

April 2019

Lightning Lake

(47.52628 N, -100.86987 W)

McLean County

- Lightning Lake is a small, natural lake in central North Dakota (Figure 1). See map at (<https://gf.nd.gov/gnf/maps/fishing/lakecontours/lightning2003.pdf>)
- There is one paved, public boat ramp on the northeast side of Lightning Lake.
- The Lightning Lake watershed is about 100 acres of mostly grassland/pasture and open water. The only crops grown are non-alfalfa hay (Table 1).
- Lightning Lake is a Class I fishery, which are “capable of supporting growth of cold water fishes (e.g., salmonids) and associated aquatic biota.”
- Lightning Lake is managed for rainbow trout, with catchable fish stocked annually. Yellow perch, largemouth bass, bluegill and walleye were also found during the last sample by the ND Game and Fish.
- Lightning Lake was previously assessed in 2008.

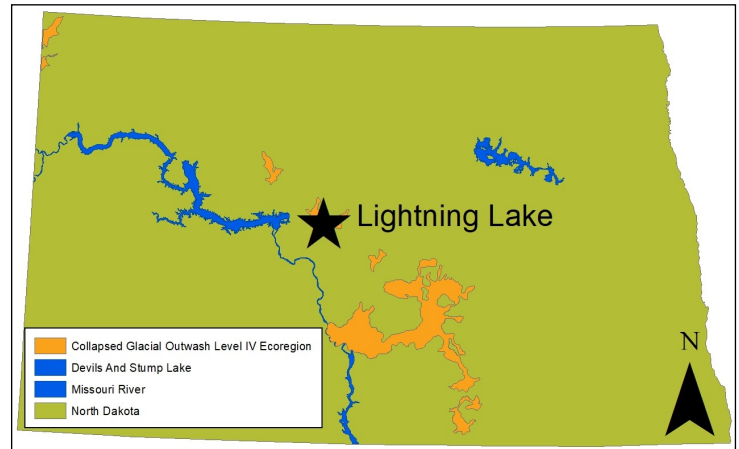


Figure 1. Location of Lightning Lake within the state

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
Grassland/Pasture	63.4%
Open Water	29.6%
Wetlands	6.7%
Agriculture	0.3%
Other Hay/Non-Alfalfa	35.7%

Temperature and Dissolved Oxygen

- Lightning Lake stratifies in the summer, with warm, well-oxygenated water at the top of the water column, and cold, low-oxygen water near the bottom.
- There was thermal stratification in May and July of 2018. Temperature change in the water column was 2.23 degrees Celsius (°C), 5.24°C and 0.18°C in May, July and September, respectively.
- All samples showed most of the lake as well-oxygenated, with only near-bottom concentration during thermal

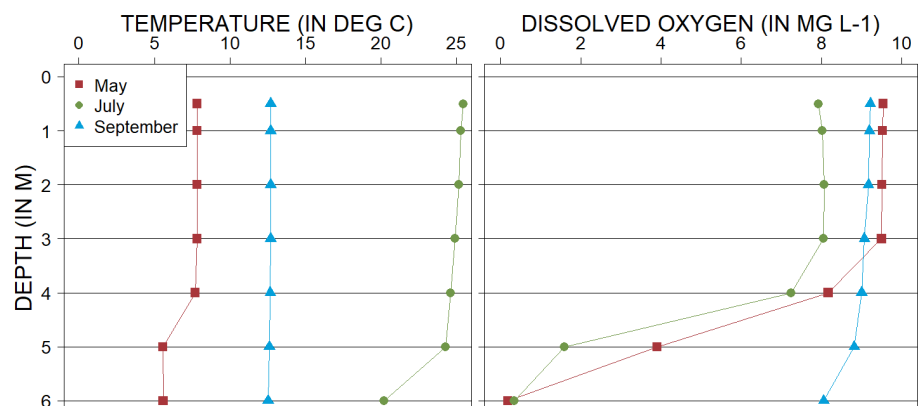


Figure 2. 2018 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter (mg L⁻¹)

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.
- Lightning Lake is a mesotrophic lake (Figure 3) that has low nutrient concentrations and low algal growth.
- Current trophic state is similar to historical indices.
- There have been no confirmed **harmful** algal (cyanobacteria) blooms at Lightning Lake.

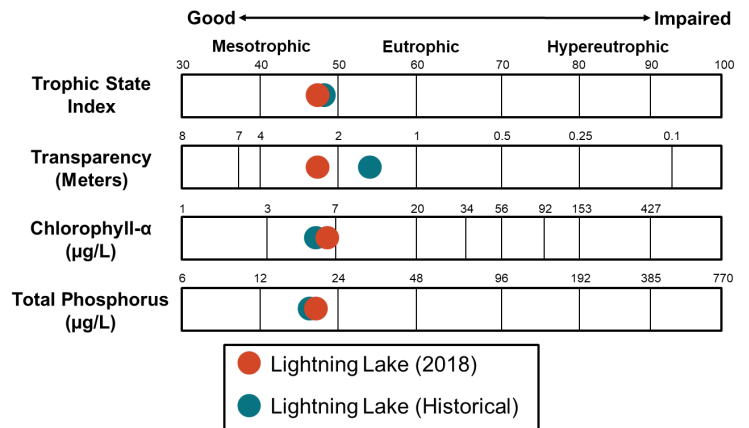


Figure 3. Trophic state indices for 2018 and historical samples

Nutrients

- Median concentration of total nitrogen (TN) in 2018 was similar to the historical median but less than the median for the Collapsed Glacial Outwash Level IV Ecoregion (hereafter, Glacial Outwash) where Lightning Lake is located (Figure 4).
- Median concentration of dissolved TN was slightly less than TN.
- Median TP concentration in 2018 was similar to historical concentrations but less than the median for the Glacial Outwash (Figure 4).
- Median concentration of dissolved phosphorus was slightly less than TP.
- Ammonia was only detected once (and at a low concentration) in Lightning Lake in 2018, while there were no detections of nitrate plus nitrite.

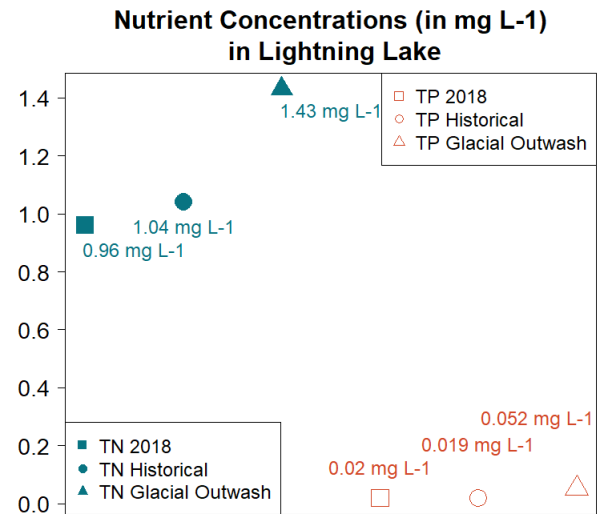


Figure 4. Median concentrations of TN and TP in mg L⁻¹ compared to regional medians

Water Chemistry

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

Measure	2018 Median	Historical Median	Ecoregion Median
Alkalinity	239 mg L ⁻¹	241 mg L ⁻¹	466 mg L ⁻¹
Bicarbonate (HCO ₃ ⁻)	262 mg L ⁻¹	250 mg L ⁻¹	464 mg L ⁻¹
Calcium (Ca ²⁺)	34.9 mg L ⁻¹	32.7 mg L ⁻¹	25.3 mg L ⁻¹
Carbonate (CO ₃ ²⁻)	14 mg L ⁻¹	22 mg L ⁻¹	58 mg L ⁻¹
Conductivity	1,340 µS cm ⁻¹	1,280 µS cm ⁻¹	1,770 µS cm ⁻¹
Dissolved Solids	901 mg L ⁻¹	846 mg L ⁻¹	1,240 mg L ⁻¹
Magnesium (Mg ²⁺)	68.8 mg L ⁻¹	58.2 mg L ⁻¹	88 mg L ⁻¹
Sodium (Na ⁺)	175 mg L ⁻¹	175 mg L ⁻¹	163 mg L ⁻¹
Sulfate (SO ₄ ²⁻)	441 mg L ⁻¹	404 mg L ⁻¹	554 mg L ⁻¹

- Sulfate and bicarbonate are co-dominant anions in Lightning Lake, while sodium and magnesium are co-dominant cations (Figure 5).
- Median concentrations of most cations and anions are similar to the historical median for the lake but less than the median for the Glacial Outwash.

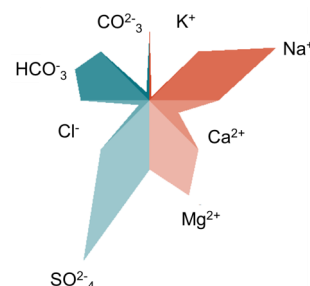


Figure 5. Maucha diagram showing ionic balance based on 2018 data