

April 2019

# Patterson Lake

(46.8590 N, -102.8554 W)

## Stark County

- Patterson Lake is a large reservoir in western North Dakota (Figure 1). See map at (<https://gf.nd.gov/gnf/maps/fishing/lakecontours/dickinsonreservoir2003.pdf>)
- There are three public boat ramps on Patterson Lake, one near the dam, one on the north shore and one on the south shore.
- The Patterson Lake watershed is about 260,000 acres of mostly grassland/pasture and agricultural land. The most common crops grown are spring wheat, corn and non-alfalfa hay (Table 1).
- Patterson 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.”
- Patterson Lake is managed for walleye, with fingerlings stocked annually. A wide variety of fish were found during the last sample by the ND Game and Fish.
- Patterson Lake was previously assessed in 1992, 1995-1996, 2000 and 2005-2006.



Figure 1. Location of Patterson 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	47.9%	8.8%
Spring Wheat	53.6%	2.8%
Other Hay/Non-Alfalfa	16.7%	73.7%
Corn	6.9%	15.4%
Grassland/Pasture	46.3%	66.2%
Developed	4.3%	16.5%
Barren	0.5%	< 0.1%
Open Water	0.4%	3.6%
Forest/Shrubland	0.4%	2.2%
Wetlands	0.2%	2.7%

## Temperature and Dissolved Oxygen

- Patterson Lake 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 recorded in July 2014. Temperature change in the water column near the dam was 0.39 degrees Celsius (°C), 6.16°C and 0.21°C in May, July and October, respectively.
- All samples showed most of the lake as well-oxygenated, except during thermal stratification.

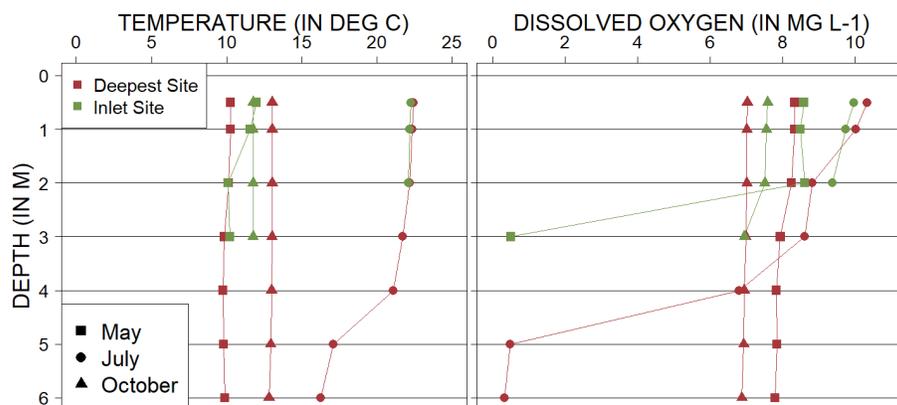


Figure 2. 2014 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter ( $mg L^{-1}$ )

## 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.
- Patterson Lake is a eutrophic lake (Figure 3) that has high nutrient concentrations and moderate algal growth.
- Current trophic state has improved slightly compared to historical indices.
- Patterson Lake has had regular confirmed **harmful** algal (cyanobacteria) blooms, last monitored in 2018.

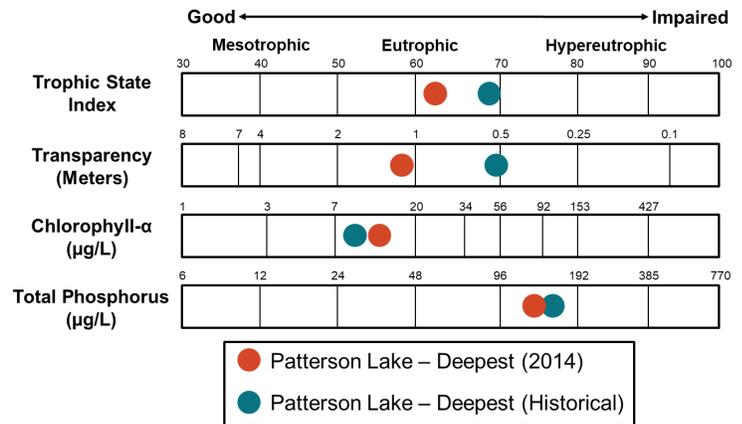


Figure 3. Trophic state indices for 2014 and historical samples

## Nutrients

- Median concentration of total nitrogen (TN) in 2014 was less than the historical median and less than the median for the Missouri Plateau Level IV Ecoregion (hereafter, Missouri Plateau) where Patterson Lake is located (Figure 4).
- Median concentration of dissolved TN was similar to TN.
- Median TP concentration in 2014 was less than the historical median but greater than the median for the Missouri Plateau (Figure 4).
- Median concentration of dissolved phosphorus was slightly less than TP.
- Ammonia was detected in all samples at Patterson Lake in 2014 with high concentrations found in May and October. Nitrate plus nitrite was found at both sites during two samples (May and October).

### Nutrient Concentrations (in mg L<sup>-1</sup>) in Patterson Lake

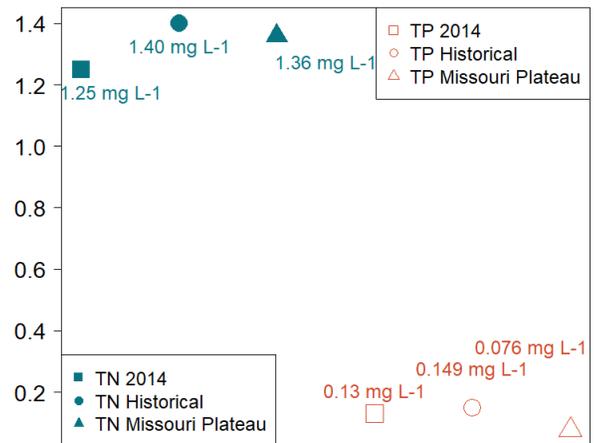


Figure 4. Median concentrations of TN and TP in mg L<sup>-1</sup> compared to regional medians

## Water Chemistry

**Table 2.** Median concentrations of selected constituents for 2014 and historical samples and from all Missouri Plateau reservoirs.

Measure	2014 Median	Historical Median	Ecoregion Median
Alkalinity	221 mg L <sup>-1</sup>	221 mg L <sup>-1</sup>	280 mg L <sup>-1</sup>
Bicarbonate (HCO <sub>3</sub> <sup>-</sup> )	227 mg L <sup>-1</sup>	260 mg L <sup>-1</sup>	291 mg L <sup>-1</sup>
Calcium (Ca <sup>2+</sup> )	70.3 mg L <sup>-1</sup>	39.6 mg L <sup>-1</sup>	49.3 mg L <sup>-1</sup>
Carbonate (CO <sub>3</sub> <sup>2-</sup> )	4 mg L <sup>-1</sup>	< 1 mg L <sup>-1</sup>	19 mg L <sup>-1</sup>
Conductivity	1,870 µS cm <sup>-1</sup>	1,060 µS cm <sup>-1</sup>	1,790 µS cm <sup>-1</sup>
Dissolved Solids	1,330 mg L <sup>-1</sup>	708 mg L <sup>-1</sup>	1,270 mg L <sup>-1</sup>
Magnesium (Mg <sup>2+</sup> )	59.3 mg L <sup>-1</sup>	21.6 mg L <sup>-1</sup>	62.3 mg L <sup>-1</sup>
Sodium (Na <sup>+</sup> )	275 mg L <sup>-1</sup>	164 mg L <sup>-1</sup>	258 mg L <sup>-1</sup>
Sulfate (SO <sub>4</sub> <sup>2-</sup> )	747 mg L <sup>-1</sup>	313 mg L <sup>-1</sup>	681 mg L <sup>-1</sup>

- Sulfate is the dominant anion in Patterson Lake, while sodium is the dominant cation (Figure 5).
- Median concentrations of most cations and anions are greater than the historical median for the lake but similar to the median for the Missouri Plateau.

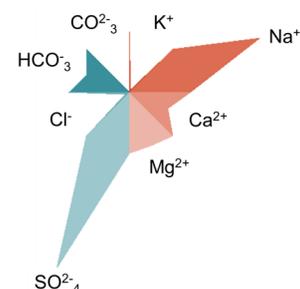


Figure 5. Maucha diagram showing ionic balance based on 2014 data