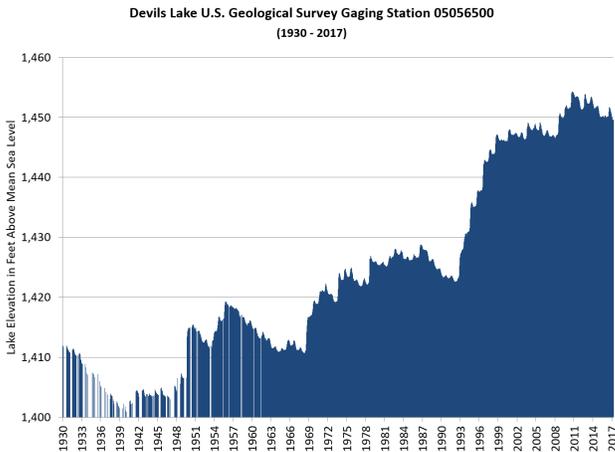


2017 Water Quality Results from Devils Lake

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Devils Lake was sampled four times in 2017—March 8-9 (winter) (through the ice), May 11 (spring), August 23 (summer), and October 16-17 (fall). Seven sites were sampled during each visit, with sampling sites in Six Mile Bay, Main Bay, East Bay, East Devils Lake, West Bay, Southwest West Bay, and Pelican Lake.

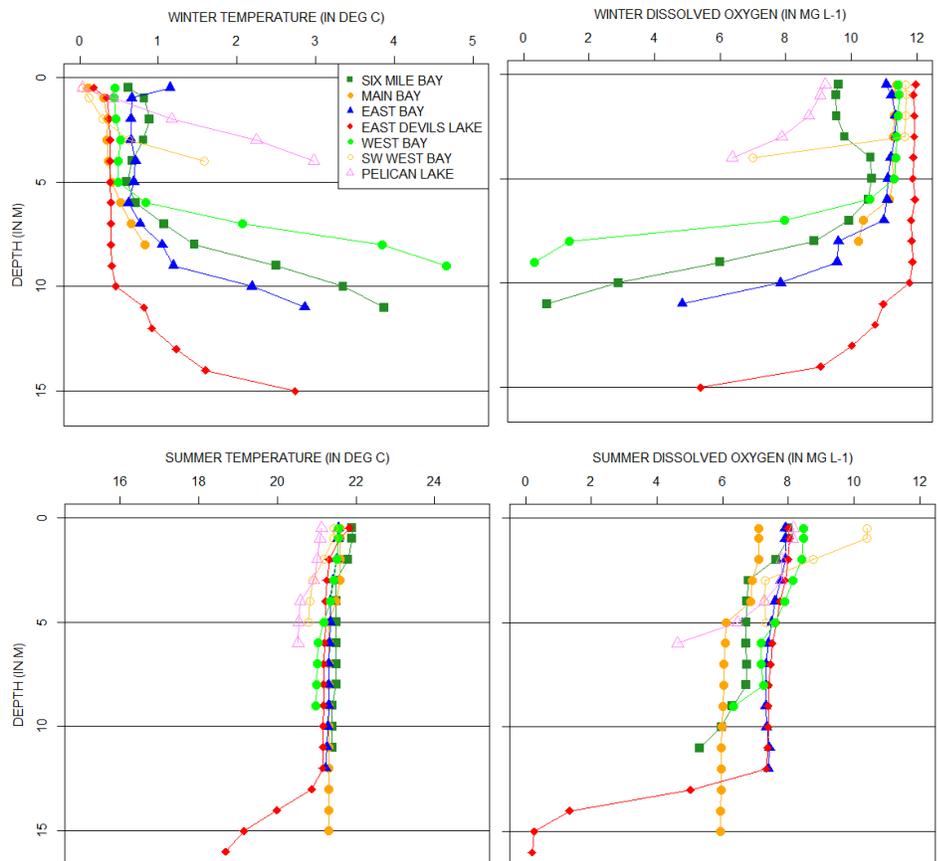
Lake elevation has remained relatively stable since 2015, with a final reading of 1,449.62 feet above sea level on December 31, 2017. This stability has not been observed at Devils Lake in recent history, as lake elevation has increased by about 30 feet since the early-1990s. The installation of two outlets, one in southwestern West Bay (2005) and one in East Devils Lake (2012), in conjunction with lower precipitation have helped to stabilize lake levels.

Temperature and Dissolved Oxygen

Temperature and dissolved oxygen (DO) profiles were taken from each site during each sampling trip using a YSI multi-probe water quality meter. A surface reading (taken at 0.5 meters) is initially taken, with values recorded for each subsequent meter.

Nearly all stations showed some reverse thermal stratification in the winter (a change of 1°C over 1 meter of depth), with the exception of Southwest West Bay and Main Bay. The warmest bottom temperatures were found in West Bay (4.7°C). In the summer, only East Devils Lake was thermally stratified, with a very deep thermocline (occurring at depths of 13 meters or greater).

Winter DO concentrations were relatively high throughout the water column at most sites, with only Six Mile Bay and West Bay being anoxic near the bottom. Similarly, only East Devils Lake was anoxic near the bottom in the summer in conjunction with thermal stratification, while all other sites were well-oxygenated throughout the water column in the summer.

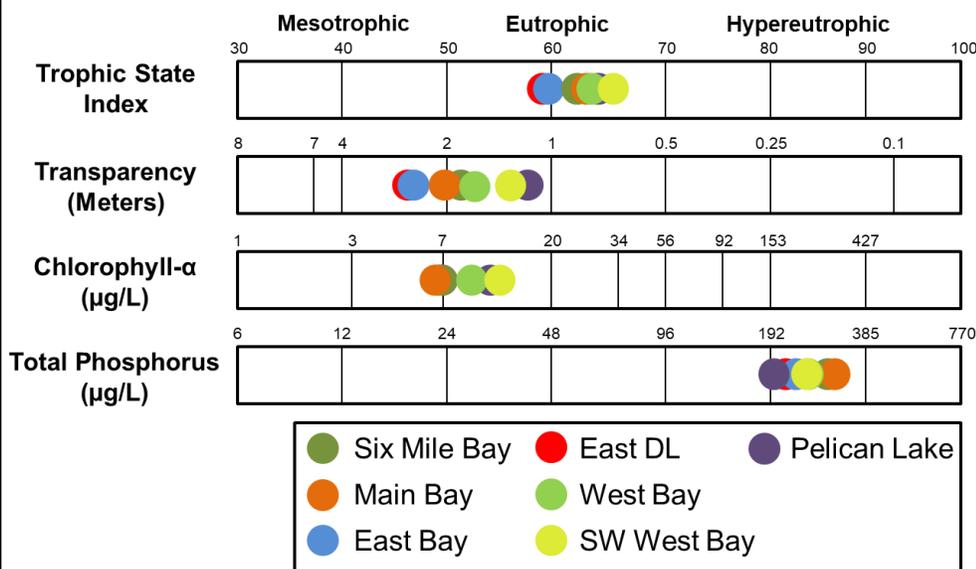


Trophic State Indices

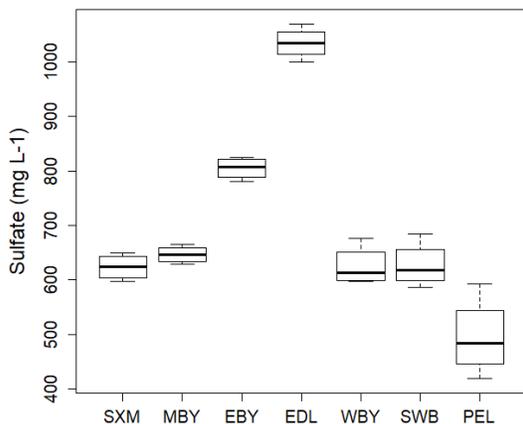
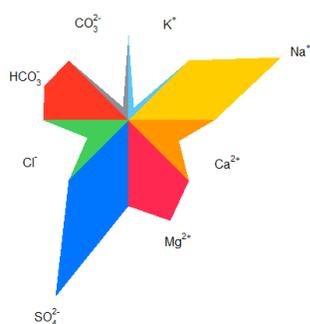
In 2017, the trophic status of Devils Lake was eutrophic at all sites, with the highest productivity (as chlorophyll- α) on the western end of the lake (i.e., West Bay, Southwest West Bay, Pelican Lake). East Bay and East Devils Lake had the highest Secchi disk transparency, while Pelican Lake and Southwest West Bay were the most turbid. The lake was strongly hyper-eutrophic based on total phosphorus concentration, which has been observed throughout the entirety of the project period (since 1995).

Harmful Algal Blooms

Devils Lake experienced harmful cyanobacteria blooms in the summer of 2017, with the Department sampling for microcystin, anatoxin-a, saxitoxin, and cylindrospermopsin. There was a bloom present from July through September, with detections of high microcystin concentrations found in Six Mile Bay, Channel A, East Bay, Graham's Island, and the Casino Boat Ramp. There were no detections of anatoxin-a, saxitoxin, or cylindrospermopsin.



Water Chemistry



Devils Lake is a sodium-sulfate dominated waterbody, with high proportions of bicarbonate and magnesium. The highest concentrations of sodium and sulfate are found in East Bay and East Devils Lake, which is of interest due to the outlet on the east end to the Sheyenne River. Despite relatively high concentrations compared to the rest of the lake, dilution has greatly decreased average concentrations of sulfate in East Devils Lake from 4,283 mg L⁻¹ in 1995 to 1,035 mg L⁻¹ in 2017. In contrast, sulfate concentrations have risen substantially since 2000 in Pelican Lake, with average concentration of 362 mg L⁻¹ in 2000 compared to 495 mg L⁻¹ in 2017. Similarly, average concentrations of sodium were greatest in East Devils Lake (436 mg L⁻¹) and lowest in Pelican Lake (191 mg L⁻¹). The sodium concentration was relatively low throughout the western part of the lake, with Six Mile Bay (256 mg L⁻¹), Main Bay (263 mg L⁻¹), West Bay (258 mg L⁻¹), and Southwest West Bay (258 mg L⁻¹) having much lower concentrations than the eastern part of the lake.

Specific conductance concentrations are highest on the east side of Devils Lake with mean measurements of 2,523 $\mu\text{S cm}^{-1}$ and 3,003 $\mu\text{S cm}^{-1}$ in East Bay and East Devils Lake, respectively. Conversely, specific conductance was in Pelican Lake, with an average concentration of 1,693 $\mu\text{S cm}^{-1}$. Concentrations of alkalinity were similar among all sampling sites, though average concentrations were still highest in East Bay (389 mg L⁻¹) and East Devils Lake (399 mg L⁻¹) and lowest in Pelican Lake (337 mg L⁻¹).