NORTH Dakota | Environmental Quality

Be Legendary.™

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Strawberry Lake

(47.76644 N, -100.86633 W)

McLean County

- Strawberry Lake is a small, natural lake in central North Dakota (Figure 1). See map at (https://gf.nd.gov/gnf/maps/fishing/lakecontours/strawberrymclean2004.pdf).
- Strawberry Lake is accessible by one public boat ramp on the northeast side of the lake.
- The Strawberry Lake watershed is about 11,000 acres of mostly grassland/pasture, agricultural land and wetlands. The most common crops grown are spring wheat, soybeans and non-alfalfa-hay (Table 1).
- Strawberry Lake is a Class III fishery, which means it is "capable of supporting natural reproduction and growth of warm water fishes (e.g., largemouth bass and bluegill) and associated aquatic biota."
- The lake is primarily managed for walleye, with fingerlings stocked biennially since 2010. Northern pike, bluegill and yellow perch are also found in the lake.
- Strawberry Lake was previously assessed in 1991-1992 and 2005-2006.

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

Table 1. *Percentage of land cover in the watershed and near the lake (NASS, 2017). Value listed of crop type represents percentage of total production.*

Land Cover Type	% in Watershed	% within 100 meters
Grassland/Pasture	58.7%	58.7%
Agriculture	16.6%	21.3%
Spring Wheat	*29.0%*	*2.6%*
Soybeans	*24.1%*	*8.7%*
Other Hay/Non-Alfalfa	*17.5%*	*46.1%*
Wetlands	10.7%	3.8%
Open Water	8.8%	5.5%
Developed	3.1%	9.2%
Forest	2.1%	1.4%

Temperature and Dissolved Oxygen

- Strawberry 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 May and July 2018. The strongest change occurred in May (change of nearly 6ºC), which may have been due to a sharp increase in temperature following ice-off (Figure 2).
- Most samples showed the lake as well -oxygenated, with only near-bottom levels without oxygen (anoxic).

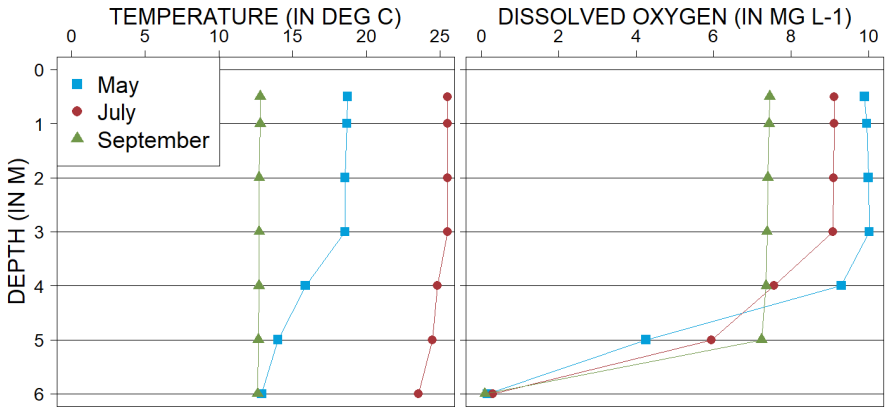

Figure 2. *2018 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter (mg L^{-1})*

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.
- Strawberry Lake is a borderline mesotrophic-eutrophic lake (Figure 3) that has relatively low nutrient concentrations and low algal growth.
- Trophic state has decreased compared to historical indices (i.e., conditions have improved), with all three scores lower than historical.
- There have been no confirmed ***harmful*** algal (cyanobacteria) blooms at Strawberry Lake.

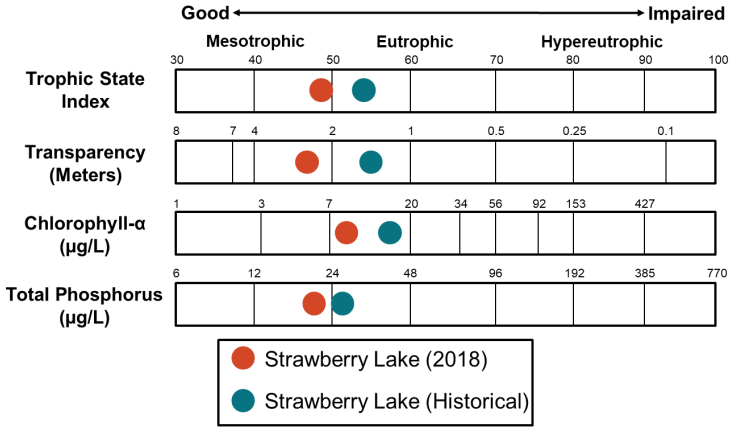

Figure 3. *Trophic state indices for 2018 and historical samples*

Nutrients

- Median concentration of total nitrogen (TN) was lower in 2018 compared to the historical median and the median for the Missouri Coteau Level IV Ecoregion (hereafter, Missouri Coteau) where Strawberry Lake is located (Figure 4).
- Median concentration of dissolved TN was similar to TN.
- Median TP concentration was lower in 2018 compared to historical concentrations and the median for the Missouri Coteau (Figure 4).
- Median concentration of dissolved phosphorus was slightly less than TP.
- Ammonia and nitrate plus nitrite were rarely above detection limits in Strawberry Lake in 2018.

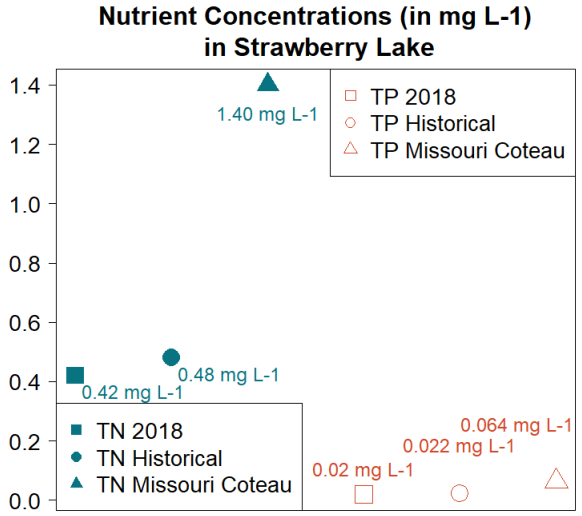

Figure 4. *Median concentrations of TN and TP in mg L^{-1} compared to regional medians*

Water Chemistry

Table 2. *Median concentrations of selected constituents for 2018 and historical samples and from all Missouri Coteau lakes.*

Measure	2018 Median	Historical Median	Ecoregion Median
Alkalinity	194 mg L^{-1}	189 mg L^{-1}	274 mg L^{-1}
Bicarbonate (HCO^-_3)	230 mg L^{-1}	214 mg L^{-1}	289 mg L^{-1}
Calcium (Ca^{2+})	47.7 mg L^{-1}	37.9 mg L^{-1}	39.8 mg L^{-1}
Carbonate (CO^{2-}_3)	4 mg L^{-1}	9.8 mg L^{-1}	21 mg L^{-1}
Conductivity	537 µS cm^{-1}	496 µS cm^{-1}	1,010 µS cm^{-1}
Dissolved Solids	318 mg L^{-1}	277 mg L^{-1}	642 mg L^{-1}
Magnesium (Mg^{2+})	35.2 mg L^{-1}	30.6 mg L^{-1}	72.4 mg L^{-1}
Sodium (Na^+)	21.9 mg L^{-1}	18.7 mg L^{-1}	62 mg L^{-1}
Sulfate (SO^{2-}_4)	86.1 mg L^{-1}	66.6 mg L^{-1}	239 mg L^{-1}

- Bicarbonate is the dominant anion in Strawberry Lake (although sulfate is relatively high), while calcium and magnesium are the co-dominant cations (Figure 5).
- Median concentrations of most cations and anions are greater than the historical median for the lake but lower for the Missouri Coteau.

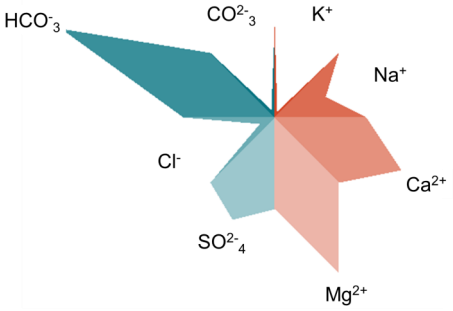

Figure 5. *Maucha diagram showing ionic balance based on 2018 data*