Crane Lake 2025 water quality monitoring

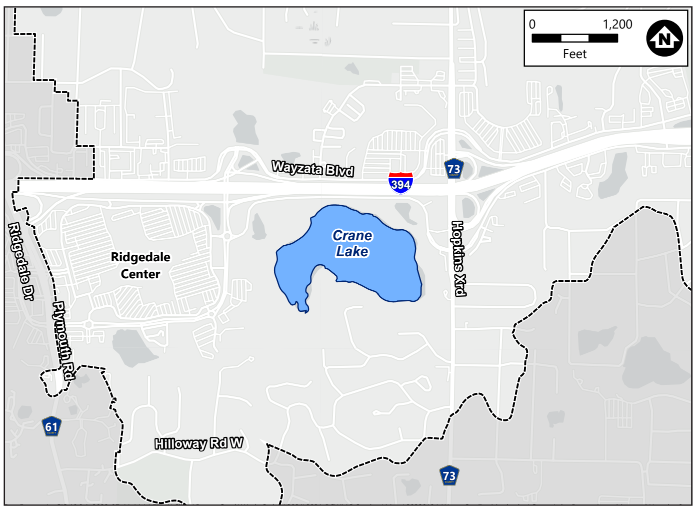


Figure 1: Crane Lake location

About Crane Lake	
BCWMC classification	Priority-2 shallow lake
Watershed area	591 acres
Lake size	30 acres
Average depth	3.3 feet
Maximum depth	5 feet
Ordinary high water level	920.5 feet
Normal water level	917.1 feet
Downstream receiving water body	Medicine Lake
Location (city)	Minnetonka
MPCA impairments	Chlorides
Aquatic invasive species	Curly-leaf pondweed, purple loosestrife, hybrid cattail
Public access	No

Monitoring water quality in Crane Lake

The Bassett Creek Watershed Management Commission (BCWMC) has monitored water quality conditions in the watershed's 10 priority lakes since 1972. This monitoring is performed to detect changes or observe trends in water quality, inform pollution modeling and studies, and target future projects. A summary of 2025 monitoring efforts on Crane Lake is provided below.

At a glance: 2025 monitoring results

In 2025, the BCWMC monitored Crane Lake for the following:

- Water chemistry (nutrients, chlorophyll *a,* chloride)
- Water clarity and dissolved oxygen
- Phytoplankton and zooplankton (microscopic plants and animals)
- Macrophytes (aquatic plants)

Results of 2025 monitoring show that Crane Lake met the applicable Minnesota Pollution Control Agency (MPCA) and BCWMC water quality standards for total phosphorus and chlorophyll *a*, but Secchi depth (a measure of water clarity) did not meet the MPCA water quality standard. Trend analyses show a significant decline in water clarity, but no significant change in total phosphorus or chlorophyll *a* concentrations over the past 26 years. Other results include the following:

- Although the average chloride (salt) concentrations were lower in 2025 than in 2016 and 2021, all of the chloride measurements in 2025 failed to meet the MPCA's chronic standard.

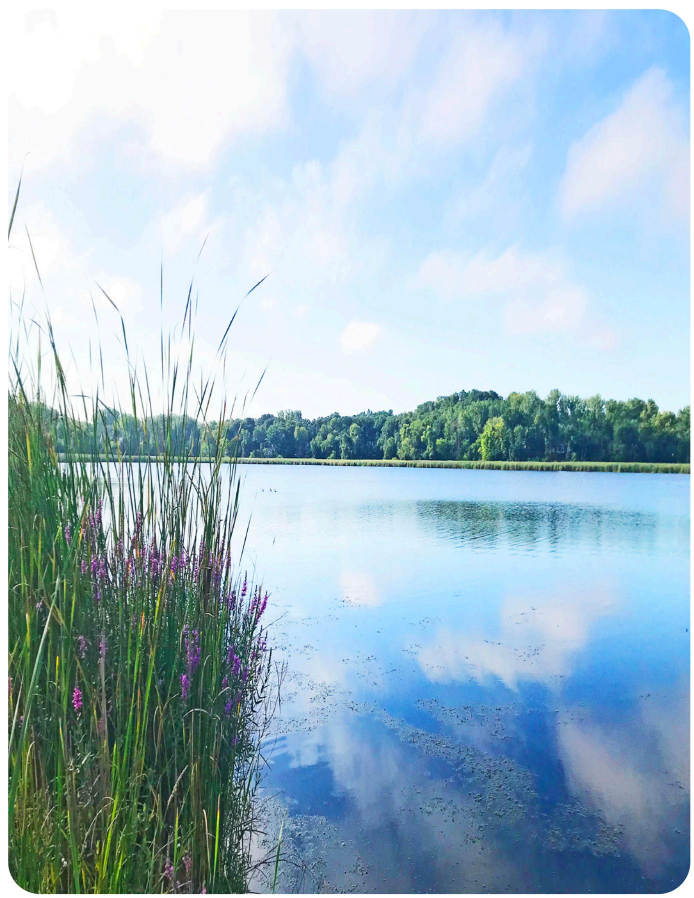
- Chloride (salt) concentrations have increased significantly in the lake from 1972 to 2025.
- In 2025, the number of plant species in the lake and the floristic quality index (FQI) value, a measure of plant species quality, were better than the Minnesota Department of Natural Resources (MNDNR) plant index of biotic integrity (IBI) thresholds.
- Summer average phytoplankton densities from 2011 to 2025 showed little variation and remained consistent with good water quality.
- Primarily driven by rising chloride levels, the zooplankton community (a variety of microscopic animals in the water column) has been in decline over the past 46 years including a decline in the total abundance and significant decline in the number of species.
- Lower chloride levels in 2025 are likely a factor in improved zooplankton numbers in 2025 which were higher than all but three summer averages from 1980 through 2021.

Recommendations

- The BCWMC recently completed a study to inform a Crane Lake Chloride Reduction Demonstration Project. It is recommended that the Commission move forward with implementing recommendations from that study to reduce the lake's chloride concentrations.
- Continue to provide education and information to residents and lake users on best practices to improve water quality and shoreline buffers and to reduce the introduction of aquatic invasive species (AIS).
- Continue water quality and biological monitoring at a 5-year frequency.

Definitions

- ***Hypereutrophic:*** Nutrient-rich lake conditions characterized by frequent and severe algal blooms and low water clarity; excessive algae can significantly reduce lake oxygen levels
- ***Eutrophic:*** Lake condition characterized by abundant accumulation of nutrients supporting dense growth of algae and other organisms; decay of algae can reduce lake oxygen levels
- ***Mesotrophic:*** Lake condition characterized by medium levels of nutrients and clear water
- ***Oligotrophic:*** Lake condition characterized by a low accumulation of dissolved nutrients, high oxygen content, sparse algae growth, and very clear water



2025 water chemistry

Total phosphorus levels

While phosphorus is necessary for plant and algae growth, excessive phosphorus leads to excessive algae growth, decreased water clarity, and impaired water quality. Common sources of phosphorus include fertilizers, leaves, grass clippings, atmospheric deposition, soil erosion, and aquatic plant die-off (such as curly-leaf pondweed). Phosphorus can also be released from sediments when dissolved oxygen concentrations are very low.

- **BCWMC/MPCA shallow lakes standard:** Summer average of 60 micrograms per liter (µg/L) or less
- **2025 range:** Low of 24 µg/L in mid-April to a high of 52 (µg/L in early September, Figure 2)
- **2025 summer average:** 38 µg/L (met BCWMC/ MPCA shallow lakes standard, Figure 2)

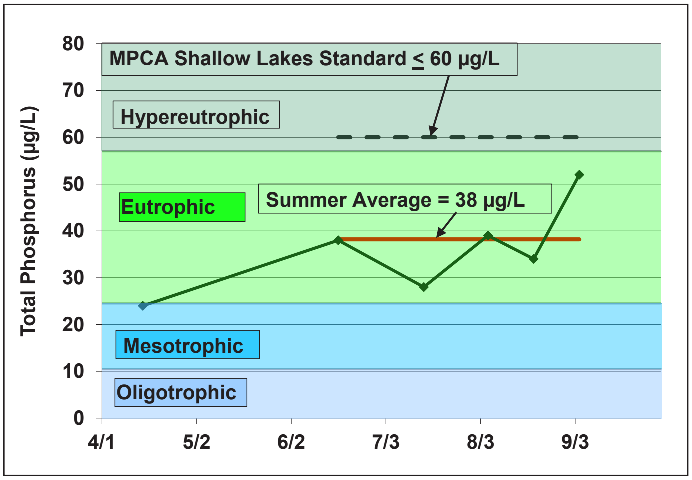


Figure 2: 2025 total phosphorus trends

Chlorophyll *a* levels

Chlorophyll *a* is a pigment in algae and generally reflects the amount of algae growth in a lake. Lakes that appear clear generally have chlorophyll *a* levels below 15 µg/L.

- **BCWMC/MPCA shallow lakes standard:** 20 µg/L or less
- **2025 range:** Low of 3 µg/L in mid-April to a high of 17 µg/L in early August (Figure 3)
- **2025 summer average:** 12 µg/L (met BCWMC/ MPCA shallow lakes standard, Figure 3)

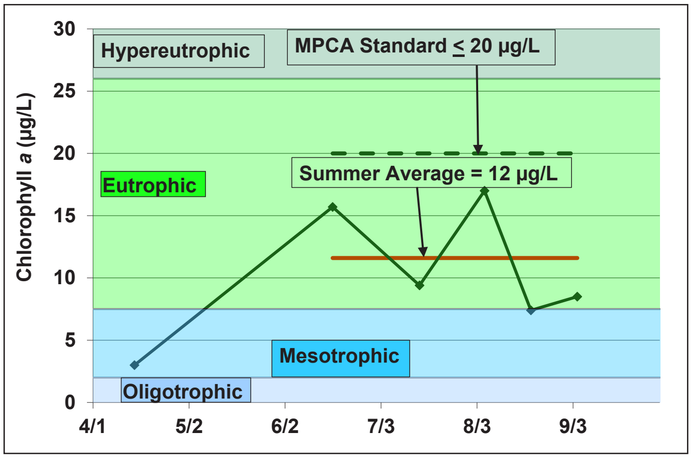


Figure 3: 2025 chlorophyll *a* trends

Water clarity

Water clarity is often affected by the amount of algae or other suspended material in a lake. It is usually measured by lowering an 8-inch "Secchi" disc into the lake and recording the depth at which it disappears from eyesight. The deeper the disc is visible, the better the water clarity.

- **BCWMC/MPCA shallow lakes standard:** 1.0 meter or more
- **2025 range:** Low of 0.6 meters in early August and early September to a high of 1.2 meters in mid-July (Figure 4)
- **2025 summer average:** 0.8 meters (fails to meet BCWMC/MPCA shallow lakes standard, Figure 4).

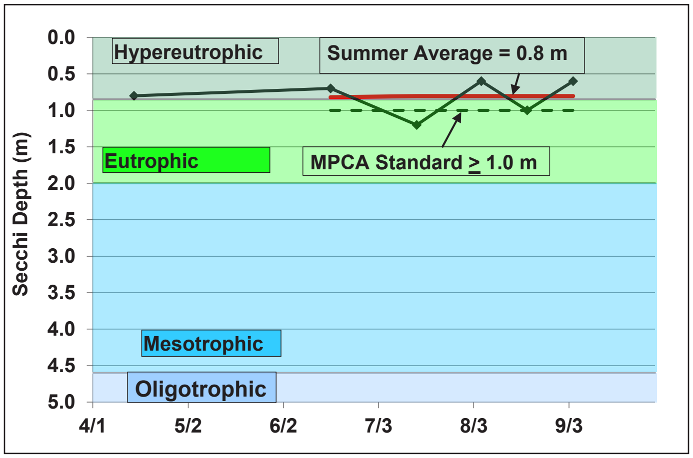


Figure 4: 2025 water clarity (Secchi disc depth) trends

Historical trends (1972–2025)

Crane Lake's summer water quality has been monitored since 1972. Figures 5 through 7 show summer averages (June through September) for total phosphorus from 1975 to 2025 and for chlorophyll *a* and Secchi disc depth from 1977 to 2025. Over this period, 48 percent of the total phosphorus averages, 54 percent of chlorophyll *a* averages, and 46 percent of Secchi disc averages met Minnesota State Water Quality Standards for shallow lakes in the North Central Hardwood Forest Ecoregion under Minnesota Rules (Minn. R. Ch. 7050.0222 Subp. 4).

All total phosphorus and chlorophyll a summer averages from 2004 through 2025 met the MPCA standards. The lake's dense plant growth limited Secchi depth to the top of plants in 2016 (0.9 meters), 2021 (0.7 meters), and 2025 (0.8 meters) and these depths failed to meet MPCA standards.

Trend analysis for the past 26 years shows:

- Declining summer average total phosphorus concentrations. Declines from 2016 through 2025 are likely due to dense growths of bearded stonewort, a plant that obtains all of its nutrients from the water.
- Nearly negligible change in summer average chlorophyll *a* concentrations over the 26-year period (0.02 µg per year).
- Declining summer average Secchi disc depths from 2016 through 2025 were due to dense plant growths that limited Secchi depth to the top of the plants.
- The decline in total phosphorus and increase in chlorophyll *a* were not statistically significant at the 95 percent confidence level, but the decline in Secchi disc depth was significant.

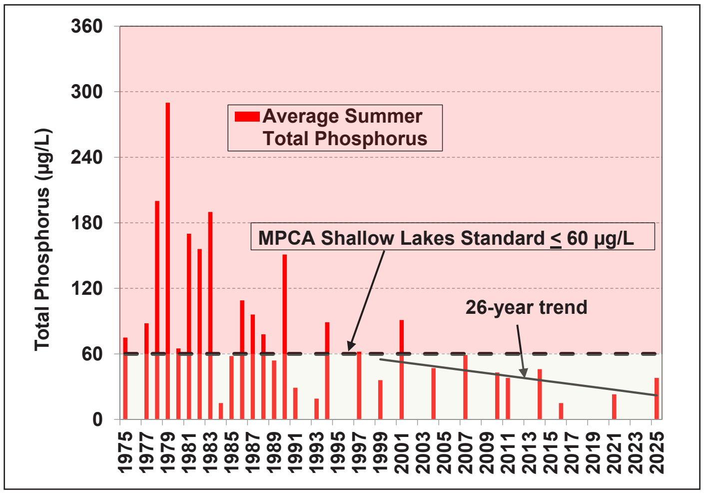


Figure 5: Historical total phosphorus trends

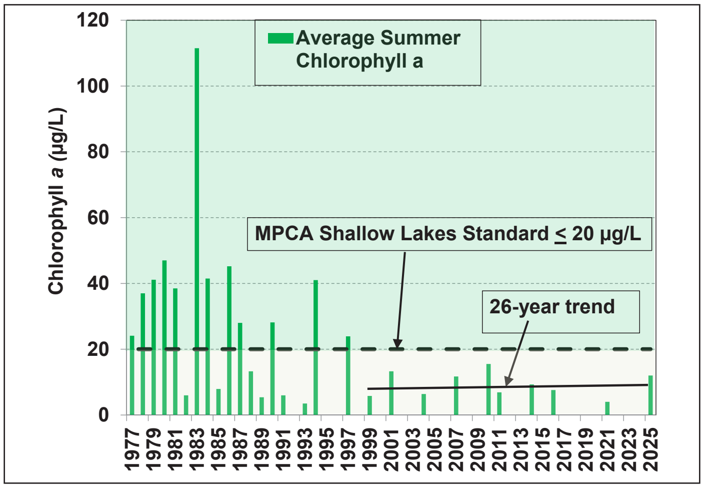


Figure 6: Historical chlorophyll *a* trends

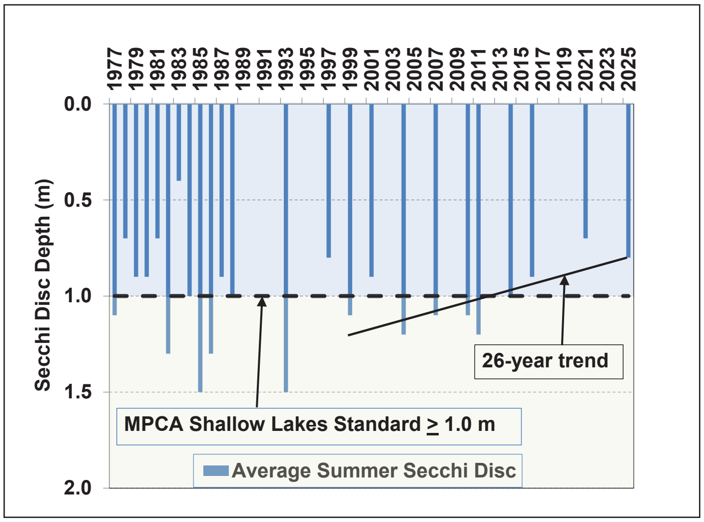


Figure 7: Historical water clarity (Secchi disc depth) trends

Chloride levels: 1972 through 2025

Chloride concentrations in area lakes have increased since the early 1990s, when many government agencies switched from sand or sand/salt mixtures to salt for winter road maintenance. When snow and ice melt, the salt goes with it, washing into lakes, streams, wetlands, and groundwater. It only takes 1 teaspoon of road salt to pollute 5 gallons of water to a point where it can no longer support freshwater life. The pollution is essentially permanent, as there is no easy or affordable way to remove chloride from water.

Because high chloride concentrations can harm fish, zooplankton, and plant life, the MPCA has established maximum and chronic chloride standards. The maximum standard is the highest concentration of chloride that aquatic organisms can be exposed to for a brief time with zero-to-slight mortality. The chronic standard is the highest chloride concentration to which aquatic life can be exposed indefinitely without causing chronic toxicity. Chronic toxicity is defined as a stimulus that lingers or continues for a long period, often one-tenth of the life span or more. Chronic effects can include mortality, reduced growth, reproductive impairment, harmful behavioral changes, and other nonlethal effects. A lake is considered impaired for chlorides if two or more measurements exceed the chronic criterion (230 mg/L) within a 3-year period or if one measurement exceeds the maximum criterion (860 mg/L).

Chloride measurements collected in Crane Lake from 1972 to 2025 are shown in Figure 8; chloride trends during this period are shown in Figure 9.

2025 chloride measurements ranged from 237 mg/L in late August to 369 mg/L in mid-June; the annual average chloride concentration was 291 mg/L. All measurements were above the chronic chloride standard and below the maximum. Crane Lake is listed on the MPCA's impaired waters list as impaired for chlorides.

Trend analyses indicate a statistically significant upward trend in chloride concentrations over the 54-year period of record at the 95-percent confidence level. Chloride concentrations measured from 1972 through 1988 were below the MPCA chronic chloride standard, except for three exceedances: 267 mg/L in June 1976, 287 mg/L in June 1977, and 268 mg/L in late August 1977. More than 50 percent of chloride concentrations estimated using specific conductance measurements from 1997–2011 exceeded the MPCA chronic chloride standard.

In 2016, measured chloride concentrations exceeded the chronic standard from April–August and declined below the standard in September. Chloride concentrations in the

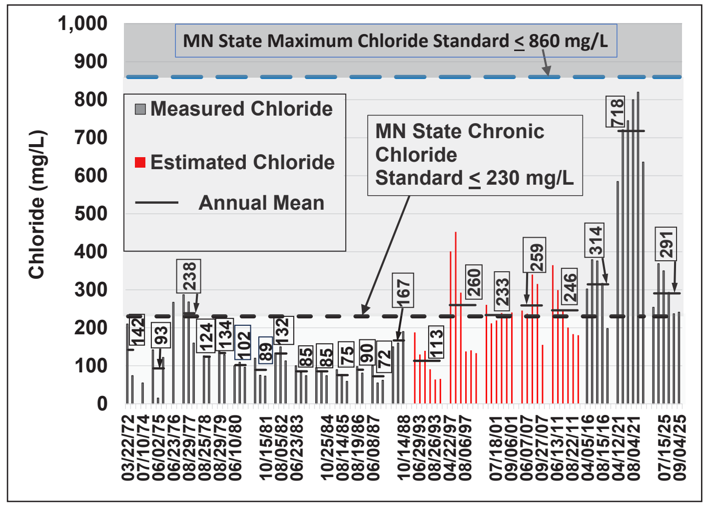


Figure 8: Historical chloride concentrations

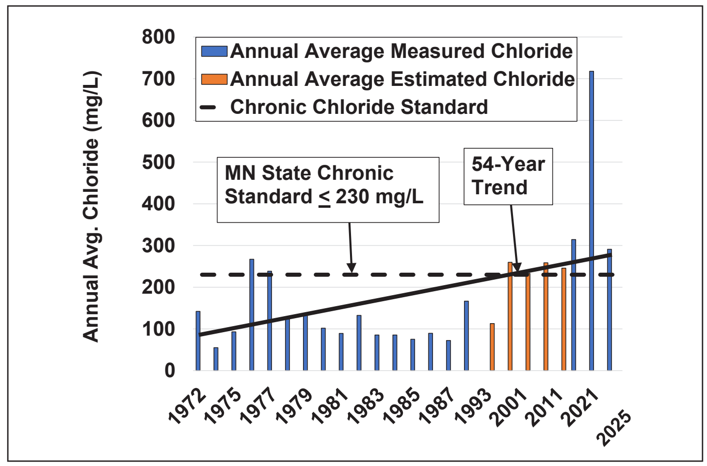


Figure 9: Historical chloride trends

lake doubled between 2016 and 2021, and all measured concentrations in 2021 exceeded the MPCA chronic chloride standard. All chloride concentrations measured in 2025 also exceeded the chronic chloride standard, although concentrations were lower than those observed in 2021.

Much more detailed information on chloride concentrations and their sources are found in the feasibility study for the Crane Lake Chloride Reduction Demonstration Project.

Macrophytes (aquatic plants): Lake plant eutrophication index of biological integrity (IBI)

Eutrophication (excessive nutrients) can have detrimental effects on a lake, including reducing the quantity and diversity of plants. The MNDNR developed a lake plant eutrophication index of biological integrity (IBI) to measure the response of a lake plant community to eutrophication. The lake plant eutrophication IBI includes two metrics: (1) the number of species in a lake and (2) the "quality" of the species, as measured by the floristic quality index (FQI). The MNDNR has determined a threshold for each metric. Lakes that score below the thresholds contain degraded plant communities and are likely stressed from anthropogenic (human-caused) eutrophication.

Crane Lake plant survey data from 1993 to 2025 were assessed to determine Plant IBI trends. Figure 10 shows the number of species and Figure 11 shows FQI scores for that period, compared with the MNDNR Plant IBI thresholds.

- **Number of species:** A shallow lake, such as Crane Lake, meets the MNDNR Plant IBI threshold when at least 11 species are present. During the period examined, the number of species in Crane Lake ranged from 5 to 15, exceeding the MNDNR Plant IBI threshold during June and August of 2007, 2016, 2021, and 2025.
- **FQI values (quality of species):** The MNDNR Plant IBI threshold for shallow lakes, as measured by FQI, is a minimum value of 17.8. During the period examined, FQI values in Crane Lake ranged from 10.7 to 20.7, exceeding the MNDNR Plant IBI threshold during August 2001, June and August 2007, June and August 2016, August 2021, and June and August 2025. The August 2025 value of 20.7 was the highest FQI value recorded to date.
- **2025 results:** The number of species and FQI values in the lake were better than the MNDNR Plant IBI thresholds in June and August.

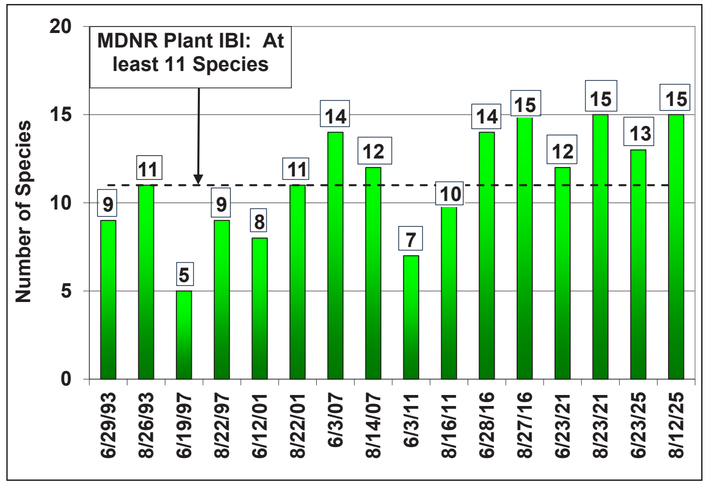


Figure 10: MNDNR plant IBI: number of species

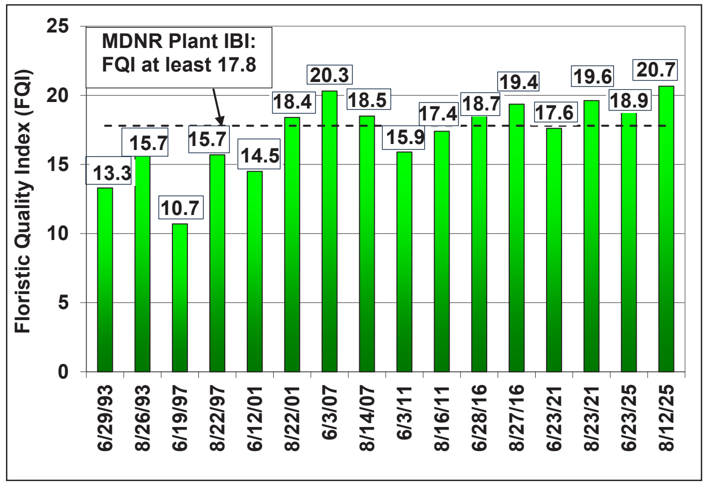


Figure 11: MNDNR plant IBI: floristic quality index (FQI)

Bearded stonewort in Crane Lake

In 2016, *Lychnothamnus barbatus* (bearded stonewort) was first observed in Crane Lake. This plant was found in nearby Westwood Lake (and Minnesota) for the first time in 2015. Bearded stonewort is in the family Characeae, algae that resemble rooted aquatic plants. Bearded stonewort obtains all of its nutrients from the water and can reduce phosphorus concentrations in a lake, improving water quality.

In 2016, bearded stonewort grew densely throughout the lake and dominated the plant community. Despite this, the lake maintained a diverse plant community that met plant IBI standards. Its frequency was similar in June (84 percent) and August (87 percent) of 2016 and in June 2021 (84 percent). From June to August 2021, bearded stonewort increased markedly, occurring at 98 percent of sample points by August. Its density also rose substantially during that period, with the share of sample points at the maximum density of 3 on a 1-to-3 scale increasing from 71 percent in June to 89 percent in August.

In 2025, bearded stonewort occupied most of the lake's littoral zone in June and, by August, formed a dense canopy at or just below the water's surface. Despite this, the lake continued to support a diverse plant community that met plant IBI standards. Its frequency increased from 80 percent of sample points in June to 90 percent in August. Density also rose, with 70 percent of sample points at the maximum rake fullness of 3 in June and 82 percent in August.

Aquatic invasive species

In 2025, three aquatic invasive species were present in Northwood Lake. Invasive species are detrimental to habitats because they spread rapidly and displace native species.

- **Curly-leaf pondweed (*Potamogeton crispus*):** Curly-leaf pondweed was first observed in Crane Lake in 1993 and was documented in 38 percent of plant surveys conducted between 1993 and 2025. In June 2025, it was found at five of the 125 sample locations, but it was not observed in August.

- **Purple loosestrife (*Lythrum salicaria*):** This emergent species has consistently been found at one or two locations along the lake's shoreline since 1993. In 2025, it was found at five locations in June and three in August. Purple loosestrife-eating beetles (*Galerucella*) were present on the plants during both surveys, and extensive beetle-related damage was noted. This damage indicates the beetles are effectively controlling purple loosestrife.

- **Hybrid cattail (*Typha glauca*):** Hybrid cattail was first observed at a single location along the northern shoreline in 2016. In 2021, it was found at a single location along the southern shoreline. In 2025, it was identified at five locations along the northern, southern, and eastern shorelines in June and three locations along the northern and southern shorelines in August.

Phytoplankton and zooplankton

Phytoplankton, or algae, are small aquatic plants naturally present in lakes. Phytoplankton derive energy from the sun through photosynthesis and provide food for several types of aquatic organisms, including zooplankton (microscopic animals), which are, in turn, eaten by fish. An inadequate phytoplankton population limits a lake's zooplankton population and indirectly limits fish production in a lake. Excess phytoplankton can reduce water clarity and dissolved oxygen.

Phytoplankton samples were collected from Crane Lake to assess water quality and the food resources available to zooplankton. Figure 12 summarizes the abundance and major phytoplankton groups observed in the lake from 1980 to 2025. Green algae, diatoms, and cryptomonads—important food sources for zooplankton—were well represented. Summer average phytoplankton densities from 2011 to 2025 showed little variation and remained consistent with good water quality, ranging from 4,181 units per milliliter in 2021 to 6,559 units per milliliter in 2025. These values were at the lower end of the summer averages recorded from 1980 to 2007, which ranged from 3,279 units per milliliter in 1993 to 39,846 units per milliliter in 1986.

Unlike phytoplankton, zooplankton do not produce their own food. As "filter feeders," they eat millions of small algae; given the right quantity and species, they can filter the volume of an entire lake in a matter of days. They are also valuable food for planktivorous fish and other organisms. Fish generally select the largest zooplankters they see and prefer cladocerans to copepods. Cladocerans swim slowly and lack the copepods' ability to escape predation by jerking or jumping out of the way.

Figure 13 summarizes the number and major zooplankton groups observed in Crane Lake for the monitored years. In 2025, small rotifers—the least preferred prey for fish—dominated the zooplankton community in April, June, late August, and September. Copepods were also common and dominated in July and early August. Summer average cladoceran abundance (12,370 per square meter) was more than an order of magnitude lower than summer averages for copepods (242,507 per square meter) and rotifers (693,622 per square meter). This low cladoceran abundance likely reflects fish predation. In shallow lakes, cladocerans are often scarce because they lack a deep-water refuge from fish. In deeper lakes, deeper water can provide enough oxygen for zooplankton but too little for fish, so cladoceran abundance is often higher.

The increase in chloride concentrations in 2021 negatively affected the zooplankton community, whereas the lower chloride concentrations measured in Crane Lake in 2025 had a positive effect. Studies have shown declines in adult cladocerans and copepods at chloride concentrations within the range measured in Crane Lake in 2021, while immature copepods (nauplii) and rotifers were less affected. In Crane Lake, summer-average abundance changed as follows:

- Cladocerans declined from 76,593 per square meter in 2016 to 1,698 per square meter in 2021, then increased to 12,370 per square meter in 2025.
- Adult copepods declined from 43,481 per square meter in 2016 to zero in 2021, then increased to 3,404 per square meter in 2025.
- Immature copepods declined from 242,048 per square meter in 2016 to 12,149 per square meter in 2021, then increased to 239,103 per square meter in 2025.
- Rotifers declined from 399,777 per square meter in 2016 to 120,993 per square meter in 2021, then increased to 693,622 per square meter in 2025.

The 2025 summer average number of zooplankton in Crane Lake was higher than all but three summer averages from 1980 through 2021.

Over the past 54 years, chloride concentrations in Crane Lake have increased significantly at the 95-percent confidence level, reducing zooplankton species diversity. Studies have similarly documented lower zooplankton diversity with increasing chloride concentrations. Consistent with those findings, the number of zooplankton species in Crane Lake has declined over the past 46 years, and trend analysis indicates that this decline is significant at the 95-percent confidence level (see Figure 14). Zooplankton abundance also declined over the same period, but that trend was not significant at the 95-percent confidence level (see Figure 15).

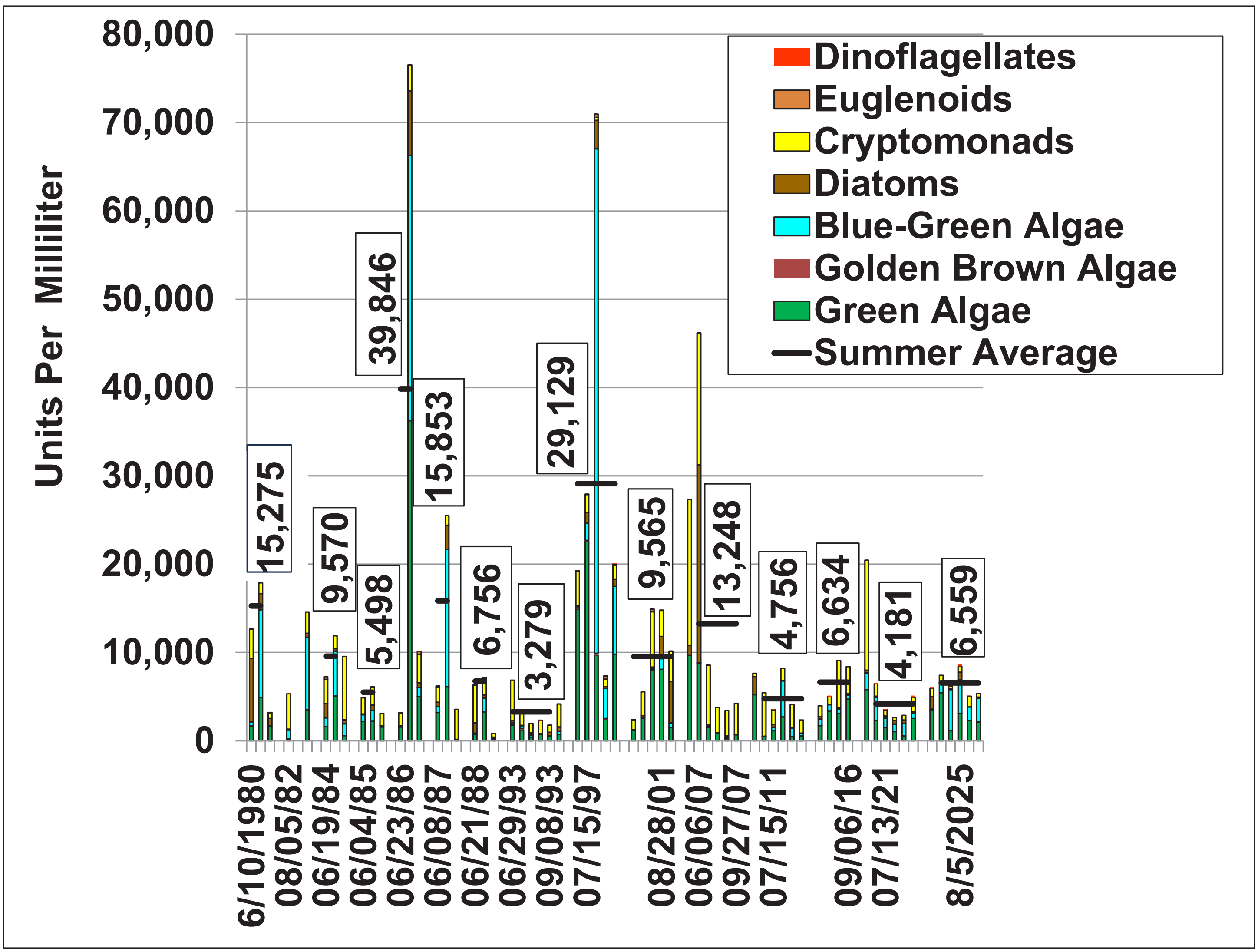


Figure 12: Historical phytoplankton

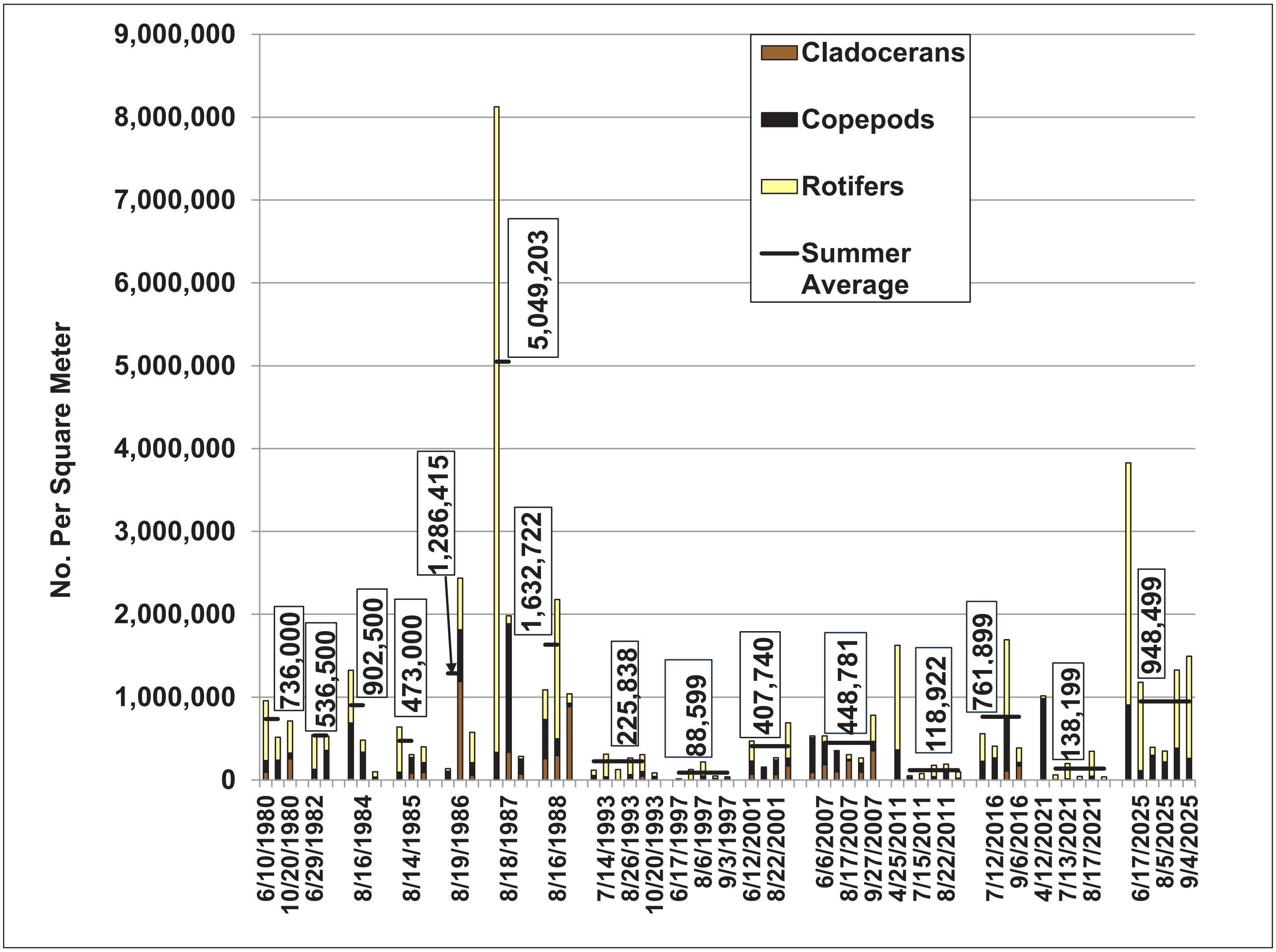


Figure 13: Historical zooplankton

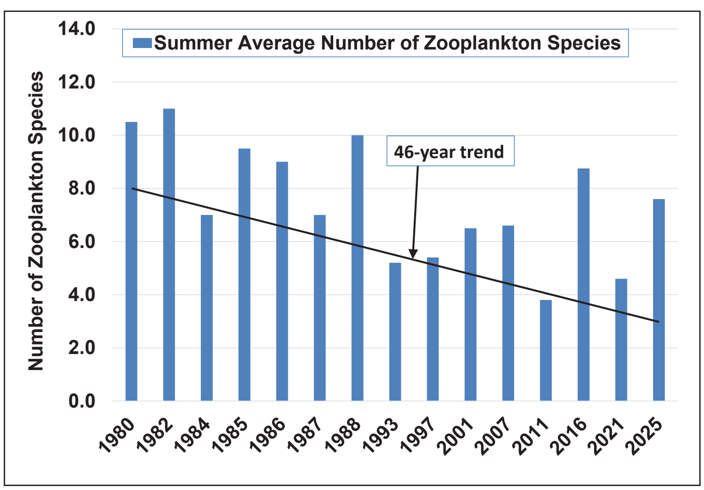


Figure 14: Historical trends in zooplankton diversity

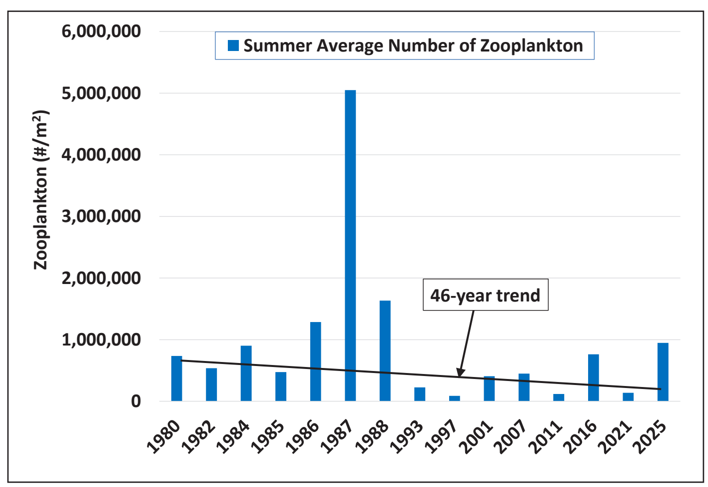


Figure 15: Historical trends in zooplankton abundance