NORTH Dakota | Environmental Quality

Be Legendary.™

Contact: Watershed Management Program

Phone: 701-328-5210

December 2021

Barnes Lake

(47.234442 N, -99.276340 W)

Stutsman County

- Barnes Lake is a large, natural lake in eastern North Dakota (Figure 1). See map at (https://gf.nd.gov/gnf/maps/fishing/lakecontours/barnes2005.pdf).
- There is one boat ramp on Barnes Lake on the west side of the lake.
- The Barnes Lake watershed is 15,000 acres of mostly agriculture. The most common crops grown are soybeans, fallow/idle cropland and spring wheat (Table 1).
- Barnes Lake is a Class III fishery, which are "capable of supporting natural reproduction and growth of warm water fishes (e.g., largemouth bass and bluegill) and associated aquatic biota."
- Barnes Lake is managed by the NDGF as a walleye fishery, with fingerlings stocked annually. Walleye, northern pike and yellow perch were captured in the last sample by the NDGF in 2020.
- Barnes Lake was previously assessed in 2008 by the NDDEQ.

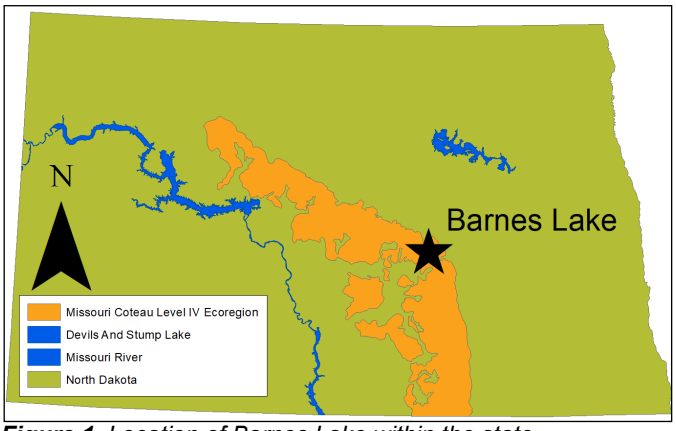

Figure 1. *Location of Barnes Lake within the state*

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	61.2%	33.6%
Soybeans	*60.6%*	*9.2%*
Fallow/Idle Cropland	*17.9%*	*39.7%*
Spring Wheat	*9.6%*	*24.0%*
Grassland/Pasture	15.5%	32.2%
Open Water	13.1%	15.7%
Wetlands	7.2%	12.5%
Developed	2.8%	5.4%
Forest	0.3%	0.6%
Barren	< 0.1%	< 0.1%

Temperature and Dissolved Oxygen

- Barnes Lake rarely 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 no thermal stratification recorded in 2021. Temperature change in the water column was 0.0 degrees Celsius (ºC), 0.1ºC, 0.0ºC, and 0.6ºC in May, June, July and October, respectively.
- Most dissolved oxygen concentrations were relatively high, with only some near-bottom anoxia in June.

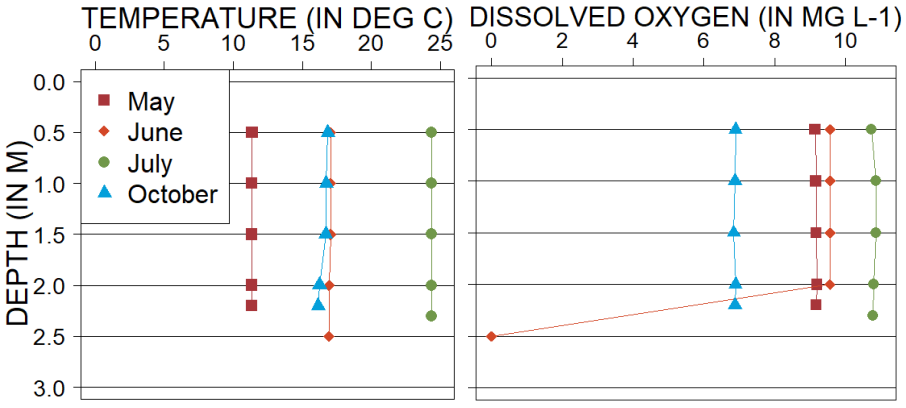

Figure 2. *2021 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter (mg L^{-1})*

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.
- Barnes Lake is a eutrophic natural lake (Figure 3) that has high nutrient concentrations but low to moderate algal growth.
- Trophic state in 2021 is comparable to historical indices.
- Barnes Lake was listed as an advisory for ***harmful*** algal (cyanobacteria) blooms in 2021.

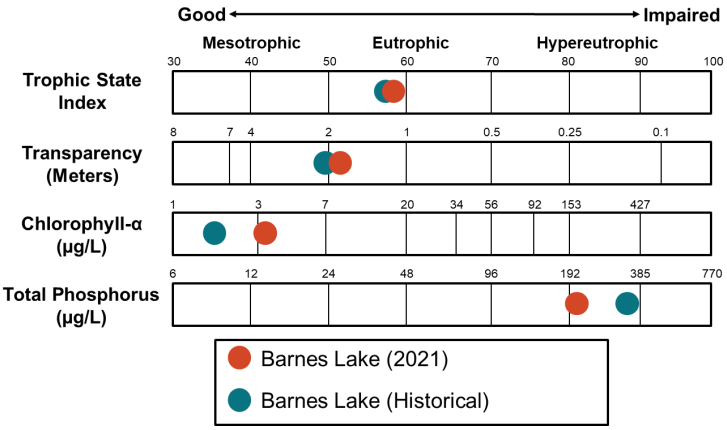

Figure 3. *Trophic state indices for 2021 and historical samples*

Nutrients

- Median concentration of total nitrogen (TN) at Barnes Lake in 2021 was less than the historical median for the lake but greater than the median for natural lakes in the Missouri Coteau Level IV Ecoregion (hereafter, Ecoregion) (Figure 4).
- Median TP concentration in 2021 was less than the median for the lake but greater than the median for the Ecoregion (Figure 4).
- Median concentrations of dissolved nutrients were comparable to concentrations of total nutrients.
- Ammonia and nitrate-plus-nitrite were not detected during most samples, but were found at relatively high concentrations in October.

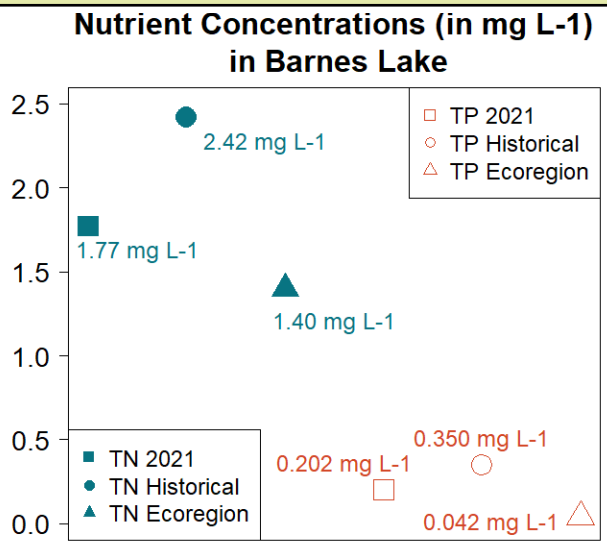

Figure 4. *Median concentrations of TN and TP in mg L^{-1} compared to regional medians*

Water Chemistry

Table 2. *Median concentrations of selected constituents for 2021 and historical samples and from all Ecoregion natural lakes.*

Measure	2021 Median	Historical Median	Ecoregion Median
Alkalinity	318 mg L^{-1}	319 mg L^{-1}	318.5 mg L^{-1}
Bicarbonate (HCO^-_3)	354.5 mg L^{-1}	283.5 mg L^{-1}	333.5 mg L^{-1}
Calcium (Ca^{2+})	74.6 mg L^{-1}	90.5 mg L^{-1}	41.2 mg L^{-1}
Carbonate (CO^{2-}_3)	16 mg L^{-1}	52 mg L^{-1}	26.5 mg L^{-1}
Conductivity	1,875 µS cm^{-1}	2,360 µS cm^{-1}	1,340 µS cm^{-1}
Dissolved Solids	1,365 mg L^{-1}	1,775 mg L^{-1}	877 mg L^{-1}
Magnesium (Mg^{2+})	139.5 mg L^{-1}	164 mg L^{-1}	91.3 mg L^{-1}
Sodium (Na^+)	170.5 mg L^{-1}	222 mg L^{-1}	127 mg L^{-1}
Sulfate (SO^{2-}_4)	735.5 mg L^{-1}	1,021 mg L^{-1}	391.5 mg L^{-1}

- Sulfate is the dominant anion in Barnes Lake, while sodium and magnesium are the dominant cations (Figure 5).
- Median concentrations of most cations and anions are less than the historical median for the lake but greater than the median for the Ecoregion.

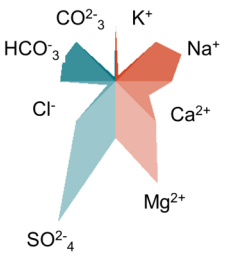

Figure 5. *Maucha diagram showing ionic balance based on 2021 data*