February 2019

Long Lake
(47.72722 N, -100.85404 W)

McLean County

- Long Lake is a long, narrow lake in central North Dakota (Figure 1). See map at (https://gf.nd.gov/gnf/maps/fishing/lakecontours/longmclean2008.pdf).

- Long Lake is accessible by one public boat ramp on the north end of the lake.

- The Long Lake watershed is about 25,000 acres of mostly grassland/pasture, agricultural land and wetlands. The most common crops grown are spring wheat, soybeans and non-alfalfa hay (Table 1).

- Long Lake is a Class IV fishery, which means it is "capable of supporting a fishery on a short-term or seasonal basis."

- The lake is primarily managed for northern pike, but hasn't been stocked since 2012. Walleye, bluegill and yellow perch are also found in the lake.

- Long Lake was previously assessed in 1991-1992 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, 2017). Value listed of crop type represents percentage of total production.*

Land Cover Type	% in Watershed	% within 500 meters
Grassland/Pasture	58.8%	70.2%
Agriculture	16.4%	11.2%
Spring Wheat	*34.1%*	*17.7%*
Soybeans	*20.3%*	*31.3%*
Other Hay/Non-Alfalfa	*17.8%*	*44.5%*
Wetlands	11.1%	5.9%
Open Water	9.6%	5.1%
Developed	2.6%	5.1%
Forest	1.5%	2.4%

Temperature and Dissolved Oxygen

- Long Lake rarely stratifies in the summer, with the majority of the water column typically well-oxygenated

- There was no thermal stratification recorded in 2018. Temperature change in the water column was 0.16 degrees Celsius (ºC), 0.68ºC and 0.00ºC in May, July and September, respectively (Figure 2).

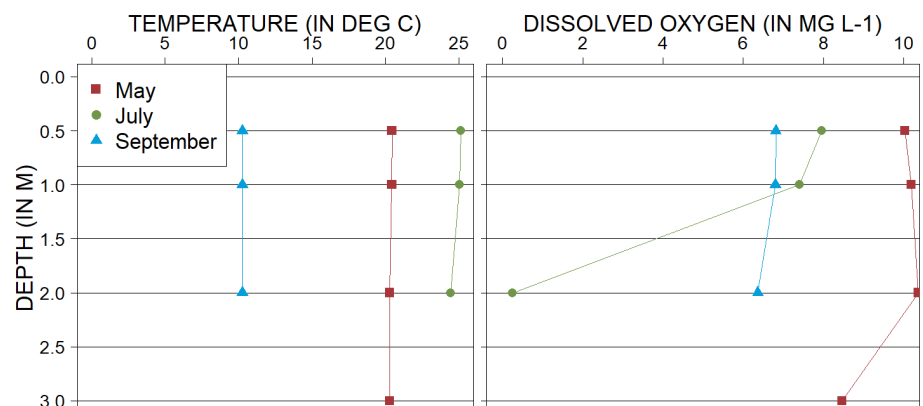- All samples in 2018 showed the lake as well-oxygenated, except near the bottom during the July sample.

Figure 2. 2018 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 eutrophic lake (Figure 3) that has relatively moderate nutrient concentrations and low algal growth but dense macrophyte growth.

- Trophic state is similar to historical indices.

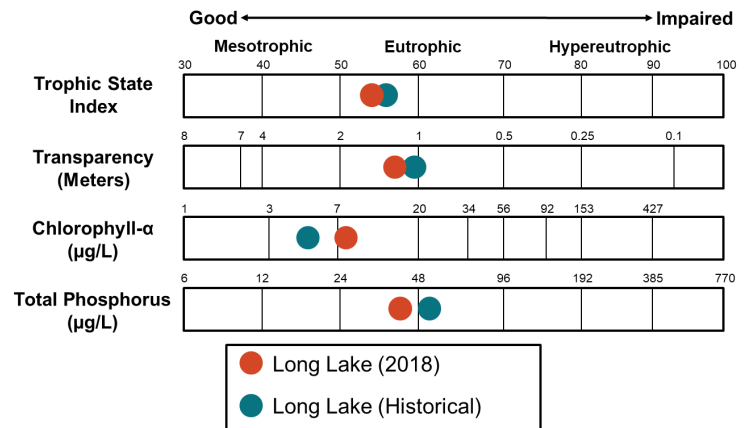- There have been no confirmed *harmful* algal (cyanobacteria) blooms at Long Lake.

Figure 3. Trophic state indices for 2018 and historical samples

Nutrients

- Median concentration of total nitrogen (TN) was greater in 2018 compared to the historical median and the median for the Missouri Coteau Level IV Ecoregion (hereafter, Missouri Coteau) where Long Lake is located (Figure 4).

- Median concentration of dissolved TN was much less than TN.

- Median TP concentration was lower in 2018 compared to historical concentrations and the median for the Missouri Coteau (Figure 4).

- Median concentration of dissolved phosphorus was much less than TP.

- Ammonia and nitrate plus nitrite were rarely above detection limits in Long Lake in 2018, but ammonia concentration was very high in September.
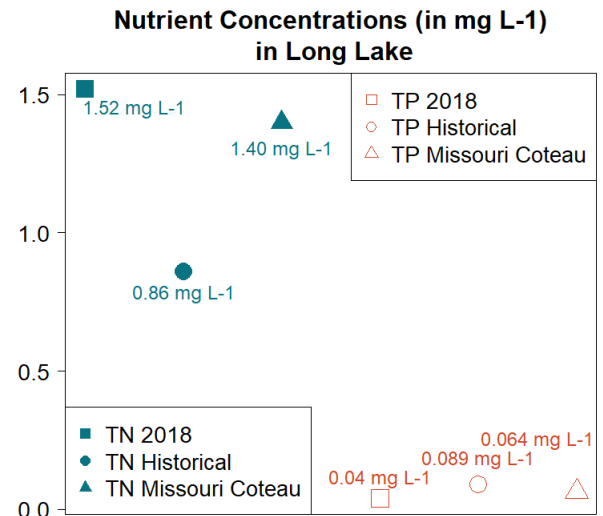

Figure 4. Median concentrations of TN and TP in mg L^{-1} compared to regional medians

Water Chemistry

Table 2. Median concentrations of selected constituents for 2018 and historical samples and from all Missouri Coteau lakes.

Measure	2018 Median	Historical Median	Ecoregion Median
Alkalinity	193 mg L^{-1}	268 mg L^{-1}	274 mg L^{-1}
Bicarbonate (HCO_3^-)	229 mg L^{-1}	264 mg L^{-1}	289 mg L^{-1}
Calcium (Ca^{2+})	40.2 mg L^{-1}	31.6 mg L^{-1}	39.8 mg L^{-1}
Carbonate (CO_3^{2-})	4 mg L^{-1}	21 mg L^{-1}	21 mg L^{-1}
Conductivity	557 µS cm^{-1}	700 µS cm^{-1}	1,010 µS cm^{-1}
Dissolved Solids	336 mg L^{-1}	392 mg L^{-1}	642 mg L^{-1}
Magnesium (Mg^{2+})	44.0 mg L^{-1}	50.9 mg L^{-1}	72.4 mg L^{-1}
Sodium (Na^+)	21.9 mg L^{-1}	34.8 mg L^{-1}	62 mg L^{-1}
Sulfate (SO_4^{2-})	97.2 mg L^{-1}	101 mg L^{-1}	239 mg L^{-1}

- Bicarbonate is the dominant anion in Long Lake (although sulfate is relatively high), while magnesium is the dominant cation (with calcium being relatively high also) (Figure 5).

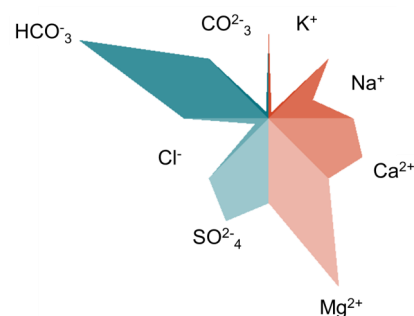- Median concentrations of most cations and anions are lower than the historical median for the lake and the Missouri Coteau.

Figure 5. Maucha diagram showing ionic balance based on 2018 data