NORTH Dakota | Environmental Quality

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# Dion Lake

(48.97899 N, -99.89365 W)

## Rolette County

- Dion Lake is a small, natural lake in northern North Dakota (https://gf.nd.gov/gnf/maps/fishing/lakecontours/dion2004.pdf).
- Dion Lake is accessible by one public boat ramp on the northeast side of the lake.
- The Dion Lake watershed is about 400 acres of mostly deciduous forest, open water and agricultural land (Table 1). The most common crops are alfalfa and non-alfalfa hay (Table 1).
- Dion Lake is a Class II fishery , which are “capable of supporting natural reproduction and growth of cool water fishes (e.g., northern pike and walleye) and associated aquatic biota.”
- The lake is primarily managed for walleye, with fingerlings stocked almost every year. Netting by the ND Game and Fish in 2018 found yellow perch, northern pike and walleye.
- Dion Lake was previously sampled in 1995-1996 and 2005-2006.

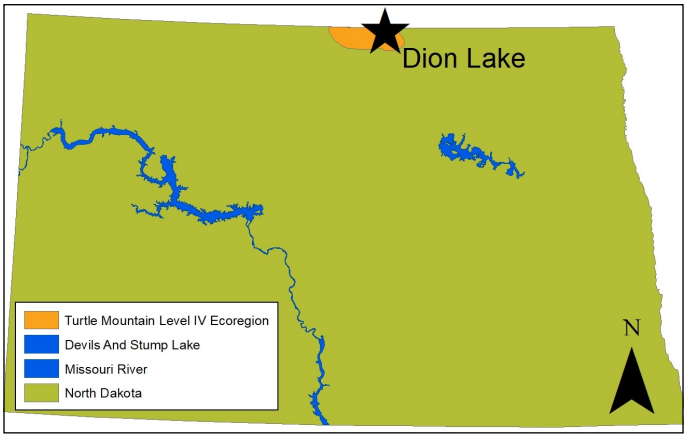


***Figure 1.*** *Location of Dion Lake within the state*

***Table 1.*** *Percentage of land cover in the watershed and near the lake (NASS, 2015). Value listed of crop type represents percentage of total production.*

| Land Cover Type | % in Watershed | % within 100 meters |
|---|---|---|
| Deciduous Forest | 44.5% | 62.3% |
| Open Water | 24.3% | 10.0% |
| Agriculture | 13.0% | 4.6% |
| *Other Hay/Non-Alfalfa* | *62.6%* | *53.3%* |
| *Alfalfa* | *36.0%* | *46.7%* |
| *Canola* | *0.9%* | *NA* |
| Grasslands/Pasture | 11.1% | 4.3% |
| Wetlands | 5.0% | 8.5% |
| Developed | 2.2% | 10.3% |

## Temperature and Dissolved Oxygen

- Dion Lake commonly 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 thermal stratification in July 2016, with a temperature change of 4.28ºC. There was also some weak stratification in May, with a change of 2.54ºC (Figure 2).
- Most samples showed the lake as well -oxygenated, with only near-bottom levels without oxygen (anoxic).

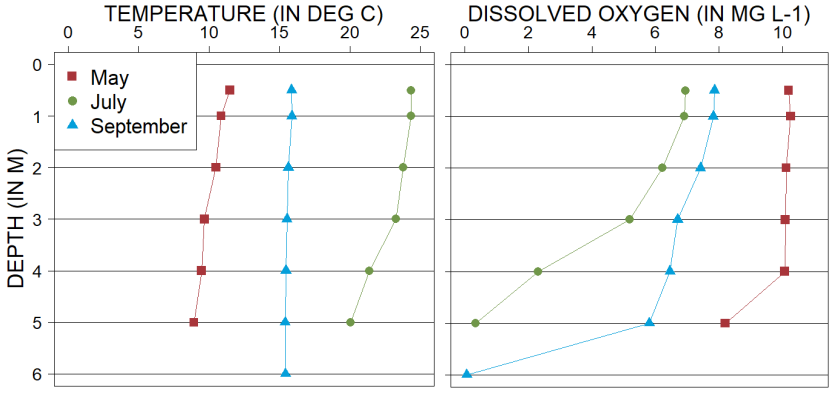


***Figure 2.*** *2016 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter (mg $L^{-1}$)*

# 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.
- Dion Lake is a mesotrophic lake (Figure 3) that has relatively low nutrient concentrations and low algal growth.
- Trophic state has improved compared to historical indices.
- There have been no confirmed ***harmful*** algal (cyanobacteria) blooms at Dion Lake.

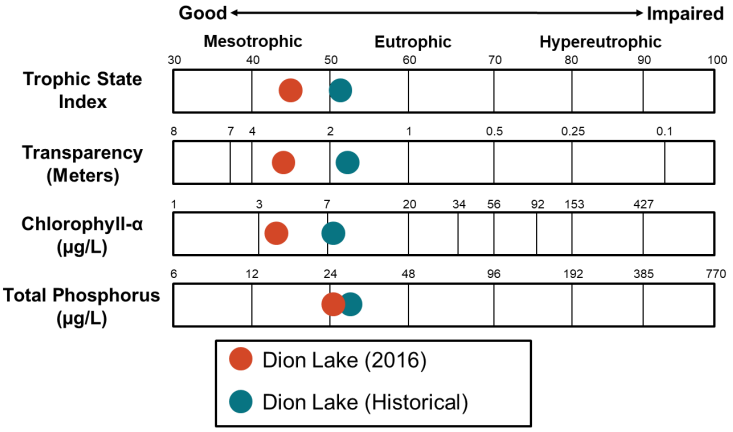


***Figure 3.*** *Trophic state indices for 2016 and historical samples*

# Nutrients

- Median concentration of total nitrogen (TN) was lower in 2016 compared to the historical median and the median for the Turtle Mountains Level IV Ecoregion (Figure 1; hereafter, Turtle Mountains) where Dion Lake is located (Figure 4).
- Median concentration of dissolved TN was similar to TN.
- Median TP concentration in 2016 was less than historical concentrations and the median for the Turtle Mountains (Figure 4).
- Median concentration of dissolved phosphorus was slightly less than TP.
- Ammonia was detected in low concentrations for every sample in 2016, while nitrate plus nitrite was not above the detection limit.

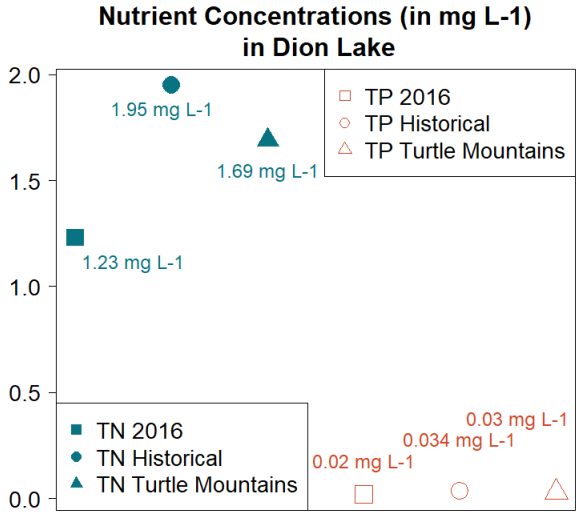


***Figure 4.*** *Median concentrations of TN and TP in mg L$^{-1}$ compared to regional medians*

# Water Chemistry

***Table 2.*** *Median concentrations of selected constituents for 2016 and historical samples and from all Turtle Mountain natural lakes.*

| Measure | 2016 Median | Historical Median | Ecoregion Median |
|---|---|---|---|
| Alkalinity | 232 mg L$^{-1}$ | 222 mg L$^{-1}$ | 290 mg L$^{-1}$ |
| Bicarbonate ($HCO^-_3$) | 279 mg L$^{-1}$ | 257 mg L$^{-1}$ | 325 mg L$^{-1}$ |
| Calcium ($Ca^{2+}$) | 35.1 mg L$^{-1}$ | 38.2 mg L$^{-1}$ | 32.4 mg L$^{-1}$ |
| Carbonate ($CO^{2-}_3$) | 2 mg L$^{-1}$ | 4 mg L$^{-1}$ | 12 mg L$^{-1}$ |
| Conductivity | 576 µS cm$^{-1}$ | 698 µS cm$^{-1}$ | 685 µS cm$^{-1}$ |
| Dissolved Solids | 330 mg L$^{-1}$ | 408 mg L$^{-1}$ | 382 mg L$^{-1}$ |
| Magnesium ($Mg^{2+}$) | 51.1 mg L$^{-1}$ | 56.8 mg L$^{-1}$ | 61.9 mg L$^{-1}$ |
| Sodium ($Na^+$) | 6.5 mg L$^{-1}$ | 7.8 mg L$^{-1}$ | 8.9 mg L$^{-1}$ |
| Sulfate ($SO^{2-}_4$) | 79.5 mg L$^{-1}$ | 137 mg L$^{-1}$ | 60 mg L$^{-1}$ |

- Bicarbonate is the dominant anion in Dion Lake, while magnesium is the dominant cation (Figure 5).
- Median concentrations of most cations and anions are lower than the historical median for the lake and for the Turtle Mountains.

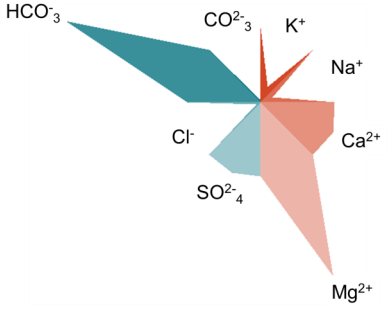


***Figure 5.*** *Maucha diagram showing ionic balance based on 2016 data*