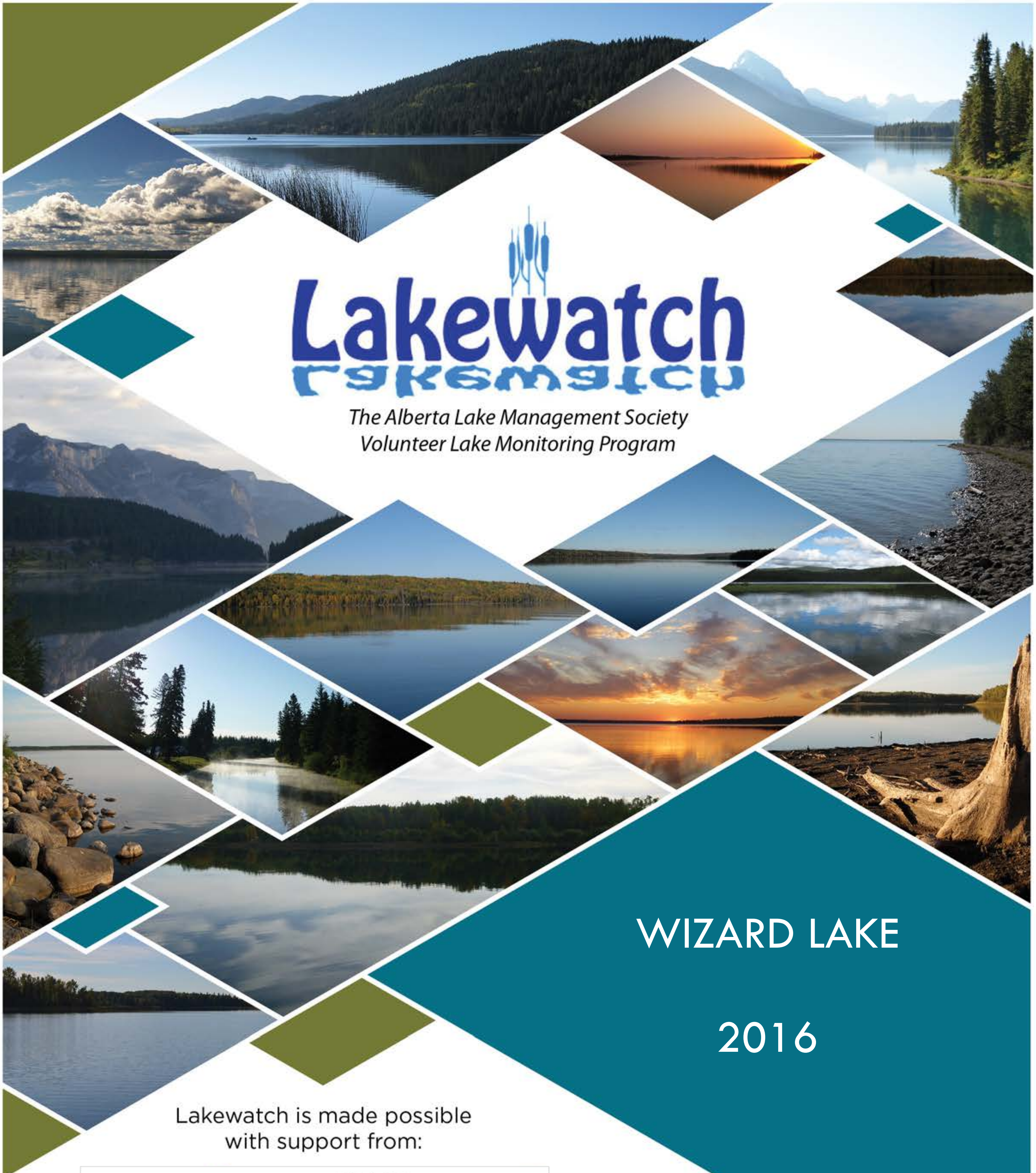

Lakewatch

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

WIZARD LAKE

2016

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Environment and Climate Change Canada
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LICA Lakeland Industry & Community Association
Beaver River Watershed Alliance
Red Deer River Watershed Alliance
MD of 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.

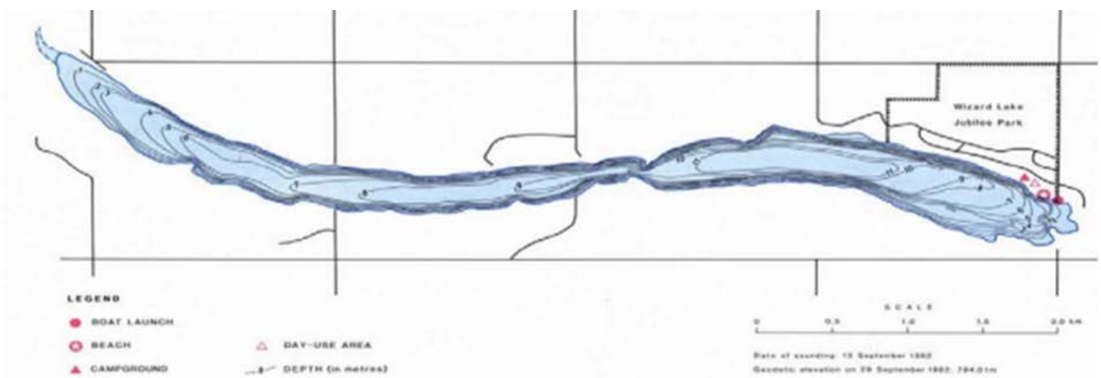
ACKNOWLEDGEMENTS

The LakeWatch program is made possible through the dedication of its volunteers. We would like to extend a special thanks to Larry MacPherson for the time and energy put into sampling Wizard 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.

WIZARD LAKE

Wizard Lake 2011. Photo by Jessica Davis

Wizard Lake is a long, serpentine, lake lying in a heavily forested, deep glacial meltwater channel 60 km southwest of the city of Edmonton. The valley provides excellent shelter from winds, making this lake very popular for water skiing. The northern shore of the lake is in the county of Leduc and the southern shore of the lake is in the county of Wetaskiwin. The First Nations name for the lake was Seksyawas Sakigan, which translates to Lizard Lake, and until the late 1960's the popular name for the lake was Conjuring Lake[1]. First Nations legends said strange noises in the lake came from 'conjuring creatures'; the creek draining the lake, which enters the North Saskatchewan River ~5 km west of Devon, is still called Conjuring Creek[2]. The year 1904 saw both the first settlers and the opening of a sawmill in the lake area. The sawmill was short-lived, closing in 1905 when the railway was not built across the area as expected. The sawmill was succeeded by the building of an underground coalmine, in operation until the 1940's. Today, the area surrounding the lake includes Wizard Lake Jubilee Park and 110 cottages on the north shore, 61 cottages on the south, and a subdivision.



Bathymetric map of Wizard Lake (Mitchell & Prepas 1990)

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1 1 Aubrey, M. K. 2006. Concise place names of Alberta. Retrieved from http://www.albertasource.ca/placenames/resources/searchcontent.php?book=1

2 Aquality Environmental Consulting (2013). Wizard Lake State of the Watershed Report 2012. Retrieved from: http://www.wizardlake.ca/uploads/1/8/0/3/18037581/state_of_watershed_complete.pdf January 9, 2014.

Wizard Lake is a popular recreation area for water skiing, SCUBA diving, and fishing. Intensive use of the lake, especially on summer weekends, led to conflict between water skiers, high-speed boat operators, canoers, and anglers. A lake management plan was prepared in 1979, which recommended dividing the lake into two zones: the boat speed in the west half of the lake was to be limited to 12 km/hr to facilitate access to anglers, while the boat speed in the east half was to be limited to 65 km/hr to allow water skiing. Yellow perch and northern pike are the most commonly fished species in the lake. Wizard Lake occupies an area of 2.48 km^2, with a maximum depth of 11 m and a mean depth of 6.2 m. The length of the lake stretches 11.5 km and has a maximum width of 0.55 km. Wizard Lake lies in the Strawberry Creek sub-basin of the North Saskatchewan River Watershed[2]. It is a eutrophic lake, usually clear, but can experience dense blue-green algae blooms during the summer months.For more detailed information on Wizard Lake and its watershed, view the State of the Watershed Report available on the Wizard Lake website at:

Cyanobacterial bloom on the surface of Wizard Lake, 2011

http://www.wizardlake.ca/uploads/1/8/0/3/18037581/state_of_watershed_complete.pdf

The watershed area for Wizard Lake is 36.99 km^2 and the lake area is 2.67 km^2. The lake to watershed ratio of Wizard Lake is 1:14. A map of the Wizard Lake watershed area can be found http://alms.ca/wp-content/uploads/2016/12/Wizard.pdf

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.

Total phosphorus (TP) in Wizard Lake had an average concentration of 43 µg/L in 2016, putting it in the eutrophic trophic classification (Table 2). TP increased throughout the summer, with a spike to the maximum concentration of 60 µg/L on August 31 (Figure 1).

Chlorophyll-*a* concentrations also increased over the course of the summer, with an average concentration of 44 µg/L in 2016 (Table 2). Historically, this is a high average for Wizard Lake and places Wizard Lake in the hypereutrophic trophic status class. A maximum concentration of 69.5 µg/L was reached on August 31 (Figure 1).

Wizard Lake had an average TKN concentration of 1.22 mg/L over five sampling dates in 2016 (Table 2). TKN correlated with increasing TP and chlorophyll-*a* concentrations, and on August 31 TKN concentrations were at a seasonal maximum of 1.4 mg/L (Figure 1).

Average pH measured as 8.5 in 2016, buffered by moderate alkalinity (176 mg/L $CaCO_3$) and bicarbonate (210 mg/L HCO_3). Sodium and calcium were the dominant ions contributing to a relatively low conductivity measure of 350 uS/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 Wizard Lake and all measured values fell within their respective guidelines (Table 3).

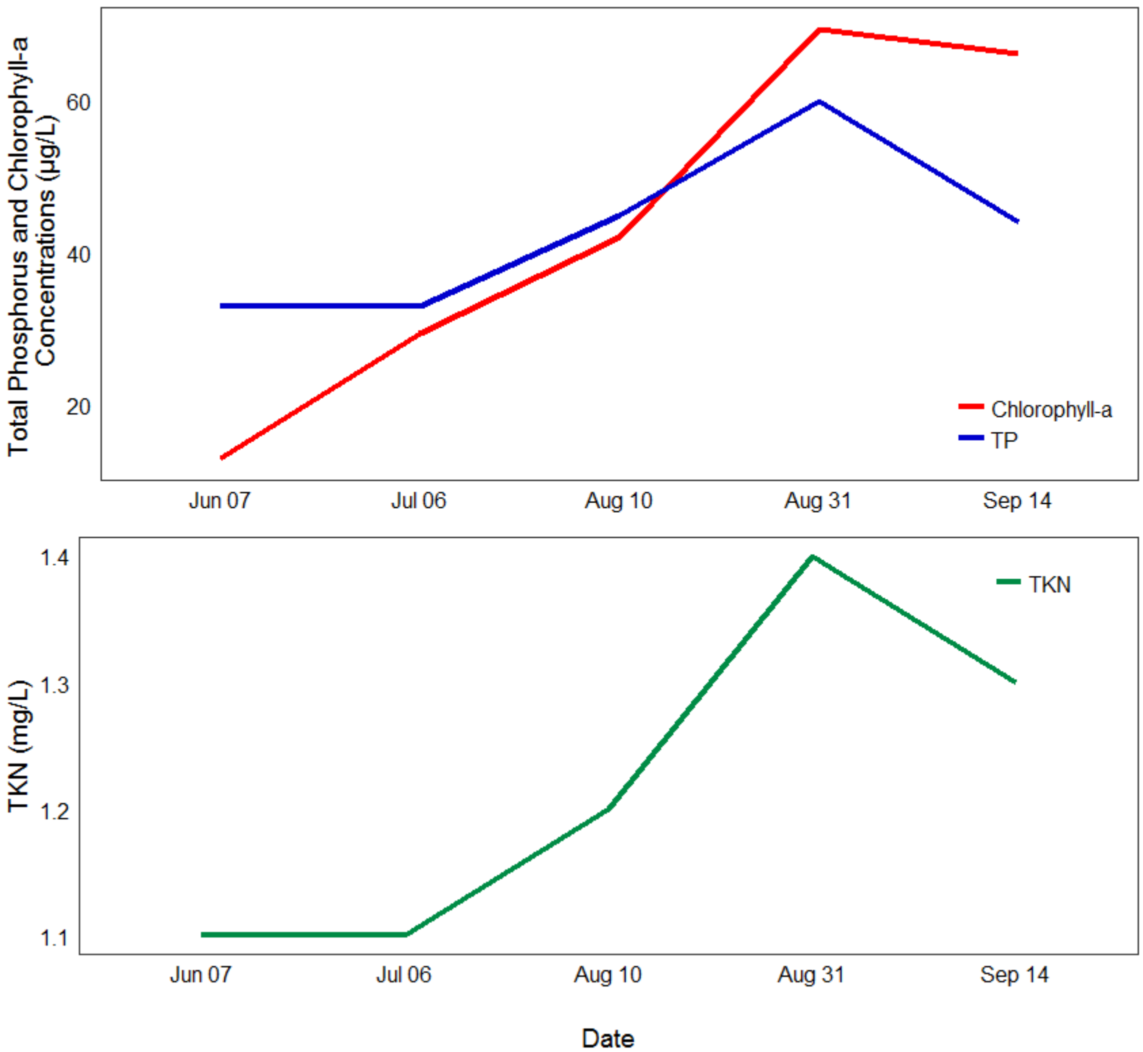

Figure 1- Total Phosphorus (TP), Total Kjeldahl Nitrogen (TKN), and Chlorophyll-*a* concentrations measured five times over the course of the summer at Wizard Lake.

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 2016 was 1.52 m, classifying Wizard Lake as eutrophic, or productive (Figure 2). A maximum Secchi depth of 3 m was recorded on June 7, but Secchi depth decreased throughout the sampling season. Decreasing water clarity at Wizard Lake is likely attributed to increasing phytoplankton biomass in the warmer summer months. Secchi depth was negatively correlated with chlorophyll-*a* concentrations (r= -0.95, df= 3, p-value= 0.013), in other words, as chlorophyll-*a* concentration increased, Secchi depth decreased.

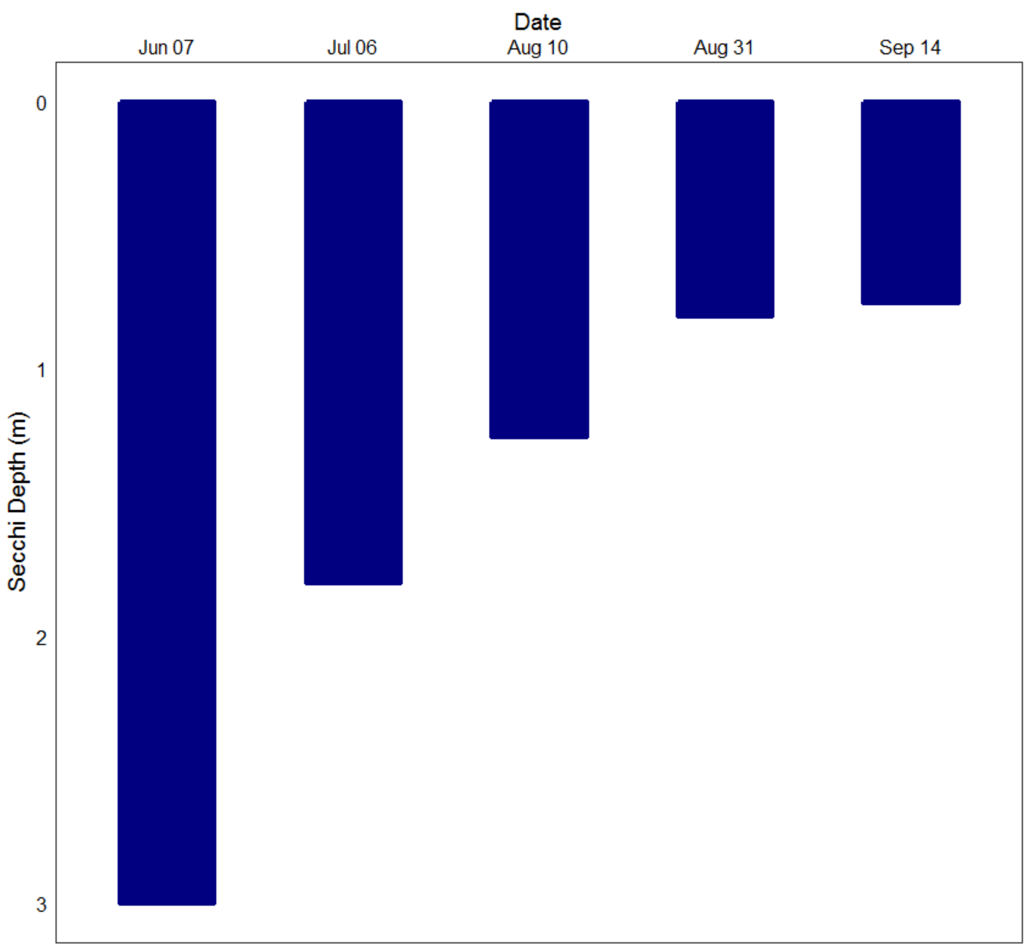

Figure 2 – Secchi depth values measured five times over the course of the summer at Wizard Lake in 2016.

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.

Wizard Lake water temperatures varied throughout the summer (Figure 3a). A maximum temperature of 20.89 °C was observed on August 10. Wizard Lake reached weak thermal stratification for the first three sampling visits, with the thermocline deepening as the surface water warmed over the course of the summer. By the fall sampling visits, the entire water column was well mixed and at a constant temperature.

Wizard 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). Wizard reached anoxic conditions at the bottom on the first three visits. This could be due to the separation of atmospheric oxygen from the surface by way of thermal stratification. By the end of August, thermal stratification was broken up, and the entire water column was well mixed and oxygenated.

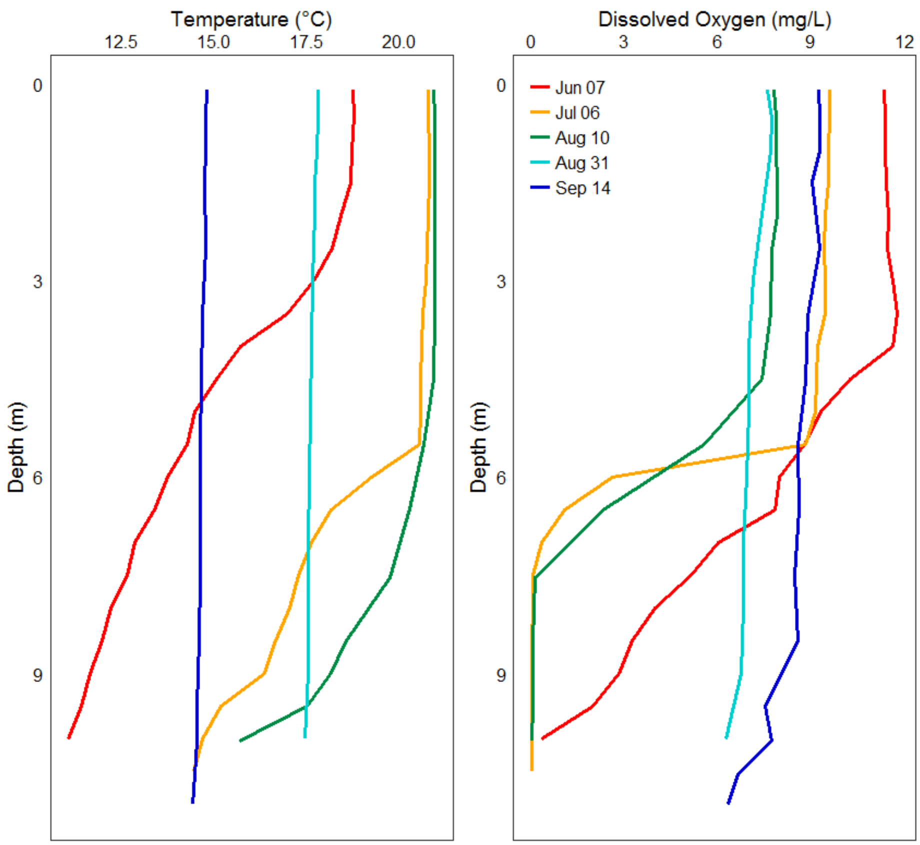

Figure 3 – a) Temperature (°C) and b) dissolved oxygen (mg/L) profiles for Wizard Lake measured five times over the course of the summer of 2016.

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.

Table 1 – Microcystin concentrations measured five times at Wizard Lake in 2016. Measurements remained below the guidelines for recreational use in 2016.

Date	**Microcystin Concentration (μg/L)**
Jun 7	0.14
Jul 6	0.61
Aug 10	1.86
Aug 31	3.08
Sep 14	1.38
Average	1.41

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 Wizard 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 Wizard Lake have remained relatively stable since Alberta Environment began monitoring the lake in 1968 (Figure 4). Since 1968, Wizard Lake water levels have fluctuated between 783.3 m asl and 784.7 m asl.

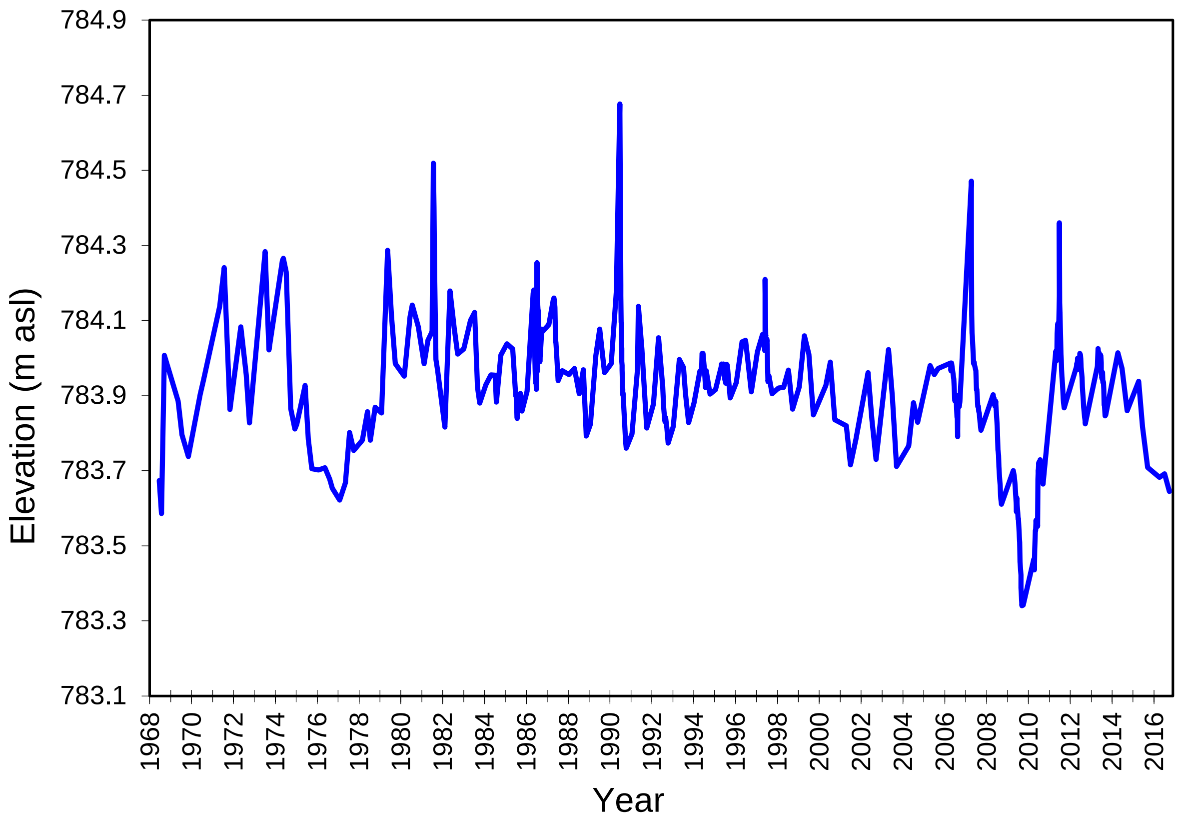

Figure 4- Water levels measured in meters above sea level (m asl) from 1968-2016. Data retrieved from Alberta Environment.

Table 2: Average Secchi depth and water chemistry values for Wizard Lake. Historical values are given for reference.

Parameter	2006	2008	2009	2010	2011	2013	2016
TP (µg/L)	48.4	50.2	51.5	47.5	75.6	52.6	43
TDP (µg/L)	13.6	12.4	18	19.5	14.2	18.8	6
Chlorophyll-*a* (µg/L)	32.6	23.9	26.8	17.1	39.2	23.8	44
Secchi depth (m)	1.33	1.43	1.81	2.71	1.15	1.36	1.52
TKN (mg/L)	1.3	1.216	1.263	1.255	1.574	1.246	1.22
NO_2 and NO_3 (µg/L)	7	2.5	46	19.5	2.5	6.4	2.5
NH_3 (µg/L)	31.4	20.6	29	81	19.4	27.6	25
DOC (mg/L)	/	/	/	12.2	14.5	13.1	12
Ca (mg/L)	25	27.9	27.8	24.45	27.5	29	25.6
Mg (mg/L)	8.5	8.9	9.73	9.09	9.25	9.23	10.6
Na (mg/L)	36	34.9	37.5	38	32.3	37.4	39.4
K (mg/L)	6	5.8	6	6.15	5.83	6	7
SO_4^{2-} (mg/L)	3.5	4.5	5	4.25	3	5.83	2.76
Cl^- (mg/L)	4.7	4.5	4.9	5.65	5	5.2	6.34
CO_3 (mg/L)	6	10	5.5	/	3.6	5.1	3.85
HCO_3 (mg/L)	202	206.3	207.3	215.5	199.8	202.4	210
pH	8.3	8.3	8.44	8.29	8.45	8.472	8.50
Conductivity (µS/cm)	335	337.3	341.3	346	337.2	354	350
Hardness (mg/L)	97	106	109.4	96	106.9	110.3	105.4
TDS (mg/L)	186	191	196	193	185	197.3	202
Microcystin (µg/L)	/	/	/	0.091	0.25	0.25	1.41
Total Alkalinity (mg/L $CaCO_3$)	172	175	176	176.5	170	174.2	176

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

Metals (Total Recoverable)	2013	2016	Guidelines
Aluminum µg/L	18	7.7	100[a]
Antimony µg/L	0.06565	0.074	6[d]
Arsenic µg/L	1.205	1.17	5
Barium µg/L	60.35	52.8	1000[d]
Beryllium µg/L	0.0015	0.029	100[c,e]
Bismuth µg/L	0.00255	0.004	/
Boron µg/L	43.85	39.3	1500
Cadmium µg/L	0.00225	0.029	0.26[b]
Chromium µg/L	0.3215	0.08	/
Cobalt µg/L	0.0312	0.06	1000[e]
Copper µg/L	0.7635	0.51	4[b]
Iron µg/L	52.15	56.3	300
Lead µg/L	0.0277	0.053	7[b]
Lithium µg/L	15.5	12.4	2500[f]
Manganese µg/L	74.6	88.1	200[f]
Molybdenum µg/L	0.3795	0.376	73[c]
Nickel µg/L	0.2135	0.095	150[b]
Selenium µg/L	0.095	0.23	1
Silver µg/L	0.011475	0.028	0.25
Strontium µg/L	230.5	211	/
Thallium µg/L	0.001175	0.0358	0.8
Thorium µg/L	0.00015	0.0148	/
Tin µg/L	0.015	0.033	/
Titanium µg/L	0.7815	0.9	/
Uranium µg/L	0.328	0.342	15
Vanadium µg/L	0.1915	0.23	100[e,f]
Zinc µg/L	1.914	0.5	30

Values represent means of total recoverable metal concentrations.

[a] Based on pH ≥ 6.5

[b] Based on water hardness > 180mg/L (as CaCO3)

[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.