

November 2020

Buffalo Lake

(48.02187 N, -99.85678 W)

Pierce County

- Buffalo Lake is a large natural lake in Northeast North Dakota (Figure 1).
- There is one public, paved boat ramp on Buffalo Lake on the east side of the lake.
- The Buffalo Lake watershed is about 230,000 acres of mostly grassland/pasture and agriculture (Table 1). Agricultural production in the watershed is dominated by spring wheat, soybeans and other hay/non-alfalfa (Table 1).
- Buffalo Lake is a Class III, warm-water fishery, which are “capable of supporting natural reproduction and growth of warm water fishes (e.g., largemouth bass and bluegill) and associated aquatic biota.”
- Buffalo Lake is no longer managed by the ND Game and Fish.
- Buffalo Lake was previously assessed in 2008.

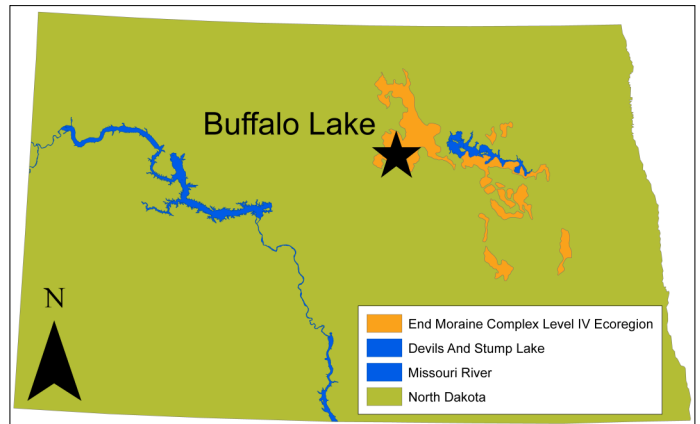


Figure 1. Location of Buffalo Lake within the state

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	41.3%	39.6%
Spring Wheat	36.3%	56.3%
Soybeans	30.9%	25.3%
Other Hay/Non-Alfalfa	9.0%	6.6%
Grassland/Pasture	35.4%	41.9%
Open Water	10.2%	3.4%
Wetlands	9.6%	8.1%
Developed	3.0%	4.0%
Forest	0.6%	3.0%
Shrubland	< 0.1%	< 0.1%

Temperature and Dissolved Oxygen

- Buffalo Lake rarely stratifies in the summer being shallow.
- Thermal stratification was recorded in July 2020. Top-to-bottom temperature changes of 0.8°C, 0.5°C, 3.5°C and 0.0°C were recorded in May, June, July and October, respectively.
- Dissolved oxygen concentrations were relatively high throughout the water column during all samples, but were relatively low during June sampling.

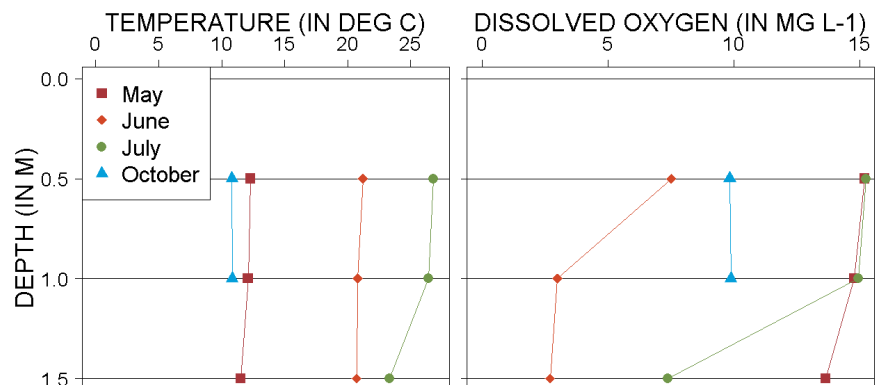


Figure 2. 2020 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter ($mg L^{-1}$)

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.
- Buffalo Lake is a hypereutrophic lake (Figure 3) that has high nutrient concentrations and dense algal growth.
- Current trophic state is similar to historical data.
- There have been confirmed **harmful** algal (cyanobacteria) blooms at Buffalo Lake in 2019 and 2020, resulting in *Water Advisories* at the lake.

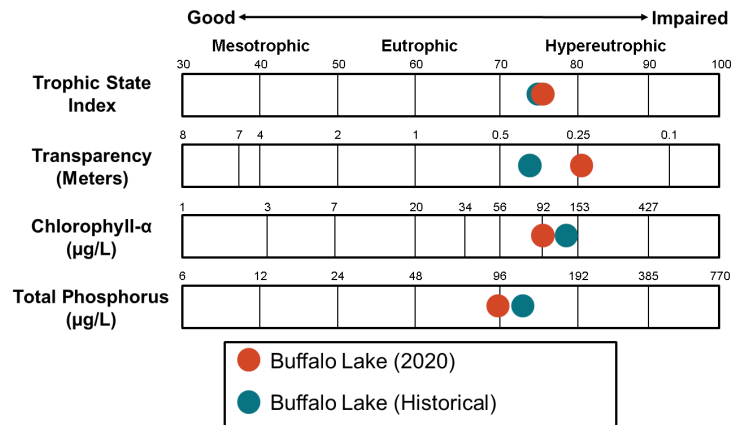


Figure 3. Trophic state indices for 2020 and historical samples

Nutrients

- Median concentration of total nitrogen (TN) in 2020 was less than the historical median for the lake but much greater than the median for the End Moraine Complex Level IV Ecoregion (hereafter, Ecoregion) where Buffalo Lake is located (Figure 4).
- Median concentration of dissolved TN was much less than TN.
- Median total phosphorus (TP) concentration in 2020 was similar to the median for the lake but greater than the median for the Ecoregion (Figure 4).
- Median concentration of dissolved phosphorus was much less than TP.
- Ammonia was detected at Buffalo Lake twice in 2020 at moderate concentrations, while nitrate-plus-nitrite was not detected in any sample.

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

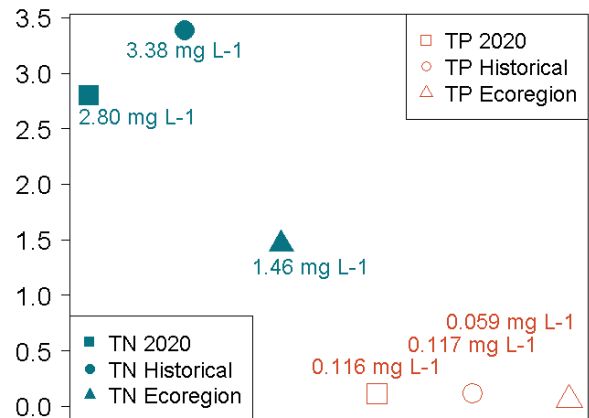


Figure 4. Median concentrations of TN and TP in mg L⁻¹ compared to regional medians

Water Chemistry

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

Measure	2020 Median	Historical Median	Ecoregion Median
Alkalinity	585 mg L ⁻¹	788.5 mg L ⁻¹	272 mg L ⁻¹
Bicarbonate (HCO ₃ ⁻)	555 mg L ⁻¹	595 mg L ⁻¹	309.5 mg L ⁻¹
Calcium (Ca ²⁺)	16.8 mg L ⁻¹	12.8 mg L ⁻¹	37.6 mg L ⁻¹
Carbonate (CO ₃ ²⁻)	73.5 mg L ⁻¹	180.5 mg L ⁻¹	12 mg L ⁻¹
Conductivity	1,305 µS cm ⁻¹	1,945 µS cm ⁻¹	1,675 µS cm ⁻¹
Dissolved Solids	816 mg L ⁻¹	1,245 mg L ⁻¹	1,150 mg L ⁻¹
Magnesium (Mg ²⁺)	47.6 mg L ⁻¹	42.5 mg L ⁻¹	102 mg L ⁻¹
Sodium (Na ⁺)	223.5 mg L ⁻¹	426 mg L ⁻¹	219 mg L ⁻¹
Sulfate (SO ₄ ²⁻)	141 mg L ⁻¹	241 mg L ⁻¹	592 mg L ⁻¹

- Bicarbonate is the dominant anion in Buffalo Lake, while sodium is the dominant cation (Figure 5).
- Median concentrations of most cations and anions are less than the historical median for the lake and less than the median for the Ecoregion.

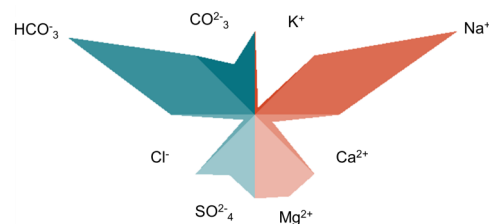


Figure 5. Maucha diagram showing ionic balance based on 2020 data