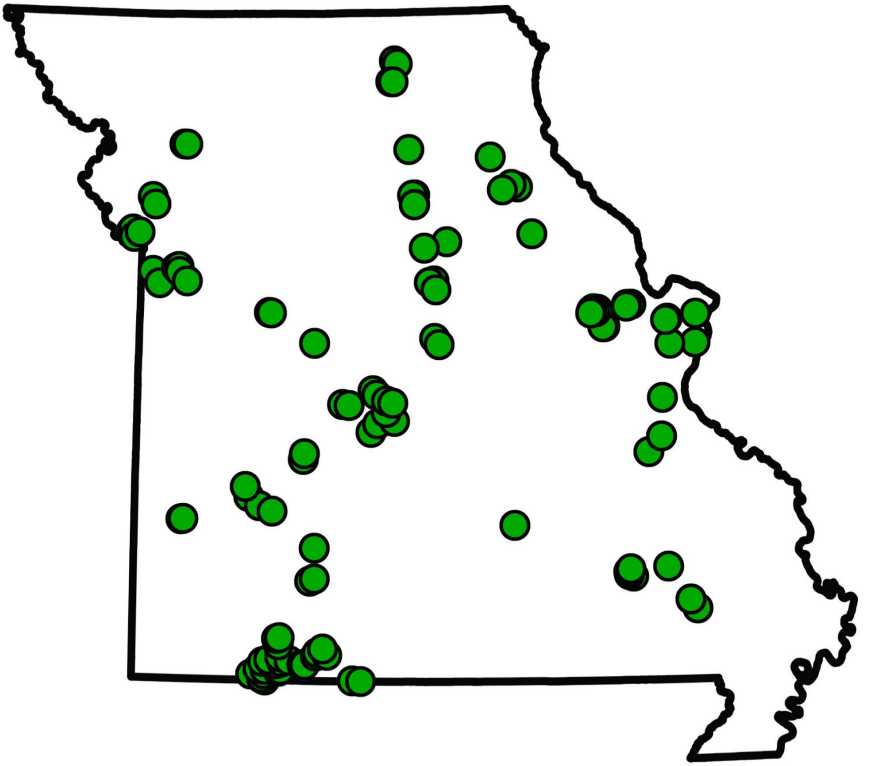
The Lakes of Missouri Volunteer Program
2019 LAKE REPORT

LAKES of MISSOURI VOLUNTEER PROGRAM

WWW.LMVP.ORG

A summary of 2019 water quality data

Lake Sites Monitored in 2019



Lakes of Missouri Volunteer Program

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 G19-NPS-07

Cover: Brenda Switzer, Missouri Master Naturalist (Great Rivers Chapter) and LMVP volunteer, prepares a chlorophyll filter at Boathouse Lake in Carondelet Park, St. Louis County.

Data are available at LMVP.org

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Above: Beth Kroes transporting her kayak to monitor Long Branch Lake. Greg Kroes 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 28 years of quality data for some of Missouri's most popular lakes.

* 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.

Angie Wendt filtering water from her sailboat on Mark Twain Lake. Doug Wendt photo.

Ammonium and Nitrate

We at the LMVP are very interested in algae and what controls it in our lakes (see page 6 for more information about algae). Nutrients are extremely important for algae growth and limiting the availability of nutrients is probably the most effective way of controlling algae growth over the long term. For many years, we have measured total nitrogen, which includes nitrogen dissolved in the water as well as nitrogen in organic particles (like algae cells). Measuring total nitrogen is a good way of counting all of the nitrogen in the water, but doesn't tell the whole story. We have decided to dig a little deeper.

Some dissolved nitrogen forms are very quickly taken up by algae while other forms can't be used by algae at all. Ammonium and nitrate are 2 parts of the total nitrogen "recipe". Ammonium and, to a lesser extent, nitrate are very quickly taken up by algae when they need more nitrogen. Finding large amounts of either (or both) in a lake can tell us a couple of things. For one, there may be runoff from land-applied plant fertilizer or animal waste. High concentrations of ammonium and/or nitrate may also suggest that something else is limiting the growth of algae. For example, another nutrient (like phosphorus) may be in short supply or perhaps water clarity is so poor that algae aren't growing to their potential due to lack of light.

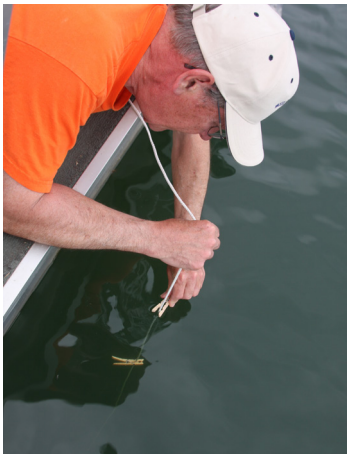
By looking at ammonium and nitrate, we hope to get closer to unravelling the mystery of our lakes by understanding what controls algae a little better.

Sunset at Timberline Lake (St. Francois County). Greg Griffin photo.

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.

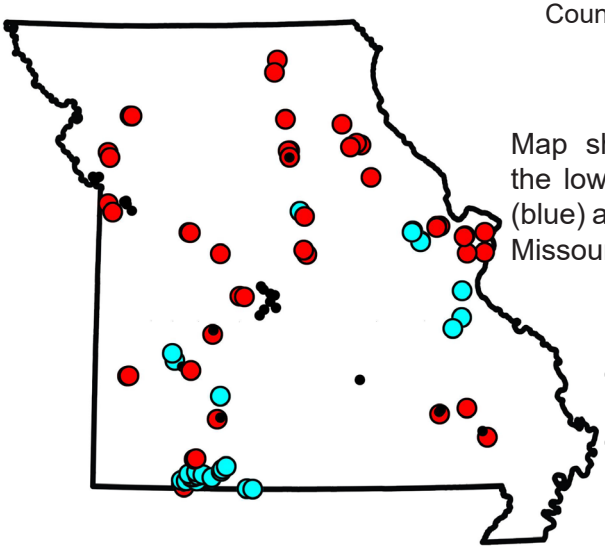
Water clarity is measured in lakes using the Secchi disk. Our volunteers lower this disk into the water until it is no longer visible and record the depth. The Secchi disk is the standard tool for lake water clarity measurement. The simplicity, low cost, and portability of the Secchi disk have ensured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



Mel Bagley measures water clarity at Lake Shayne (Washington and St. Francois Counties)

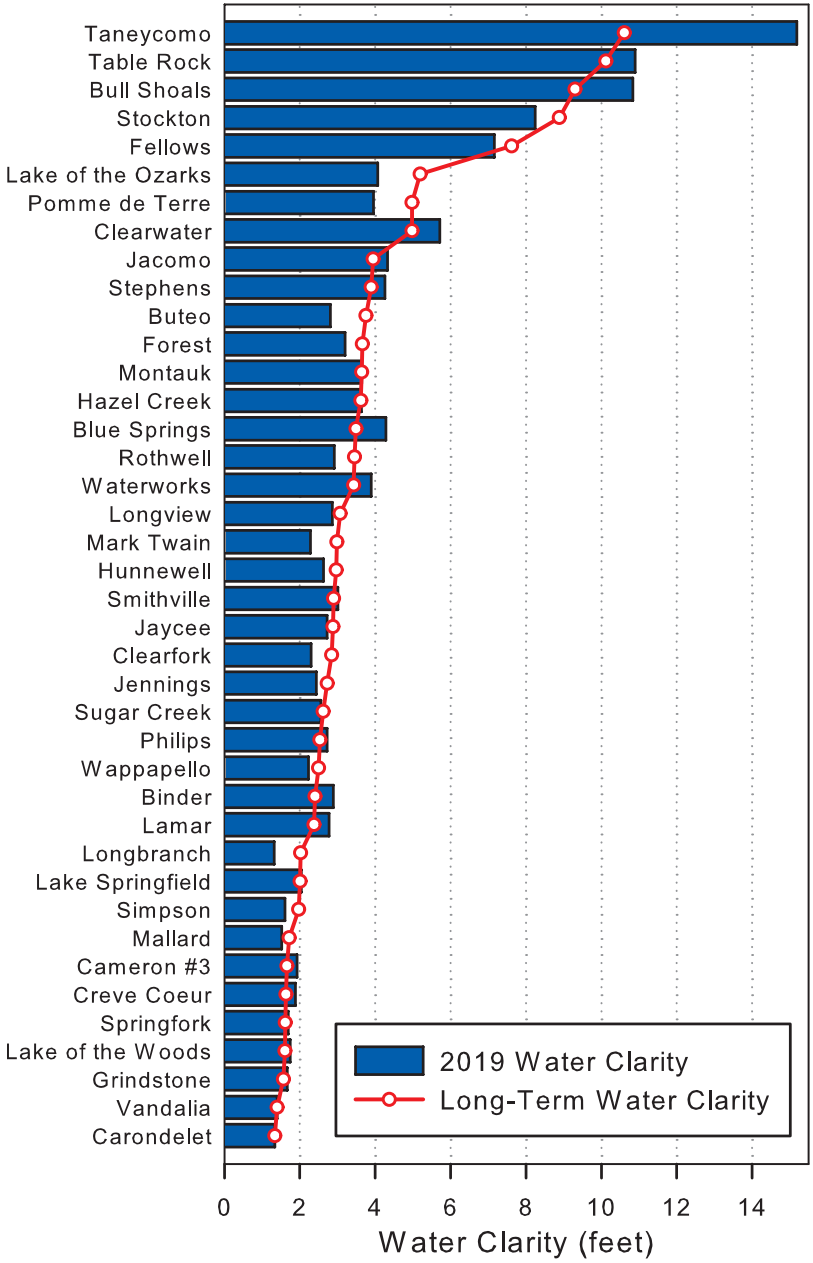
Water Clarity in Missouri Lakes

Missouri lakes historically, on average, have about 3 feet of clarity near the dam, and clarity decreases with distance from the dam. In 2019, the average LMVP volunteer-measured lake water clarity was 4.7 feet. In 2019, our water clarity measurements ranged from 4 inches to 24 feet.



Map shows lake sites with the lowest (red) and highest (blue) average water clarity in Missouri during 2019.

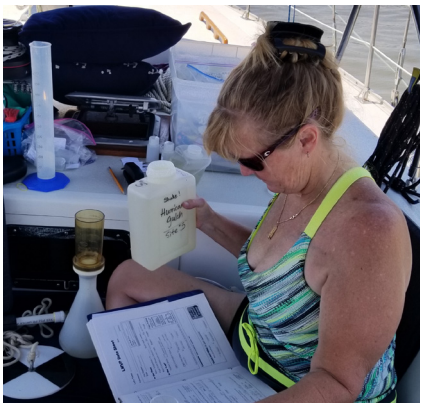
Average water clarity values for 40 public lakes monitored (at or near the dam) by LMVP volunteers in 2019 (bars). Long-term lake values shown in red.



Chlorophyll

Algae are tiny plant-like organisms found in lakes (and nearly everywhere else). Algae use the sun's energy to convert CO_2 and nutrients into carbohydrates via photosynthesis. We estimate the amount of algae present by measuring the presence of the photosynthetic pigment, chlorophyll.

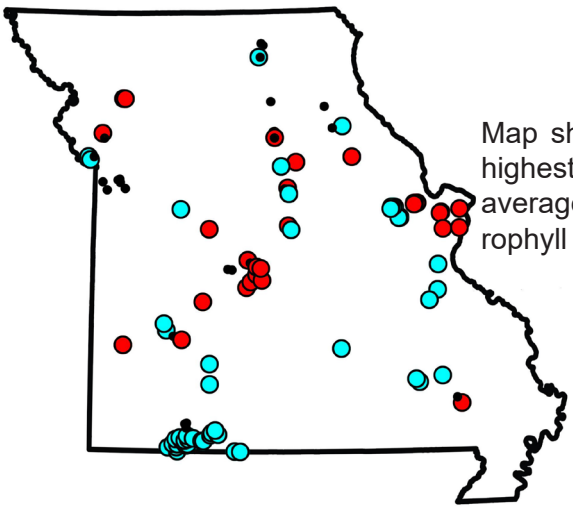
Other organisms, like zooplankton, mussels, and certain fishes, consume algae. These organisms are in turn eaten by predators, moving the sun's energy through the food web. While algae are essential for other aquatic life, too much algae can be a problem. Algal populations can increase quite rapidly (bloom) in the presence of excess nutrients and throw the lake out of balance. Algae blooms can create a number of problems. For example, dissolved oxygen levels in the water will vary widely between day and night during a bloom and other aquatic organisms will suffer as a result.



Angie Wendt processes a chlorophyll filter. Doug Wendt photo.

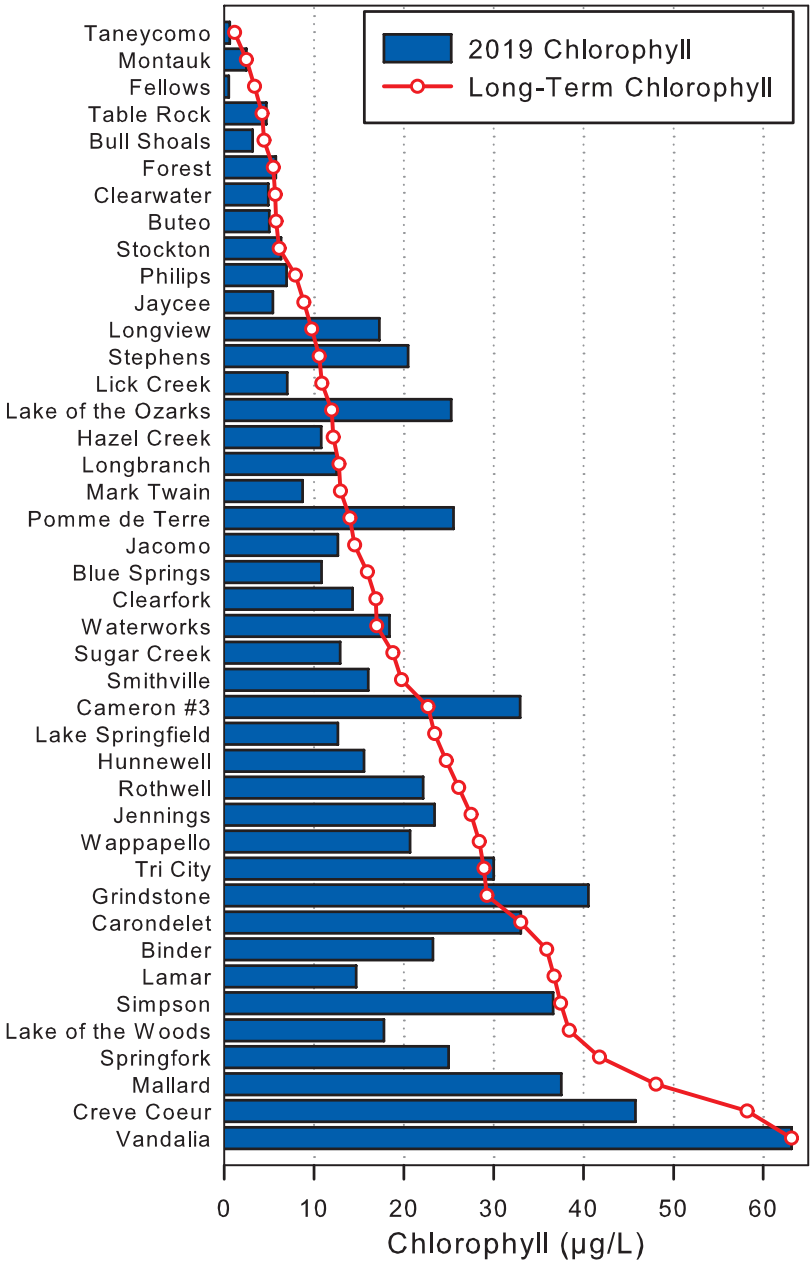
Chlorophyll In Missouri Lakes

On average, Missouri lakes have 21 µg/L of chlorophyll at the dam. The average 2019 LMVP chlorophyll value was 16.4 µg/L, with individual values ranging from 0.1 to 158.4 µg/L.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of chlorophyll in Missouri during 2019.

Average Chlorophyll values for 42 public lakes monitored (at or near the dam) by LMVP volunteers in 2019 (bars). Long-term lake values shown in red.



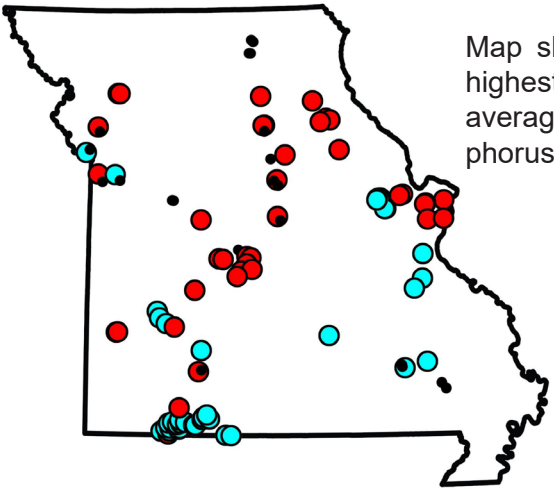
Total Phosphorus

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

The best approach to managing phosphorus and the excess algal 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 the key to reducing phosphorus in lakes.

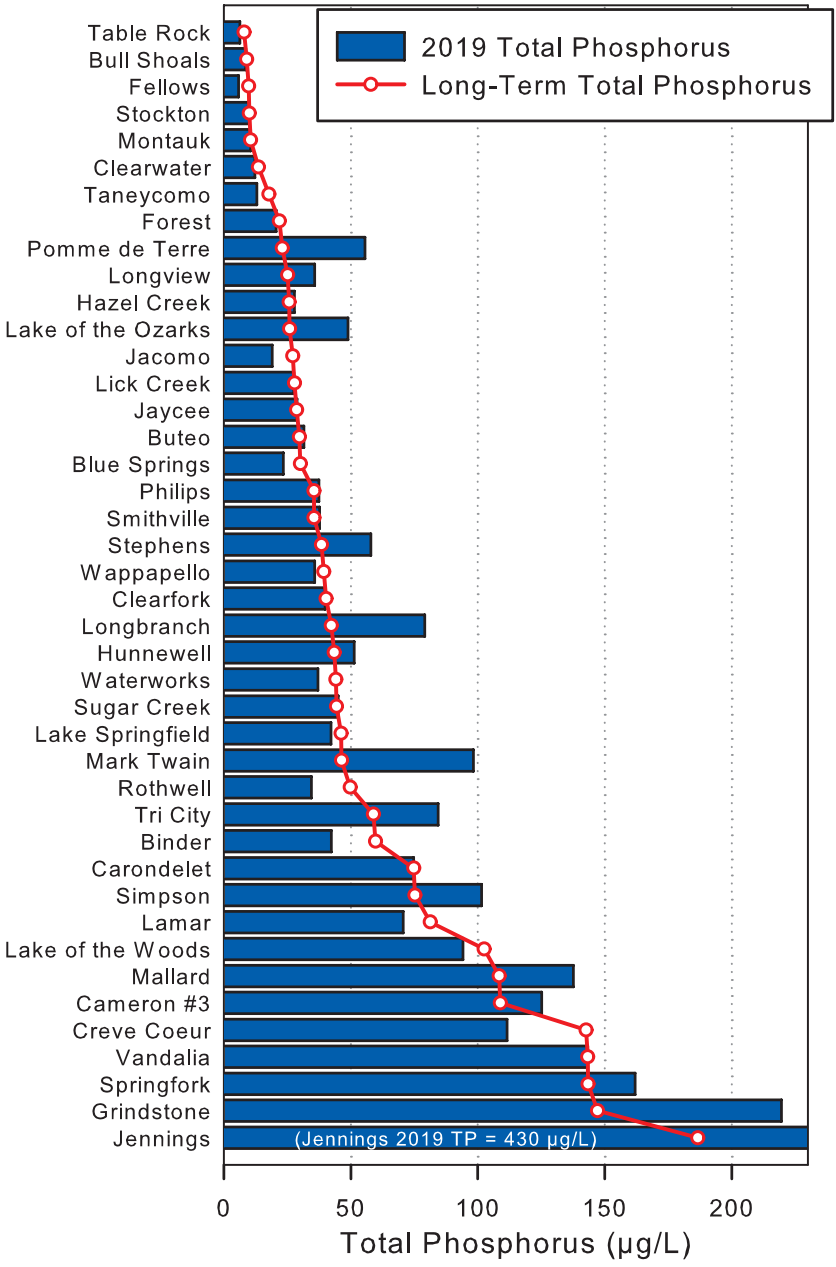
Long-term data from 167 lakes indicate the average Missouri lake phosphorus concentration is 58 µg/L near the dam. The 2019 LMVP average was 47 µg/L. Individual values ranged from 3 to 573 µg/L.

Lick Creek Lake (Boone County). Dan Obrecht photo.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of phosphorus in Missouri during 2019.

Average Total Phosphorus values for 42 public lakes monitored (at or near the dam) by LMVP volunteers in 2019 (bars). Long-term lake values shown in red.



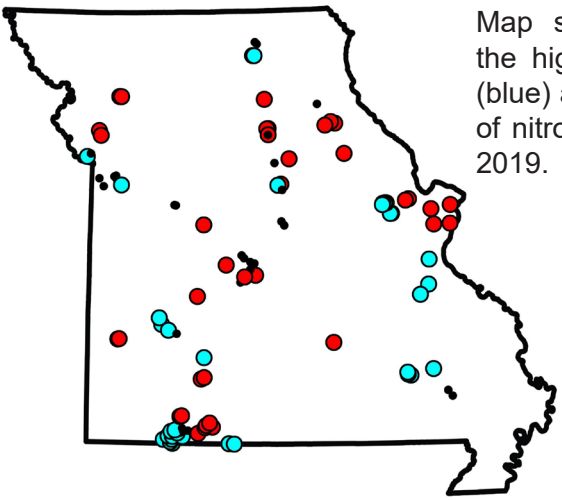
Total Nitrogen

Nitrogen, like phosphorus, is a naturally-occurring element and a required nutrient for algae. Because algae require roughly twenty times more nitrogen than phosphorus, nitrogen can limit algal 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.

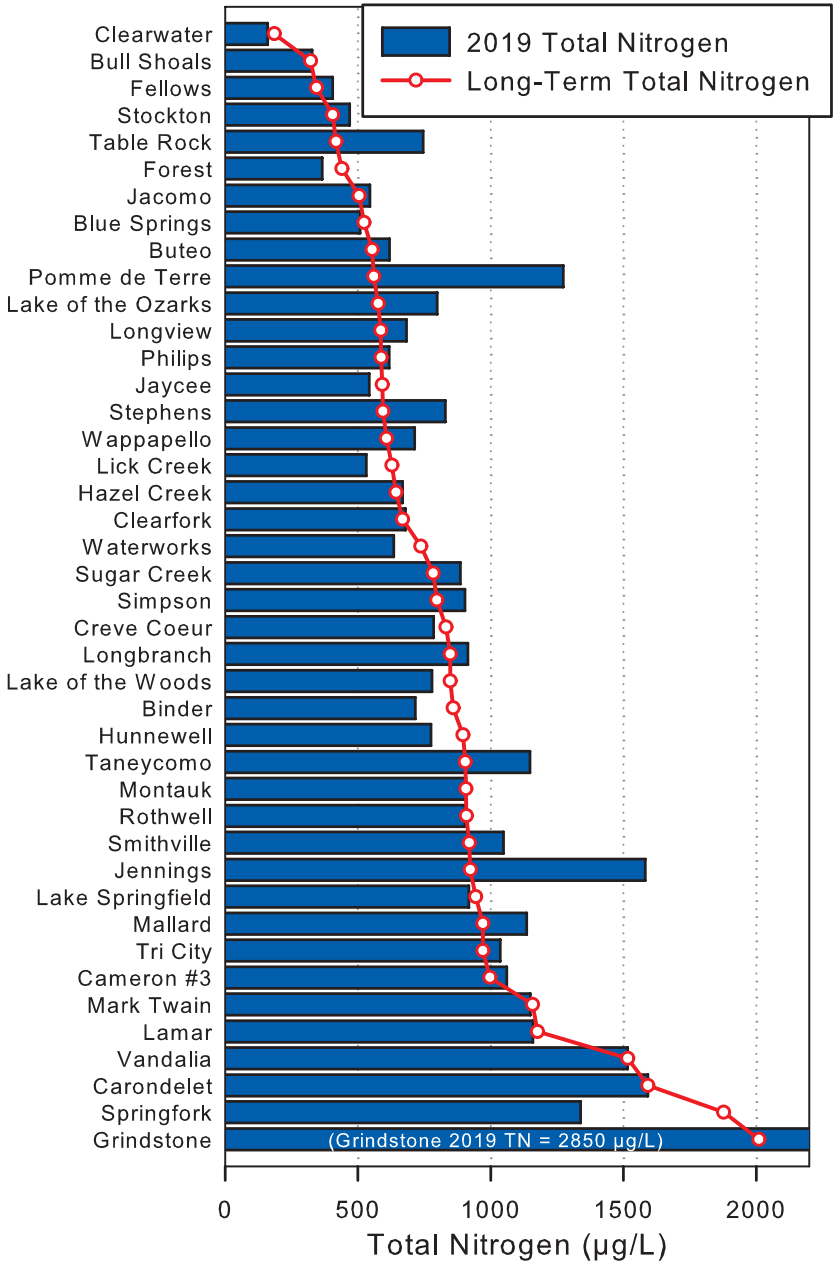
Turtles basking on a log in Table Rock Lake. Mary Hillinger photo.

The long-term average near-dam nitrogen concentration for 167 Missouri lakes is 800 µg/L. The LMVP 2019 average nitrogen value was 760 µg/L, with individual values ranging from 130 to 4830 µg/L.



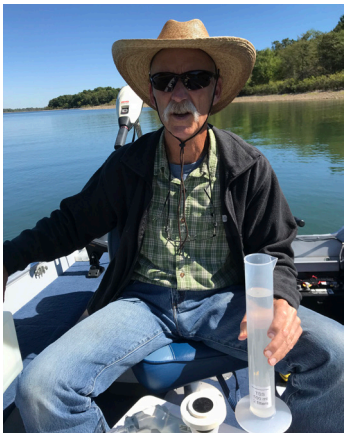
Map shows lake sites with the highest (red) and lowest (blue) average concentrations of nitrogen in Missouri during 2019.

Average Total Nitrogen values for 42 public lakes monitored (at or near the dam) by LMVP volunteers in 2019 (bars). Long-term lake values shown in red.



Suspended Sediment

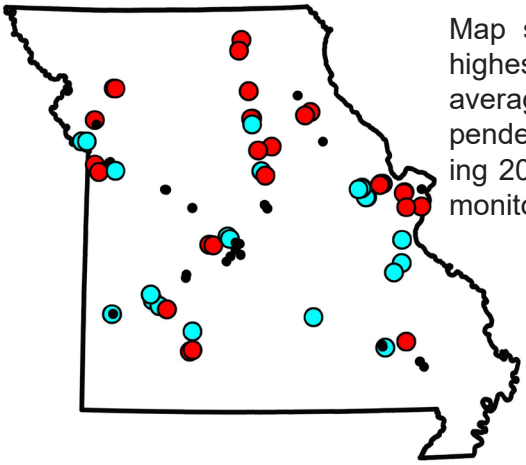
Suspended sediment can wash in from the landscape during a rain event, be scoured from the stream bank by an inflowing stream, erode from the shoreline by wave action, or it can be re-suspended from the lake bottom. These soil particles will eventually settle downward, where they will begin to fill the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



Craig Dare processes suspended sediment filters on Stockton Lake.
(Kathryn Lackey photo)

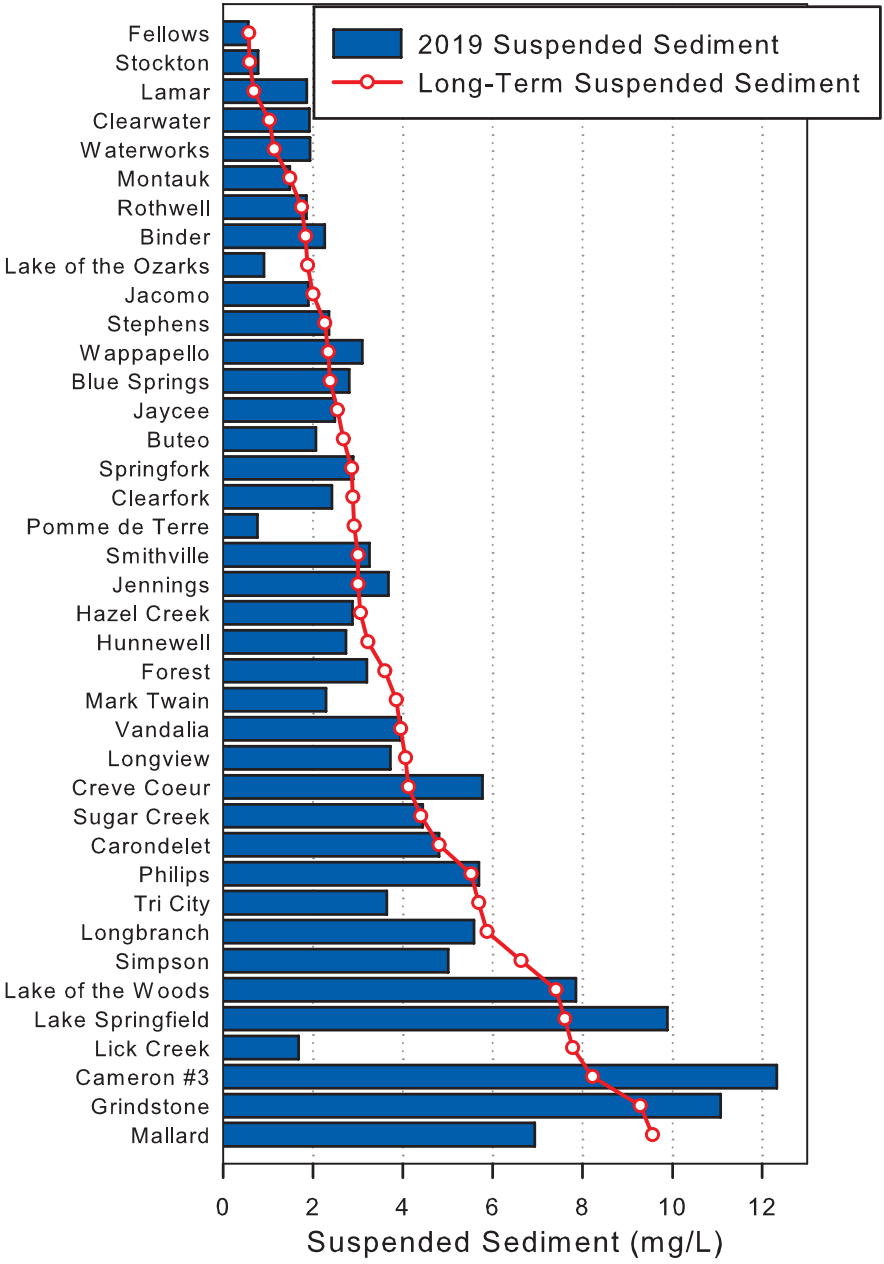
Suspended sediment will block light entering the water and because phosphorus binds so readily to sediment, any sediment washing into the lake will bring additional nutrients. The best way to deal with suspended sediment is to keep the soil on the ground in the watershed with erosion control measures. 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 2019 LMVP average was 4.3 mg/L with observed values ranging from 0.1 to 92.9 mg/L.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of suspended sediment in Missouri during 2019. 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 2019 (bars). Long-term lake values shown in red.



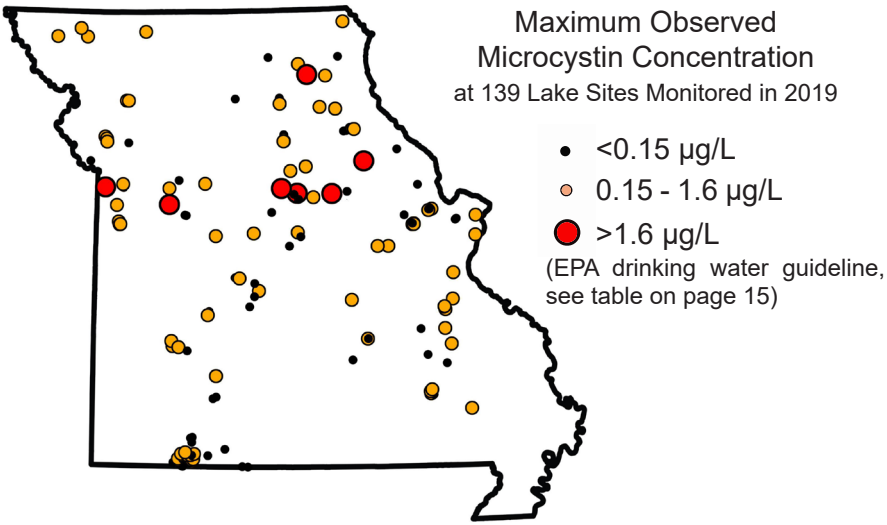
Algal Toxins in Missouri

In 2019, LMVP volunteers and employees of the University of Missouri Limnology Laboratory monitored 139 Missouri Lake sites for the presence of 2 algal toxins. 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 2019. 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. No samples exceeded the EPA recommended recreational exposure level of 8.0 µg/L.

The map on the opposite page similarly shows maximum observed cylindrospermopsin concentrations during 2019. In 2019, only 2 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. Visit the link at the top of the opposite page to report a suspicious algae bloom.



EPA Recommended Microcystin and Cylindrospermopsin Guidelines

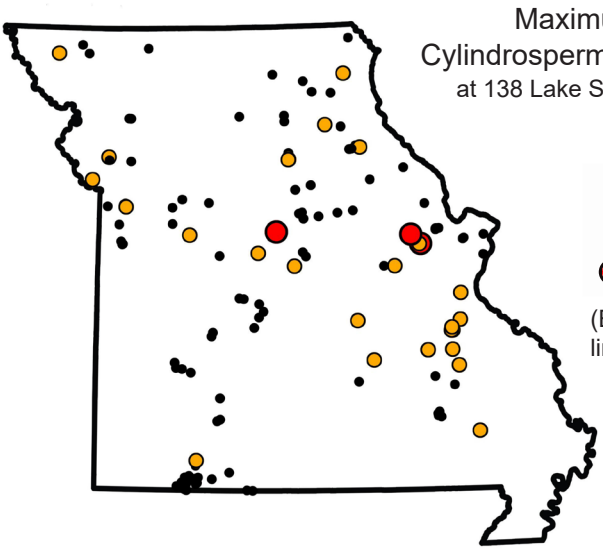
	Recreational Exposure	Drinking Water	
Microcystin:	8.0 µg/L	Bottle-fed infants and pre-school children	0.3 µg/L
		School-age children and adults	1.6 µg/L
Cylindrospermopsin:	15.0 µg/L	Bottle-fed infants and pre-school children	0.7 µg/L
		School-age children and adults	3.0 µg/L

Opposite: Maximum microcystin concentration measured at 139 lake sites in 2019

Above: EPA draft recommended criteria for Microcystin and Cylindrospermopsin in surface waters of the USA, revised May 2019

Below: Maximum cylindrospermopsin concentration measured at 138 lake sites in 2019

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), fish kills, freshwater jellyfish, and much more.

Beth Kroes returns from sampling Long Branch Lake.

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: Caroline Toole (left) and Quentin Phillips (right) collect their water sample at Lake of the Ozarks. Don Toole photo.

Back cover: Sunset at Stockton Lake. Rob Speer photo.

The Lakes of Missouri Volunteer Program
302 ABNR Building
University of Missouri
Columbia, MO 65211
1 800 895 2260

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