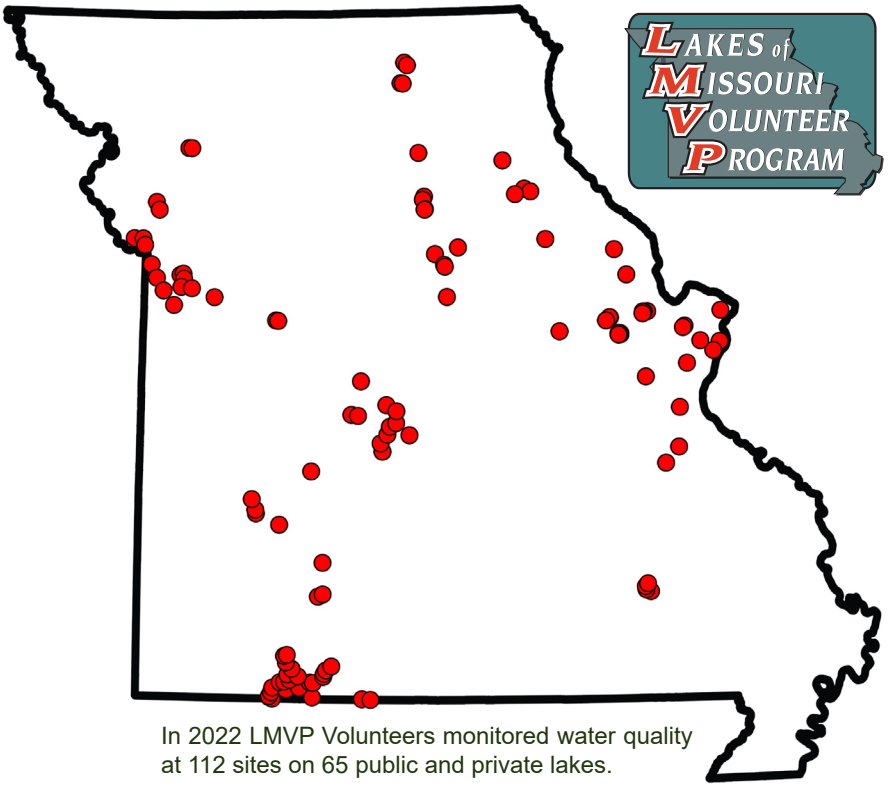
The Lakes of Missouri Volunteer Program
2022 LAKE REPORT

WWW.LMVP.ORG

A summary of 2022 water quality data

Lake Sites Monitored in 2022



In 2022 LMVP Volunteers monitored water quality at 112 sites on 65 public and private lakes.

University of Missouri

Missouri Department of Natural Resources

Environmental Protection Agency Region 7 through the Missouri Department of Natural Resources has provided partial funding for this project under Section 319 of the Clean Water Act. MoDNR Cooperative Agreement G22-NPS-02

Cover: A juvenile (eft) central newt crosses the road at Finger Lakes State Park (Boone County). Sarah Davis photo.

Data are available at LMVP.org

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Above: Several species of waterfowl visiting Sugar Creek Lake (Randolph County). Lynn Fair and Frank Fillo photo.

About the LMVP

The Lakes of Missouri Volunteer Program (LMVP) enlists volunteer scientists to track the effects of nonpoint source pollution in Missouri's lakes by measuring a variety of water quality elements. Using volunteer-generated data, we document water quality and patterns over time. When pollution problems occur, lake managers will use the information to apply remedies and measure the effectiveness of their efforts.

LMVP volunteers monitor at 3-week intervals from late spring to early fall. Samples are processed in the volunteers' homes using laboratory equipment provided by LMVP. The processed samples are stored in volunteers' freezers until picked up by LMVP staff. Samples are subsequently analyzed at the University of Missouri's Limnology Laboratory following accepted standard methods.

LMVP data are research quality and have been used in several scientific journal articles. One study* shows LMVP data to be of comparable quality to data collected by employees of the University of Missouri. The LMVP data set provides up to 30 years of quality data for some of Missouri's most popular lakes.

Hope Martin, Jessie Martin, and Arthur Davis-Stober collecting water samples on Finger Lake in Finger Lakes State Park. Sarah Davis photo.

*D. Obrecht, M. Milanick, B. Perkins, D. Ready and J. Jones. 1998. Evaluation of data generated from lake samples collected by volunteers. Lake Reserv Manag. 14, pp 21-27.

30 Years of LMVP

On April 11, 1992, Bob Epperson, Wanda Epperson, and Ron Fuhrken collected the first water sample for LMVP at Blue Springs Lake in Jackson County. According to the paperwork it was raining and 60 degrees. One hour later another group collected the second LMVP sample at nearby Prairie Lee Lake. Since that rainy day in 1992, LMVP volunteers have collected over 18,000 water samples from 314 locations on 141 Missouri lakes. These many measurements contribute to Missouri's impressive lake water quality data record and are instrumental in our state's efforts to reduce water pollution.

To celebrate our 30th anniversary, we held a gathering in Columbia to honor our volunteers and connect them with those who use the data. Several people gave short presentations about the origins of LMVP, how the data are used, and an emerging pollutant of concern, plastic. The event was held at Waves Cider Company and catered by Pizza Tree.

One of the volunteers who collected the first LMVP sample, Ron Fuhrken, is still collecting samples! He now samples at Longview Lake, also in Jackson County. Thirty years after that first sample was collected we trained a new volunteer to sample at nearby Prairie Lee Lake. With the continued support of our impressive volunteers, the Missouri Department of Natural Resources, and the Environmental Protection Agency, we plan to continue providing valuable lake water quality data for at least another 30 years.

Above: Volunteers past, present, and future gather in Columbia to celebrate the Lakes of Missouri Volunteer Program's 30th birthday.

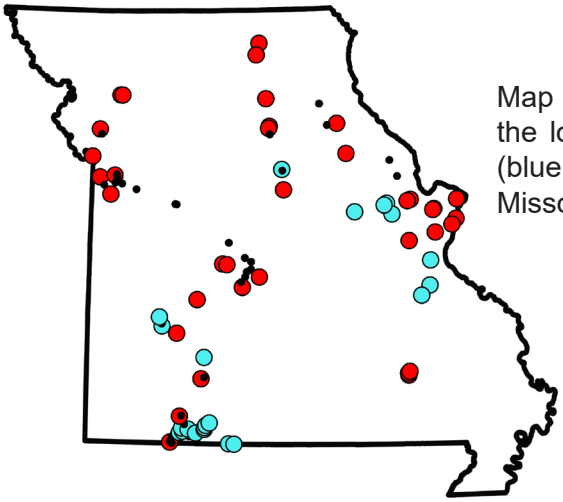
Water Clarity

When we see murky water, we assume water quality is poor. Conversely, when we see clear water, we assume the water quality is good. Of course, water quality is not that simple, but monitoring water clarity is a good way to track the things that make water turbid. In Missouri, those things are usually algae and sediment.

Water clarity is measured in lakes using the Secchi disk. Our volunteers lower this disk into the water until it is no longer visible and record the depth. The Secchi disk is the standard tool for lake water clarity measurement. The simplicity, low cost, and portability of the Secchi disk have ensured its continued use for over 150 years.

Missouri lakes historically, on average, have about 3 feet of clarity near the dam, and clarity decreases with distance from the dam. In 2022, the average LMVP volunteer-measured lake water clarity was 4.6 feet and our water clarity measurements ranged from 4 inches to over 21 feet.

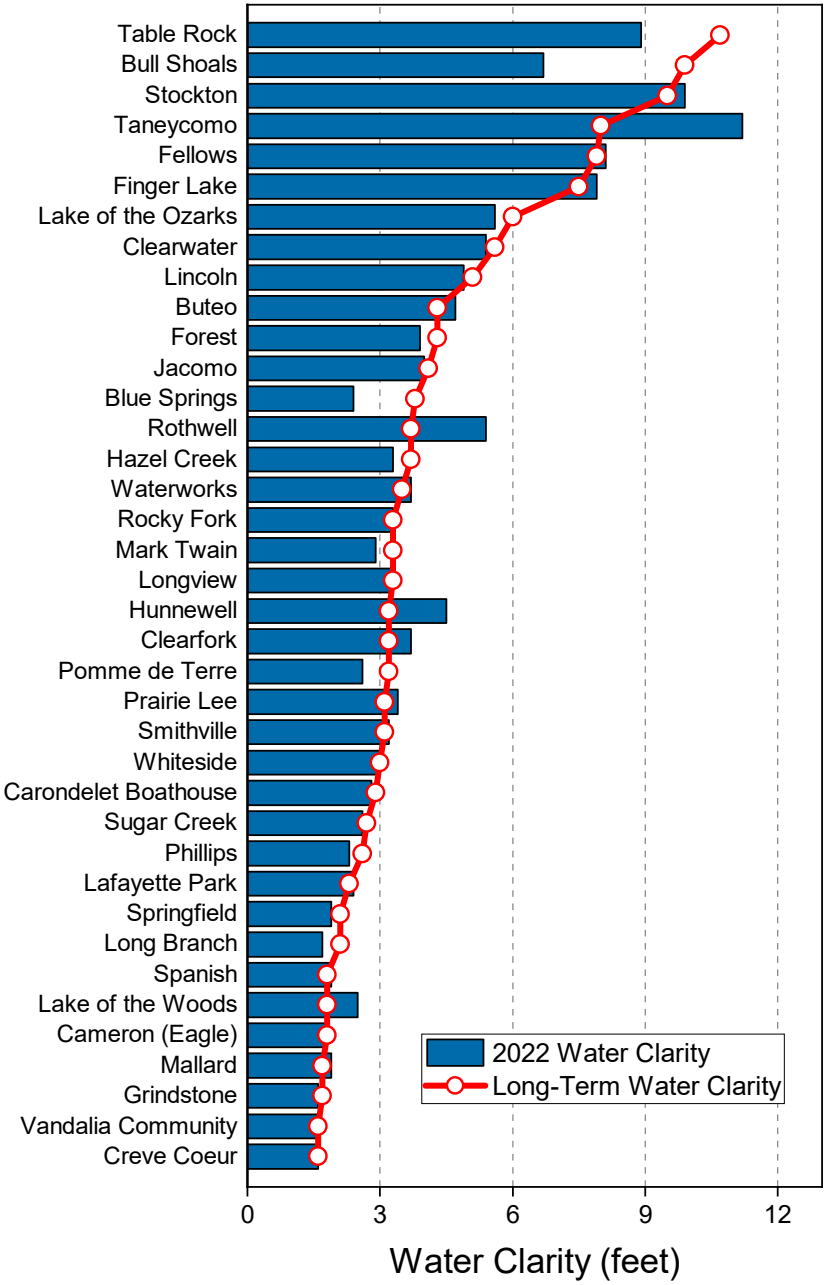
Micah Davis-Stober and Frank Klaas measuring water clarity in Finger Lakes State Park (Boone County). Sarah Davis photo.



Map shows lake sites with the lowest (red) and highest (blue) average water clarity in Missouri during 2022.

Water Clarity
- Secchi < 3 feet
- Secchi 3 - 6 feet
- Secchi > 6 feet

Average water clarity values for 38 public lakes monitored (at or near the dam) by LMVP volunteers in 2022 (bars). Long-term lake values shown in red.



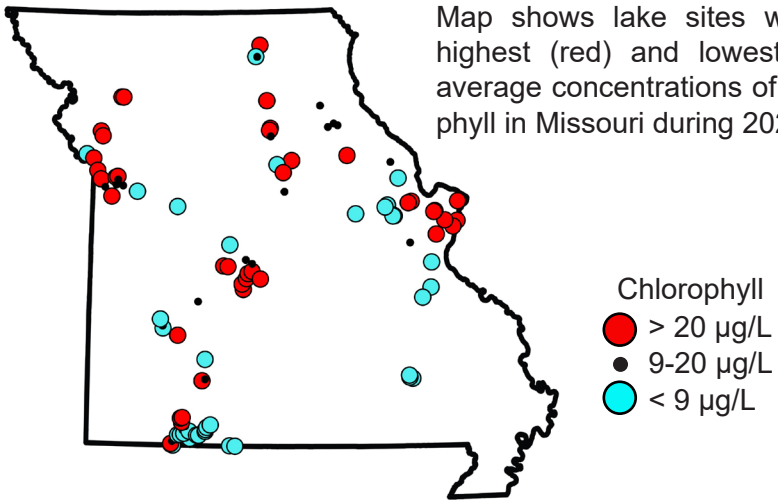
Chlorophyll

Phytoplankton (algae and cyanobacteria, or bluegreen algae) are tiny plant-like organisms found in lakes that use the sun's energy to convert CO_2 and nutrients into carbohydrates via photosynthesis. We estimate the amount of phytoplankton present by measuring the presence of the photosynthetic pigment, chlorophyll. High chlorophyll values indicate the presence of too much phytoplankton

Many organisms consume phytoplankton. These are in turn eaten by predators, moving the sun's energy through the food web. While phytoplankton are essential for other aquatic life, too much can be a problem. Phytoplankton populations can increase quite rapidly (bloom) in the presence of excess nutrients and throw the lake out of balance.

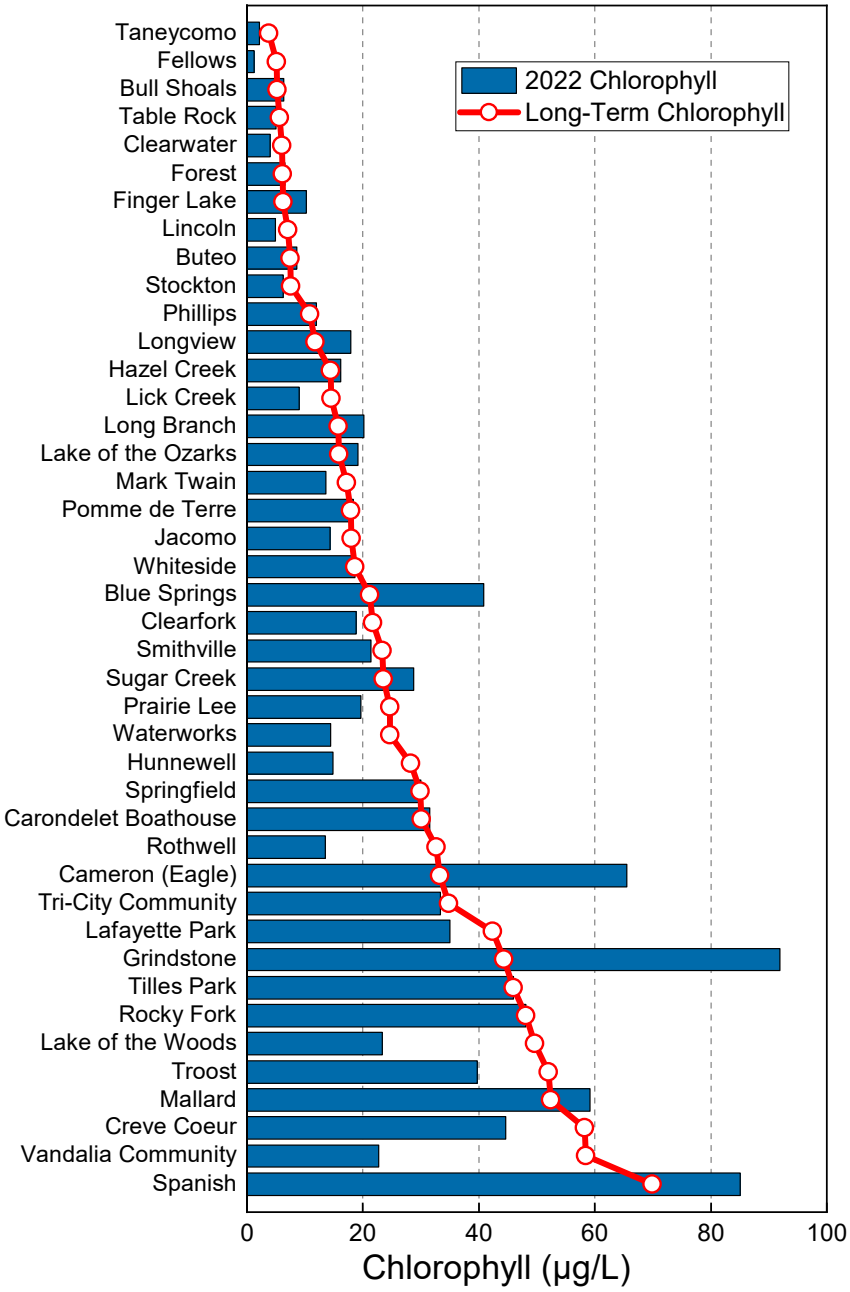
On average, Missouri lakes have around 21 µg/L of chlorophyll at the dam. The average 2022 LMVP chlorophyll value was 19.6 µg/L, with individual values ranging from 0.3 to 325.6 µg/L.

Sania and Zain Rehman preparing chlorophyll filters for analysis at Table Rock Lake. Anees Afroze photo.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of chlorophyll in Missouri during 2022.

Average chlorophyll values for 42 public lakes monitored (at or near the dam) by LMVP volunteers in 2022 (bars). Long-term lake values shown in red.



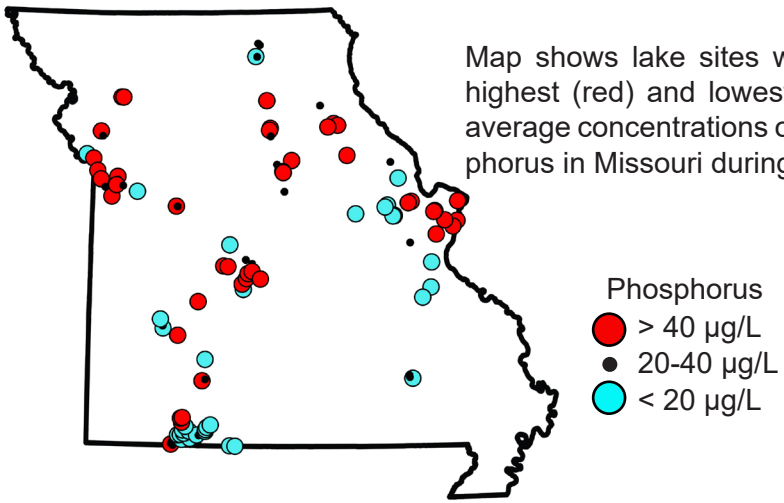
Total Phosphorus

Phosphorus is a naturally occurring element and a required nutrient for life. In Missouri lakes, the amount of phytoplankton a lake can support is often controlled by the phosphorus concentrations in the water. Phosphorus levels vary across (and within) lakes, with some lake sites having nearly immeasurable amounts and others having hundreds of micrograms per liter (µg/L). Lakes with high phosphorus concentrations often have problematic phytoplankton levels that reduce recreational opportunities and are detrimental to other aquatic life.

The best approach to managing phosphorus and the excess phytoplankton growth associated with it is to keep the phosphorus on the landscape and out of the lake. Wise applications of fertilizers to terrestrial systems, reductions of phosphorus in sewage effluent, proper maintenance of septic systems and management of animal waste are key to reducing phosphorus in lakes.

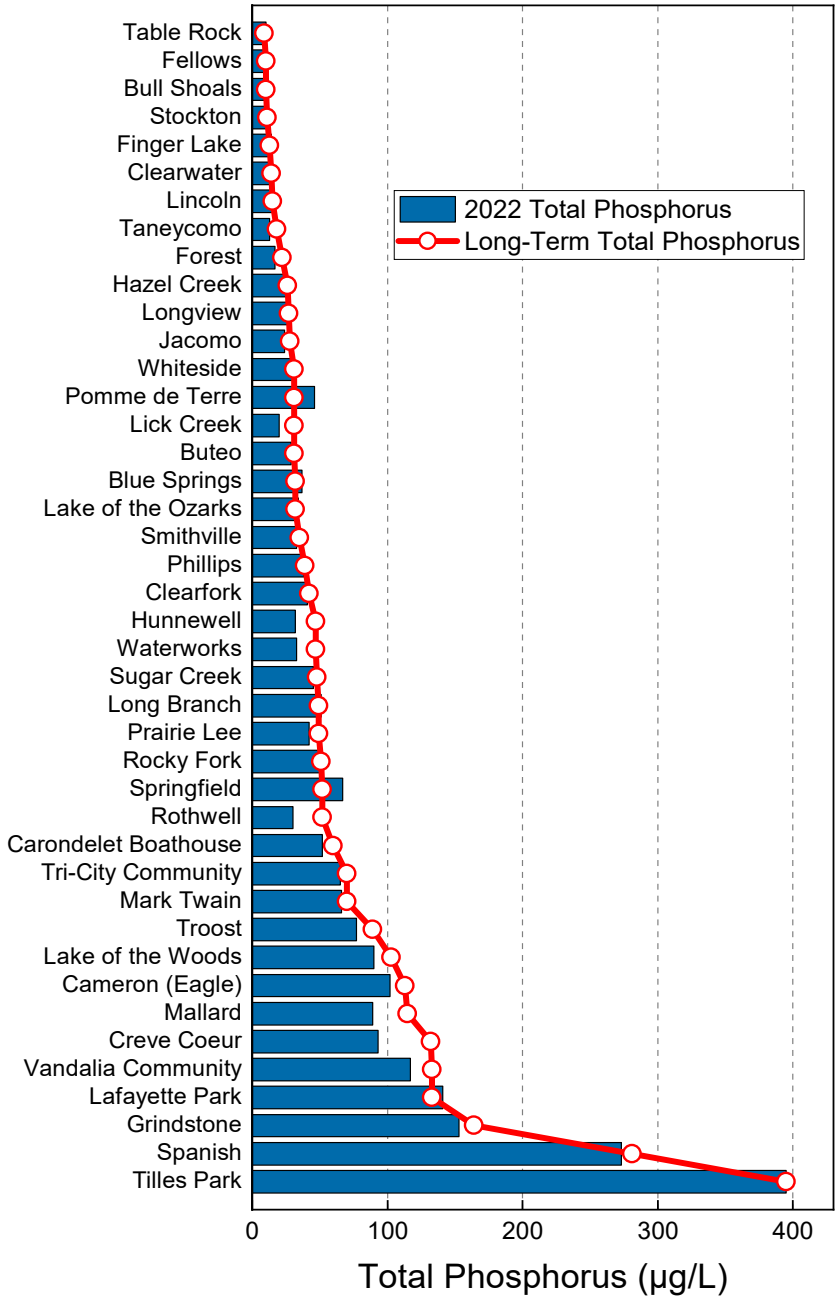
Long-term data from 167 lakes indicate the average Missouri lake phosphorus concentration is 58 µg/L near the dam. The 2022 LMVP average was 44 µg/L. Individual values ranged from 3 to 506 µg/L.

Rufus navigates Lynn Fair and Frank Fillo to their sampling site on Sugar Creek Lake (Randolph County)



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of phosphorus in Missouri during 2022.

Average total phosphorus values for 42 public lakes monitored (at or near the dam) by LMVP volunteers in 2022 (bars). Long-term lake values shown in red.



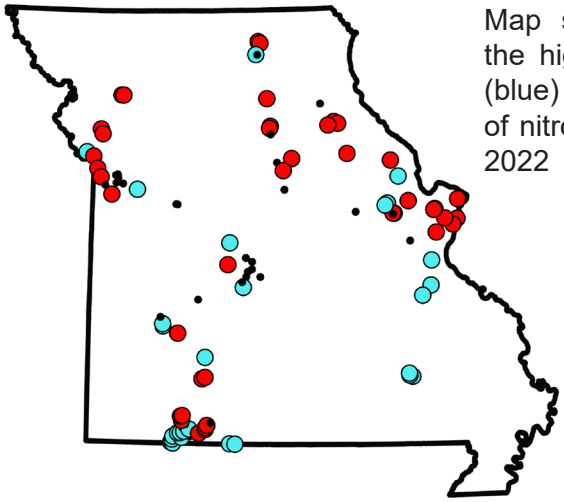
Total Nitrogen

Nitrogen, like phosphorus, is a naturally-occurring element and a required nutrient for phytoplankton. Because phytoplankton require roughly twenty times more nitrogen than phosphorus, nitrogen can limit phytoplankton growth even though it is present in higher concentrations.

Sources of excess phosphorus also apply to nitrogen. However, nitrogen doesn't bind to soil particles as strongly as phosphorus, so eroded soil entering a lake will have less of an effect on nitrogen values than on phosphorus. Secondly, nitrogen has a gas phase while phosphorus does not. This means nitrogen can leave the lake as a gas and it can also enter the lake from the atmosphere.

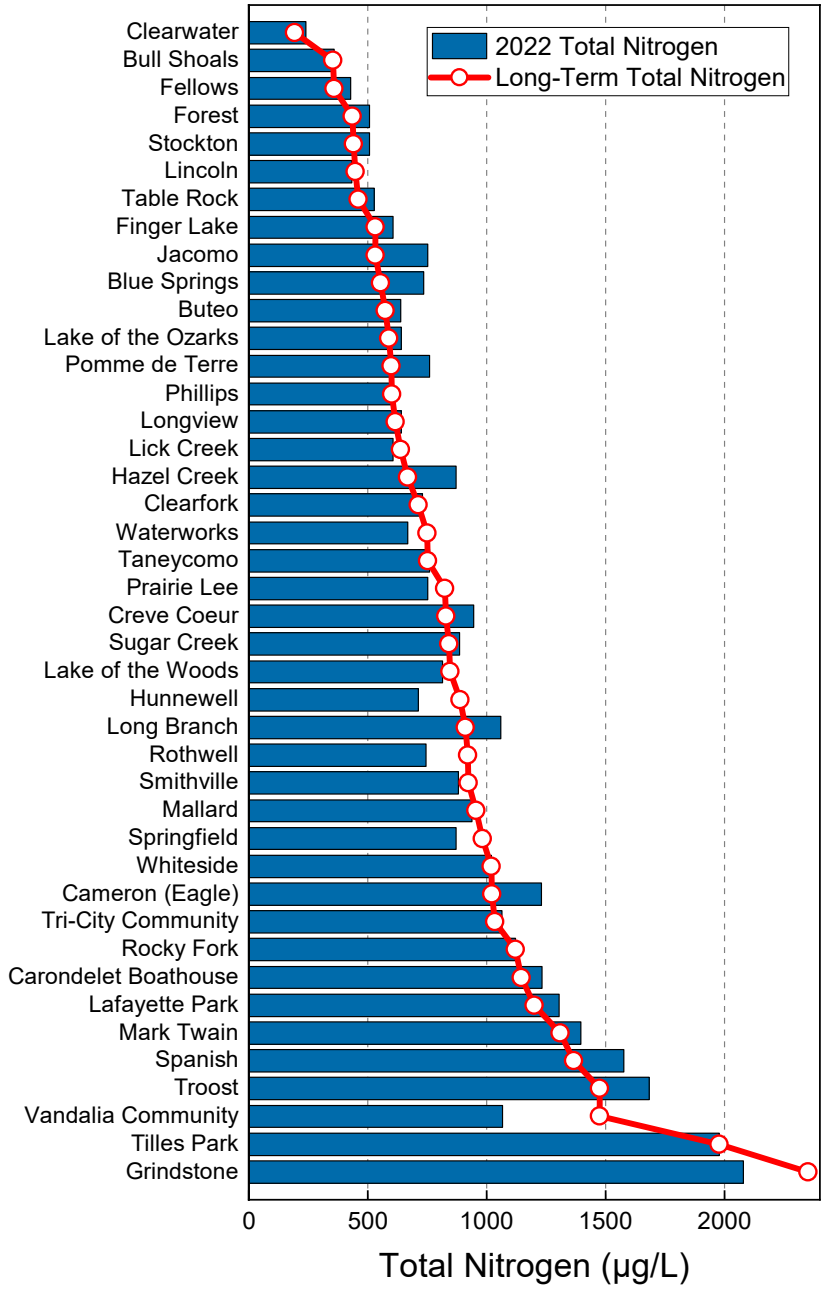
The long-term average near-dam nitrogen concentration for 167 Missouri lakes is 800 µg/L. The LMVP 2022 average nitrogen value was 765 µg/L, with individual values ranging from 150 to 2790 µg/L.

Tim Davis "on deck" at his Lake of the Ozarks home laboratory.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of nitrogen in Missouri during 2022

Average total nitrogen values for 42 public lakes monitored (at or near the dam) by LMVP volunteers in 2022 (bars). Long-term lake values shown in red.



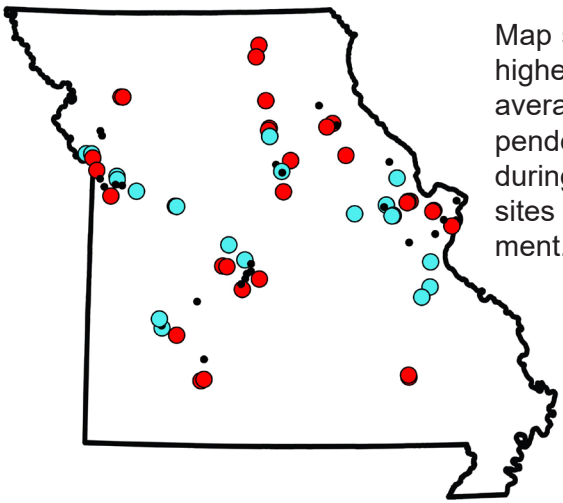
Suspended Sediment

Suspended sediment can wash in from the landscape during a rain event, be scoured from the stream bank, erode from the shoreline by wave action, or it can be re-suspended from the lake bottom. These soil particles will eventually settle downward, where they will begin to fill the lake in. Because of their hydrology and location in eroding valleys, reservoirs are much more susceptible to filling in than natural lakes.

Suspended sediment will block light entering the water and because phosphorus binds so readily to sediment, any sediment washing into the lake will bring additional nutrients. The best way to deal with suspended sediment is to keep the soil on the ground in the watershed with erosion control measures. Removing grass carp from the lake will also help, as these fish destroy the vegetation that breaks up wave activity and holds sediment to the lake's bottom.

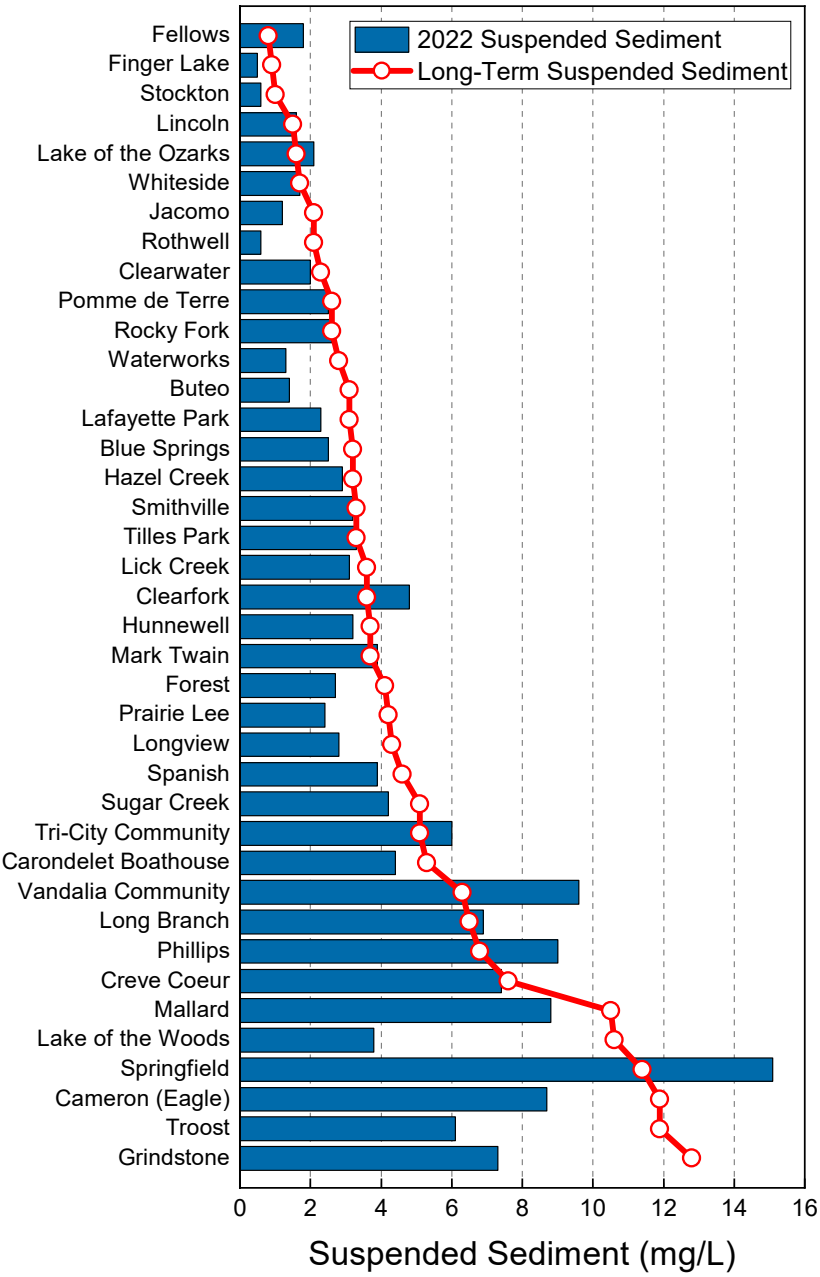
The long-term average Missouri near-dam suspended sediment value is 3.1 mg/L. The 2022 LMVP average was 4.4 mg/L with observed values ranging from 0.1 to 47.3 mg/L.

Arthur Davis-Stober moves a juvenile box turtle from the road at Finger Lakes State Park. Sarah Davis photo.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of suspended sediment in Missouri during 2022. Note: not all lake sites monitor suspended sediment.

Average suspended sediment values for 39 public lakes monitored (at or near the dam) by LMVP volunteers in 2022 (bars). Long-term lake values shown in red.



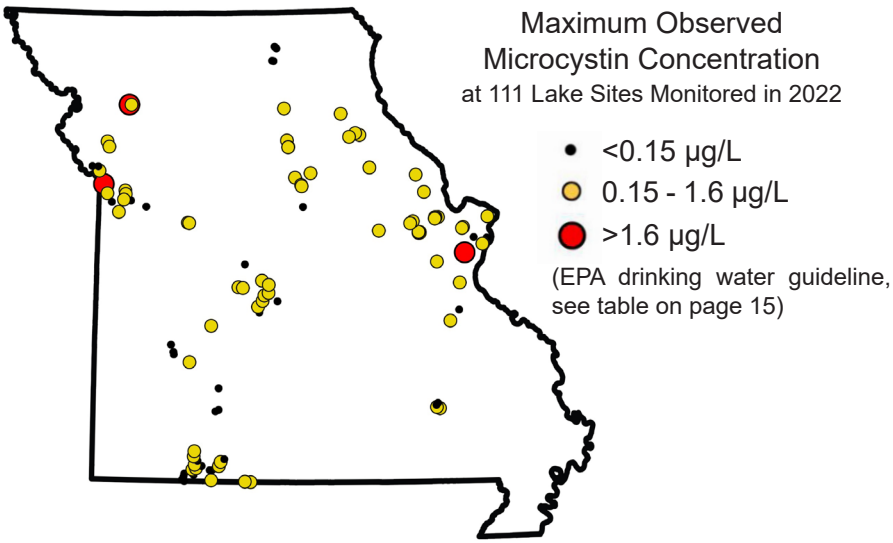
Cyanotoxins in Missouri

In 2022, LMVP volunteers monitored 111 Missouri lake sites for the presence of 2 cyanotoxins. These toxins are produced by cyanobacteria, or bluegreen algae. Microcystin (the most commonly observed toxin) and cylindrospermopsin are both hepatotoxins, meaning they affect the liver.

The map below shows the maximum microcystin value observed at each of the lake sites in Missouri during 2022. A small black dot means that all samples from that particular lake had undetectable concentrations of microcystin. Large red circles mean that at least one observation had a concentration greater than 1.6 µg/L, EPA's finished drinking water recommendation for school-aged children and adults. Three lakes exceeded 1.6 µg/L in 2022. One lake, Troost in Jackson County, exceeded that value on all 8 sampling dates and twice exceeded the recreational exposure limit of 8 µg/L.

The map on the opposite page similarly shows maximum observed cylindrospermopsin concentrations during 2022. Three lakes exceeded the EPA finished drinking water recommendation for school-age children and adults (3.0 µg/L). No samples exceeded EPA recommended recreational exposure value (15 µg/L).

Toxin levels can vary greatly from one lake visit to the next, so if you see suspicious water don't swim in it and keep your pets out of it.

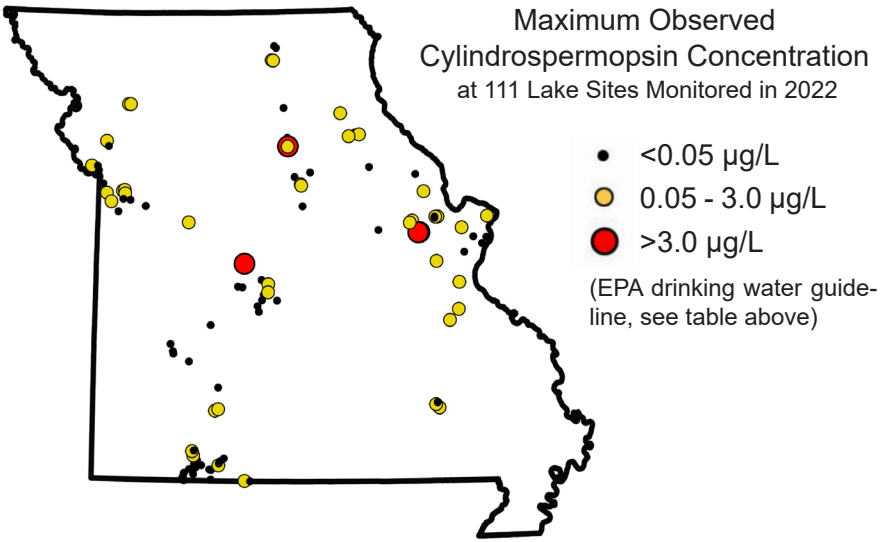


EPA Recommended Microcystin and Cylindrospermopsin Guidelines

	Recreational Exposure	Drinking Water	
Microcystin:	8.0 µg/L	Bottle-fed infants and pre-school children	0.3 µg/L
		School-age children and adults	1.6 µg/L
Cylindrospermopsin:	15.0 µg/L	Bottle-fed infants and pre-school children	0.7 µg/L
		School-age children and adults	3.0 µg/L

Opposite: Maximum microcystin concentration measured at 111 lake sites.
Above: EPA draft recommended criteria for Microcystin and Cylindrospermopsin in surface waters of the USA.
Below: Maximum cylindrospermopsin concentration measured at 111 lake sites.

Algal toxin monitoring was made possible thanks to a joint effort between
- *Missouri Department of Health and Senior Services.*
- *Missouri Department of Natural Resources*
- *The Lakes of Missouri Volunteer Program*
- *University of Missouri*



LMVP Newsletter

The Water Line is the email newsletter of the LMVP. To sign up, send an email to info@LMVP.org, or visit LMVP.org.

Issues of The Water Line discuss topics such as cyanobacteria (bluegreen algae), zooplankton, freshwater jellyfish, aquatic fungi and much more.

This October, 2022 photo from Aunts Creek at Table Rock Lake shows the low water level following the dry summer of 2022. Mary Hillinger photo.

LMVP.org

The LMVP hosts an abundance of information about local lakes, lake ecology, water quality and water in general at its website.

Visit www.LMVP.org and see for yourself!

While you're on the computer or your phone, give us a "Like" on Facebook!

Joining the LMVP

Becoming a volunteer:

- Pick a lake you are willing to monitor every three weeks between April and September (one or two hour commitment each visit).
- Make sure you have access to a boat and all the appropriate safety equipment.
- We will provide you with all necessary supplies and come to your lake to train you one-on-one.

Volunteer duties:

- Measure water temperature, water clarity, and collect water samples.
- Record observations about wave conditions.
- Process water for laboratory analysis.
- Preserve and store all processed samples.

Above: Madison Sieg samples the Flat Creek arm of Table Rock Lake. David Casaletto photo.
Back Cover: Dusk at Phillips Lake (Boone County). Julie Youmans photo.

The Lakes of Missouri Volunteer Program
302 ABNR Building
University of Missouri
Columbia, MO 65211
573 882 5430

LAKES of MISSOURI VOLUNTEER PROGRAM

Scan the code with your cell phone to report a suspicious algae bloom.

Or call:

- Missouri Department of Natural Resources
  573-634-2436
- Missouri Department of Health and Senior Services
  800-392-0272