

November 2019

Cottonwood Lake

(48.585822 N, -103.447920 W)

Williams County

- Cottonwood Lake is a large natural lake in northwest North Dakota (Figure 1). See map at (<https://gf.nd.gov/gnf/maps/fishing/lakecontours/cottonwoodwilliams2003.pdf>).
- There is one public, paved boat ramp on Cottonwood Lake on the south side of the lake.
- The Cottonwood Lake watershed is about 22,000 acres of mostly agriculture and grassland/pasture. The most common crops grown are durum wheat, peas and lentils (Table 1).
- Cottonwood 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.”
- Cottonwood Lake is managed walleye, with fingerlings stocked annually. Yellow perch, northern pike and walleye were captured during the last sample by the ND Game and Fish.
- Cottonwood Lake was previously assessed in 2009.

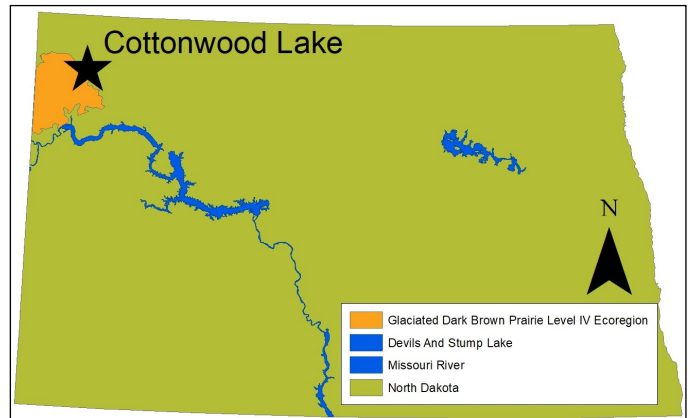


Figure 1. Location of Cottonwood Lake within the state

Table 1. Percentage of land cover in the watershed and near the lake (NASS, 2013). Value listed of crop type represents percentage of total production

Land Cover Type	% in Watershed	% within 500 meters
Agriculture	60.2%	38.6%
<i>Durum Wheat</i>	60.7%	58.8%
<i>Peas</i>	11.8%	0.2%
<i>Lentils</i>	10.5%	13.5%
Grassland/Pasture	28.2%	51.5%
Developed	4.1%	6.7%
Open Water	4.1%	0.7%
Wetlands	2.8%	0.7%
Forest	0.4%	0.8%
Shrubland	0.3%	0.9%

Temperature and Dissolved Oxygen

- Cottonwood Lake can occasionally stratify 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 at Cottonwood Lake in 2014. Temperature change in the water column was 0.1 degrees Celsius (°C), 1.4°C and 0.3°C in May, July and October, respectively.
- Dissolved oxygen concentrations high during all samples, but declined with weak stratification in July.

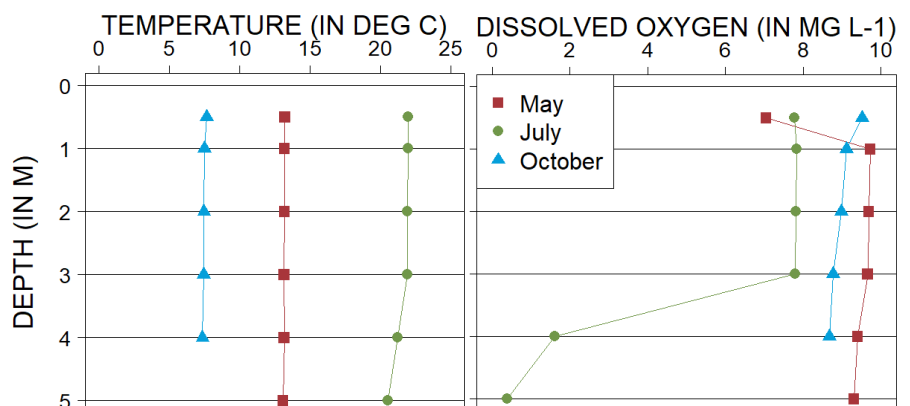


Figure 2. 2014 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter ($mg L^{-1}$)

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.
- Cottonwood Lake is a hypereutrophic lake (Figure 3) that has high nutrient concentrations and dense algal growth.
- Current trophic state has improved compared to historical indices, though severe blooms still occur.
- Cottonwood Lake has had confirmed **harmful** algal (cyanobacteria) blooms.

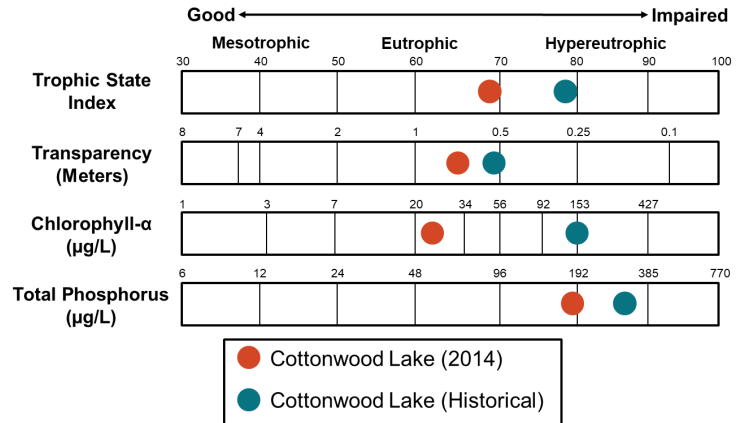


Figure 3. Trophic state indices for 2014 and historical samples

Nutrients

- Median concentration of total nitrogen (TN) in 2014 was much less than the historical median for the lake. There is very little historical data for natural lakes in the Glaciated Dark Brown Prairie Level IV Ecoregion, where Cottonwood Lake is located.
- Median concentration of dissolved TN was slightly less than TN.
- Median TP concentration in 2014 was much less than the median for the lake (Figure 4).
- Median concentration of dissolved phosphorus was slightly less than TP.
- Ammonia and nitrate-plus-nitrite were both detected once at low concentrations in 2014 at Cottonwood Lake.

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

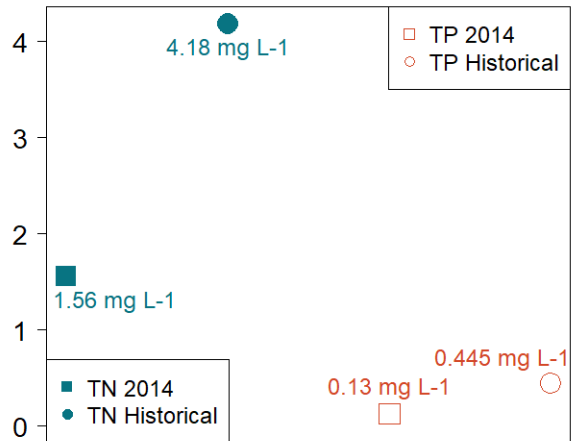


Figure 4. Median concentrations of TN and TP in mg L⁻¹ compared to regional medians

Water Chemistry

Table 2. Median concentrations of selected constituents for 2014 and historical samples from the lake

Measure	2014 Median	Historical Median
Alkalinity	335 mg L ⁻¹	314 mg L ⁻¹
Bicarbonate (HCO ₃ ⁻)	368 mg L ⁻¹	251 mg L ⁻¹
Calcium (Ca ²⁺)	64.6 mg L ⁻¹	49.8 mg L ⁻¹
Carbonate (CO ₃ ²⁻)	17 mg L ⁻¹	36 mg L ⁻¹
Conductivity	1,060 µS cm ⁻¹	1,210 µS cm ⁻¹
Dissolved Solids	709 mg L ⁻¹	825 mg L ⁻¹
Magnesium (Mg ²⁺)	61.7 mg L ⁻¹	66.3 mg L ⁻¹
Sodium (Na ⁺)	83.6 mg L ⁻¹	124 mg L ⁻¹
Sulfate (SO ₄ ²⁻)	257 mg L ⁻¹	332 mg L ⁻¹

- Sulfate and bicarbonate are the dominant anions in Cottonwood Lake, while sodium, calcium and magnesium are the dominant cations (Figure 5).
- Median concentrations of most cations and anions are greater than the historical median for the lake.

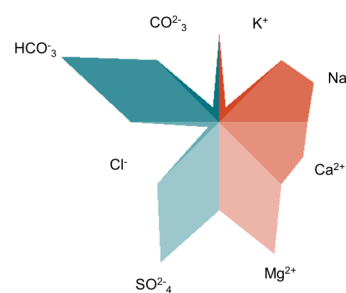


Figure 5. Maucha diagram showing ionic balance based on 2014 data