

April 2019

Harvey Reservoir

(47.76298 N, -99.92176 W)

Wells County

- Harvey Reservoir is a long, narrow reservoir in north-central North Dakota (Figure 1). See map at (<https://gf.nd.gov/gnf/maps/fishing/lakecontours/harvey2003.pdf>).
- There is one public boat ramp on Harvey Reservoir on the north side of the lake.
- The Harvey Reservoir watershed is about 401,000 acres of mostly agricultural land and grassland/pasture. The most common crops grown are spring wheat and soybeans (Table 1).
- Harvey Reservoir 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.”
- Harvey Reservoir is managed for walleye, with fingerlings stocked annually. Black bullhead, northern pike, white sucker, walleye and yellow perch were found during the last sample by the ND Game and Fish.
- Harvey Reservoir was previously assessed in 1990-1992.

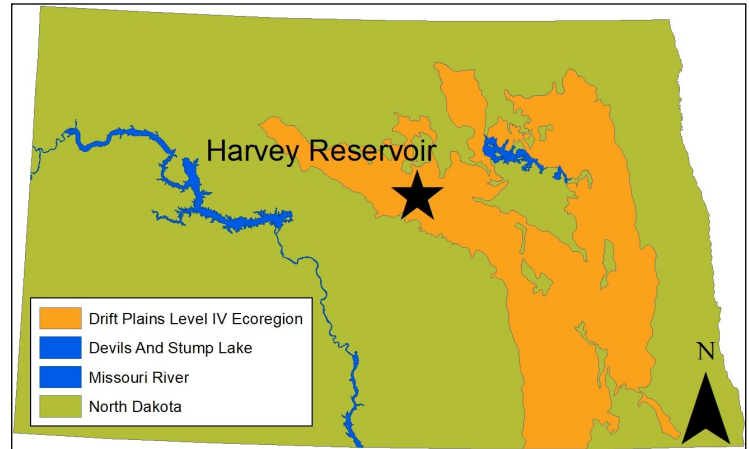


Figure 1. Location of Harvey Reservoir within the state

Table 1. Percentage of land cover in the watershed and near the lake (NASS, 2015). Value listed of crop type represents percentage of total production

| Land Cover Type | % in Watershed | % within 500 meters |
|-------------------|----------------|---------------------|
| Agriculture | 49.9% | 31.5% |
| Spring Wheat | 36.6% | 31.1% |
| Soybeans | 32.3% | 20.6% |
| Barley | 7.3% | 1.2% |
| Grassland/Pasture | 32.1% | 46.0% |
| Wetlands | 7.1% | 6.3% |
| Open Water | 6.6% | 1.1% |
| Developed | 4.2% | 14.9% |
| Forest | 0.1% | 0.3% |

Temperature and Dissolved Oxygen

- Harvey Reservoir 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 July 2016. Temperature change in the water column in 2016 was 0.85 degrees Celsius (°C), 2.75°C and 0.04°C in May, July and September, respectively.
- Dissolved oxygen concentration was relatively high during most samples, except near the bottom during thermal stratification and in August 2017.

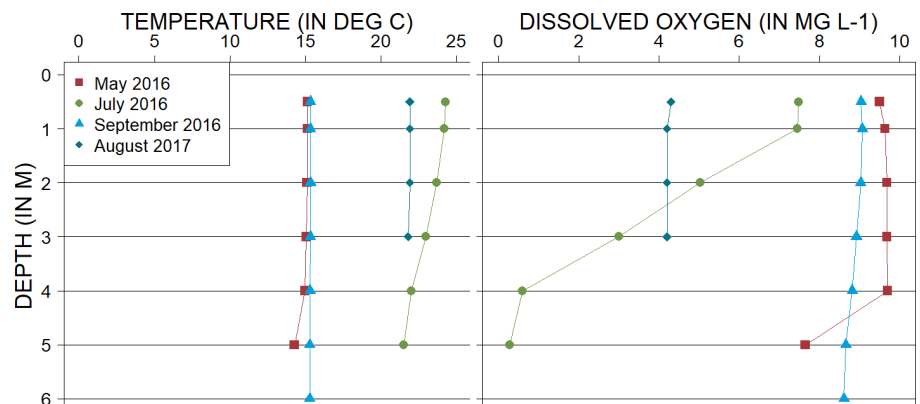


Figure 2. 2016-2017 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter ($mg L^{-1}$)

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.
- Harvey Reservoir is a eutrophic reservoir (Figure 3) that has high nutrient concentrations but moderate algal growth.
- Current trophic state has improved compared to historical indices, driven by a decrease in TP.
- Harvey Reservoir experiences frequent, harmful cyanobacteria blooms.

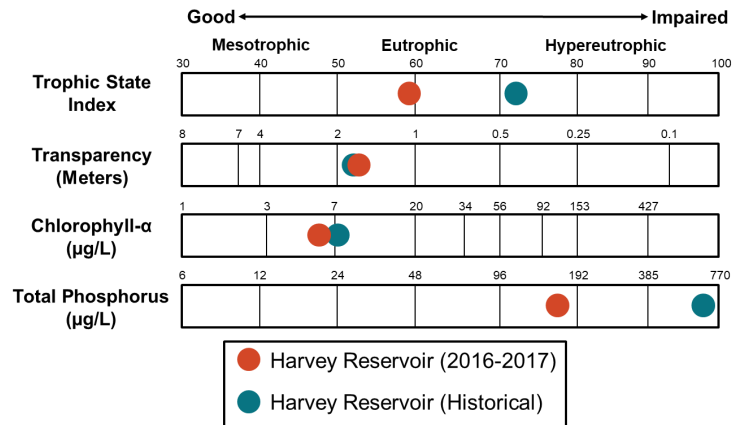


Figure 3. Trophic state indices for 2016-2017 and historical samples

Nutrients

- Median concentration of total nitrogen (TN) in 2016-2017 was less than the historical median for the lake but similar to the median for the Drift Plains Level IV Ecoregion (hereafter, Drift Plains) where Harvey Reservoir is located (Figure 4).
- Median concentration of dissolved TN was similar to TN.
- Median TP concentration in 2016-2017 was much less than the historical median for the lake and less than the median for the Drift Plains (Figure 4).
- Median concentration of dissolved phosphorus was slightly less than TP.
- Ammonia was detected in all samples at Harvey Reservoir in 2016-2017, while there was one detection of nitrate plus nitrite.

Nutrient Concentrations (in mg L⁻¹) in Harvey Reservoir

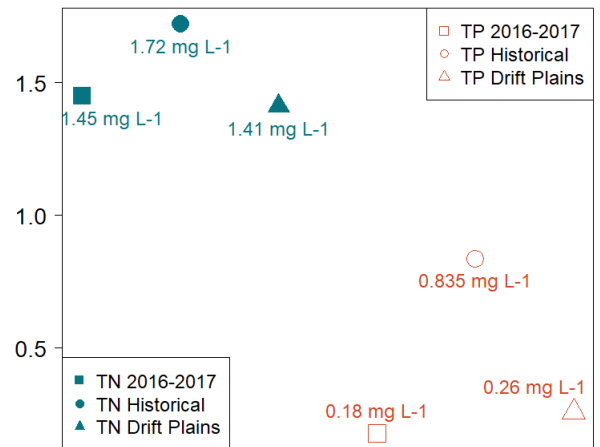


Figure 4. Median concentrations of TN and TP in mg L⁻¹ compared to regional medians

Water Chemistry

Table 2. Median concentrations of selected constituents for 2016-2017 and historical samples and from all Drift Plains reservoirs.

| Measure | 2016-2017 Median | Historical Median | Ecoregion Median |
|--|---------------------------|---------------------------|---------------------------|
| Alkalinity | 454 mg L ⁻¹ | 738 mg L ⁻¹ | 311 mg L ⁻¹ |
| Bicarbonate (HCO ₃ ⁻) | 477 mg L ⁻¹ | 725 mg L ⁻¹ | 341 mg L ⁻¹ |
| Calcium (Ca ²⁺) | 43.3 mg L ⁻¹ | 30.7 mg L ⁻¹ | 73.8 mg L ⁻¹ |
| Carbonate (CO ₃ ²⁻) | 25.5 mg L ⁻¹ | 73.5 mg L ⁻¹ | 14 mg L ⁻¹ |
| Conductivity | 1,955 µS cm ⁻¹ | 1,909 µS cm ⁻¹ | 1,081 µS cm ⁻¹ |
| Dissolved Solids | 1,225 mg L ⁻¹ | 1,270 mg L ⁻¹ | 713 mg L ⁻¹ |
| Magnesium (Mg ²⁺) | 63.0 mg L ⁻¹ | 30.0 mg L ⁻¹ | 52.5 mg L ⁻¹ |
| Sodium (Na ⁺) | 311 mg L ⁻¹ | 394 mg L ⁻¹ | 106 mg L ⁻¹ |
| Sulfate (SO ₄ ²⁻) | 544 mg L ⁻¹ | 313 mg L ⁻¹ | 271 mg L ⁻¹ |

- Sulfate and bicarbonate are co-dominant anions in Harvey Reservoir, while sodium is the dominant cation (Figure 5).
- Median concentrations of most cations and anions are much greater than the historical median for the lake and greater than the median for the Drift Plains.

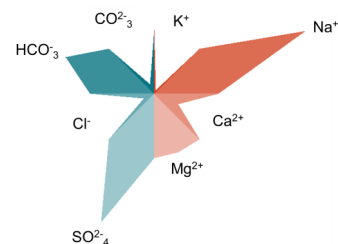


Figure 5. Maucha diagram showing ionic balance based on 2016-2017 data