

November 2020

# Alkali Lake

(46.02617 N, -97.383 W)

## Sargent County

- Alkali Lake is a large natural lake in southeast North Dakota (Figure 1). See map at (<https://gf.nd.gov/gnf/maps/fishing/lakecontours/alkalisargent2011.pdf>).
- There is one public, paved boat ramp on Alkali Lake on the north side of the lake.
- The Alkali Lake watershed is difficult to delineate considering the dynamic nature of the water table. Land cover surrounding Alkali Lake is dominated by agriculture and wetlands, with the former dominated by corn and soybeans (Table 1).
- Alkali Lake is a Class III, warm-water fishery, which are “capable of supporting natural reproduction and growth of warm water fishes (e.g., largemouth bass and bluegill) and associated aquatic biota.”
- Alkali Lake is managed for walleye, with fingerlings stocked annually. Common carp, black crappie, bullhead, freshwater drum, walleye, northern pike and green sunfish were captured during the last sample by the ND Game and Fish in 2018.
- Alkali Lake was previously assessed in 1992-1993.

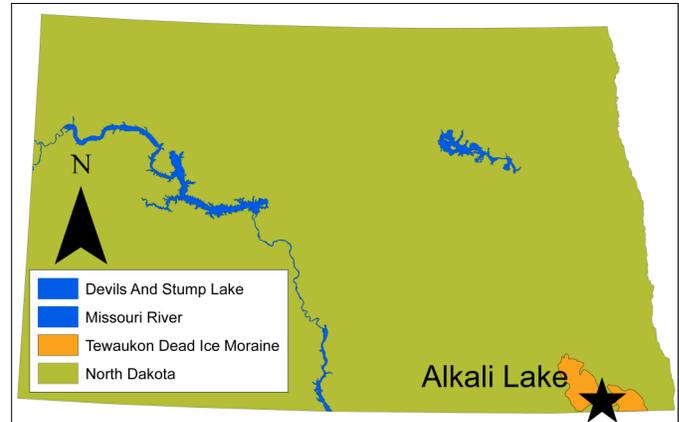


Figure 1. Location of Alkali Lake within the state

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	% within 500 meters
Agriculture	43.8%
Corn	51.8%
Soybeans	29.0%
Spring Wheat	9.0%
Wetlands	32.6%
Grassland/Pasture	8.8%
Open Water	6.8%
Developed	6.1%
Forest	1.8%
Barren	0.1%

## Temperature and Dissolved Oxygen

- Alkali Lake does stratify during the open-water season.
- There was no thermal stratification recorded in 2020. Top-to-bottom temperature changes of 1.4°C, 0.1°C, 2.4°C and 0.5°C were recorded in May, June, July and October, respectively.
- Dissolved oxygen concentrations were relatively high throughout the water column during all samples, though it did decline sharply with weak stratification in July.

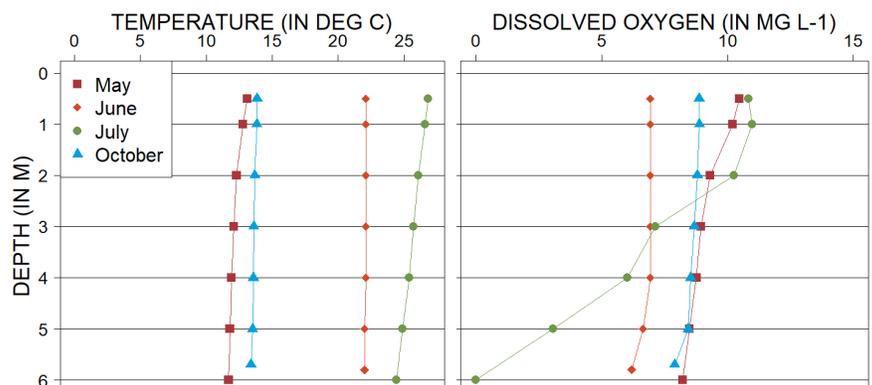


Figure 2. 2020 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter ( $mg L^{-1}$ )

## 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.
- Alkali Lake is a eutrophic lake (Figure 3) that has relatively high nutrient concentrations and moderate algal growth.
- Current trophic state is similar to historical data.
- Alkali Lake had a confirmed **harmful** algal (cyanobacteria) bloom in 2020, where the NDDEQ had a warning and an advisory posted.

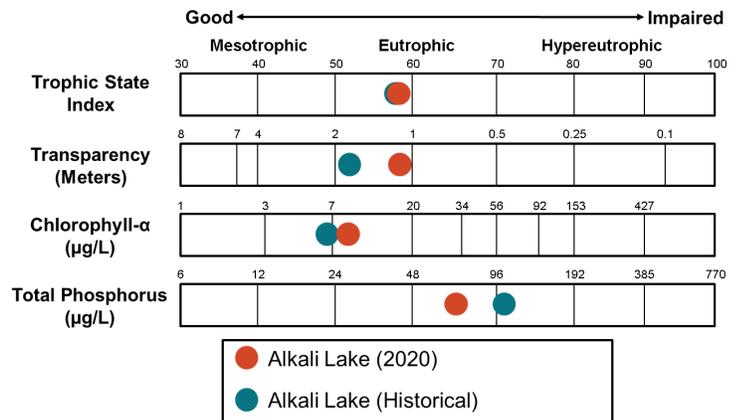


Figure 3. Trophic state indices for 2020 and historical samples

## Nutrients

- Median concentration of total nitrogen (TN) in 2020 was much less than the historical median for the lake but greater than the median for the Tewaukon Dead Ice Moraine Level IV Ecoregion (hereafter, Ecoregion) where Alkali Lake is located (Figure 4).
- Median concentration of dissolved TN was less than TN.
- Median total phosphorus (TP) concentration in 2020 was less than the median for the lake and less than the median for the Ecoregion (Figure 4).
- Median concentration of dissolved phosphorus was less than TP.
- Ammonia was detected at Alkali Lake in 2020 for about half of samples with some high concentrations, while nitrate-plus nitrite was not detected.

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

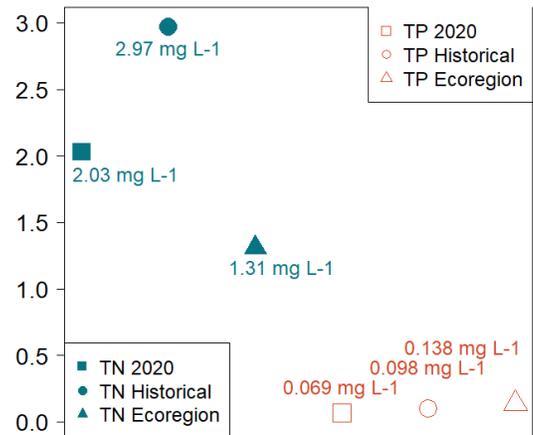


Figure 4. Median concentrations of TN and TP in mg L<sup>-1</sup> compared to regional medians

## Water Chemistry

Table 2. Median concentrations of selected constituents for 2020 and historical samples and from all Ecoregion natural lakes.

Measure	2020 Median	Historical Median	Ecoregion Median
Alkalinity	417 mg L <sup>-1</sup>	864 mg L <sup>-1</sup>	287 mg L <sup>-1</sup>
Bicarbonate (HCO <sub>3</sub> <sup>-</sup> )	469 mg L <sup>-1</sup>	744 mg L <sup>-1</sup>	321 mg L <sup>-1</sup>
Calcium (Ca <sup>2+</sup> )	51.8 mg L <sup>-1</sup>	19.3 mg L <sup>-1</sup>	119 mg L <sup>-1</sup>
Carbonate (CO <sub>3</sub> <sup>2-</sup> )	20 mg L <sup>-1</sup>	161 mg L <sup>-1</sup>	10 mg L <sup>-1</sup>
Conductivity	2,805 µS cm <sup>-1</sup>	9,132 µS cm <sup>-1</sup>	1,886 µS cm <sup>-1</sup>
Dissolved Solids	1,920 mg L <sup>-1</sup>	7,100 mg L <sup>-1</sup>	1,410 mg L <sup>-1</sup>
Magnesium (Mg <sup>2+</sup> )	128 mg L <sup>-1</sup>	241 mg L <sup>-1</sup>	118 mg L <sup>-1</sup>
Sodium (Na <sup>+</sup> )	410 mg L <sup>-1</sup>	2,170 mg L <sup>-1</sup>	89.8 mg L <sup>-1</sup>
Sulfate (SO <sub>4</sub> <sup>2-</sup> )	826 mg L <sup>-1</sup>	3,110 mg L <sup>-1</sup>	765 mg L <sup>-1</sup>

- Sulfate is the dominant anion in Alkali Lake, while sodium is the dominant cation (Figure 5).
- Median concentrations of most cations and anions are much less than the historical median for the lake but greater than the median for the Ecoregion.

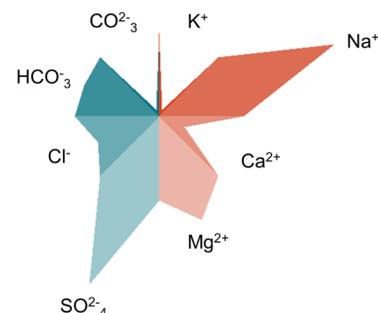


Figure 5. Maucha diagram showing ionic balance based on 2020 data