may have been greater than 1.35 m, the bottom of the lake is only 2.7 m. When the euphotic depth is equal to the bottom depth, light is likely able to penetrate all the way to the bottom of the lake. This impacts the amount of habitat that could support the growth of rooted macrophytes, as well as sediment dwelling algae and cyanobacteria.

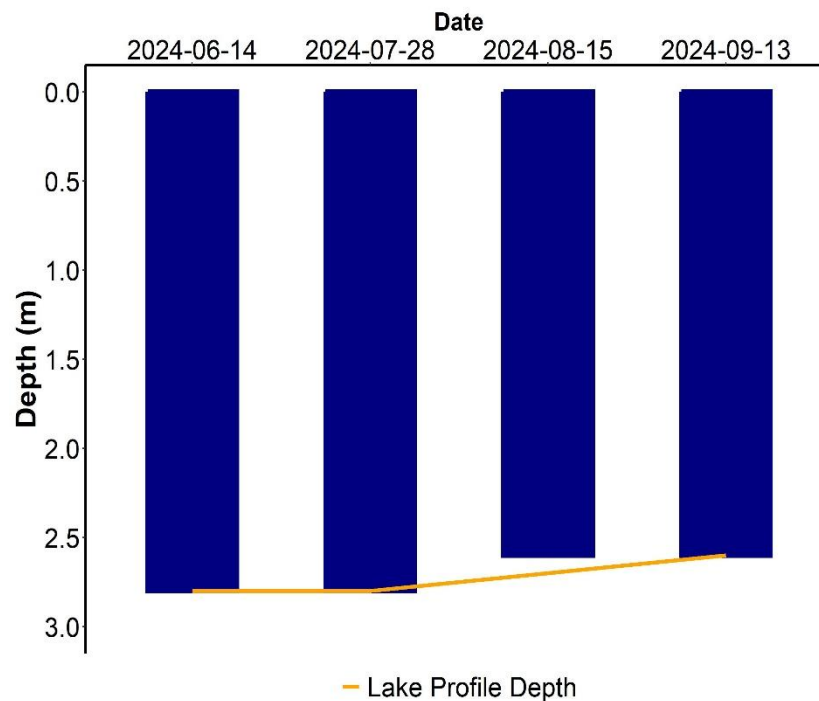


Figure 3. Euphotic depth values measured over the course of the summer at Lacombe Lake in 2024.

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 Lacombe Lake showed some variation throughout the summer, with the August 15 sampling having the warmest temperatures at 21.54 °C (Figure 4). The lake was mixed during all sampling trips.

Due to the lack of thermal stratification, Lacombe Lake remained well oxygenated during all sampling dates, measuring above the CCME guidelines of 6.5 mg/L dissolved oxygen⁴ (Figure 4).

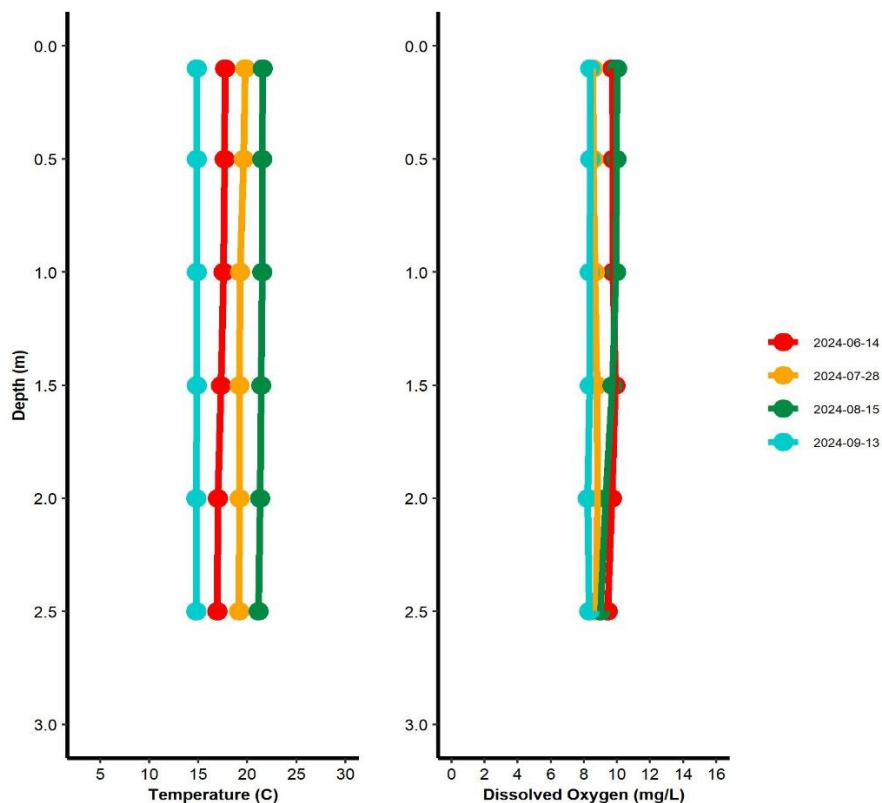


Figure 4. Temperature (°C) and dissolved oxygen (mg/L) profiles for Lacombe Lake measured over the course of the summer of 2024.

⁴ 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 Lacombe Lake fell below the recreational guideline of 10 µg/L⁵ 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 Lacombe Lake in 2024.

| Date | Microcystin Concentration (µg/L) |
|----------------|----------------------------------|
| 06/14/2024 | < 0.1 |
| 07/28/2024 | 0.52 |
| 08/15/2024 | 0.44 |
| 09/13/2024 | 0.34 |
| Average | 0.34 |

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 Lacombe 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 not collected from Lacombe Lake in 2024.

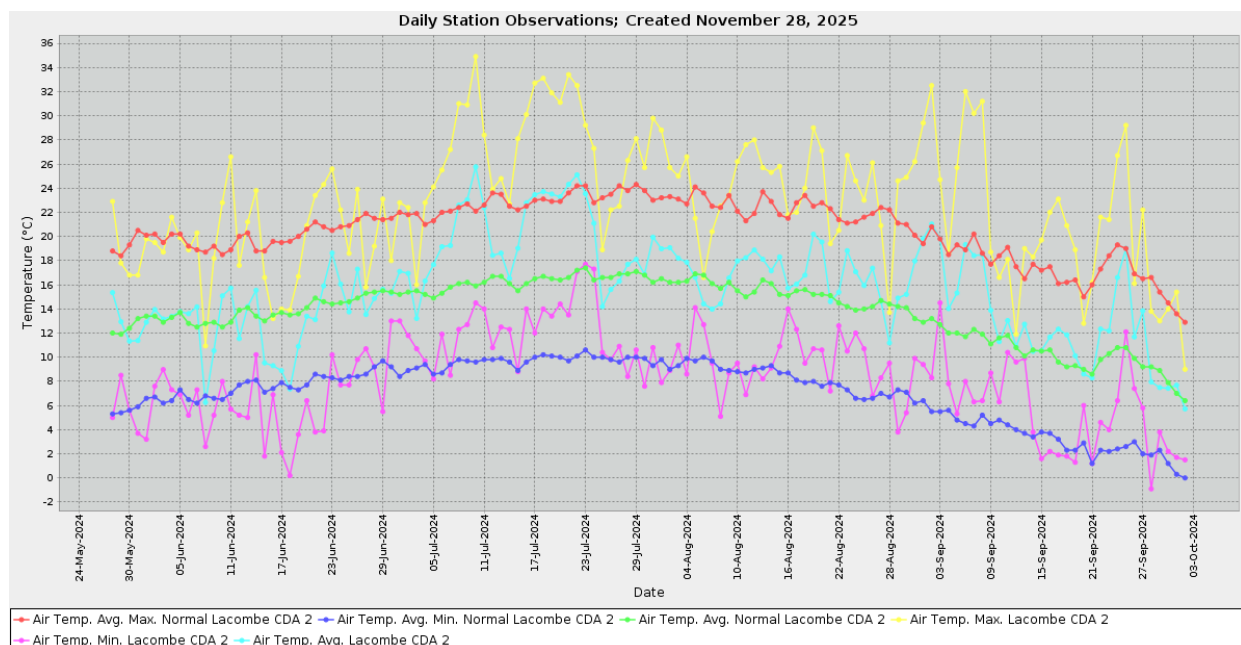
WEATHER AND LAKE STRATIFICATION

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, Lacombe Lake experienced a warmer and windier summer compared to normal, with substantially 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 0.2°C. July was the warmest month, with the average temperature being 19.9°C. 2024 also broke heat records on numerous days in July and September, including the hottest day recorded on July 10 at 34.9°C. August and September were warmer than average months, with the average temperature being 16.8°C and 13.3°C, respectfully.

Lacombe Lake received much less precipitation than it normally receives throughout the summer months (over 100 mm difference). The actual precipitation in 2024 was 186 mm total, versus a normal amount of 273 mm. Precipitation was sporadic over the summer months (Figure 5).

Strong winds were also observed throughout the sampling season.



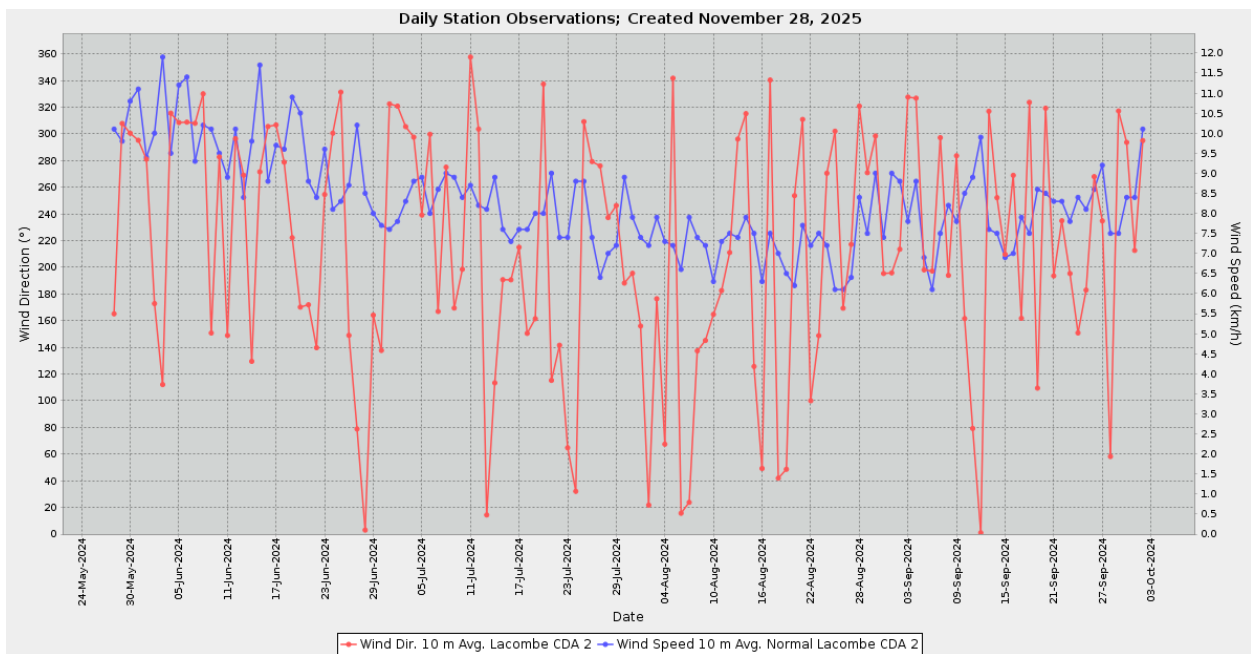
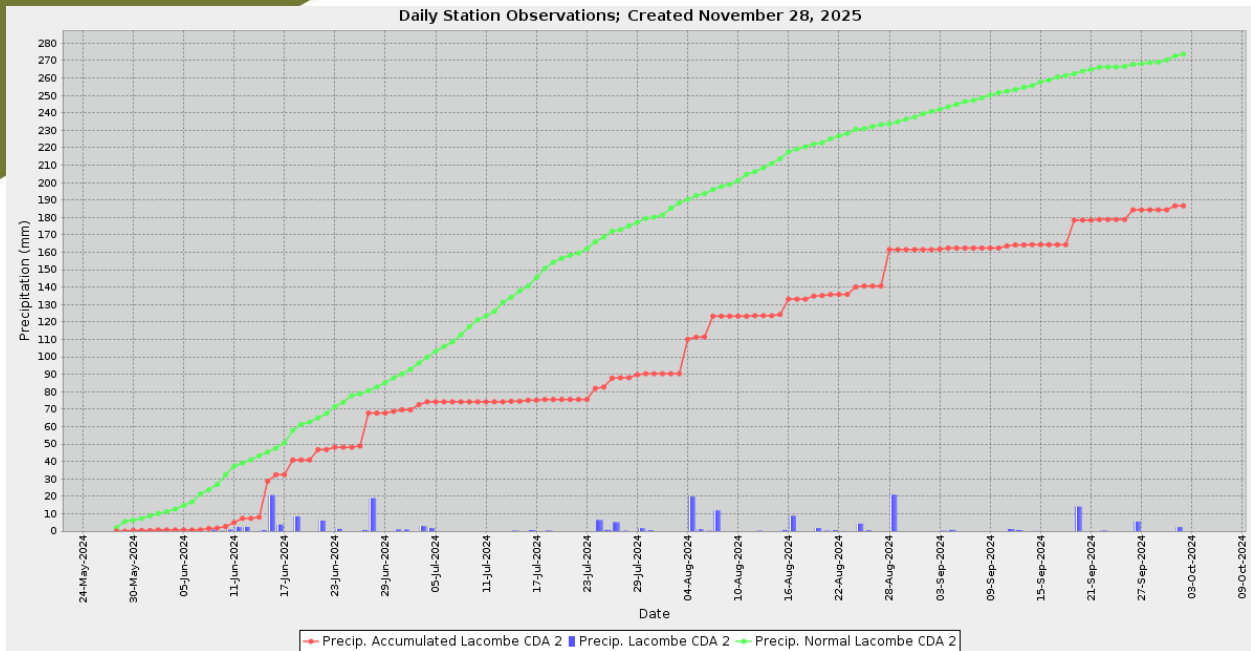
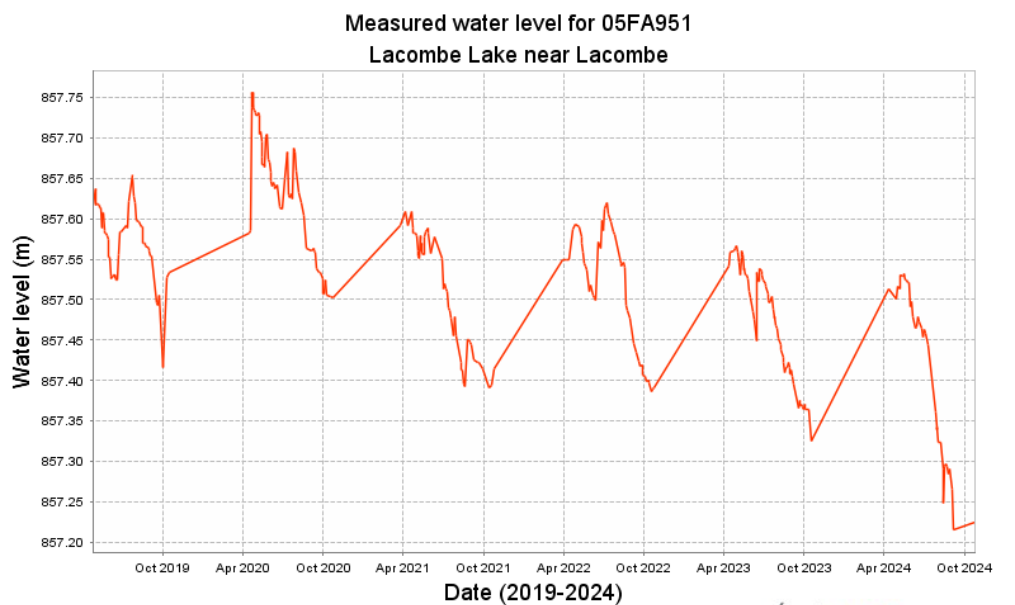


Figure 5. Air temperature (°C), wind speed (km/h), and precipitation (mm) measured from Lacombe CDA 2 weather station northeast of Lacombe Lake. Weather data provided by Agriculture, Forestry and Rural Economic Development, Alberta Climate Information Service (ACIS) <https://acis.alberta.ca>.

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 Lacombe Lake were lower than has been seen in the last five years (857.5 masl; Figure 6). Due to the lack of precipitation in 2024 (Figure 5), water levels continued to drop as water evaporated from the lake to the lowest levels since the period of record in 2019 at 857.2 masl.



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Alberta Government Environment and Climate Change Canada

Figure 6. Water levels measured at Lacombe Lake in metres above sea level (masl) from 2019-2024. 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 Lacombe Lake.

| Parameter | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|--|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| TP (µg/L) | 23 | 19 | 16 | 26 | 22 | 21 | 25 | 21 | 23 | 20 | 19 |
| TDP (µg/L) | 5 | 6 | 3 | 4 | 5 | 4 | 3 | 4 | 3 | 4 | 3 |
| Chlorophyll-a (µg/L) | 8.0 | 7.5 | 8.6 | 15.0 | 12.0 | 10.4 | 8.7 | 17.3 | 13.8 | 17.6 | 8.2 |
| Secchi depth (m) | 1.54 | 1.74 | 1.77 | 1.45 | 1.38 | 1.76 | 1.22 | 1.46 | 1.34 | 1.60 | 1.57 |
| TKN (mg/L) | 1.3 | 1.4 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.6 | 1.6 | 1.6 | 1.3 |
| NO ₂ -N and NO ₃ -N (µg/L) | 5 | - | 2 | 2 | 2 | 2 | 3 | 3 | 63 | 10 | 39 |
| NH ₃ -N (µg/L) | - | - | 54 | 15 | 20 | 10 | 48 | 22 | 13 | 86 | 17 |
| DOC (mg/L) | - | 17 | 15 | 15 | 15 | 14 | 13 | 14 | 16 | 12 | 16 |
| Ca ²⁺ (mg/L) | - | 20 | 21 | 24 | 24 | 18 | 26 | 24 | 25 | 26 | 16 |
| Mg ²⁺ (mg/L) | - | 32 | 34 | 31 | 31 | 29 | 27 | 31 | 33 | 36 | 38 |
| Na ⁺ (mg/L) | - | 33 | 36 | 32 | 34 | 32 | 29 | 32 | 34 | 38 | 42 |
| K ⁺ (mg/L) | - | 12 | 12 | 11 | 12 | 11 | 10 | 11 | 11 | 12 | 12 |
| SO ₄ ²⁻ (mg/L) | 14 | 16 | 14 | 13 | 14 | 15 | 15 | 16 | 14 | 14 | 14 |
| Cl ⁻ (mg/L) | 21 | 25 | 25 | 27 | 25 | 24 | 24 | 28 | 29 | 32 | 34 |
| CO ₃ ²⁻ (mg/L) | 6.6 | 13.8 | 8.4 | 6.8 | 10.8 | 12.0 | 1.6 | 6.2 | 4.9 | 7.5 | 25.2 |
| HCO ₃ ²⁻ (mg/L) | 265.75 | 230.00 | 254.0 | 255.00 | 247.5 | 212.5 | 242.5 | 247.5 | 242.5 | 285.0 | 220.0 |
| pH | 8.49 | 8.78 | 8.62 | 8.53 | 8.59 | 8.84 | 8.27 | 8.52 | 8.45 | 8.43 | 8.87 |
| Conductivity (µS/cm) | 502 | 478 | 490 | 515 | 492 | 450 | 460 | 502 | 498 | 530 | 525 |
| Hardness (mg/L) | - | - | 192 | 185 | 188 | 165 | 178 | 188 | 198 | 210 | 198 |
| TDS (mg/L) | 278 | 266 | 280 | 278 | 278 | 250 | 260 | 280 | 278 | 315 | 292 |
| Microcystin (µg/L) | 0.15 | 0.38 | 0.28 | 1.41 | 0.54 | 0.34 | 0.22 | 0.39 | 0.34 | 0.23 | 0.34 |
| Total Alkalinity (mg/L CaCO ₃) | 230 | 212 | 224 | 220 | 218 | 195 | 205 | 218 | 208 | 250 | 222 |

Table 3. Concentrations of metals measured in Lacombe 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 | 2014 | 2015 | 2016 | 2017 | 2018 | Guidelines |
|-------------------|--------|--------|-------|--------|--------|--------------------------|
| Aluminum (µg/L) | 14 | 11.57 | 7.2 | 6.05 | 2.97 | 100 ^a |
| Antimony (µg/L) | 0.06 | 0.064 | 0.057 | 0.062 | 0.09 | / |
| Arsenic (µg/L) | 0.91 | 0.96 | 0.8 | 1 | 1.24 | 5 |
| Barium (µg/L) | 62.2 | 45.7 | 44.5 | 57.1 | 90.3 | / |
| Beryllium (µg/L) | 0.004 | 0.0073 | 0.004 | 0.0015 | 0.0015 | 100 ^{c,d} |
| Bismuth (µg/L) | 5e-04 | 0.0302 | 5e-04 | 0.0015 | 0.0023 | / |
| Boron (µg/L) | 45.8 | 46.6 | 47.7 | 46.8 | 61 | 1500 |
| Cadmium (µg/L) | 0.002 | 0.003 | 0.001 | 0.005 | 0.005 | 0.36 ^b |
| Chromium (µg/L) | 0.175 | 0.18 | 0.04 | 0.05 | 0.05 | / |
| Cobalt (µg/L) | 0.033 | 0.041 | 0.01 | 0.055 | 0.059 | 500, 1000 ^{c,d} |
| Copper (µg/L) | 0.398 | 0.697 | 0.37 | 0.28 | 0.673 | 4 ^b |
| Iron (µg/L) | 17.7 | 12.4 | 10.4 | 5.95 | 15.7 | 300 |
| Lead (µg/L) | 0.015 | 0.105 | 0.021 | 0.031 | 0.052 | 7 ^b |
| Lithium (µg/L) | 19.8 | 22.13 | 24.7 | 24.3 | 29.77 | 2500 ^d |
| Manganese (µg/L) | 48.1 | 53.2 | 51 | 57.4 | 412.33 | 130 ^e |
| Molybdenum (µg/L) | 0.137 | 0.104 | 0.102 | 0.084 | 0.091 | 73 |
| Nickel (µg/L) | 0.042 | 0.109 | 0.035 | 1.2 | 0.267 | 150 ^b |
| Selenium (µg/L) | 0.175 | 0.057 | 0.22 | 0.3 | 0.467 | 1 |
| Silver (µg/L) | 0.001 | 0.0053 | 0.001 | 5e-04 | 7e-04 | 0.25 |
| Strontium (µg/L) | 199.5 | 139.3 | 131 | 184.5 | 291 | / |
| Thallium (µg/L) | 0.0016 | 0.0121 | 4e-04 | 0.001 | 0.001 | 0.8 |
| Thorium (µg/L) | 0.002 | 0.094 | 0.004 | 0.005 | 0.001 | / |
| Tin (µg/L) | 0.01 | 0.03 | 0.02 | 0.03 | 0.06 | / |
| Titanium (µg/L) | 0.865 | 0.983 | 0.76 | 1.065 | 1.483 | / |
| Uranium (µg/L) | 0.678 | 0.522 | 0.524 | 0.476 | 0.703 | 15 |
| Vanadium (µg/L) | 0.185 | 0.167 | 0.2 | 0.146 | 0.118 | 100 ^{c,d} |
| Zinc (µg/L) | 0.95 | 1.37 | 0.6 | 0.4 | 1.53 | 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#_aqf_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 Lacombe Lake. In sum, a significant increasing trend was detected in chlorophyll-*a*. No significant trend was detected in TP, TDS, or Secchi depth. 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 Lacombe Lake Lake data from 2014 to 2024.

| Parameter | Date Range | Direction of Significant Change |
|------------------------|------------|---------------------------------|
| Total Phosphorus | 2014-2024 | No Change |
| Chlorophyll- <i>a</i> | 2014-2024 | Increasing |
| Total Dissolved Solids | 2014-2024 | No Change |
| Secchi Depth | 2014-2024 | No Change |

Definitions

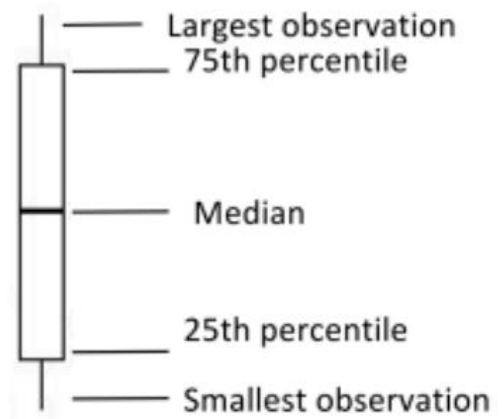
Median: the value in a range of ordered numbers that falls in the middle.

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 showed no significant change in Lacombe Lake since 2014 (Tau = 0.0773, $p = 0.5013$).

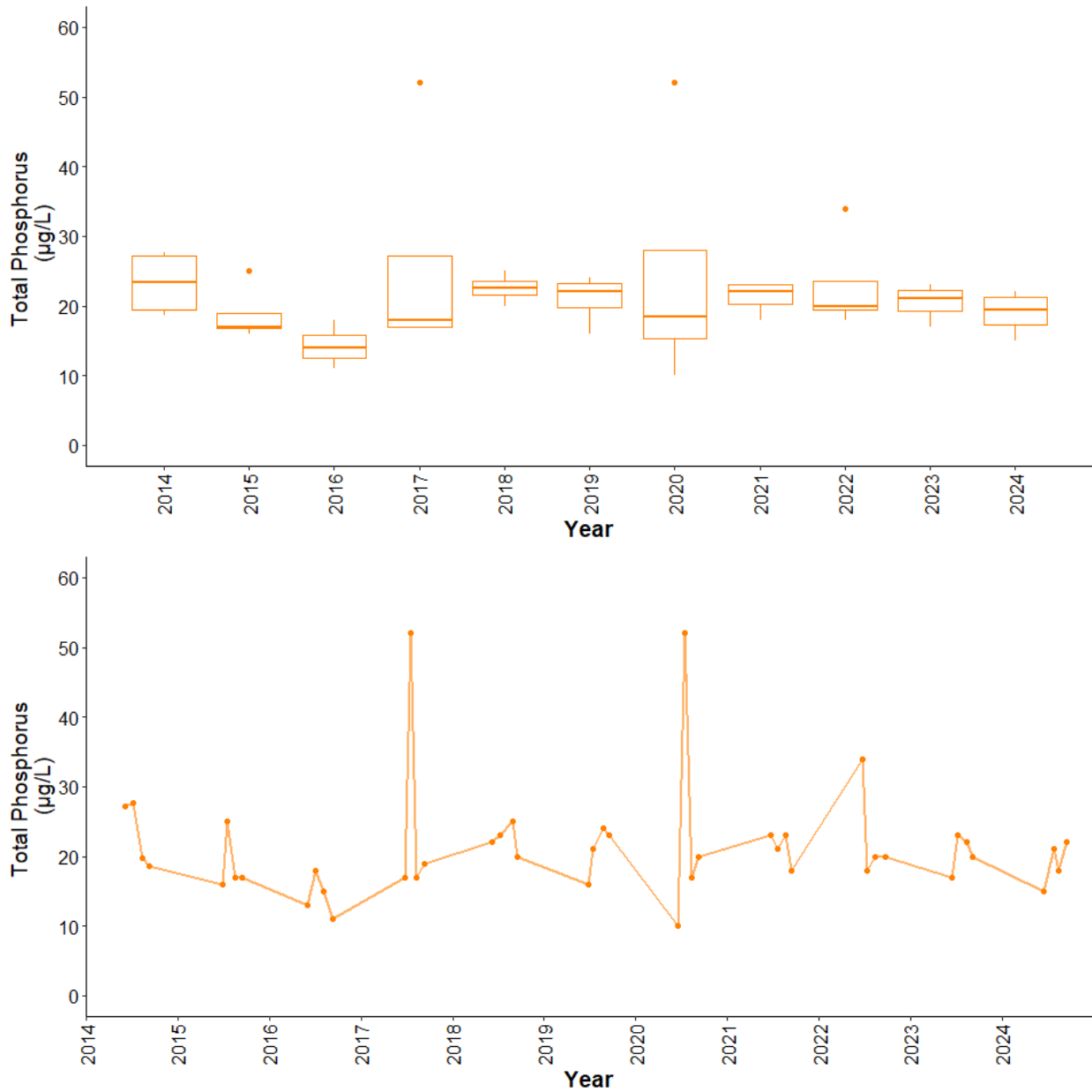


Figure 7. Monthly total phosphorus (TP) concentrations measured between June and September over the long term sampling dates between 2014 and 2024 ($n = 44$). The value closest to the 15th day of the month was chosen to represent the monthly value in cases with multiple monthly samples.

Chlorophyll-*a*

Trend analysis of chlorophyll-*a* over time showed it has significantly increased at Lacombe Lake (Tau = 0.2955, $p = 0.0111$).

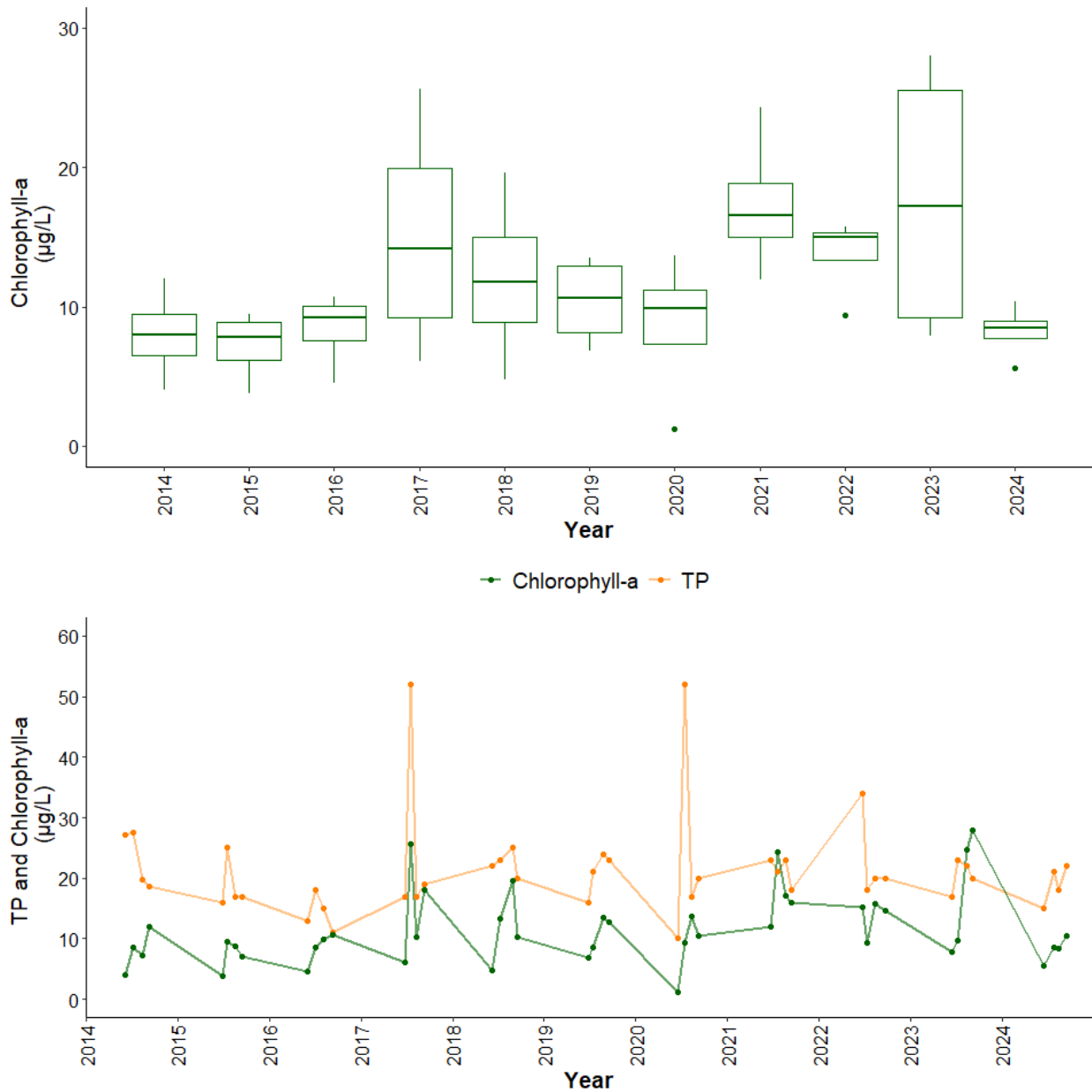


Figure 8. Monthly chlorophyll-*a* concentrations measured between June and September over the long term sampling dates between 2014 and 2024 ($n = 44$). The value closest to the 15th day of the month was chosen to represent the monthly value in cases with multiple monthly samples. Line graph is overlain by TP concentrations.

Total Dissolved Solids (TDS)

Trend analysis of TDS showed no significant change in Lacombe Lake from 2014-20204 (Tau = 0.1864, $p = 0.1037$). Trend analysis of major ions at Lacombe Lake indicates that chloride is significantly increasing over time (Figure 10). All other ions do not show a significant increasing or decreasing trend.

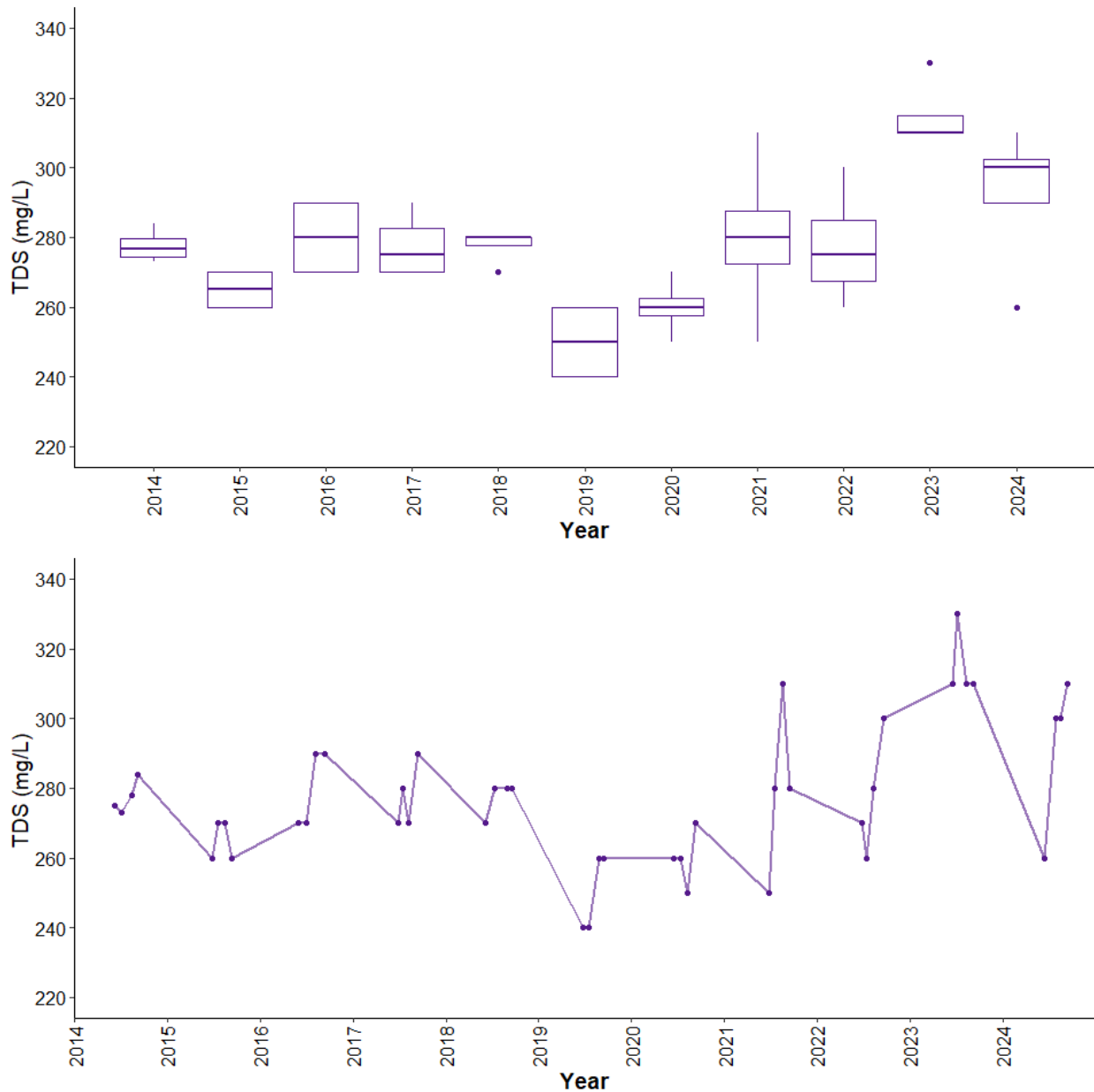


Figure 9. Monthly TDS values measured between June and September over the long term sampling dates between 2014 and 2024 ($n = 44$). The value closest to the 15th day of the month was chosen to represent the monthly value in cases with multiple monthly samples.

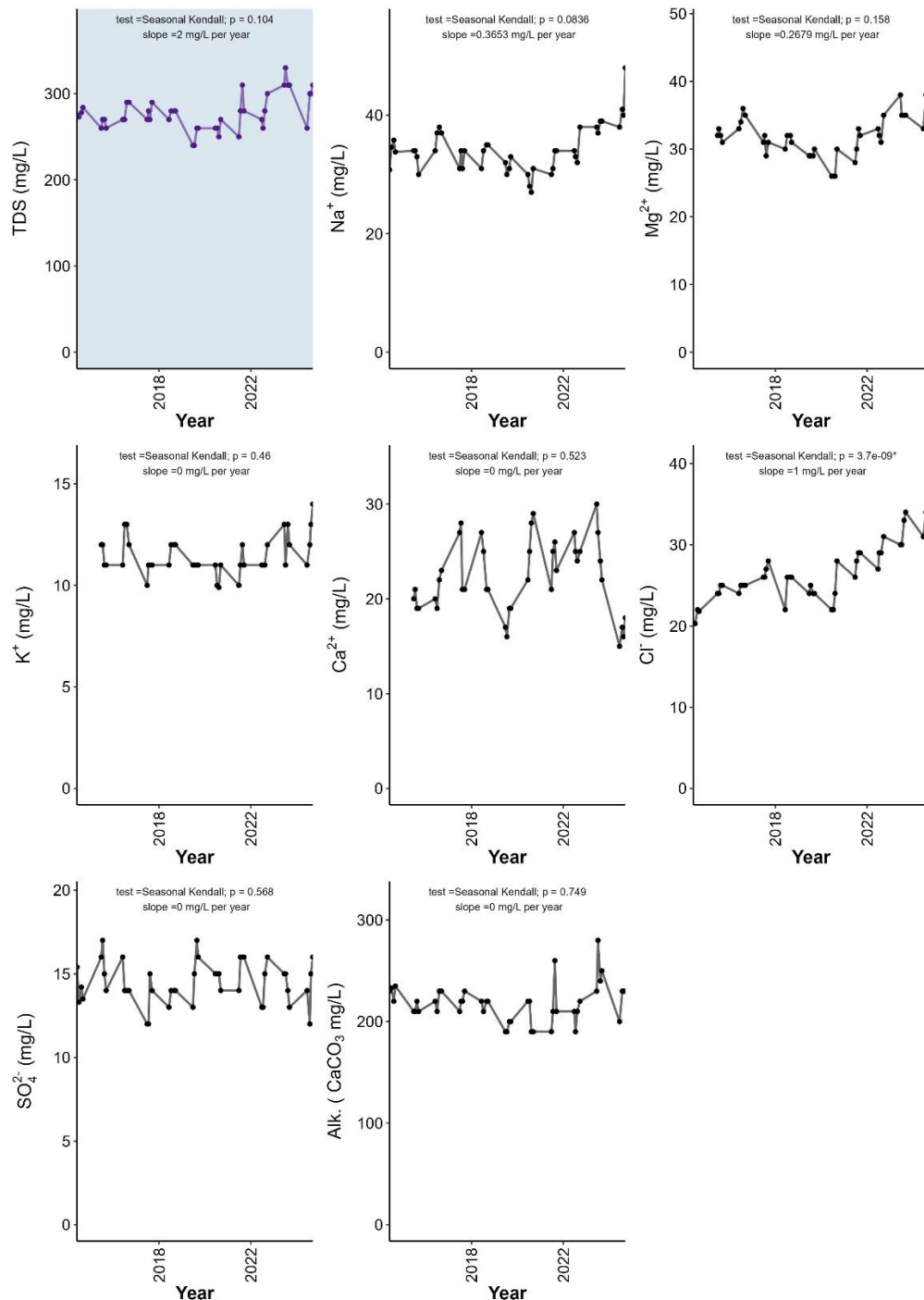


Figure 10. Concentrations of TDS (top left, blue panel), major ions (sodium = Na⁺, magnesium = Mg²⁺, potassium = K⁺, calcium = Ca²⁺, chloride = Cl⁻, sulphate = SO₄²⁻), and total alkalinity (Alk., as mg/L CaCO₃) measured monthly between June and September on sampling dates between 2014 and 2024. Also 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), and the slope of the trend. Test selection follows method outline in the ALMS Guide to Trend Analysis on Alberta Lakes. 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 showed that it has not significantly changed at Lacombe Lake since 2014 (Tau = -0.0817, $p = 0.4897$).

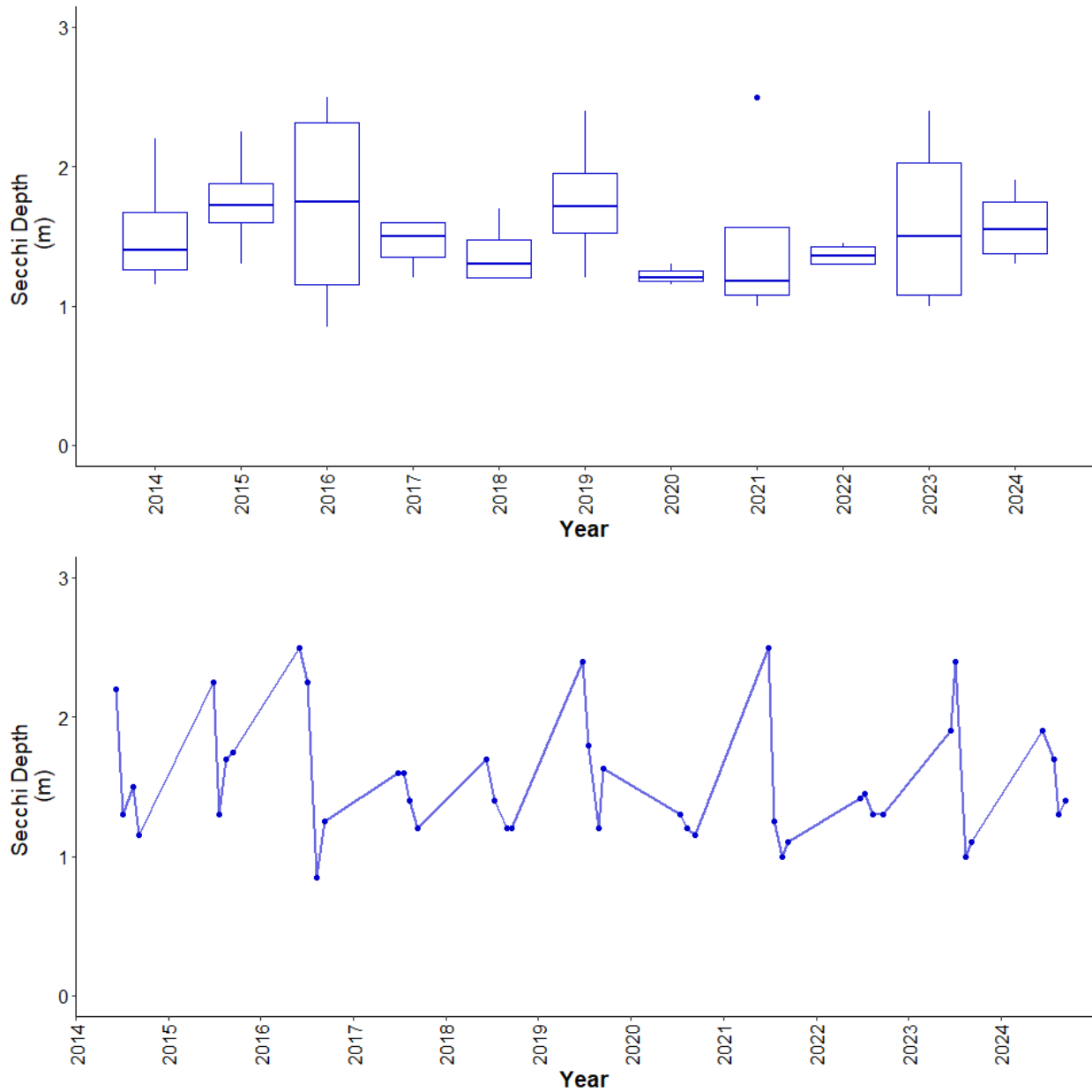


Figure 11. Monthly Secchi depth values measured between June and September over the long term sampling dates between 2014 and 2024 ($n = 43$). The value closest to the 15th day of the month was chosen to represent the monthly value in cases with multiple monthly samples.

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 2014-2024 on Lacombe Lake data.

| Definition | Unit | Total Phosphorus (TP) | Chlorophyll- <i>a</i> | 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 | 0.0773 | 0.2955 | 0.1864 | -0.0817 |
| The extent of the trend | Slope (units per Year) | 0.0125 | 0.4595 | 2 | -0.0071 |
| The statistic used to find significance of the trend | Z | 0.6725 | 2.5411 | 1.627 | -0.6908 |
| Number of samples included | n | 44 | 44 | 44 | 43 |
| The significance of the trend | <i>p</i> | 0.5013 | 0.0111* | 0.1037 | 0.4897 |

**p* < 0.05 is significant within 95%