June 2020

Rice Lake
(46.035749 N, -100.082612 W)

Emmons County

- Rice Lake is a large natural lake in south-central North Dakota (Figure 1). See map at (https://gf.nd.gov/gnf/maps/fishing/lakecontours/riceemmons2004.pdf).

- There is one public, paved boat ramp on Rice Lake on the southwest side of the lake, though as of 2019 the ramp was flooded.

- The Rice Lake watershed is about 46,000 acres of mostly agriculture and grassland/pasture. The most common crops grown are soybeans, spring wheat, and corn (Table 1).

- Rice 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."

- Rice Lake is managed for walleye, with fingerlings of each stocked annually. Walleye, northern pike and yellow perch were captured during the last sample by the ND Game and Fish.
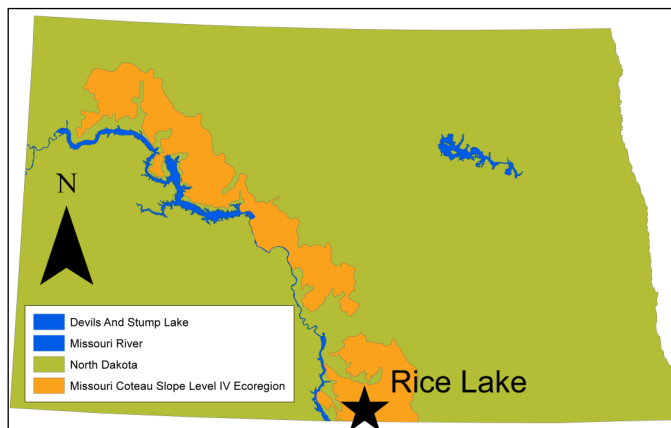
- Rice Lake was previously assessed in 2006-2007.

Figure 1. Location of Rice Lake within the state

Table 1. Percentage of land cover in the watershed and near the lake (NASS, 2018). Value listed of crop type represents percentage of total production

Land Cover Type	% in Watershed	% within 500 meters
Agriculture	63.4%	44.0%
Soybeans	*36.5%*	*26.7%*
Spring Wheat	*27.3%*	*6.2%*
Corn	*15.2%*	*10.2%*
Grassland/Pasture	27.8%	39.0%
Developed	4.1%	11.5%
Open Water	3.9%	4.7%
Wetlands	0.6%	0.7%
Forest	< 0.1%	< 0.1%
Shrubland	< 0.1%	< 0.1%

Temperature and Dissolved Oxygen

- Rice Lake rarely stratifies in the summer despite being relatively deep.

- There was no thermal stratification recorded in 2019. There was very little temperature change during any profile recorded in 2019, with the largest change being 0.1ºC in October.

- Dissolved oxygen concentrations were relatively high throughout the water column during all samples.
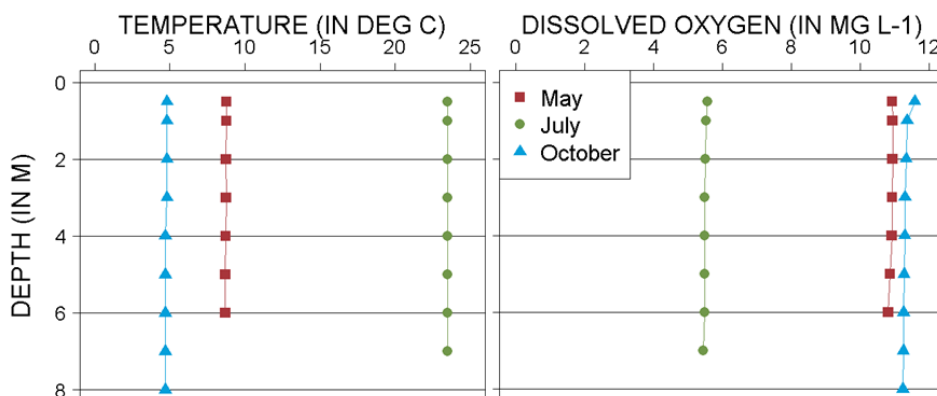

Figure 2. 2019 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter (mg L^{-1})

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.

- Rice Lake is a hypereutrophic lake (Figure 3) that has high nutrient concentrations and dense algal growth.

- Current trophic state has improved slightly compared to historical data.

- Rice Lake has not had any confirmed *harmful* algal (cyanobacteria) blooms.
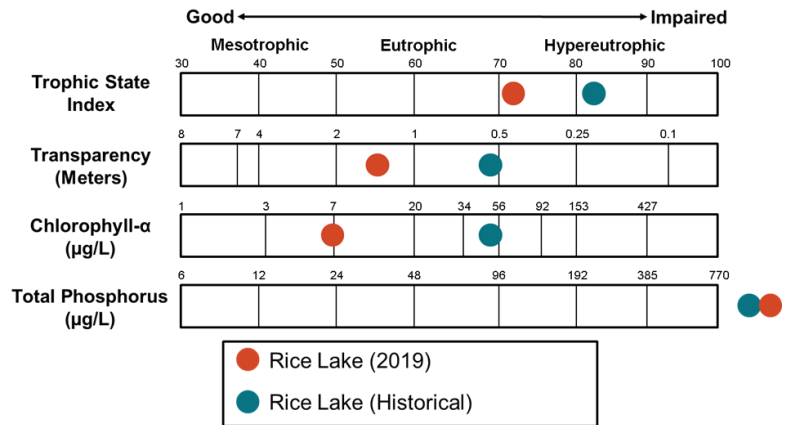

Figure 3. *Trophic state indices for 2019 and historical samples*

Nutrients

- Median concentration of total nitrogen (TN) in 2019 was less than the historical median for the lake and much less than the median for the Missouri Coteau Slope Level IV Ecoregion (hereafter, Ecoregion) where Rice Lake is located (Figure 4).

- Median •concentration of dissolved TN was slightly less than TN.

- Median TP concentration in 2019 was greater than the median for the lake and much greater than the median for the Ecoregion (Figure 4).

- Median concentration of dissolved phosphorus was slightly less than TP.

- Ammonia was detected once at a low concentration at Rice Lake in 2019, while nitrate-plus-nitrite was found at relatively high concentrations in two samples.
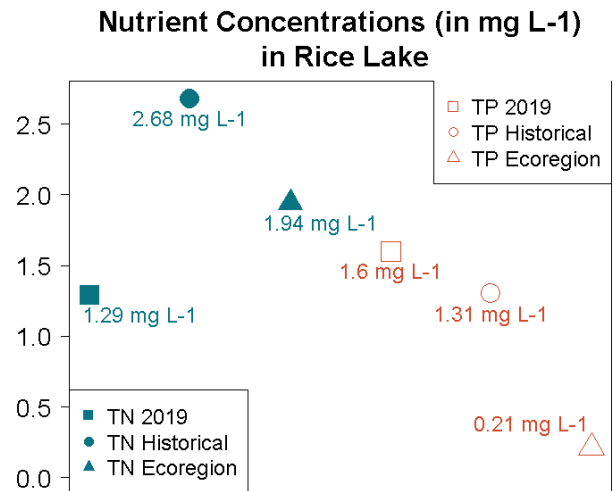

Figure 4. *Median concentrations of TN and TP in mg L^{-1} compared to regional medians*

Water Chemistry

Table 2. *Median concentrations of selected constituents for 2019 and historical samples and from all Ecoregion natural lakes.*

Measure	2019 Median	Historical Median	Ecoregion Median
Alkalinity	323 mg L^{-1}	502 mg L^{-1}	380 mg L^{-1}
Bicarbonate (HCO_3^-)	374 mg L^{-1}	452 mg L^{-1}	408 mg L^{-1}
Calcium (Ca^{2+})	43.1 mg L^{-1}	49.0 mg L^{-1}	38.8 mg L^{-1}
Carbonate (CO_3^{2-})	10 mg L^{-1}	83 mg L^{-1}	28.5 mg L^{-1}
Conductivity	811 µS cm^{-1}	1,260 µS cm^{-1}	1,405 µS cm^{-1}
Dissolved Solids	492 mg L^{-1}	826 mg L^{-1}	961 mg L^{-1}
Magnesium (Mg^{2+})	34.3 mg L^{-1}	62.0 mg L^{-1}	74.8 mg L^{-1}
Sodium (Na^+)	59.3 mg L^{-1}	132 mg L^{-1}	155 mg L^{-1}
Sulfate (SO_4^{2-})	92.2 mg L^{-1}	165 mg L^{-1}	385 mg L^{-1}

- Bicarbonate is the dominant anion in Rice Lake, while magnesium, calcium and sodium are co-dominant cations (Figure 5).

- Median concentrations of most cations and anions are less than the historical median for the lake and less than the median for the Ecoregion.
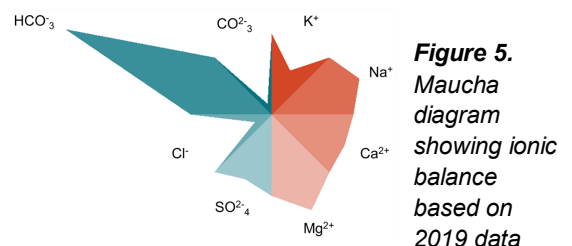

Figure 5. *Maucha diagram showing ionic balance based on 2019 data*