Item 5C.
BCWMC 7-21-22

Westwood Lake 2021 water quality monitoring

The Bassett Creek Watershed Management Commission (BCWMC) has monitored water quality conditions in the watershed's 10 priority lakes since 1972. This monitoring is done to detect changes or trends in water quality and evaluate the effectiveness of efforts to preserve or improve water quality. A summary of 2021 monitoring efforts on Westwood Lake is provided below; more comprehensive information can be found on pages 2–6.

At a glance: 2021 monitoring results

In 2021, the BCWMC monitored Westwood Lake for:

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

Results of 2021 monitoring show that Westwood Lake met the applicable Minnesota Pollution Control Agency (MPCA) and Bassett Creek Watershed Management Commission (BCWMC) water quality standards for total phosphorus, chlorophyll *a*, Secchi disc (a measure of clarity), and chlorides. Trend analyses show no significant changes in Secchi disc, total phosphorus, or chlorophyll *a* over the past 10 years. Other results include:

- Westwood Lake has a healthy and diverse aquatic plant community.
- 2021 phytoplankton and zooplankton numbers were within the range observed since 1982.
- The results of an aquatic invasive species (AIS) suitability analysis indicate that Westwood Lake's water quality meets the requirements for rusty crayfish, zebra mussels, and starry stonewort but only partially meets the suitability requirements for spiny waterflea, faucet snail, and Chinese mystery snail. Hence, these species would likely survive but may not thrive in Westwood Lake.

About Westwood Lake

BCWMC classification	Priority-1 shallow lake
Watershed area	463 acres
Lake size	38 acres
Average depth	4.2 feet
Maximum depth	6 feet
Ordinary high water level	887.8 feet (NGVD29)
Normal water level	887.6 feet (NAVD88)
Downstream receiving waterbody	Main stem Bassett Creek
Location (city)	St. Louis Park
MPCA impairments	None
Aquatic invasive species	Curly-leaf pondweed, purple loosestrife, narrow-leaved cattail, reed canary grass
Public access	Yes (canoe access in park)

Recommendations

- Continue to provide education and information to the Westwood Hills Nature Center and lake users to reduce the chance of AIS introduction
- Continue water quality and biological monitoring at a 3-year frequency

Water chemistry monitoring: 2021

Total phosphorus levels

While phosphorus is necessary for plant and algae growth, excessive phosphorus leads to excessive growth, decreased water clarity, and water quality impairment.

- BCWMC/MPCA standard: 60 micrograms per liter (µg/L) or less
- Range: Low of 18 µg/L in early September to a high of 36 µg/L in early August
- Summer average: 27 µg/L (met BCWMC/MPCA standard)

Chlorophyll *a* levels

Chlorophyll *a* is a pigment in algae and generally reflects the amount of algae growth in a lake. Lakes with clear water generally have chlorophyll *a* levels less than 15 micrograms per liter (µg/L).

- BCWMC/MPCA standard: 20 µg/L or less
- Range: Low of 2.2 µg/L in early September to a high of 8.5 µg/L in April, mid-August, and October
- Summer average: 5.0 µg/L (met BCWMC/MPCA standard)

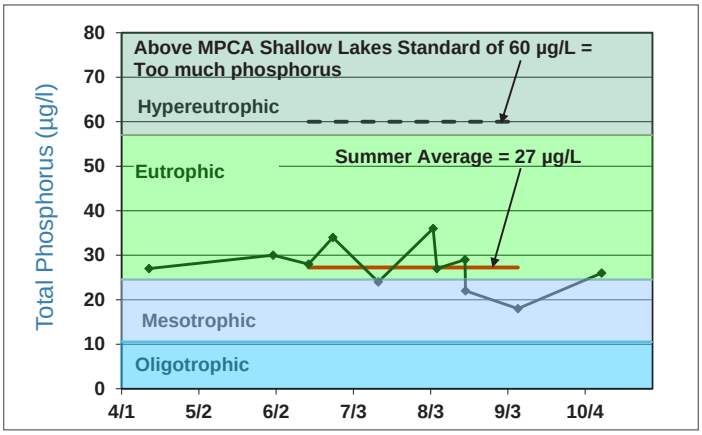
Water clarity

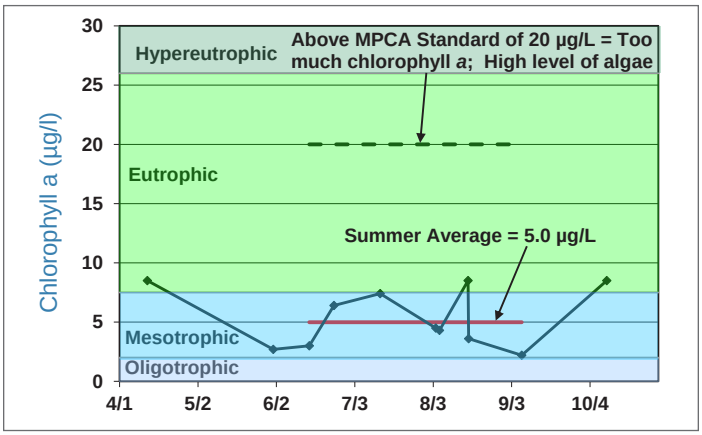
Water clarity is affected by the amount of algae and other suspended materials in a lake. It is usually measured by lowering an 8-inch "Secchi" disc into the lake (see bottom photo); the depth at which the disc's alternating black-and-white pattern is no longer visible is considered a measure of the water's transparency or clarity.

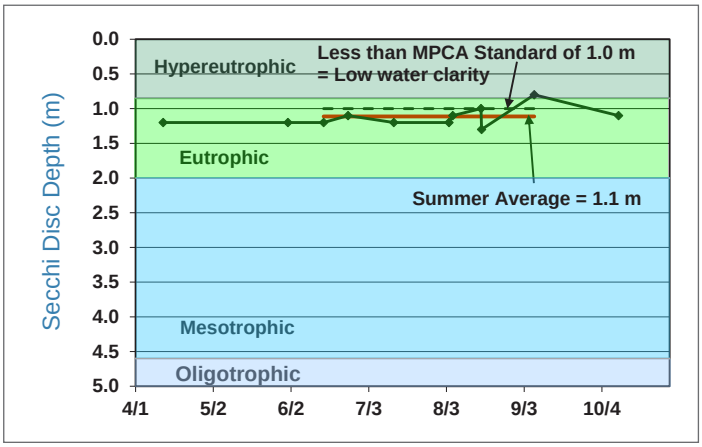
- BCWMC/MPCA standard: 1.0 meter or more.
- Range: From the lake bottom during April through July (1.2 meters) and mid-August (1.3 meters) to the top of submerged aquatic plants during early August (1.2 meters) and early September (0.8 meters)
- Summer average: 1.1 meters (met BCWMC/MPCA standard)

Definitions

- **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
- **Hypereutrophic:** Nutrient-rich lake conditions characterized by frequent and severe algal blooms and low transparency
- **Mesotrophic:** Lake condition characterized by medium levels of nutrients and clear water
- **Oligotrophic:** Lake condition characterized by a low level of dissolved nutrients, high oxygen content, and sparse algae growth







Water chemistry monitoring from 1977–2021: historical trends

Summer water quality in Westwood Lake has been monitored since 1977. Data have been collected by BCWMC (1977–2021) and the Citizen Assisted Monitoring Program (CAMP, 1993–2021). 2021 monitoring was done by BCWMC and the Citizen Assisted Monitoring Program (CAMP).

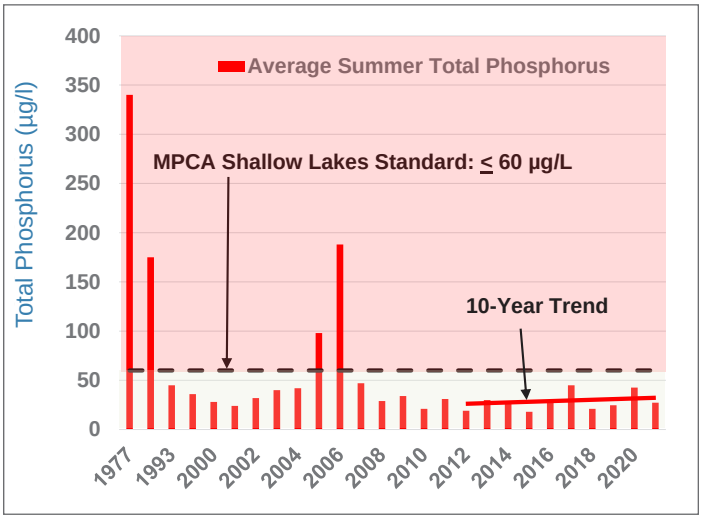
Summer averages (June through September) of total phosphorus, chlorophyll *a*, and Secchi disc depth from 1977–2021 are shown in the figures at right. In 1977 and 1982, these averages generally failed to meet BCWMC/MPCA standards but have generally met the standards since 1982. Exceptions include high chlorophyll *a* values in 2001, high total phosphorus values in 2005 and 2006, and a low Secchi disc depth in 2017. During the period of record, 85 percent of total phosphorus and 92 percent of chlorophyll *a* and Secchi disc summer averages met the Minnesota State Water Quality Standards for shallow lakes in the North Central Hardwood Forest Ecoregion, as published in Minnesota Rules (Minn. R. Ch. 7050.0222 Subp. 4). Summer averages of total phosphorus, chlorophyll *a*, and Secchi depth met the BCWMC/MPCA standards in 2021.

Trend analyses for the last 10 years show:

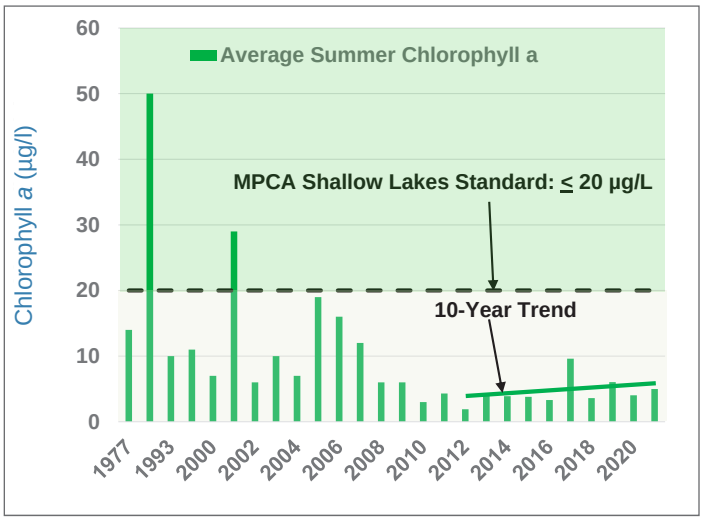
- Slightly increasing (worsening) summer average total phosphorus concentrations.
- Slightly increasing (worsening) summer average chlorophyll *a* concentrations.
- No change in summer average Secchi disc depths.

None of these changes are statistically significant (95-percent confidence level).

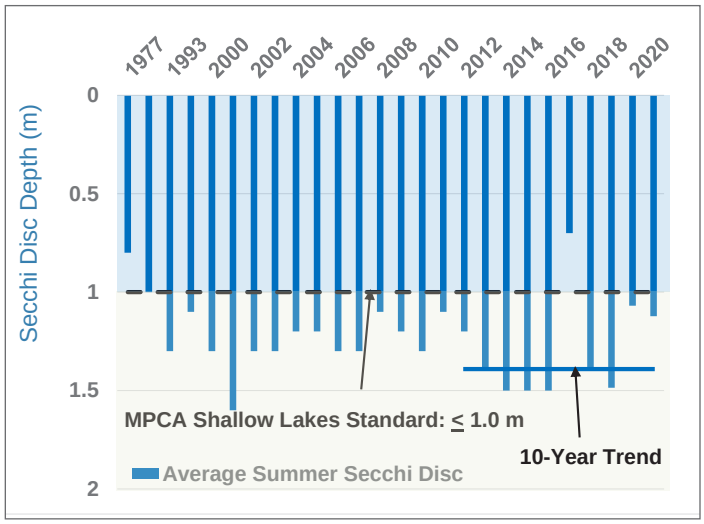
Total phosphorus trends



Chlorophyll *a* trends



Water clarity trends

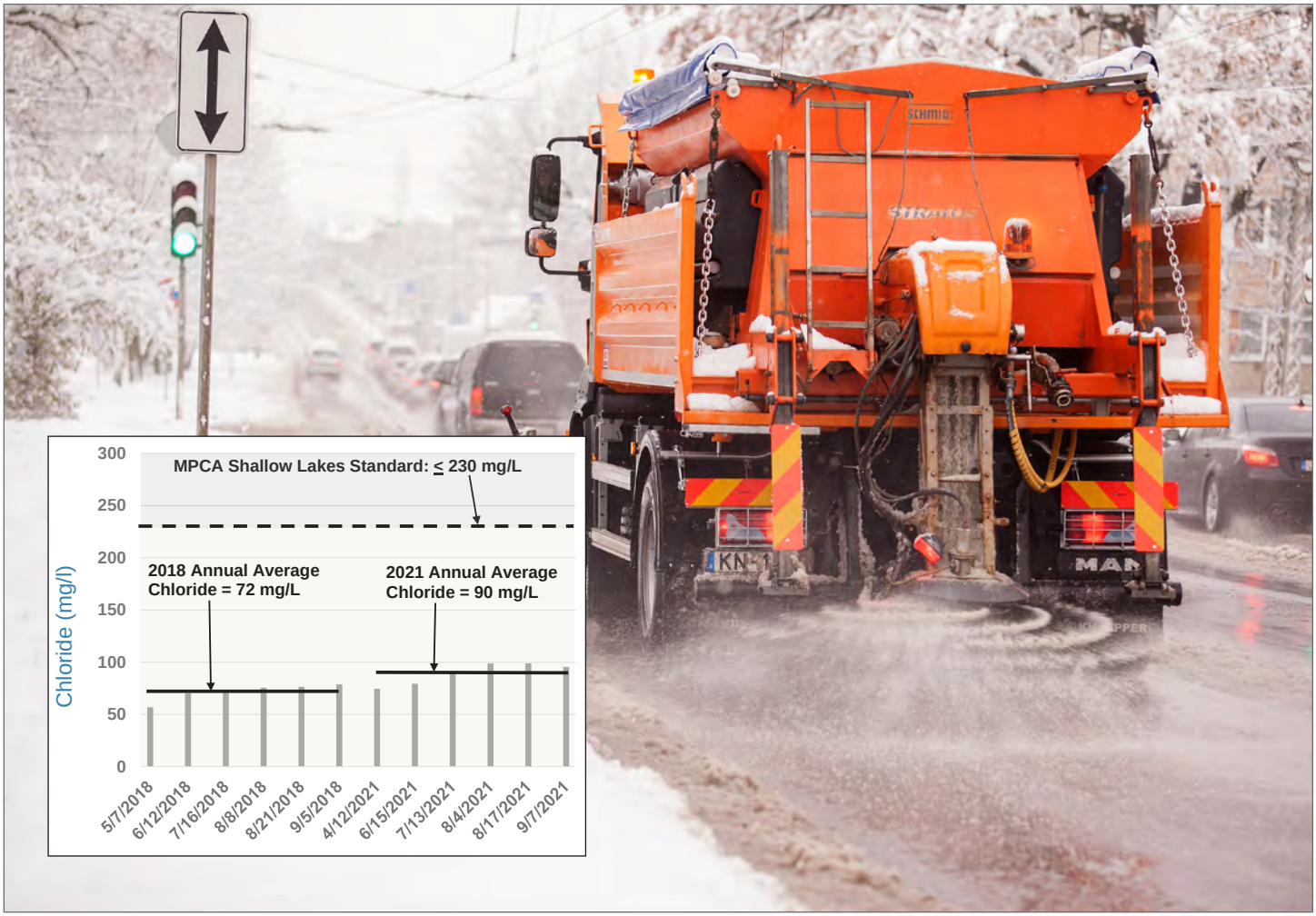


Chloride levels in 2018 and 2021

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 permanently pollute 5 gallons of water. And, once in the water, there is no way to remove chloride.

Because high chloride concentrations can harm fish and plant life, the MPCA 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 that 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 the life span or more. A chronic effect can be mortality, reduced growth, reproduction impairment, harmful changes in behavior, and other nonlethal effects. A lake is considered impaired 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).

All measurements during 2018 and 2021 were well below the maximum and chronic chloride standards. There was an increase in chloride between 2018 and 2021. The 2021 average annual chloride concentration (90 mg/L) was 25 percent higher than the 2018 average (72 mg/L) but well below the maximum and chronic chloride standards.



Increased use of chloride for road maintenance has had an impact on chloride levels in Twin Cities metro area lakes.

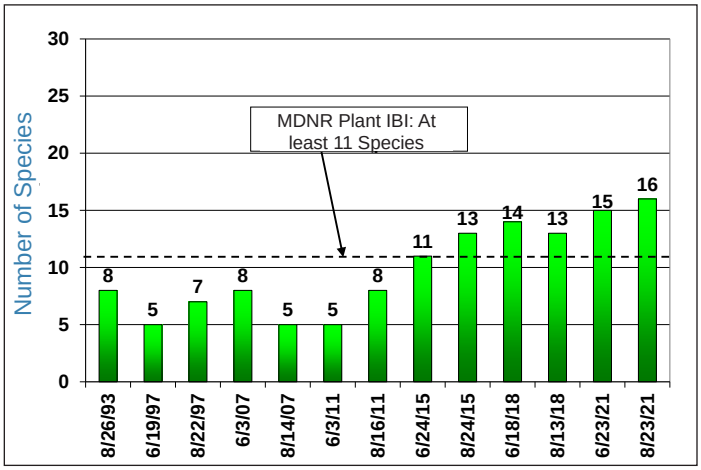
Macrophytes (aquatic plants)

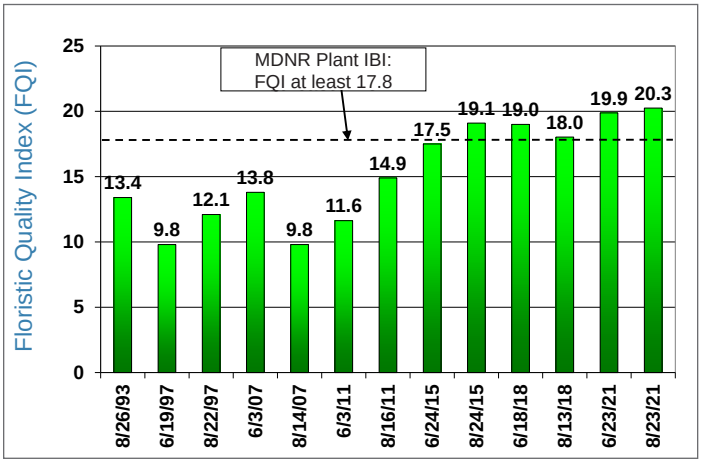
Lake Plant Eutrophication Index of Biological Integrity (IBI)

Eutrophication (excessive nutrients) may 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 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.

Plant survey data from 1993 to 2021 were assessed to determine Plant IBI trends. The figures at right show Westwood Lake FQI scores and the number of species for that period compared to the MNDNR Plant IBI thresholds.

- **Number of species:** A shallow lake such as Westwood Lake meets the MNDNR Plant IBI threshold when at least 11 species exist. During the period examined, the number of species in Westwood Lake ranged from 5 to 16, exceeding the MNDNR Plant IBI threshold from 2015 through 2021. Fifteen to 16 species were observed in the lake in 2021, the highest number to date.
- **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 Westwood Lake ranged from 9.8 to 20.3, bettering the MNDNR Plant IBI threshold from August 2015 through 2021. FQI scores from 19.9 to 20.3 were observed in 2021, the highest scores to date.
- **2021 results:** Both the number of species in the lake and FQI values were better than the MNDNR Plant IBI thresholds and improved in 2021.





Aquatic invasive species

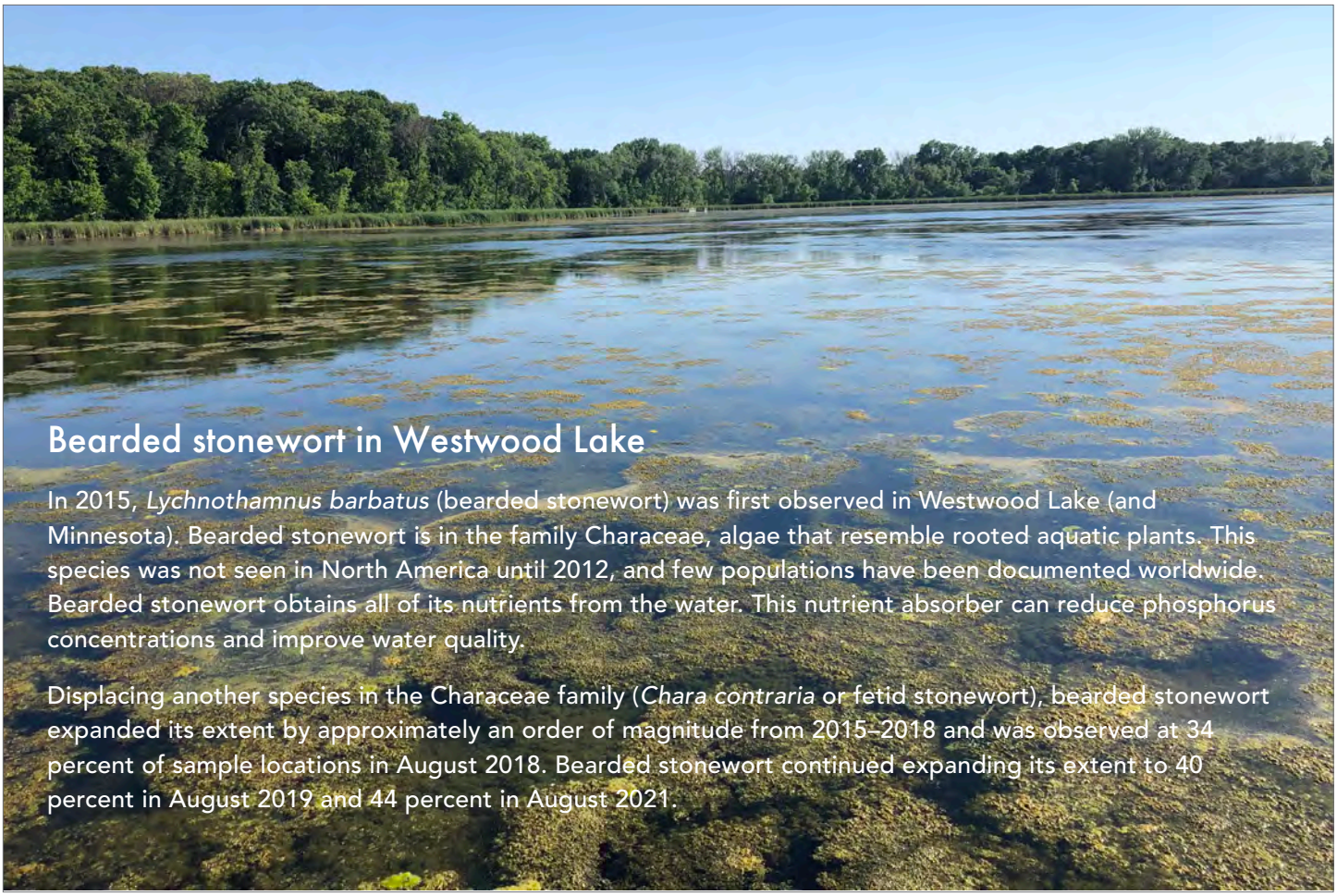
In 2021, four aquatic invasive species (AIS) were known to be present in Westwood Lake; no species was considered problematic.

- **Curly-leaf pondweed (*Potamogeton crispus*):** Though prevalent, the curly-leaf pondweed coexisted with native plants at relatively low densities.
- **Purple loosestrife (*Lythrum salicaria*):** This emergent species was found at five locations along the north shoreline in 2021. It was found at similar locations in 2015 and 2018.
- **Narrow-leaved cattail (*Typha angustifolia*):** Narrow-leaved cattail was observed at four locations along the northern shoreline in 2021. It was observed in similar locations in 2015 and 2018.
- **Reed canary grass (*Phalaris arundinacea*):** For the first time since monitoring began in 1993, reed canary grass was found in Westwood Lake in 2018—at three locations along the north shoreline in June and one location in August. In 2021, it was observed along the north shoreline at one location in both June and August. It has not expanded its footprint.

Suitability of Westwood Lake for AIS

Many aquatic invasive species (AIS) residing in Minnesota have not yet been observed in Westwood Lake but could be introduced. For example, both zebra mussels and starry stonewort are present in nearby Medicine Lake but have not yet been observed in Westwood Lake. A suitability analysis was performed to evaluate whether Westwood Lake water quality would support the introduction of six AIS (starry stonewort, zebra mussels, spiny waterflea, faucet snail, Chinese mystery snail, and rusty crayfish).

The analysis compared 2021 water quality in Westwood Lake with the water quality conditions required for each species, specifically evaluating total phosphorus, chlorophyll a, Secchi disc depth, trophic state index (TSI), water temperature, dissolved oxygen, specific conductance, calcium, magnesium, sodium, alkalinity, hardness, and calcium carbonate. The results indicate that the water quality of Westwood Lake meets the suitability requirements for rusty crayfish, zebra mussel, and starry stonewort but only partially meets the suitability requirements for spiny waterflea, faucet snail, and Chinese mystery snail. Hence, these species would likely survive but may not thrive in Westwood Lake.



Bearded stonewort in Westwood Lake

In 2015, *Lychnothamnus barbatus* (bearded stonewort) was first observed in Westwood Lake (and Minnesota). Bearded stonewort is in the family Characeae, algae that resemble rooted aquatic plants. This species was not seen in North America until 2012, and few populations have been documented worldwide. Bearded stonewort obtains all of its nutrients from the water. This nutrient absorber can reduce phosphorus concentrations and improve water quality.

Displacing another species in the Characeae family (*Chara contraria* or fetid stonewort), bearded stonewort expanded its extent by approximately an order of magnitude from 2015–2018 and was observed at 34 percent of sample locations in August 2018. Bearded stonewort continued expanding its extent to 40 percent in August 2019 and 44 percent in August 2021.

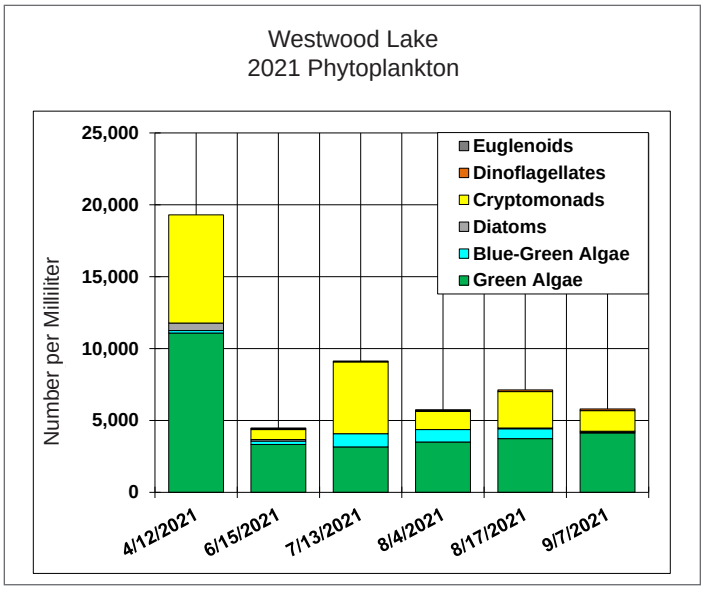
Phytoplankton and zooplankton

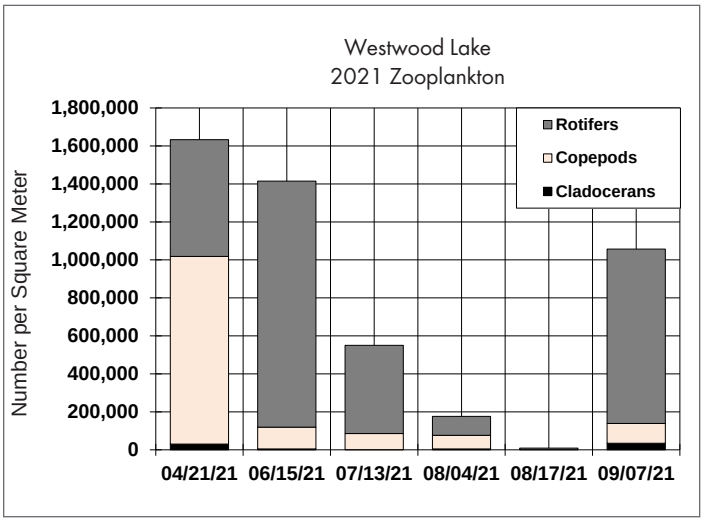
Samples of phytoplankton, microscopic aquatic plants, were collected from Westwood Lake to evaluate water quality and the quality of food available to zooplankton (microscopic animals). Phytoplankton numbers declined from April to June and remained low throughout the summer, indicating good water quality. Cryptomonads and green algae, good food sources for the lake's zooplankton, were dominant throughout the monitored period. Blue-green algae, associated with water quality problems and a potential source of health concerns, were present in very low numbers. 2021 phytoplankton numbers were within the range of observed since 1982.

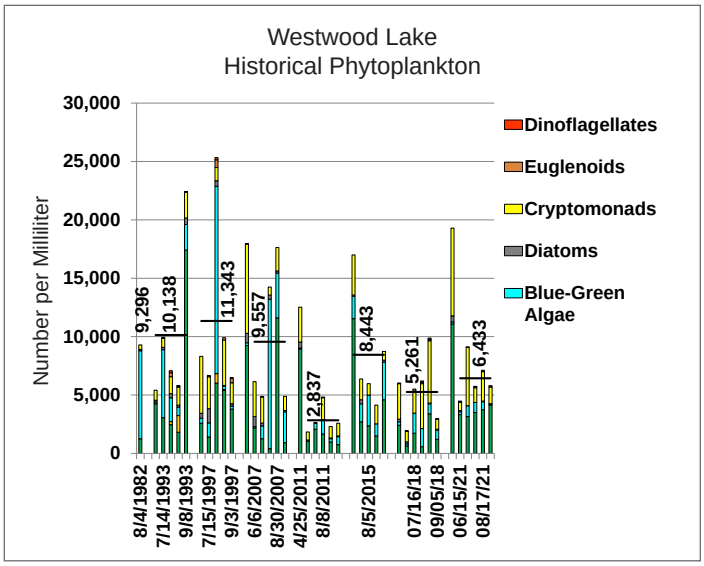
Unlike phytoplankton, zooplankton do not produce their own food. As "filter feeders," they eat millions of small algae; given the right quantity and species, they can filter the volume of an entire lake in a matter of days. They are also valuable food for planktivorous fish and other organisms.

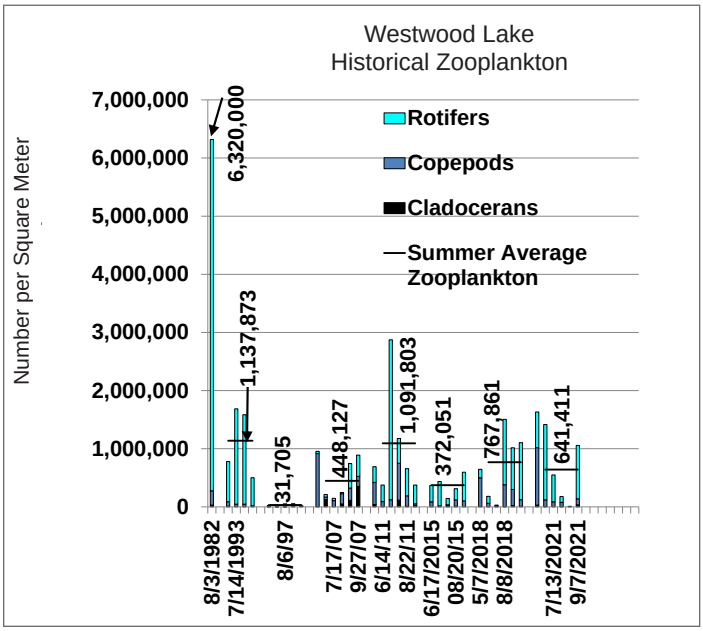
The 2021 zooplankton composition reflects the impact of fish predation on the community. Fish generally select the largest zooplankters they see and prefer cladocerans to copepods because they swim slowly and lack the copepods' ability to escape predation by jerking or jumping out of the way. Rotifers, the least preferred food for fish, dominated the community throughout 2021 (except for April), and copepods consistently occurred in higher numbers than cladocerans. Because rotifers and copepods do not graze as heavily on algae as the larger cladocerans, they generally have a limited impact on the lake's water quality. This suggests that future Westwood Lake water quality efforts should focus on phosphorus management to reduce the nutrients that contribute to algae growth.

2021 zooplankton numbers were within the range observed since 1982.









A Thank You to Our Volunteers

Each year volunteers from across the watershed participate in the Citizen Assisted Monitoring Program (CAMP) coordinated and funded by the Metropolitan Council with assistance and additional funding from the BCWMC. These volunteers spend hours on their lakes collecting water samples and data that augment data collected through BCWMC routine monitoring. Their work is an important piece of the overall BCWMC monitoring program and their time and dedication are greatly appreciated!

Bassett Creek Watershed Management Commission
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