

November 2020

West Stump Lake

(47.87642 N, -98.3633 W)

Nelson County

- West Stump Lake is a large natural lake in northeastern North Dakota (Figure 1). See map at (<https://gf.nd.gov/gnf/maps/fishing/lakecontours/stumps2013.pdf>).
- There is one public, paved boat ramp on West Stump Lake on the south 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 West Stump Lake.



Figure 1. Location of West 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

- West Stump Lake can stratify in the summer.
- There was no true stratification recorded in 2020. Top-to-bottom temperature changes of 0.7°C, 3.3°C, and 1.7°C were recorded in May, June and July, 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 near the bottom in June and July.

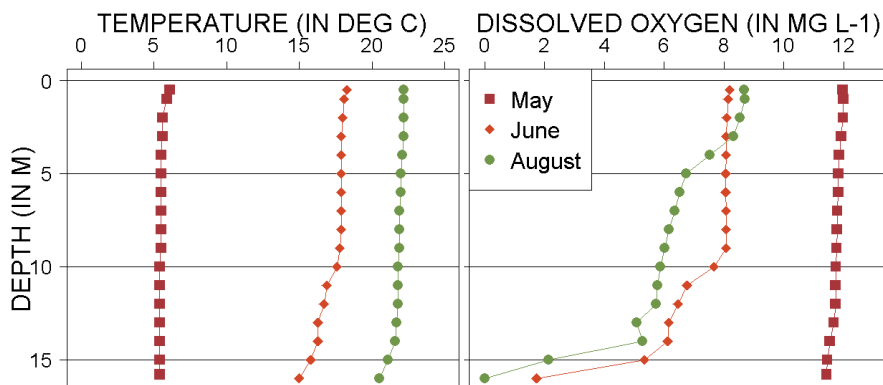


Figure 2. 2020 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter (mg L^{-1})

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.
- West 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 comparison.
- Stump Lake seems to have annual **harmful** algal (cyanobacteria) blooms with **warnings** and **advisories** posted many years.

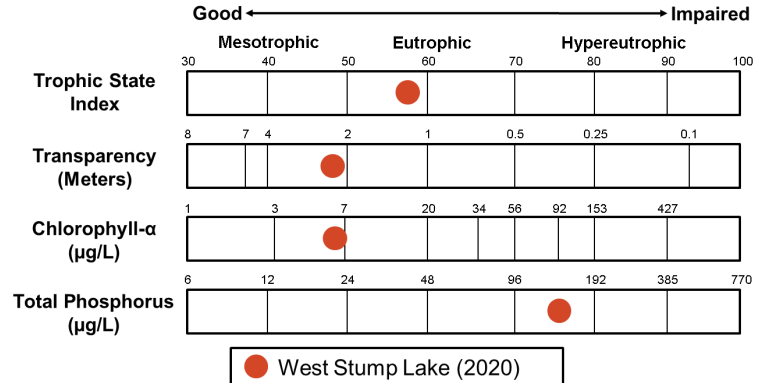


Figure 3. Trophic state indices for 2020 and historical samples

Nutrients

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

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

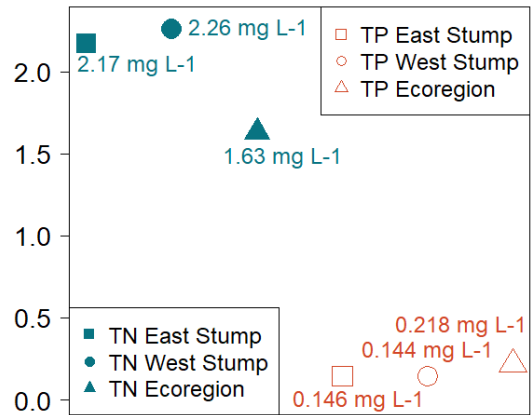


Figure 4. Median concentrations of TN and TP in mg L⁻¹ compared to regional medians

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 | East Stump 2020 Median | Ecoregion Median |
|--|---------------------------|---------------------------|---------------------------|
| Alkalinity | 426 mg L ⁻¹ | 426 mg L ⁻¹ | 283 mg L ⁻¹ |
| Bicarbonate (HCO ₃ ⁻) | 480 mg L ⁻¹ | 485 mg L ⁻¹ | 322 mg L ⁻¹ |
| Calcium (Ca ²⁺) | 91.2 mg L ⁻¹ | 94.3 mg L ⁻¹ | 78 mg L ⁻¹ |
| Carbonate (CO ₃ ²⁻) | 19 mg L ⁻¹ | 16 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 | 4,300 mg L ⁻¹ | 4,440 mg L ⁻¹ | 754 mg L ⁻¹ |
| Magnesium (Mg ²⁺) | 225 mg L ⁻¹ | 223.5 mg L ⁻¹ | 59.3 mg L ⁻¹ |
| Sodium (Na ⁺) | 943 mg L ⁻¹ | 970 mg L ⁻¹ | 85.3 mg L ⁻¹ |
| Sulfate (SO ₄ ²⁻) | 2,295 mg L ⁻¹ | 2,360 mg L ⁻¹ | 294 mg L ⁻¹ |

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

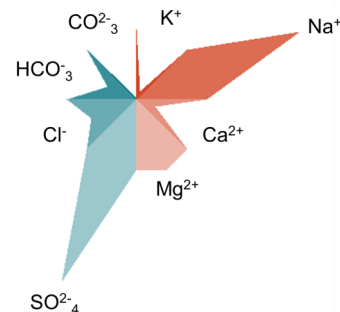


Figure 5. Maucha diagram showing ionic balance based on 2020 data