

December 2021

Hurdsfield-Tuffy Lake

(47.45612 N, -99.86443 W)

Wells County

- Hurdsfield-Tuffy Lake is a large lake in central North Dakota (Figure 1). See map at (<https://gf.nd.gov/gnf/maps/fishing/lakecontours/hurdsfieldtuffy2012.pdf>).
- Hurdsfield-Tuffy Lake is accessible by one public boat ramp on the south end of the lake.
- The Hurdsfield-Tuffy Lake watershed is about 37,000 acres of mostly agriculture and grassland/pasture. The most common crops grown are spring wheat and soybeans, but there is also a substantial amount of fallow/idle cropland (Table 1).
- Hurdsfield-Tuffy Lake is not classified in the North Dakota water quality standards.
- The lake is primarily managed for walleye, with fingerlings stocked most years. Only walleye and common carp were found in the lake during the last sampling event by the NDGF.
- Hurdsfield-Tuffy Lake was last sampled in 2016 by the NDDEQ.

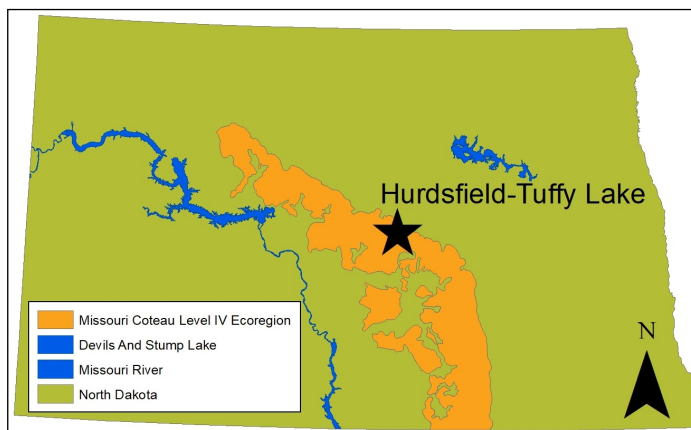


Figure 1. Location of Hurdsfield-Tuffy Lake within the state

Table 1. Percentage of land cover in the watershed and near the lake (NASS, 2020). Value listed of crop type represents percentage of total production.

Land Cover Type	% in Watershed	% within 500 meters
Agriculture	48.5%	50.5%
Soybeans	35.9%	36.6%
Fallow/Idle Cropland	29.2%	38.2%
Spring Wheat	17.8%	18.1%
Grassland/Pasture	25.2%	21.6%
Open Water	15.6%	12.4%
Wetlands	8.0%	11.9%
Developed	2.3%	15.4%
Forest	0.4%	0.6%

Temperature and Dissolved Oxygen

- Hurdsfield-Tuffy Lake does stratify in the summer, with the majority of the water column typically well-oxygenated
- There was thermal stratification recorded in June 2021. Temperature change in the water column was 4.1 degrees Celsius (°C) in June, with changes of 2.1°C, 1.4°C and 0.1°C in May, July and October, respectively (Figure 2).
- All samples in 2021 showed the lake as well-oxygenated, except toward the bottom in June and July.

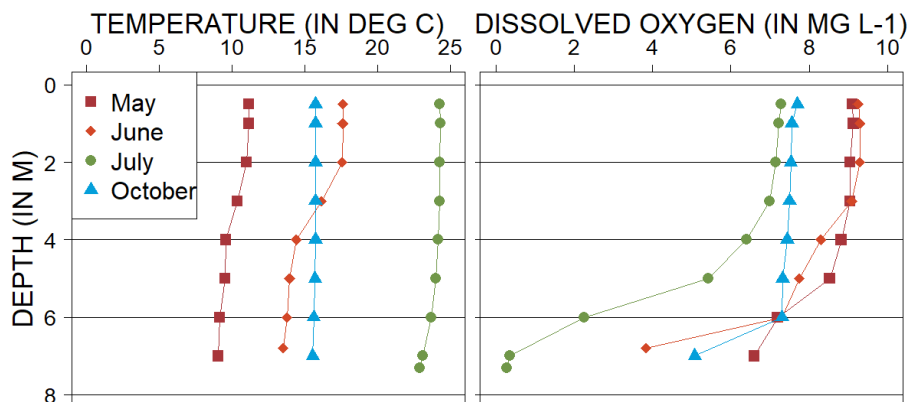


Figure 2. 2021 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter (mg L^{-1})

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.
- Hurdsfield-Tuffy Lake is a eutrophic lake (Figure 3) that has relatively high nutrient concentrations but moderate algal growth.
- TSI score in 2021 was improved compared to historical indices.
- There have been no confirmed **harmful** algal (cyanobacteria) blooms at Hurdsfield-Tuffy Lake, but NDDoH has investigated several reports.

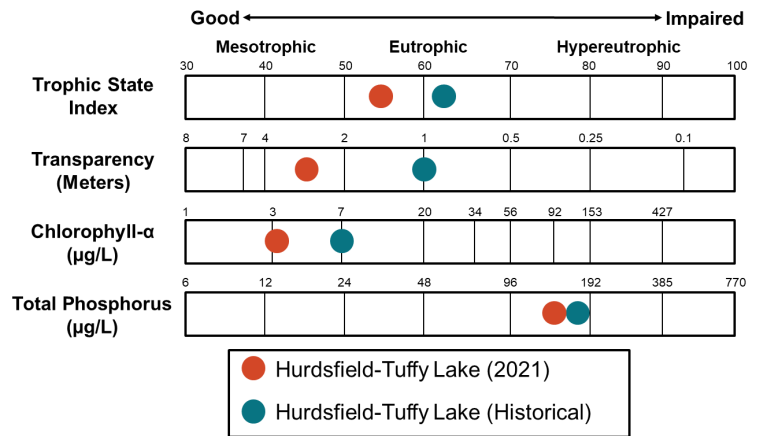


Figure 3. Trophic state indices for 2021 and historical samples

Nutrients

- Median concentration of total nitrogen (TN) at Hurdsfield-Tuffy Lake in 2021 was comparable to the historical median for the lake but much greater than the historical median for the Missouri Coteau Level IV Ecoregion (hereafter, Missouri Coteau) (Figure 4).
- Median TP concentration in 2021 was less than the median for the lake but much greater than the historical median for Missouri Coteau (Figure 4).
- Median concentration of dissolved nutrients were similar to total nutrients.
- Ammonia and nitrate plus nitrite were detected during most samples in 2021, with relatively high concentrations of ammonia in July and October.

Nutrient Concentrations (in mg L⁻¹) in Hurdsfield-Tuffy Lake

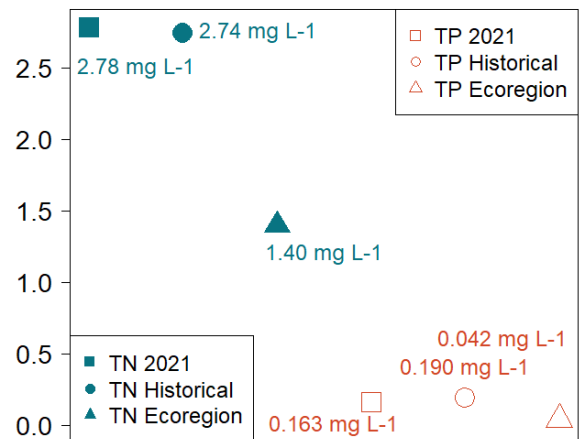


Figure 4. Median concentrations of TN and TP in mg L⁻¹ compared to regional medians

Water Chemistry

Table 2. Median concentrations of selected constituents for 2021 and historical samples and from all Missouri Coteau lakes.

Measure	2021 Median	Historical Median	Ecoregion Median
Alkalinity	477 mg L ⁻¹	447 mg L ⁻¹	318.5 mg L ⁻¹
Bicarbonate (HCO ₃ ⁻)	506.5 mg L ⁻¹	487 mg L ⁻¹	333.5 mg L ⁻¹
Calcium (Ca ²⁺)	80.4 mg L ⁻¹	69.4 mg L ⁻¹	41.2 mg L ⁻¹
Carbonate (CO ₃ ²⁻)	37 mg L ⁻¹	29 mg L ⁻¹	26.5 mg L ⁻¹
Conductivity	3,240 µS cm ⁻¹	2,750 µS cm ⁻¹	1,340 µS cm ⁻¹
Dissolved Solids	2,535 mg L ⁻¹	2,070 mg L ⁻¹	877 mg L ⁻¹
Magnesium (Mg ²⁺)	244.5 mg L ⁻¹	188 mg L ⁻¹	91.3 mg L ⁻¹
Sodium (Na ⁺)	381.5 mg L ⁻¹	328 mg L ⁻¹	127 mg L ⁻¹
Sulfate (SO ₄ ²⁻)	1,440 mg L ⁻¹	1,140 mg L ⁻¹	391.5 mg L ⁻¹

- Sulfate was the dominant anion in Hurdsfield-Tuffy Lake, while sodium and magnesium were co-dominant cations (Figure 5).
- Median concentrations of most cations and anions are greater than the historical median for the lake and the median concentration for the Missouri Coteau.

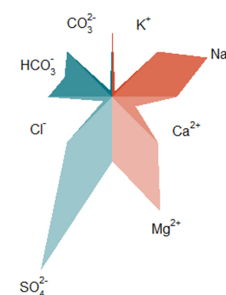


Figure 5. Maucha diagram showing ionic balance based on 2021 data