

November 2020

East Stump Lake

(47.87642 N, -98.3633 W)

Nelson County

- East Stump Lake is a large natural lake in northeastern North Dakota (Figure 1). See map at (<https://gf.nd.gov/gnf/maps/fishing/lakecontours/stumpse2013.pdf>).
- There is one public, paved boat ramp on East Stump Lake on the east side of the lake.
- The Stump Lake watershed is about 2,500,000 acres of mostly agriculture, though the watershed is much smaller when Stump Lake is not connected to Devils Lake. Agricultural production in the watershed is dominated by spring wheat, soybeans and canola (Table 1).
- Stump Lake is not classified in the state's water quality standards.
- Stump Lake is managed as a walleye fishery, with high numbers of fingerlings stocked annually. Walleye, yellow perch, northern pike, white bass and white sucker were captured during the last sample by the ND Game and Fish in 2019.
- ND DEQ has no historical water quality data for East Stump Lake.



Figure 1. Location of East Stump Lake within the state

Table 1. Percentage of land cover in the watershed and near the lake (NASS, 2019). Value listed of crop type represents percentage of total production

Land Cover Type	% in Watershed	% within 500 meters
Agriculture	63.8%	66.6%
Spring Wheat	39.0%	43.9%
Soybeans	26.7%	31.8%
Canola	14.1%	1.9%
Wetlands	12.3%	11.3%
Open Water	11.8%	2.9%
Grassland/Pasture	8.0%	13.6%
Developed	3.2%	2.7%
Forest	1.0%	2.9%
Barren	< 0.1%	< 0.1%

Temperature and Dissolved Oxygen

- East Stump Lake commonly stratifies in the summer.
- Thermal stratification was recorded in June and July 2020. Top-to-bottom temperature changes of 1.6°C, 8.2°C, and 10.2°C were recorded in May, June and August, respectively. There was no profile recorded during the October sample
- Dissolved oxygen concentrations were relatively high throughout the water column during all samples, but did decline sharply in the hypolimnion in June and August.

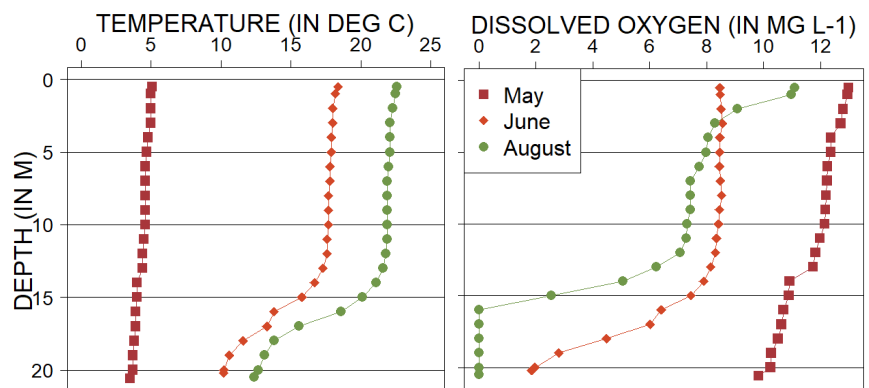


Figure 2. 2020 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter ($mg L^{-1}$)

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.
- East Stump Lake is a eutrophic lake (Figure 3) that has relatively high nutrient concentrations and moderate algal growth.
- ND DEQ has no historical data for Stump Lake.
- Stump Lake seems to have annual *harmful* algal (cyanobacteria) blooms with *warnings* and *advisories* posted many years.

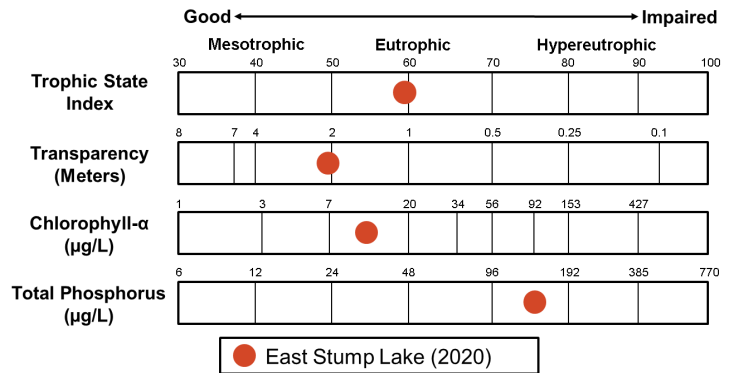


Figure 3. Trophic state indices for 2020 and historical samples

Nutrients

- Median concentration of total nitrogen (TN) at East Stump Lake in 2020 was similar to the 2020 median for West Stump Lake but greater than the median for the Glacial Lake Basins Level IV Ecoregion (hereafter, Ecoregion) where East Stump Lake is located (Figure 4).
- Median concentration of dissolved TN was similar to TN.
- Median total phosphorus (TP) concentration at East Stump Lake in 2020 was similar to the median for West Stump Lake but less than the median for the Ecoregion (Figure 4).
- Median concentration of dissolved phosphorus was less than TP.
- Ammonia and nitrate-plus-nitrite were detected at East Stump Lake in about half of samples.

Nutrient Concentrations (in mg L⁻¹) in Stump Lake

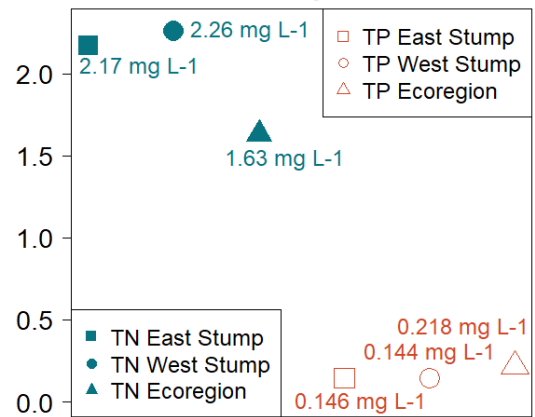


Figure 4. Median concentrations of TN and TP in mg L⁻¹ compared to regional medians

Water Chemistry

Table 2. Median concentrations of selected constituents for 2020 East Stump and West Stump samples and from all Ecoregion natural lakes.

Measure	2020 Median	West Stump 2020 Median	Ecoregion Median
Alkalinity	426 mg L ⁻¹	426 mg L ⁻¹	283 mg L ⁻¹
Bicarbonate (HCO ₃ ⁻)	485 mg L ⁻¹	480 mg L ⁻¹	322 mg L ⁻¹
Calcium (Ca ²⁺)	94.3 mg L ⁻¹	91.2 mg L ⁻¹	78 mg L ⁻¹
Carbonate (CO ₃ ²⁻)	16 mg L ⁻¹	19 mg L ⁻¹	8 mg L ⁻¹
Conductivity	5,685 µS cm ⁻¹	5,685 µS cm ⁻¹	1,160 µS cm ⁻¹
Dissolved Solids	4,440 mg L ⁻¹	4,300 mg L ⁻¹	754 mg L ⁻¹
Magnesium (Mg ²⁺)	223.5 mg L ⁻¹	225 mg L ⁻¹	59.3 mg L ⁻¹
Sodium (Na ⁺)	970 mg L ⁻¹	943 mg L ⁻¹	85.3 mg L ⁻¹
Sulfate (SO ₄ ²⁻)	2,360 mg L ⁻¹	2,295 mg L ⁻¹	294 mg L ⁻¹

- Sulfate is the dominant anion in East Stump Lake, while sodium is the dominant cation (Figure 5).
- Median concentrations of most cations and anions at East Stump Lake are similar to median for West Stump Lake but much greater than the median for the Ecoregion.

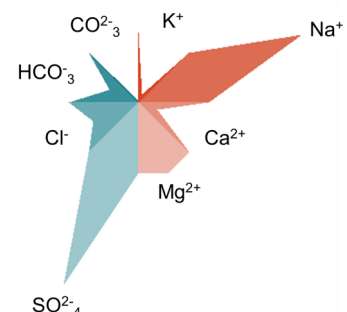


Figure 5. Maucha diagram showing ionic balance based on 2020 data