

December 2020

North Golden Lake

(47.59153 N, -97.63124 W)

Steele County

- North Golden Lake is a natural lake in Northeast North Dakota (Figure 1). See map at (<https://gf.nd.gov/gnf/maps/fishing/lakecontours/goldennorth2004.pdf>).
- There are two public boat ramps on North Golden Lake, one each on the north and south sides of the lake.
- The North Golden Lake watershed is difficult to delineate given diverted flows in the area. Agriculture is the dominant land cover near the lake and is dominated by soybeans, spring wheat and dry beans.
- North Golden 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.”
- North Golden Lake is managed for walleye, with fingerlings stocked annually. Black bullhead, yellow perch, walleye, brown bullhead, white sucker and northern pike were captured during the last sample by the ND Game and Fish in 2018.
- North Golden Lake was previously assessed in 1991-1992.

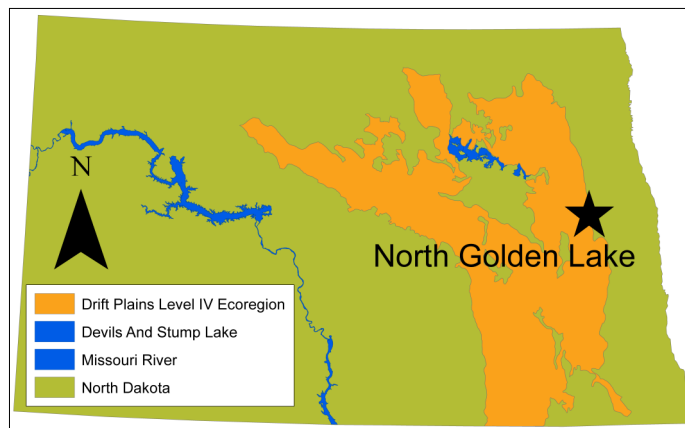


Figure 1. Location of North Golden Lake within the state

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

Land Cover Type	% within 500 meters
Agriculture	64.5%
Soybeans	36.4%
Spring Wheat	36.0%
Dry Beans	21.4%
Grassland/Pasture	17.9%
Wetlands	10.3%
Open Water	2.9%
Developed	2.9%
Forest	1.5%
Barren	< 0.1%

Temperature and Dissolved Oxygen

- North Golden Lake rarely stratifies during the open-water season.
- Some thermal stratification was recorded in July 2020. Top-to-bottom temperature changes of 0.0°C, 0.2°C, 1.4°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 did decline with some stratification.

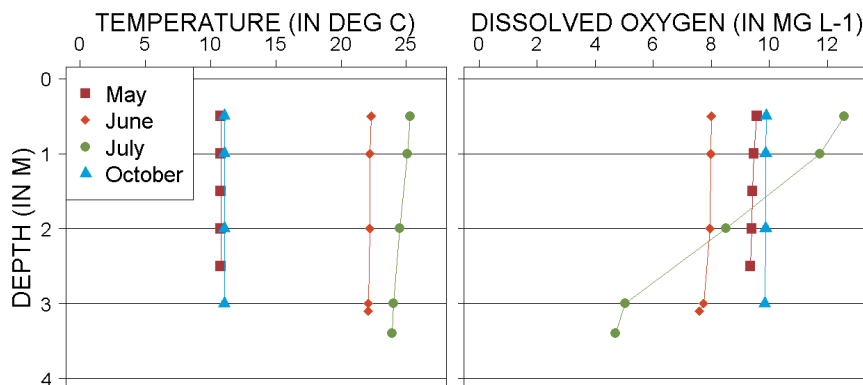


Figure 2. 2020 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter ($mg L^{-1}$)

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.
- North Golden Lake is a eutrophic lake (Figure 3) that has moderate nutrient concentrations and moderate algal growth.
- Current trophic state is similar to historical data.
- There have been no confirmed **harmful** algal (cyanobacteria) blooms at North Golden Lake as of 2020.

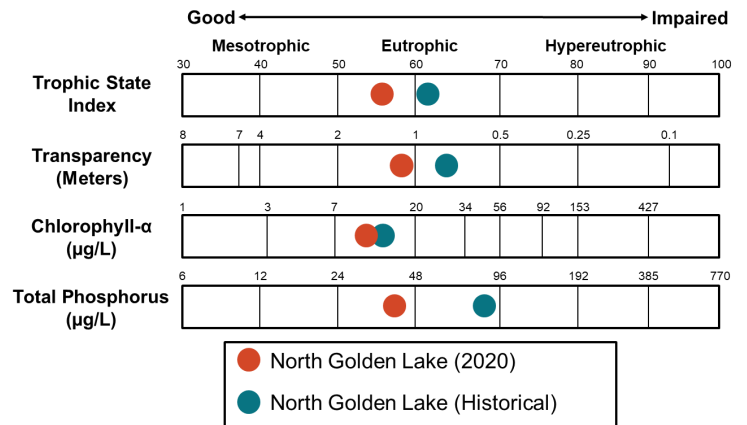


Figure 3. Trophic state indices for 2020 and historical samples

Nutrients

- Median concentration of total nitrogen (TN) in 2020 was less than the median for the Drift Plains Level IV Ecoregion (hereafter, Ecoregion) where North Golden Lake is located (Figure 4). There is no historical TN data for North Golden Lake.
- Median concentration of dissolved TN was slightly less than TN.
- Median total phosphorus (TP) concentration in 2020 was less than the median for the lake and less than the median for the Ecoregion (Figure 4).
- Median concentration of dissolved phosphorus was less than TP.
- Ammonia was not detected at North Golden Lake in 2020, while nitrate-plus-nitrite was detected only once.

Nutrient Concentrations (in mg L⁻¹) in North Golden Lake

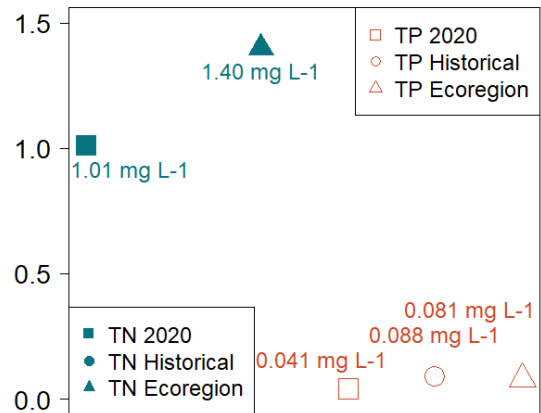


Figure 4. Median concentrations of TN and TP in mg L⁻¹ compared to regional medians

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	229.5 mg L ⁻¹	262 mg L ⁻¹	249 mg L ⁻¹
Bicarbonate (HCO ₃ ⁻)	268.5 mg L ⁻¹	267 mg L ⁻¹	283.5 mg L ⁻¹
Calcium (Ca ²⁺)	95.5 mg L ⁻¹	54.7 mg L ⁻¹	47.8 mg L ⁻¹
Carbonate (CO ₃ ²⁻)	10 mg L ⁻¹	23.5 mg L ⁻¹	17.5 mg L ⁻¹
Conductivity	1,350 $\mu\text{S cm}^{-1}$	1,611 $\mu\text{S cm}^{-1}$	1,395 $\mu\text{S cm}^{-1}$
Dissolved Solids	943 mg L ⁻¹	1,060 mg L ⁻¹	1,070 mg L ⁻¹
Magnesium (Mg ²⁺)	84.5 mg L ⁻¹	104 mg L ⁻¹	88.4 mg L ⁻¹
Sodium (Na ⁺)	93.4 mg L ⁻¹	170 mg L ⁻¹	117 mg L ⁻¹
Sulfate (SO ₄ ²⁻)	493.5 mg L ⁻¹	501 mg L ⁻¹	587.5 mg L ⁻¹

- Sulfate is the dominant anion in North Golden Lake, while calcium, magnesium and sodium are the dominant cations (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 (Table 2).

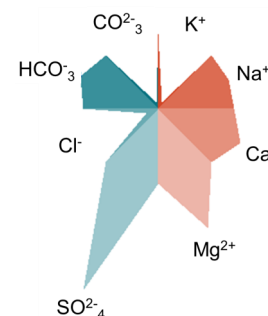


Figure 5. Maucha diagram showing ionic balance based on 2020 data