NORTH Dakota | Environmental Quality

Be Legendary.™

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December 2019

Matejcek Dam

(48.224309 N, -97.929606 W)

Walsh County

- Matejcek Dam is a long, narrow reservoir in northeast North Dakota (Figure 1).
- There is one boat ramp on Matejcek Dam on the east side of the lake.
- The Matejcek Dam watershed is about 73,000 acres of mostly agriculture. The most common crops grown are spring wheat, canola and soybeans (Table 1).
- Matejcek Dam 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."
- The North Dakota Game and Fish has reported fish kills in Matejcek Dam in 2018 and 2019, greatly decreasing quality of fishing at the lake.
- Matejcek Dam was previously assessed in 1991 -1992, 2010 and 2012-2013.

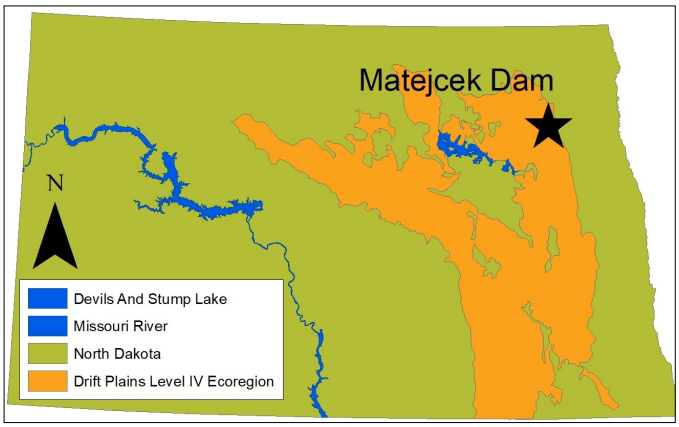

Figure 1. *Location of Matejcek Dam within the state*

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	59.4%	50.0%
Spring Wheat	*41.1%*	*34.6%*
Canola	*23.8%*	*< 0.1%*
Soybeans	*22.7%*	*39.7%*
Wetlands	17.9%	4.0%
Grassland/Pasture	16.3%	20.1%
Developed	4.3%	5.4%
Open Water	1.4%	2.4%
Forest	0.8%	17.9%
Shrubland	< 0.1%	< 0.1%

Temperature and Dissolved Oxygen

- Matejcek Dam 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 recorded at every visit in 2019 as the lake never broke stratification. Temperature change in the water column was 13.8 degrees Celsius (ºC), 16.3ºC, 22.5ºC, 17.1ºC, 12.4ºC and 2.5ºC from May through October.
- The majority of the water column was anoxic throughout the year.

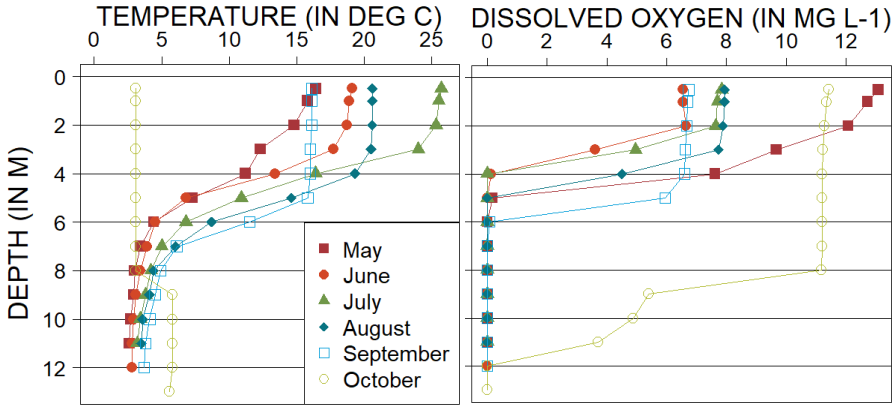

Figure 2. *2019 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter (mg L^{-1})*

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.
- Matejcek Dam is a eutrophic reservoir (Figure 3) that has high nutrient concentrations but moderate algal growth.
- Trophic state in 2019 was improved compared to historical indices.
- Matejcek Dam has had reported but not confirmed ***harmful*** algal (cyanobacteria) blooms in the summer.

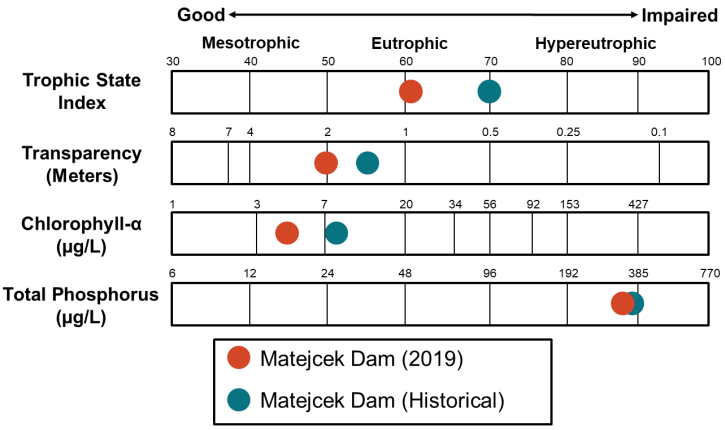

Figure 3. *Trophic state indices for 2019 and historical samples*

Nutrients

- Median concentration of total nitrogen (TN) in 2019 was less than the historical median for the lake but greater than the median for reservoirs in the Drift Plains Level IV Ecoregion (hereafter, Ecoregion) where Matejcek Dam is located (Figure 4).
- Median concentration of dissolved TN was slightly less than TN.
- Median TP concentration in 2019 was less than the median for the lake but greater than the median for the Ecoregion (Figure 4).
- Median concentration of dissolved phosphorus was slightly less than TP.
- Ammonia was detected in all but one sample in 2019 at Matejcek Dam, while nitrate-plus-nitrite was detected in three samples.

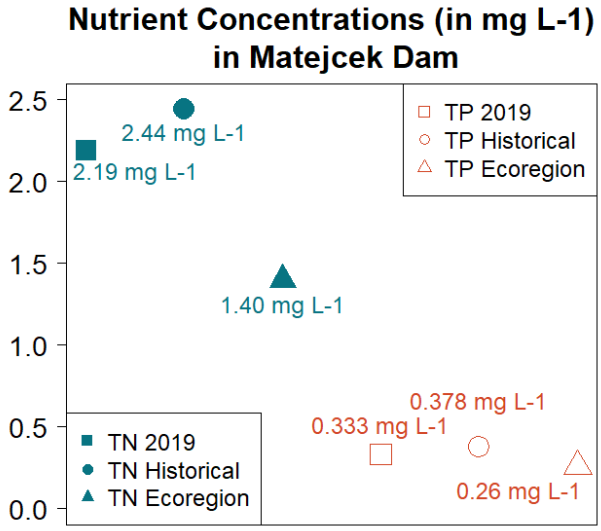

Figure 4. *Median concentrations of TN and TP in mg L^{-1} compared to regional medians*

Water Chemistry

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

Measure	2019 Median	Historical Median	Ecoregion Median
Alkalinity	324 mg L^{-1}	377 mg L^{-1}	311 mg L^{-1}
Bicarbonate (HCO^-_3)	370 mg L^{-1}	441 mg L^{-1}	343 mg L^{-1}
Calcium (Ca^{2+})	86.5 mg L^{-1}	99.8 mg L^{-1}	74.6 mg L^{-1}
Carbonate (CO^{2-}_3)	12.5 mg L^{-1}	11 mg L^{-1}	14 mg L^{-1}
Conductivity	2,200 µS cm^{-1}	2,170 µS cm^{-1}	1,100 µS cm^{-1}
Dissolved Solids	1,590 mg L^{-1}	1,600 mg L^{-1}	734 mg L^{-1}
Magnesium (Mg^{2+})	102.5 mg L^{-1}	106 mg L^{-1}	52.9 mg L^{-1}
Sodium (Na^+)	289 mg L^{-1}	271 mg L^{-1}	106.5 mg L^{-1}
Sulfate (SO^{2-}_4)	808 mg L^{-1}	784 mg L^{-1}	275 mg L^{-1}

- Sulfate is the dominant anion in Matejcek Dam, while sodium and magnesium are the dominant cations (Figure 5).
- Median concentrations of most cations and anions are similar to the historical median for the lake and greater than the median for the Ecoregion.

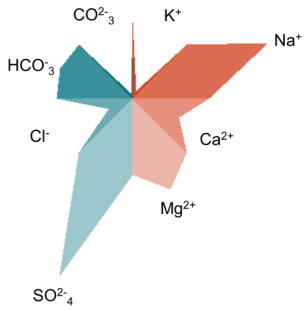

Figure 5. *Maucha diagram showing ionic balance based on 2019 data*