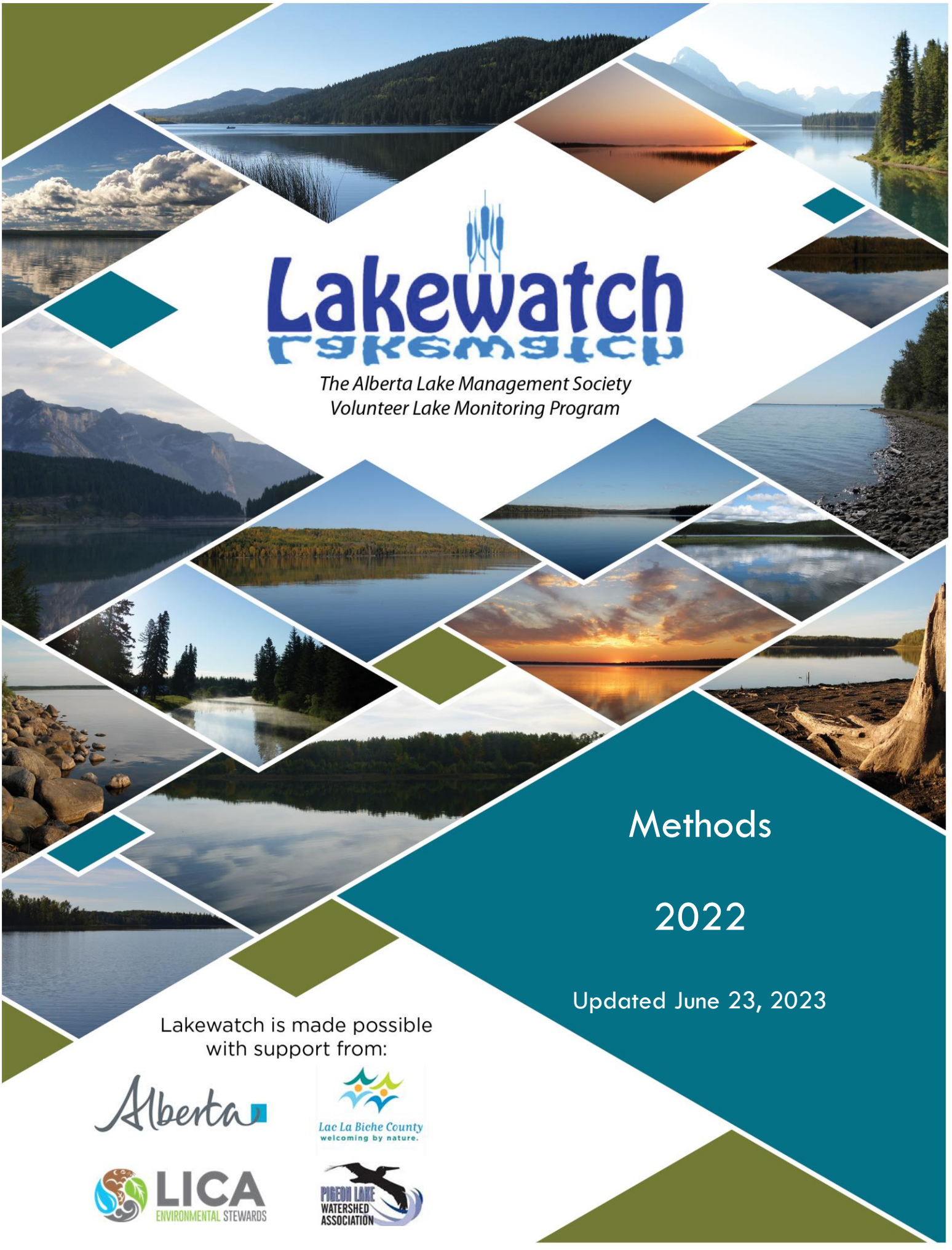

Lakewatch

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

Methods

2022

Updated June 23, 2023

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ALBERTA LAKE MANAGEMENT SOCIETY'S LAKEWATCH PROGRAM

LakeWatch has several important objectives, one of which is to collect and interpret water quality data from Alberta's Lakes. Equally important is educating lake users about aquatic environments, encouraging public involvement in lake management, and facilitating cooperation and partnerships between government, industry, the scientific community and lake users. LakeWatch reports are designed to summarize basic lake data in understandable terms for the widest audience, and are not meant to be a complete synopsis of information about specific lakes. Additional information is available for many lakes that have been included in LakeWatch, and readers requiring more information are encouraged to seek those sources.

ALMS would like to thank all who express interest in Alberta's aquatic environments, and particularly those who have participated in the LakeWatch program. These leaders in stewardship give us hope that our water resources will not be the limiting factor in the health of our environment.

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

ACKNOWLEDGEMENTS

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

METHODS

Profiles: Profile data is measured at the deepest spot in the main basin of the lake using a multi-meter probe. At the profile site, temperature, dissolved oxygen, pH, conductivity and redox potential are measured at 0.5 – 1.0 m intervals. Additionally, Secchi depth is measured at the profile site and used to calculate the euphotic depth (ie. the depth where light is 1% of light at the surface). If the calculated depth of the euphotic depth is greater than the depth of the lake, then the euphotic zone is recorded as the depth of the lake. If the Secchi disk is visible at the bottom of the lake at the profile location, the Secchi depth is right-censored (ie. recorded as greater than the bottom depth; > 3.0 m), and the euphotic depth is equal to the bottom depth. Metals are collected at the profile site, by hand grab, from the surface on one visit over the season, usually in August.

Composite samples: At 10 sites across the lake (less for smaller lakes), water is collected from the euphotic zone using weighted tygon tubing with a one-way foot valve and combined across sites into one composite sample. If the euphotic zone is deeper than the depth of water at a 'composite' sample site, then the sample is taken to 1m above the bottom sediments. This water is collected for analysis of water chemistry, chlorophyll-a, nutrients and microcystin. Quality control (QC) data for total phosphorus was taken as a triplicate true split on one sampling date.

Sample Analysis: ALMS submits samples to the following accredited labs for analysis: Routine water chemistry and nutrients are analyzed by Bureau Veritas, chlorophyll-*a* and metals are analyzed by Innotech Alberta, and microcystin is analyzed by the Alberta Centre for Toxicology (ACFT).

Invasive Species: Invasive mussel monitoring involved sampling with a 63 µm plankton net at three sample sites twice through the summer season, to determine the presence of juvenile dreissenid mussel veligers, and spiny water flea. Technicians also collect potential Eurasian watermilfoil (*Myriophyllum spicatum)* specimens and submit them for further analysis at the Alberta Plant Health Lab, to genetically differentiate whether the sample was the invasive Eurasian watermilfoil or a native watermilfoil. In addition, select lakes may be subject to a bioblitz, where a concerted effort to sample the lake's aquatic plant diversity took place.

Data Storage and Analysis: Data is stored in the Water Data System (WDS), a module of the Environmental Management System (EMS) run by Alberta Environment and Protected Areas (AEPA). Data goes through a complete validation process by ALMS and AEPA. Users should use caution when comparing historical data, as sampling and laboratory techniques have changed over time (e.g. detection limits). For more information on data storage, see AEPS Surface Water Quality Data Reports at www.alberta.ca/surface-water-quality-data.aspx.

Data analysis is done using the program R.[1] Data is reconfigured using packages tidyr[2] and dplyr[3] and figures are produced using the package ggplot2.[4] Trophic status for each lake is classified based on lake water characteristics using values from Nurnberg (1996).[5] The Canadian Council for Ministers of the Environment (CCME) guidelines for the Protection of Aquatic Life are used to compare heavy metals and dissolved oxygen

[1] R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.
[2] Wickman, H. and Henry, L. (2017). tidyr: Easily Tidy Data with 'spread ( )' and 'gather ( )' Functions. R package version 0.7.2. https://CRAN.R-project.org/package=tidyr.
[3] Wickman, H., Francois, R., Henry, L. and Muller, K. (2017). dplyr: A Grammar of Data Manipulation. R package version 0.7.4. http://CRAN.R-project.org/package=dplyr.
[4] Wickham, H. (2009). ggplot2: Elegant Graphics for Data Analysis. Springer-Verlag New York.
[5] Nurnberg, G.K. (1996). Trophic state of clear and colored, soft- and hardwater lakes with special consideration of nutrients, anoxia, phytoplankton and fish. Lake and Reservoir Management 12: 432-447.

measurements. Pearson's Correlation tests are used to examine relationships between total phosphorus (TP), chlorophyll-*a,* total Kjeldahl nitrogen (TKN) and Secchi depth, providing a correlation coefficient (r) to show the strength (0-1) and a p-value to assess significance of the relationship.

Weather data incorporated into the reports to contextualize lake temperature, mixing and stratification was accessed through the 'Weather Station Data' tool from the Alberta Climate Information Service (ACIS; http://agriculture.alberta.ca/acis/weather-data-viewer.jsp). Data represented in the 'Weather & Lake Stratification' figures in the LakeWatch 2022 reports are daily data, from June 1st, 2022 to October 15th, 2022. Parameters incorporated are 'Observed Temperature,' 'Normal Temperature,' 'Observed Accumulated Precipitation,' 'Normal Accumulated Precipitation,' 'Total Solar Radiation at 2m,' 'Normal Total Solar Radiation Energy,' 'Wind Speed at 10m' or 'Wind Speed at 2m, and Normal Average Wind Speed at 10 meter height.' Note that normal data represents average data that has been interpolated, from 1961 – 2018.[6] For each lake, the weather station was selected to best represent the weather conditions that lake experienced, based on proximity to that lake's profile sampling location. Weather stations selected for temperature and precipitation data were all within 25km of the lake's profile location. If wind and solar radiation data was not available for the weather station in closest proximity, then this data was accessed at the next closest weather station within 40km from the profile location of the lake.

Water level data incorporated into the reports is accessed online from either Alberta Environment and Parks (https://rivers.alberta.ca/), and/or from Environment and Climate Change Canada (https://wateroffice.ec.gc.ca/search/historical_e.html). The data is visualized at the frequency reported from Alberta Environment and Parks, and as daily data from Environment and Climate Change Canada. The historical yearly average line on the figures is calculated by first calculating an average level for each year, and then calculating the average from those yearly averages. This was done to reduce the influence of water levels in years where level measurements were collected at high frequencies – this buffers the yearly average line against variability in measurement numbers over the historical record.

Historical Data Tables: The data used to report average yearly levels of lake water quality parameters is presented in the tables within the reports and is accessed online from Alberta Environment and Parks (http://environment.alberta.ca/apps/EdwReportViewer/LakeWaterQuality.aspx). For all data that is reported as below detection limit, a value of half of the reported detection limit is used to calculate the yearly averages, for each water quality parameter. Note that sampling effort can vary between lakes and between years, and not all parameters reported within the table will always have been analyzed historically (leading to '\' being used to indicate when data is unavailable). While microcystin and metals data is also reported in tables within the reports, this data is not available through the link above. Historical metals and microcystin data reported is gathered from previous LakeWatch reports, or using the Alberta Government's Water Quality Data (WQD) Portal (https://environment.extranet.gov.ab.ca/apps/WaterQuality/dataportal/DataDownload/Index/).

[6] Agriculture, Forestry and Rural Economic Development, Government of Alberta (2019). Alberta Climate Information Service (ACIS) Definitions. http://agriculture.alberta.ca/acis/docs/Station-viewer-y2019_m03_d27.pdf