

November 2020

Mount Carmel Dam

(48.91087 N, -98.28561 W)

Cavalier County

- Mount Carmel Dam is a long, narrow reservoir in northeastern North Dakota (Figure 1). See map at (<https://gf.nd.gov/gnf/maps/fishing/lakecontours/mtcarmel2005.pdf>).
- There is one public, paved boat ramp on Mount Carmel Dam on the south side of the lake.
- The Mount Carmel Dam watershed is about 45,000 acres of mostly agriculture. Agricultural production in the watershed is dominated by spring wheat, soybeans and corn (Table 1).
- Mount Carmel Dam is a Class II, cool-water fishery, which are “capable of supporting natural reproduction and growth of cool water fishes (e.g., northern pike and walleye) and associated aquatic biota.”
- Mount Carmel Dam is managed as a walleye fishery, with fingerlings stocked annually. Yellow perch, white sucker, northern pike, walleye and black crappie were captured during the last sample by the ND Game and Fish in 2019.
- Mount Carmel Dam was previously assessed in 1991, 1996-1997 and 2005-2006.

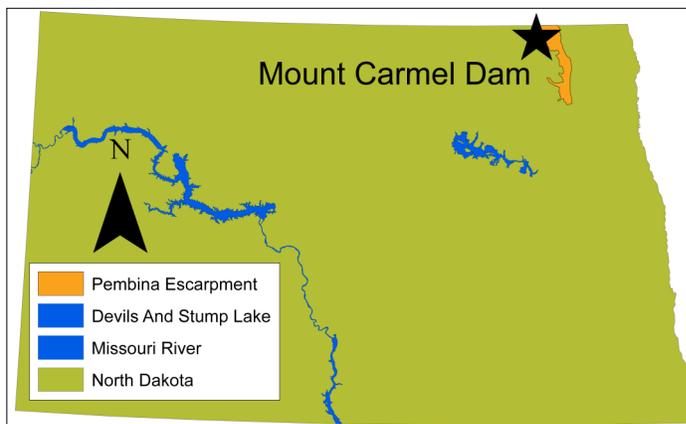


Figure 1. Location of Mount Carmel Dam within the state

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	88.7%	57.8%
Spring Wheat	50.6%	33.1%
Canola	37.6%	46.2%
Soybeans	10.3%	14.2%
Developed	3.6%	4.7%
Grassland/Pasture	3.3%	23.8%
Wetlands	3.1%	7.7%
Open Water	0.9%	1.8%
Forest	0.4%	4.0%
Shrubland	< 0.1%	0.1%

Temperature and Dissolved Oxygen

- Mount Carmel Dam will stratify in the summer.
- Thermal stratification was recorded in June and July 2020. Top-to-bottom temperature changes of 1.4°C, 3.7°C, 5.7°C and 0.1°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 sharply in the hypolimnion in July.

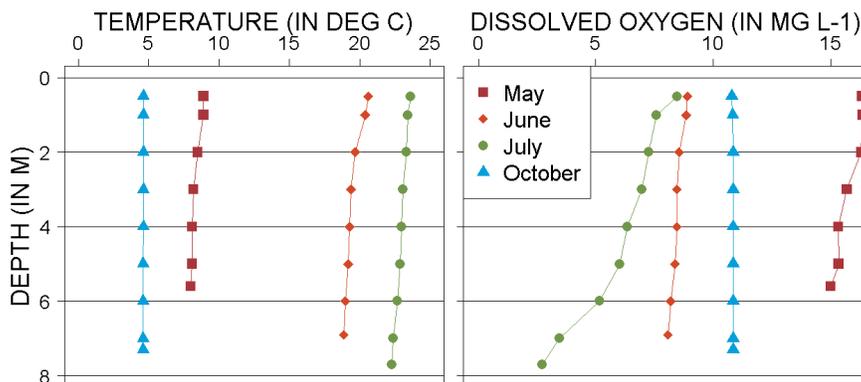


Figure 2. 2020 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter ($mg L^{-1}$)

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.
- Mount Carmel Dam is a eutrophic lake (Figure 3) that has high nutrient concentrations but moderate algal growth.
- Current trophic state is similar to historical data.
- There was a *warning* posted at Mount Carmel Dam in 2020 because of a large **harmful** algal (cyanobacteria) bloom.

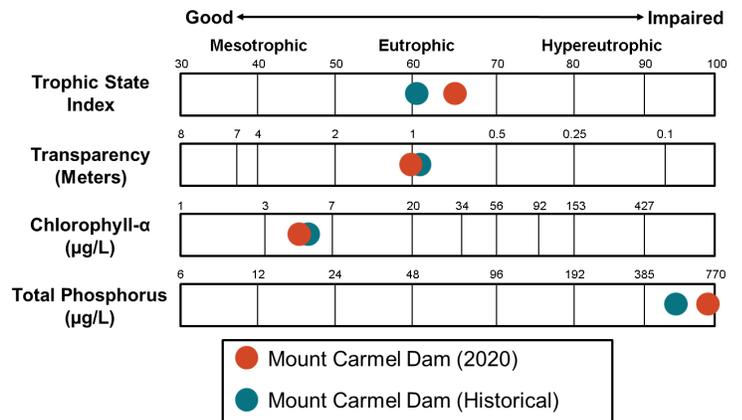


Figure 3. Trophic state indices for 2020 and historical samples

Nutrients

- Median concentration of total nitrogen (TN) in 2020 was much less than the historical median for the lake. There are no other sampled lakes on the Pembina Escarpment Level IV Ecoregion (hereafter, Ecoregion) where Mount Carmel Dam is located, so there will be no Ecoregion comparisons made.
- Median concentration of dissolved TN was similar to TN.
- Median total phosphorus (TP) concentration in 2020 was greater than the median for the lake (Figure 4).
- Median concentration of dissolved phosphorus was similar to TP.
- Ammonia and nitrate-plus-nitrite were detected at Mount Carmel Dam for greater than half of all samples in 2020.

Nutrient Concentrations (in mg L⁻¹) in Mount Carmel Dam

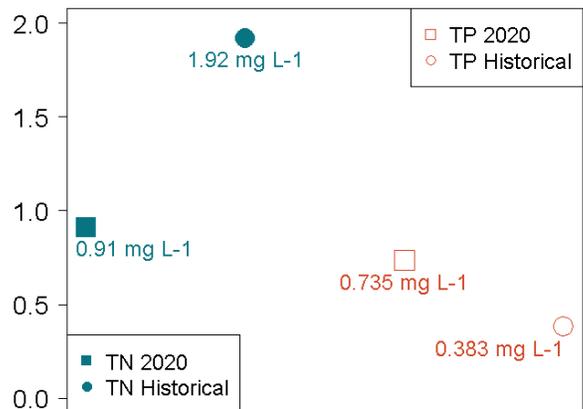


Figure 4. Median concentrations of TN and TP in mg L⁻¹ compared to regional medians

Water Chemistry

Table 2. Median concentrations of selected constituents for 2020 and historical samples.

Measure	2020 Median	Historical Median
Alkalinity	168.5 mg L ⁻¹	174 mg L ⁻¹
Bicarbonate (HCO ₃ ⁻)	205 mg L ⁻¹	213 mg L ⁻¹
Calcium (Ca ²⁺)	50.2 mg L ⁻¹	72.6 mg L ⁻¹
Carbonate (CO ₃ ²⁻)	< 1 mg L ⁻¹	< 1 mg L ⁻¹
Conductivity	661 µS cm ⁻¹	866 µS cm ⁻¹
Dissolved Solids	407 mg L ⁻¹	556 mg L ⁻¹
Magnesium (Mg ²⁺)	19.8 mg L ⁻¹	26.6 mg L ⁻¹
Sodium (Na ⁺)	55.7 mg L ⁻¹	68.9 mg L ⁻¹
Sulfate (SO ₄ ²⁻)	153.5 mg L ⁻¹	240 mg L ⁻¹

- Sulfate and bicarbonate are the dominant anions in Mount Carmel Dam, while calcium and sodium are the dominant cations (Figure 5).
- Median concentrations of most cations and anions are less than the historical median for the lake.

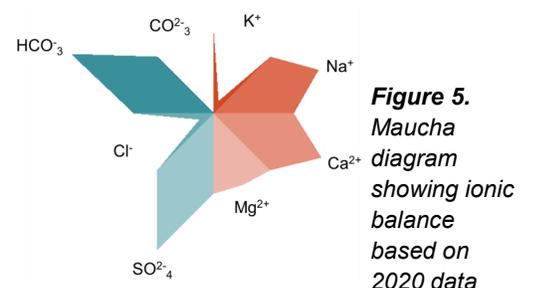


Figure 5. Maucha diagram showing ionic balance based on 2020 data