NORTH Dakota | Environmental Quality
Be Legendary.™

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December 2021

Lake Darling

(48.465016 N, -101.580277 W)

Renville County

- Lake Darling is a large reservoir in northwestern North Dakota (Figure 1). See map at (https://gf.nd.gov/gnf/maps/fishing/lakecontours/darlingoverview2020.pdf).
- There are multiple access points around the lake.
- The Lake Darling watershed is about 940,000 acres (not including Canada) of mostly agriculture. The most common crops grown are spring wheat, canola and soybeans (Table 1).
- Lake Darling is a Class II fishery, which are "capable of supporting natural reproduction and growth of cool water fishes (e.g., walleye and northern pike) and associated aquatic biota."
- Lake Darling is managed by the USFWS as a walleye fishery, with fingerlings of stocked annually. Walleye, white sucker, yellow perch and northern pike were captured in the last sample in 2020.
- Lake Darling was previously sampled in 1997-1998, 2015 and 2016-2017.

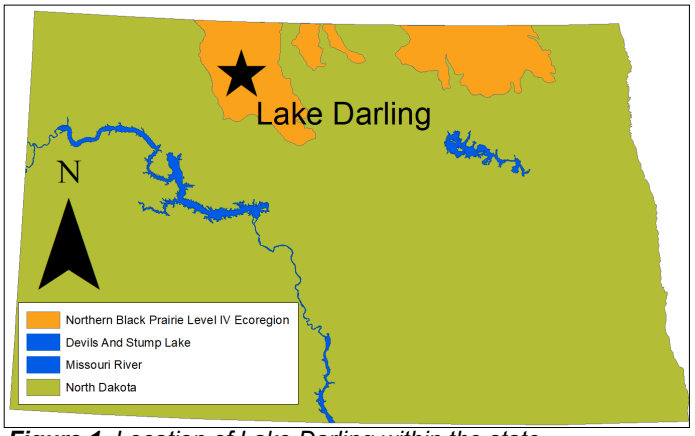

Figure 1. *Location of Lake Darling within the state*

Table 1. *Percentage of land cover in the watershed and near the lake (NASS, 2020). Value listed of crop type represents percentage of total production*

Land Cover Type	% in Watershed	% within 500 meters
Agriculture	70.8%	6.9%
Spring Wheat	*33.6%*	*22.6%*
Canola	*18.2%*	*9.8%*
Soybeans	*14.6%*	*9.2%*
Grassland/Pasture	16.6%	79.4%
Wetlands	4.2%	6.0%
Developed	4.1%	2.5%
Open Water	3.7%	3.9%
Forest	0.3%	0.9%
Barren	0.2%	0.2%

Temperature and Dissolved Oxygen

- Lake Darling can stratify in the summer, though the lake is usually well-mixed.
- Thermal stratification was recorded in June 2021. Temperature change in the water column was 0.4 degrees Celsius (ºC), 1.7ºC, 0.3ºC and 0.0ºC in May, June, August and October, respectively.
- Dissolved oxygen concentrations remained high at Lake Darling throughout all samples.

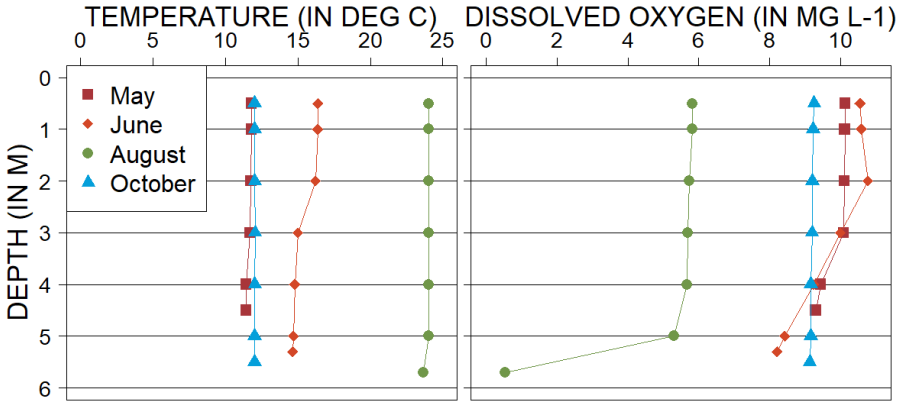

Figure 2. *2021 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter (mg L^{-1})*

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.
- Lake Darling is a eutrophic reservoir (Figure 3) with relatively high nutrient concentrations, moderate algal growth and moderate transparency.
- Trophic state in 2021 was improved compared to historical indices.
- Lake Darling has been listed for confirmed ***harmful*** algal (cyanobacteria) blooms in the past.

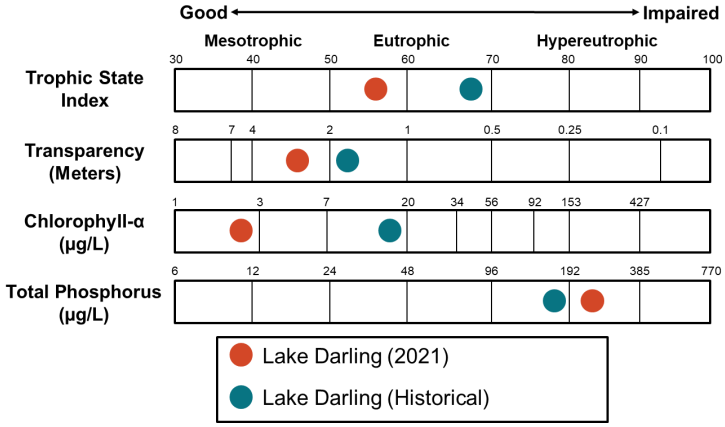

Figure 3. *Trophic state indices for 2021 and historical samples*

Nutrients

- Median concentration of total nitrogen (TN) at Lake Darling in 2021 was greater than the historical median for the lake but similar to the median for reservoirs in the Northern Black Prairie Level IV Ecoregion (hereafter, Ecoregion) (Figure 4).
- Median TP concentration at Lake Darling in 2021 was greater than the median for the lake and the median for the Ecoregion (Figure 4).
- Median concentrations of dissolved nutrients at Lake Darling in 2021 were comparable to total nutrient concentrations .
- Ammonia was not detected at Lake Darling in 2021, while nitrate-plus-nitrite was only detected in October at a low concentration.

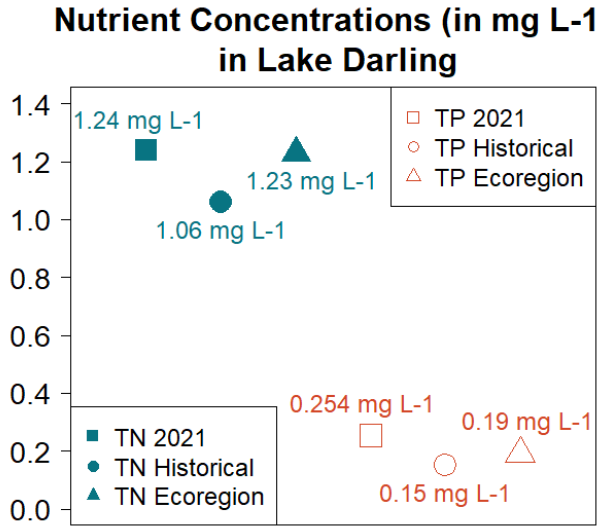

Figure 4. *Median concentrations of TN and TP in mg L^{-1} compared to regional medians*

Water Chemistry

Table 2. *Median concentrations of selected constituents for 2021 and historical samples and from all Ecoregion reservoirs.*

Measure	2021 Median[1]	Historical Median[1]	Ecoregion Median
Alkalinity	313.5 mg L^{-1}	233.5 mg L^{-1}	307.5 mg L^{-1}
Bicarbonate (HCO^-_3)	349 mg L^{-1}	274.5 mg L^{-1}	320.5 mg L^{-1}
Calcium (Ca^{2+})	60.6 mg L^{-1}	49.2 mg L^{-1}	60.6 mg L^{-1}
Carbonate (CO^{2-}_3)	12 mg L^{-1}	3.5 mg L^{-1}	14.5 mg L^{-1}
Conductivity	1,390 µS cm^{-1}	855 µS cm^{-1}	1,435 µS cm^{-1}
Dissolved Solids	886 mg L^{-1}	515.5 mg L^{-1}	973 mg L^{-1}
Magnesium (Mg^{2+})	65.7 mg L^{-1}	30.2 mg L^{-1}	67.9 mg L^{-1}
Sodium (Na^+)	124 mg L^{-1}	70.7 mg L^{-1}	160 mg L^{-1}
Sulfate (SO^{2-}_4)	401.5 mg L^{-1}	187 mg L^{-1}	429 mg L^{-1}

[1]From the site near the dam; 386036 for 2021 data, 384140 for historical

- Sulfate and bicarbonate are co-dominant anions in Lake Darling, while sodium and magnesium are co-dominant cations (Figure 5).
- Median concentrations of most cations and anions are greater than the historical median for the lake and less than the median for the Ecoregion.

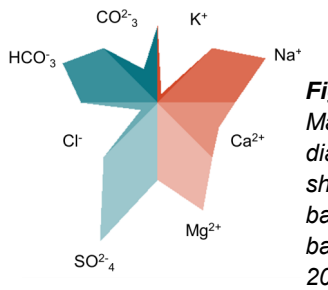

Figure 5. *Maucha diagram showing ionic balance based on 2021 data*