NORTH Dakota | Environmental Quality

Be Legendary.™

Contact: Watershed Management Program

Phone: 701-328-5210

February 2019

Long Lake

(48.92628 N, -100.25706 W)

Bottineau County

- Long Lake is a popular natural lake in northern North Dakota (https://gf.nd.gov/gnf/maps/fishing/lakecontours/longbottineau2010.pdf).
- Long Lake is accessible by one public boat ramp on the west side of the lake.
- The Long Lake watershed is about 6,800 acres of mostly deciduous forest, open water and agricultural land (Table 1). The most common crops are alfalfa, other hay/non-alfalfa and spring wheat (Table 1).
- Long Lake is a Class II fishery , which are "capable of supporting natural reproduction and growth of cool water fishes (e.g., northern pike and walleye) and associated aquatic biota."
- Long Lake is managed for walleye, with fingerlings were stocked annually. The most recent sampling survey by the ND Game and Fish found northern pike, walleye, yellow perch and black bullhead.
- Long Lake was previously sampled in 1995-1996 and 2005-2006.

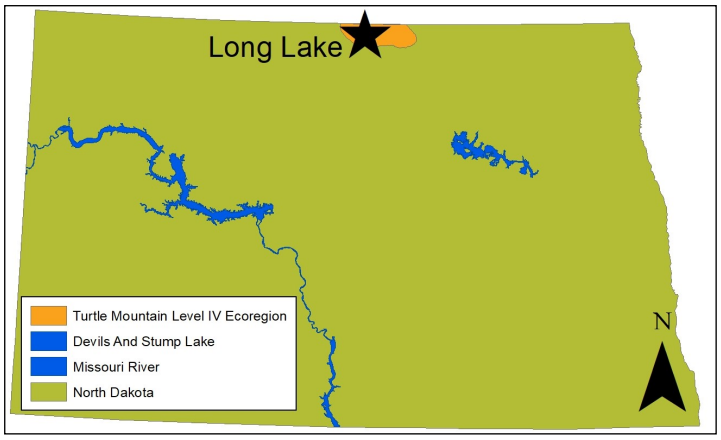

Figure 1. *Location of Long Lake within the state*

Table 1. *Percentage of land cover in the watershed and near the lake (NASS, 2014). Value listed of crop type represents percentage of total production*

Land Cover Type	% in Watershed	% within 500 meters
Deciduous Forest	46.8%	55.9%
Open Water	25.0%	16.8%
Agriculture	14.3%	10.0%
Alfalfa	*27.4%*	*38.3%*
Other Hay/Non-Alfalfa	*23.4%*	*47.5%*
Spring Wheat	*18.5%*	*8.3%*
Grassland/Pasture	7.9%	10.2%
Developed	4.1%	4.8%
Wetlands	1.9%	1.7%

Temperature and Dissolved Oxygen

- Long Lake commonly stratifies in the summer, with warm, well-oxygenated water at the top of the water column, and cold, low-oxygen water near the bottom.
- Stratification was only observed in July of 2015, with a temperature change of 2.15 degrees Celsius (ºC), with most of the change occurring near the bottom (Figure 2).
- All samples showed the lake as well-oxygenated, except near the bottom during thermal stratification.

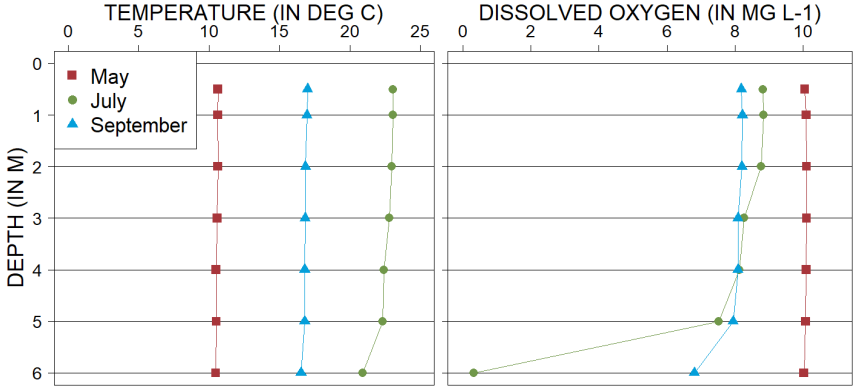

Figure 2. *2015 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter (mg L^{-1})*

Trophic State Indices

- Trophic state is a measure used by scientists to assess the condition (where lower scores indicate better water quality) of a lake using three common measures: total phosphorus (TP), Secchi disk transparency and chlorophyll-a concentration.
- Long Lake is a borderline mesotrophic-eutrophic lake (Figure 3) that has moderate nutrient concentrations and moderate algal growth.
- Trophic state is relatively similar to historical indices.
- There have been no confirmed ***harmful*** algal (cyanobacteria) blooms at Long Lake.

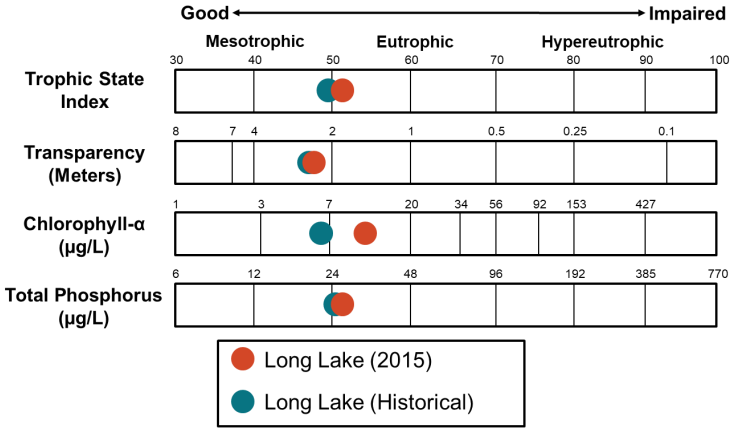

Figure 3. *Trophic state indices for 2015 and historical samples*

Nutrients

- Median concentration of total nitrogen (TN) was lower in 2015 compared to the historical median and the median for the Turtle Mountains Level IV Ecoregion (Figure 1; hereafter, Turtle Mountains) where Long Lake is located (Figure 4).
- Median concentration of dissolved TN was similar to TN.
- Median TP concentration in 2015 was less than historical concentrations and the median for the Turtle Mountains (Figure 4).
- Median concentration of dissolved phosphorus were similar to TP.
- Ammonia and nitrate plus nitrite were rarely above detection limits in Long Lake in 2015.

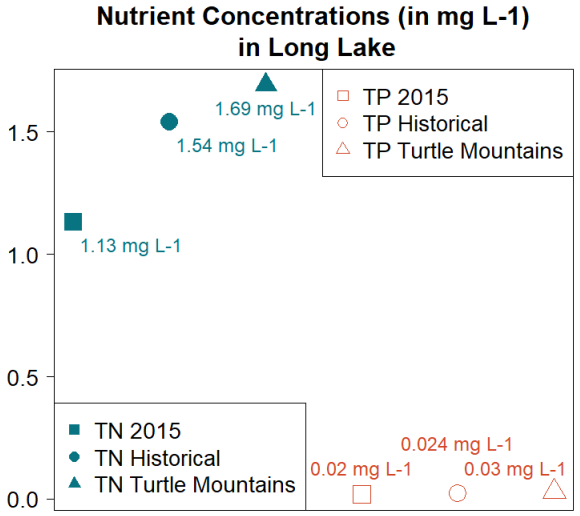

Figure 4. *Median concentrations of TN and TP in mg L^{-1} compared to regional medians*

Water Chemistry

Table 2. *Median concentrations of selected constituents for 2015 and historical samples and from all Turtle Mountain natural lakes.*

Measure	2015 Median	Historical Median	Ecoregion Median
Alkalinity	287 mg L^{-1}	295 mg L^{-1}	290 mg L^{-1}
Bicarbonate (HCO^-_3)	315 mg L^{-1}	328 mg L^{-1}	325 mg L^{-1}
Calcium (Ca^{2+})	40.6 mg L^{-1}	33.9 mg L^{-1}	32.4 mg L^{-1}
Carbonate (CO^{2-}_3)	18 mg L^{-1}	19 mg L^{-1}	12 mg L^{-1}
Conductivity	622 µS cm^{-1}	694 µS cm^{-1}	685 µS cm^{-1}
Dissolved Solids	363 mg L^{-1}	400 mg L^{-1}	382 mg L^{-1}
Magnesium (Mg^{2+})	58.2 mg L^{-1}	63.9 mg L^{-1}	61.9 mg L^{-1}
Sodium (Na^+)	7.8 mg L^{-1}	9.0 mg L^{-1}	8.9 mg L^{-1}
Sulfate (SO^{2-}_4)	60.3 mg L^{-1}	85 mg L^{-1}	60 mg L^{-1}

- Bicarbonate is the dominant anion in Long Lake, while magnesium is the dominant cation (Figure 5).
- Median concentrations of most cations and anions are lower than the historical median and the Ecoregion median.

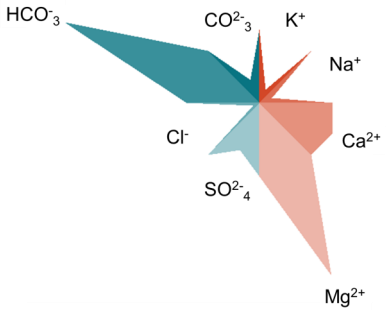

Figure 5. *Maucha diagram showing ionic balance based on 2015 data*