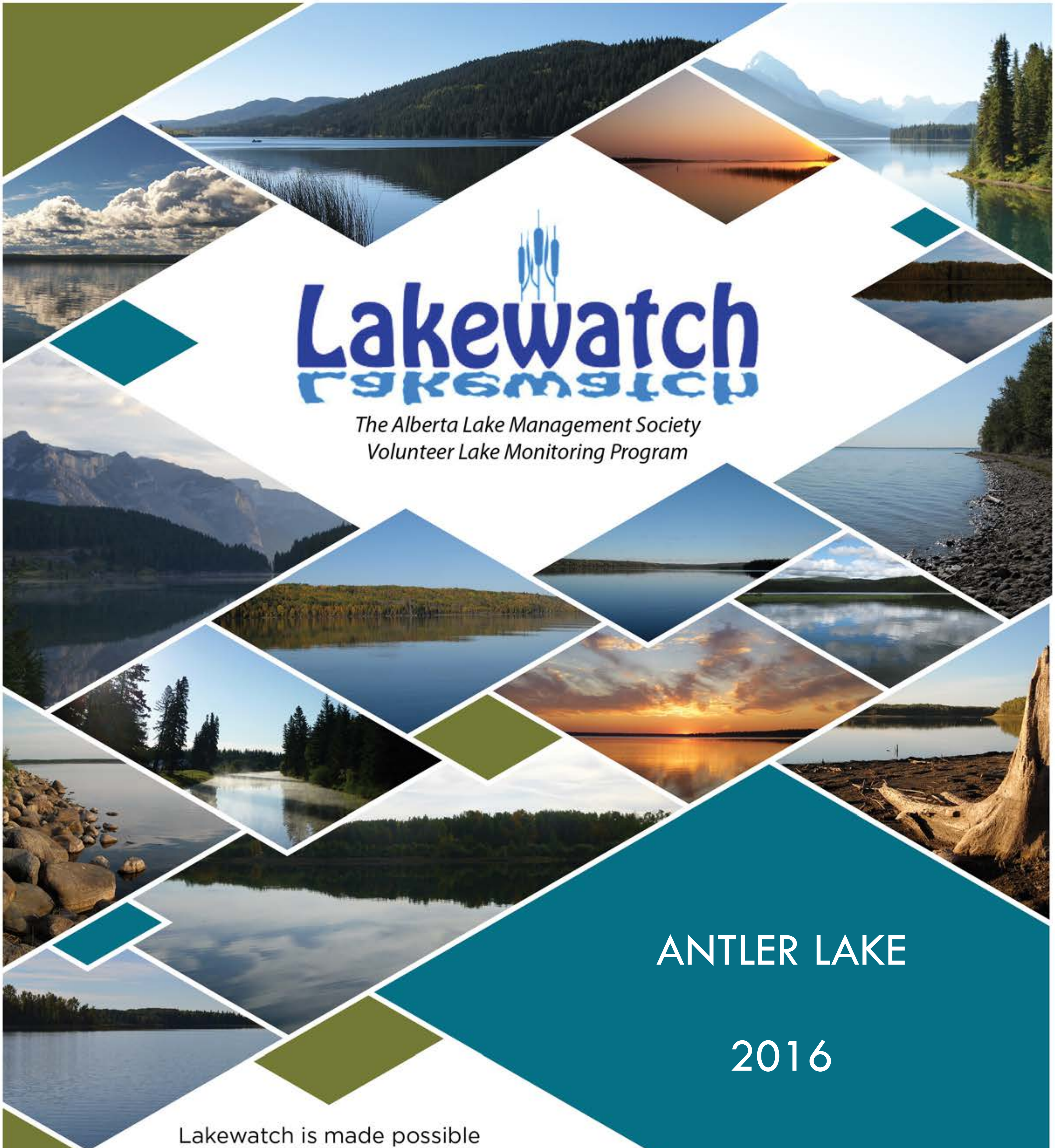

Lakewatch

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

ANTLER LAKE

2016

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LICA Lakeland Industry & Community Association

Beaver River Watershed Alliance

Red Deer River Watershed Alliance

MD61 Wainwright

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.

ACKNOWLEDGEMENTS

The LakeWatch program is made possible through the dedication of its volunteers. We would like to extend a special thanks to Leah Hamonic, President of the Antler Lake Stewardship Committee, and her children Collette and Xavier, for their time and energy put into sampling Antler Lake in 2016. We would also like to thank Alicia Kennedy, Ageleky Bouzetos, and Breda Muldoon who were summer technicians in 2016. Executive Director Bradley Peter was instrumental in planning and organizing the field program. Alicia Kennedy was instrumental in report design. This report was prepared by Bradley Peter and Laura Redmond. The Beaver River Watershed, the Lakeland Industry and Community Association, Environment Canada, and Alberta Environment and Parks are major sponsors of the LakeWatch program.

ANTLER LAKE

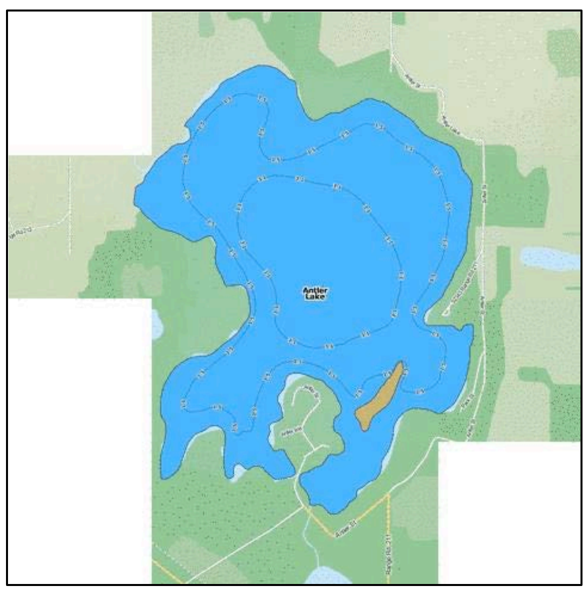
Antler Lake is located 18 km east of Sherwood Park and 25 km northwest of Tofield. The lake is near Cooking Lake and Elk Island National Park, in the Boreal Forest dry-mixedwood region[1]. There is a small island, Hazelnut Island, on the lake with dense shrubs and sparse patches of mature birch and small poplar.

Antler Lake. Photo by the Antler Lake Stewardship Committee.

Antler Lake was once a smaller fishing spot: species caught here included Northern Pike, Perch and Rainbow Trout[2]. Local anglers suggest the lake now supports only small minnow species (pers. comm.) There are cottage residences along the eastern and southern shores, and Hazelnut Island has minor development. The maximum depth of Antler Lake is ~ 1 m, and the eastern shore has a cattail marsh.

The Antler Lake Stewardship Committee became formalized in March 2016 as a registered non-profit society. Their mission is to create a community that shares the responsibility of being the best stewards of Antler Lake and the Antler Lake watershed. In 2016, the Antler Lake Stewardship Committee partnered with the North Saskatchewan Watershed Alliance to develop a State of the Watershed Report. This report is expected to be completed in 2018.

The watershed area for Antler Lake is 18.33 km^2 and the lake area is 2.57 km^2. The lake to watershed ratio of Antler Lake is 1:7. A map of the Antler Lake watershed area can be found here. (http://alms.ca/wp-content/uploads/2016/12/Antler.pdf)



Map of Antler Lake, AB (GPS Nautical Charts)

[1] Government of Alberta. N.d. http://www.albertaparks.ca/antler-lake-island/
[2] HookandBullet.com. 2017. http://www.hookandbullet.com/fishing-antler-lake-north-cooking-lake-ab/

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.

Antler Lake shows increases in most of its water quality parameters since measurements were first taken in 1987 (Table 1). This increase is likely tied to changes in water quantity as evaporation will increase the concentration of the most water quality variables.

Total phosphorus (TP) in Antler Lake in 2016 had an average concentration of 380 µg/L (Table 2). This puts Antler Lake well into the hypereutrophic, or very productive, trophic classification. TP reached a maximum of 490 µg/L on June 28^{th}, and remained high over the course of the summer (Figure 1), with lower values in the spring and autumn.

Average chlorophyll-*a* concentration in Antler Lake was 121 µg/L in 2016 (Table 2). Therefore, chlorophyll-*a* levels also placed this lake in the hypereutrophic classification. Chlorophyll-*a* increased steadily through the summer, and reached a maximum concentration of 183 µg/L on September 12^{th} (Figure 1).

TKN concentrations in Antler Lake increased throughout the summer, with a maximum concentration measured at 5.5 mg/L (Figure 1). The average concentration of TKN was measured as 4.9 mg/L (Table 2).

Average pH measured as 8.97 in 2016, buffered by moderate alkalinity (196 mg/L $CaCO_3$) and bicarbonate (196 mg/L HCO_3). Calcium, sodium and chloride were the dominant ions contributing to a relatively moderate conductivity measure of 534 µS/cm (Table 2).

METALS

Samples were analyzed for metals once 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.

Metals were measured once at Antler Lake and all measured values are listed in Table 3. Aluminum had a concentration measuring 165 µg/L, which is above its recommended guideline of 100 µg/L. However, aluminum and iron levels were both high, which is indicative of sediment contamination of the water samples which is common in shallow lakes.

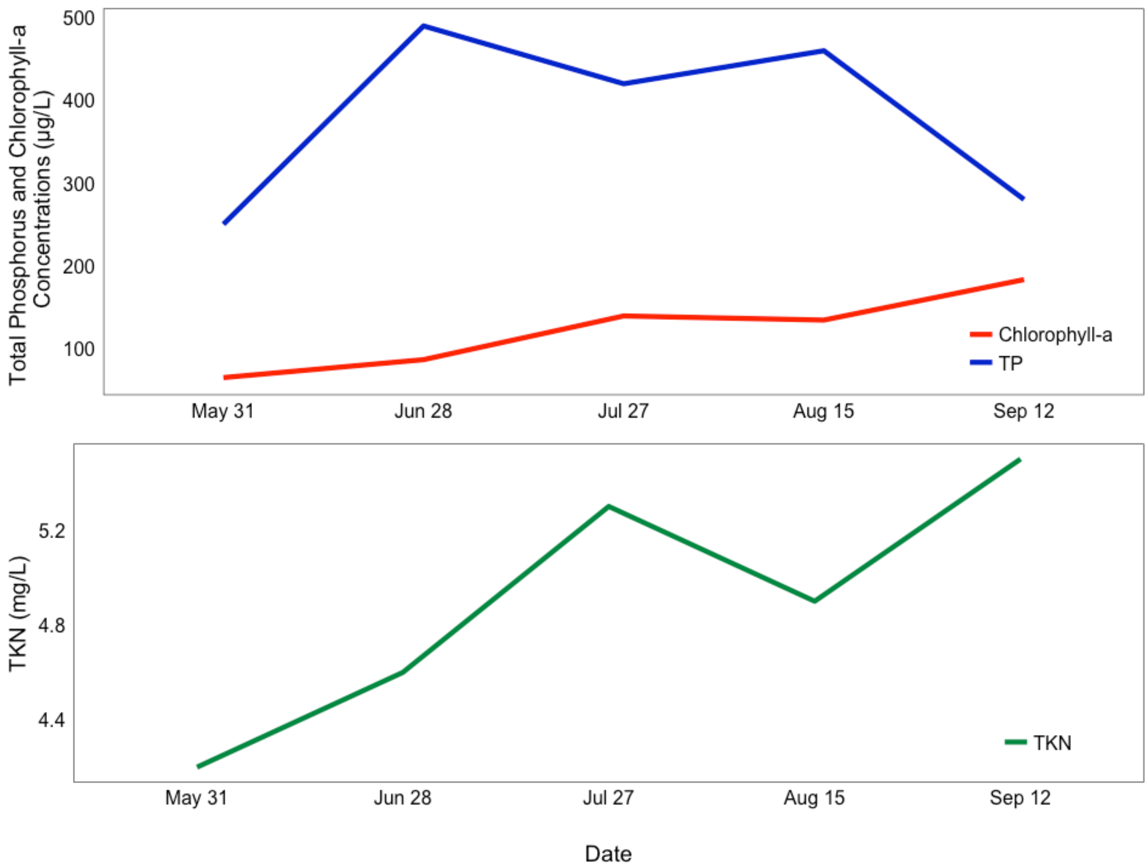


Figure 1- Total Phosphorus (TP), Total Kjeldahl Nitrogen (TKN), and Chlorophyll-*a* concentrations measured five times over the course of the summer at Antler Lake.

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 in Antler Lake was 0.4 m in 2016 (Table 2). Water clarity in Antler Lake was relatively consistent over the course of the summer (Figure 2), and given that the maximum depth of Antler Lake is only 1.2 m, photosynthesis can occur through most of the water column, contributing to its high productivity.

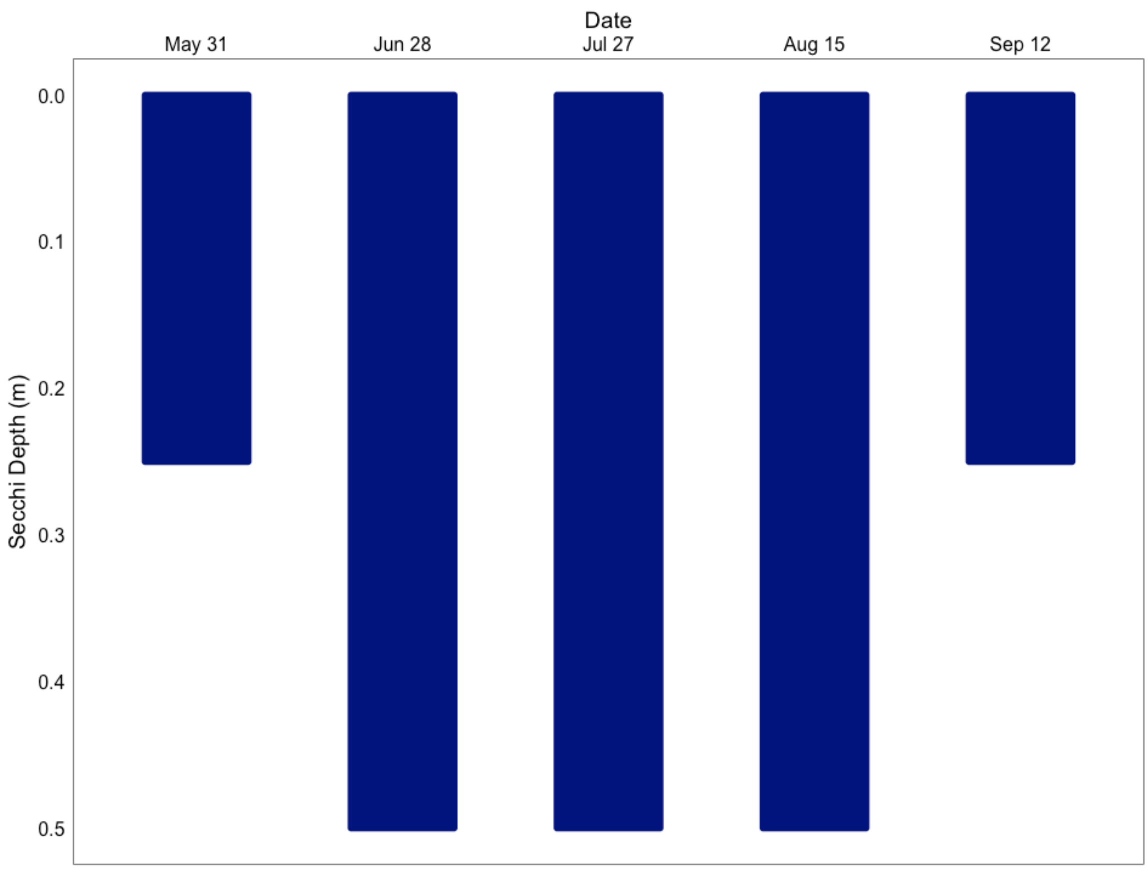


Figure 2 – Secchi depth values measured five times over the course of the summer at Antler Lake in 2016.

WATER TEMPERATURE AND DISSOLVED OXYGEN

Water temperature and dissolved oxygen 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.

Water temperature varied across the sampling season in Antler Lake. The maximum surface temperature (22.87°C) was measured on July 27 (Figure 3a). However, by June 28, temperatures remained stable through the water column at about 22°C until temperatures decreased again to around 11°C in September. Antler Lake can be classified as polymictic, because the entire water column mixes fully multiple times throughout the summer. Therefore, thermal stratification was never observed in Antler Lake.

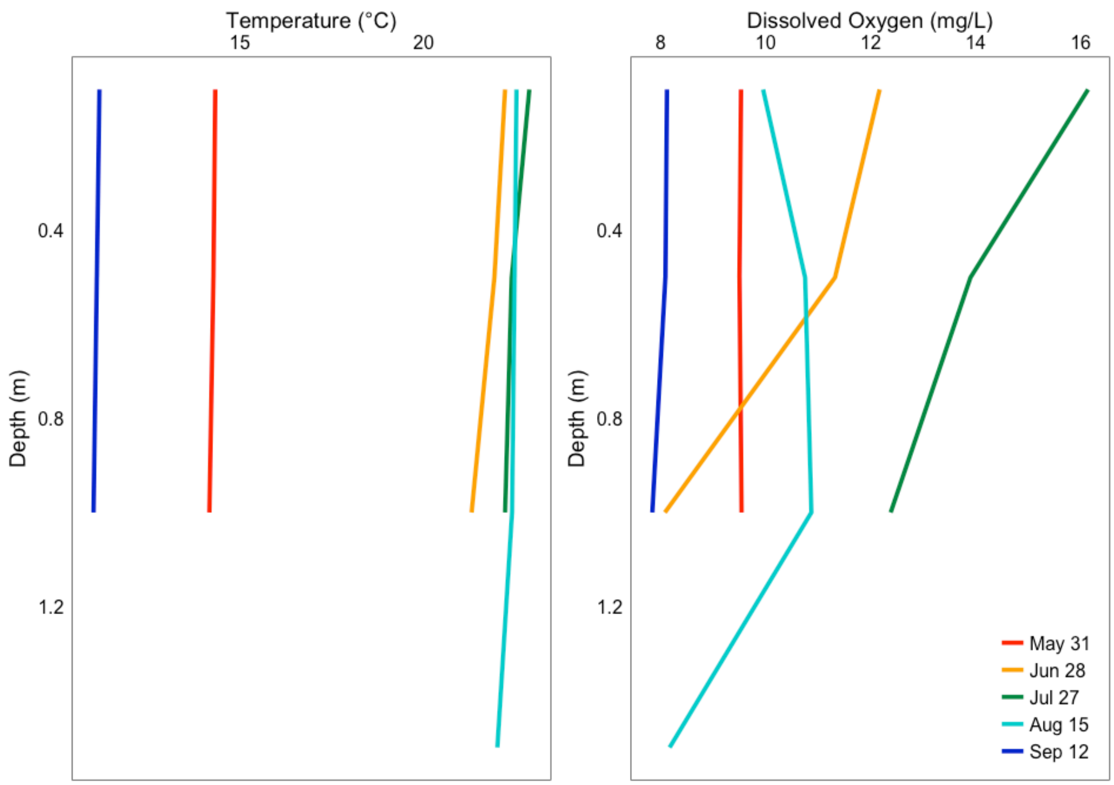


Figure 3 – a) Temperature (°C) and b) dissolved oxygen (mg/L) profiles for Antler Lake measured five times over the course of the summer of 2016.

Antler Lake remained well oxygenated at the surface throughout the summer, measuring above the Canadian Council for Ministers of the Environment guidelines of 6.5 mg/L for the Protection of Aquatic Life (Figure 3b). Antler Lake never reached anoxia, given the lack of thermal stratification, which allowed for full mixing throughout the entire sampling period.

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.

All microcystin measurements remained well below the recommended limit for recreational use at Antler Lake in 2016 (Table 1).

Table 1 – Microcystin concentrations measured five times at Antler Lake in 2016.

Date	Microcystin Concentration (μg/L)
May 31	0.31
Jun 28	0.40
Jul 27	0.34
Aug 15	0.94
Sep 12	1.11
Average	0.62

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 2016, no invasive mussels were detected in Antler Lake.

WATER LEVELS

There are many factors influencing water quantity. Some of these factors include the size of the lakes 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 in Antler Lake have remained relatively stable since Alberta Environment began monitoring the lake in 1959, with a decline between the late 1990's and around 2011 (Figure 4). Since 1959, Antler Lake water levels have fluctuated between 737.2 m asl and 739.1 m asl.

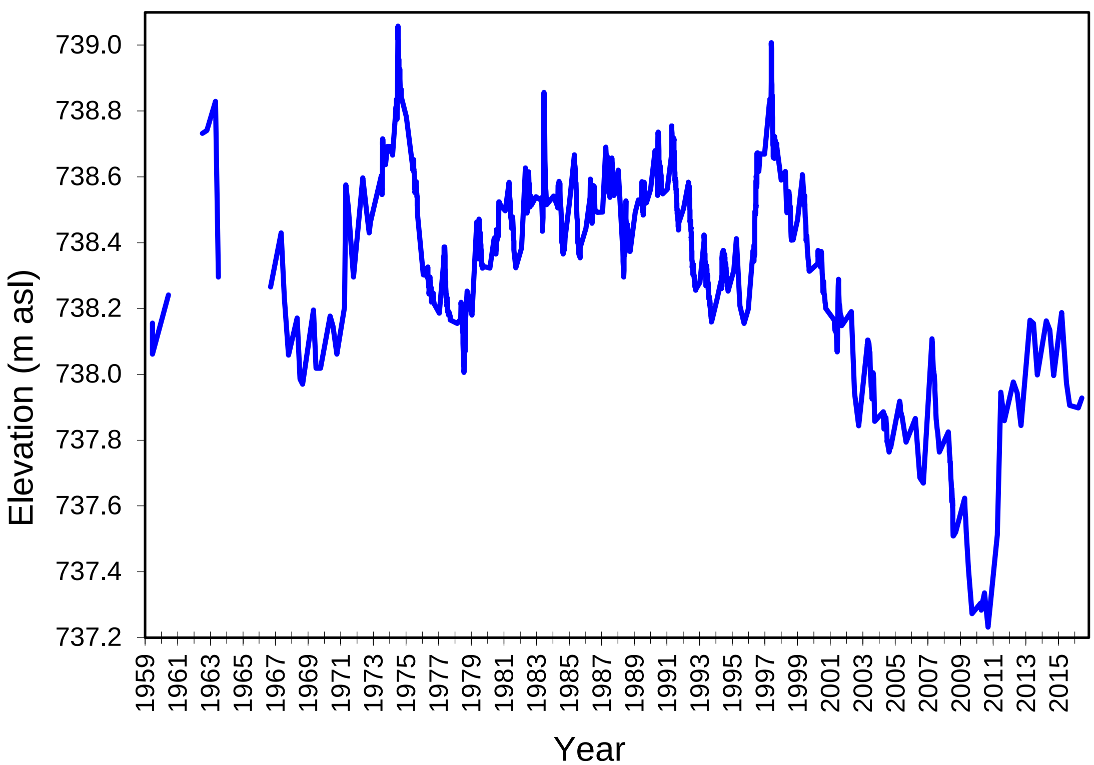


Figure 4- Water levels measured in meters above sea level (m asl) from 1959- 2016. Data retrieved from Alberta Environment.

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

Parameter	1987	2016
TP (µg/L)	190	380
TDP (µg/L)	86	188
Chlorophyll-*a* (µg/L)	46	121
Secchi depth (m)	0.88	0.4
TKN (mg/L)	2.4	4.9
NO_2 and NO_3 (µg/L)	6	19.02
NH_3 (µg/L)	57	42.8
DOC (mg/L)	22.1	38.8
Ca (mg/L)	28	39.6
Mg (mg/L)	9	18.8
Na (mg/L)	14	37.8
K (mg/L)	13	32.6
SO_4^{2-} (mg/L)	23	33
Cl^- (mg/L)	7	35
CO_3 (mg/L)	<5.0	21.78
HCO_3 (mg/L)	144	196
pH	8.28	8.968
Conductivity (µS/cm)	305	534
Hardness (mg/L)	108	176
TDS (mg/L)	167	320
Microcystin (µg/L)	/	0.62
Total Alkalinity (mg/L $CaCO_3$)	122	196

Table 3: Concentrations of metals measured once in Antler Lake. The CCME heavy metal Guidelines for the Protection of Freshwater Aquatic Life (unless otherwise indicated) are presented for reference.

Metals (Total Recoverable)	2016	Guidelines
Aluminum µg/L	165	100[a]
Antimony µg/L	0.154	6[d]
Arsenic µg/L	1.87	5
Barium µg/L	57.9	1000[d]
Beryllium µg/L	0.015	100[c,e]
Bismuth µg/L	0.002	/
Boron µg/L	98.7	1500
Cadmium µg/L	0.012	0.26[b]
Chromium µg/L	0.29	/
Cobalt µg/L	0.339	1000[e]
Copper µg/L	0.91	4[b]
Iron µg/L	229	300
Lead µg/L	0.356	7[b]
Lithium µg/L	37.6	2500[f]
Manganese µg/L	80.6	200[f]
Molybdenum µg/L	0.761	73[c]
Nickel µg/L	0.979	150[b]
Selenium µg/L	0.24	1
Silver µg/L	0.003	0.25
Strontium µg/L	198	/
Thallium µg/L	0.0024	0.8
Thorium µg/L	0.0186	/
Tin µg/L	0.033	/
Titanium µg/L	4.96	/
Uranium µg/L	0.577	15
Vanadium µg/L	1.53	100[e,f]
Zinc µg/L	2.8	30

Values represent means of total recoverable metal concentrations.

[a] Based on pH ≥ 6.5

[b] Based on water hardness > 180mg/L (as $CaCO_3$)

[c] CCME interim value.

[d] Based on Canadian Drinking Water Quality guideline values.

[e] Based on CCME Guidelines for Agricultural use (Livestock Watering).

[f] Based on CCME Guidelines for Agricultural Use (Irrigation).

A forward slash (/) indicates an absence of data or guidelines.