The Lakes of Missouri Volunteer Program

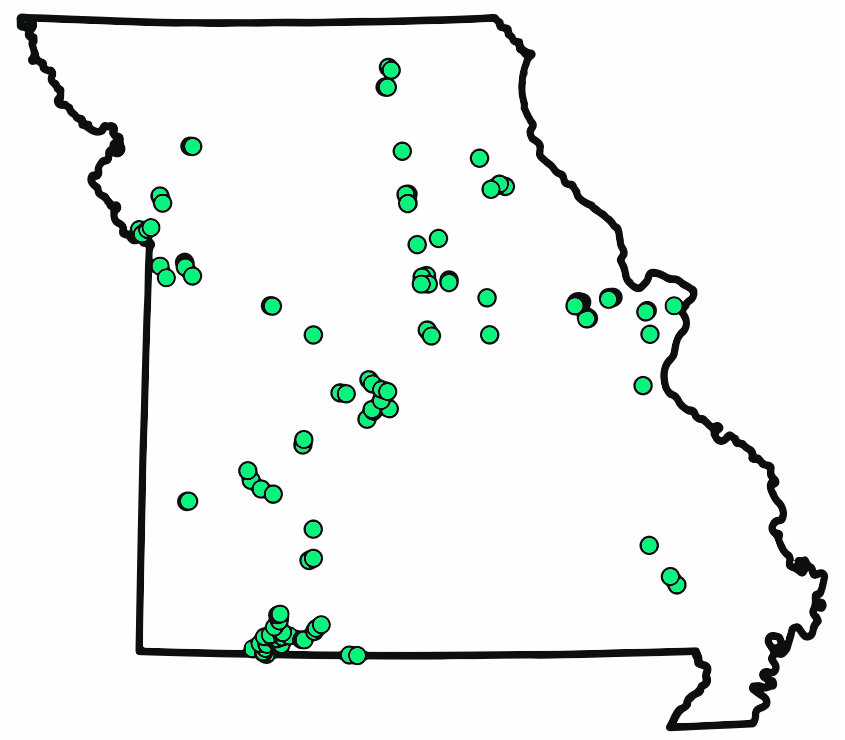
2018 LAKE REPORT

LAKES of MISSOURI VOLUNTEER PROGRAM

WWW.LMVP.ORG

A summary of 2018 water quality data

Lake Sites Monitored in 2018



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: A tree felled by a beaver along the shores of a Wayne County lake in Southeast Missouri.

Data are available at LMVP.org

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Bridge over the upper Little Niangua arm of Lake of the Ozarks in Camden County. (Bryan Vance 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 27 years of quality data for some of Missouri's most popular lakes.

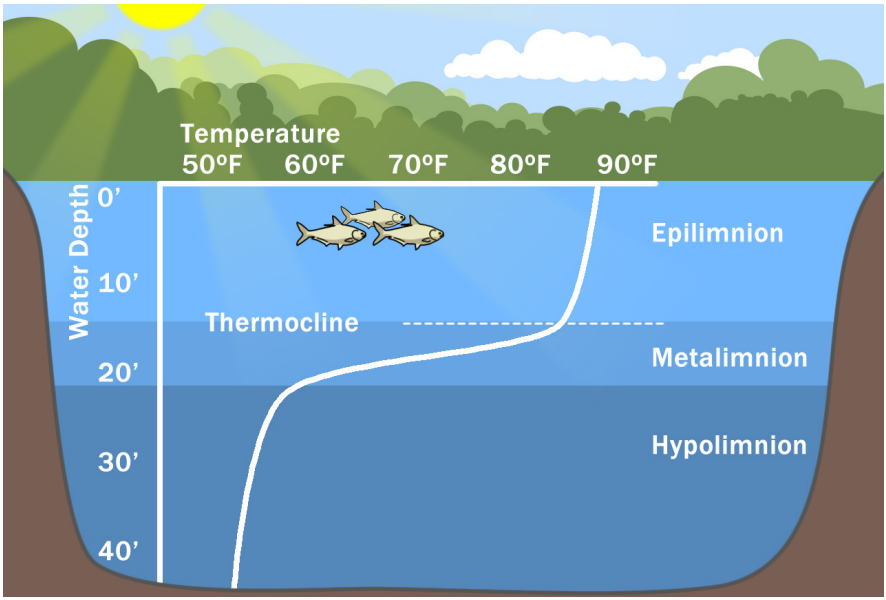
* D. Obrecht, M. Milanick, B. Perkins, D. Ready and J. Jones. 1998. Evaluation of data generated from lake samples collected by volunteers. Lake Reserv Manag. 14, pp 21-27.

Tools of the trade. A canoe loaded to sample Philips Lake in Boone County. (Julie Youmans photo)

The Thermocline an important lake feature

What is a thermocline?

The thermocline is the depth where water temperature rapidly cools. Water is densest at 39.2°F (4° Celsius), just above freezing. Water's density decreases as it warms (or freezes). In spring, when the sun heats the lake's surface, warmer water rises and leaves the colder water near the bottom. As the surface continues to warm, the difference in temperature (and density) between the top and bottom water becomes greater. Eventually there are 2 distinct layers, the *epilimnion* at the top and the *hypolimnion* at the bottom. Between these two layers is a third, less distinct, transition layer called the *metalimnion*, the top edge of which is called the thermocline. These layers generally don't mix with one another until autumn, when the surface water cools and the lake "turns over," or mixes from top to bottom.



Why is this important?

As bacteria break down organic matter at the lake's bottom, they consume oxygen. By mid-summer, the hypolimnion of a Missouri lake is usually depleted of oxygen; that's bad news for fish and most other organisms at the bottom of the lake. Knowing the thermocline depth and when the layers form helps us understand water quality changes throughout the season and across the years.

Water Clarity

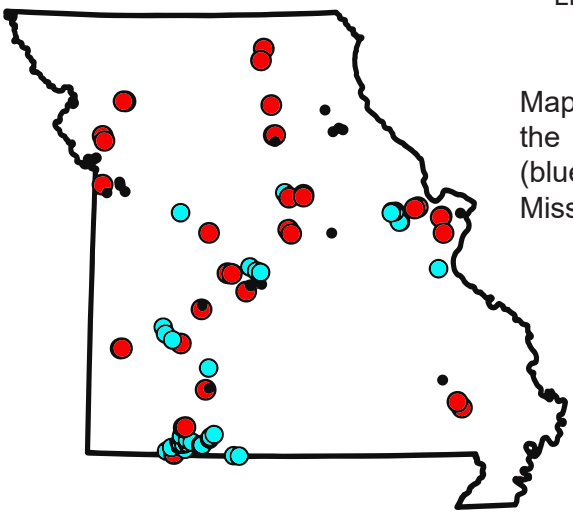
When we see murky water, we assume water quality is poor. Conversely, when we see clear water, we assume the water quality is good. Of course, water quality is not that simple, but monitoring water clarity is a good way to track the things that make water turbid. In Missouri, those things are usually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

Heather Allen removes her sunglasses to take a Secchi reading on Lake Wapappello in Wayne County. (Eric Limanen photo)

Water Clarity in Missouri Lakes

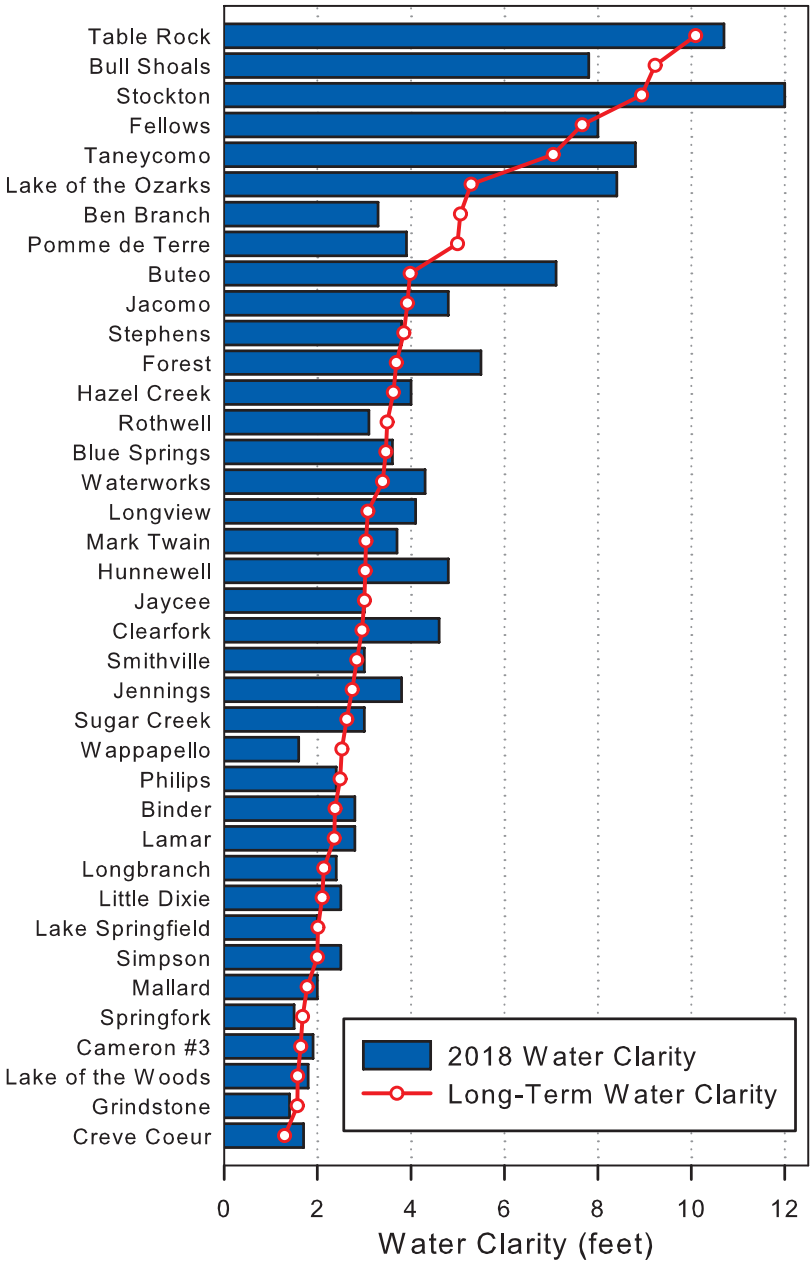
Missouri lakes historically, on average, have about 3 feet of clarity near the dam, and clarity decreases with distance from the dam. In 2018, the average LMVP volunteer-measured lake water clarity was just over 5 feet. In 2018, our water clarity measurements ranged from 10 inches to 21 feet.



Map shows lake sites with the lowest (red) and highest (blue) average water clarity in Missouri during 2018.

Water Clarity
- Secchi < 3 feet
- Secchi 3.1 - 6 feet
- Secchi > 6 feet

Average water clarity values for 38 public lakes monitored (at or near the dam) by LMVP volunteers in 2018 (bars). Long-term lake values shown in red.



Chlorophyll

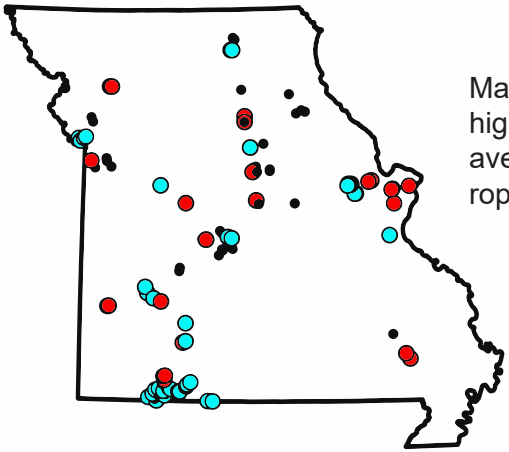
Algae are tiny plant-like organisms found in lakes (and nearly everywhere else). Algae use the sun's energy to convert CO_2 and nutrients into carbohydrates via photosynthesis. We estimate the amount of algae present by measuring the presence of the photosynthetic pigment, chlorophyll.

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.

Chlorophyll In Missouri Lakes

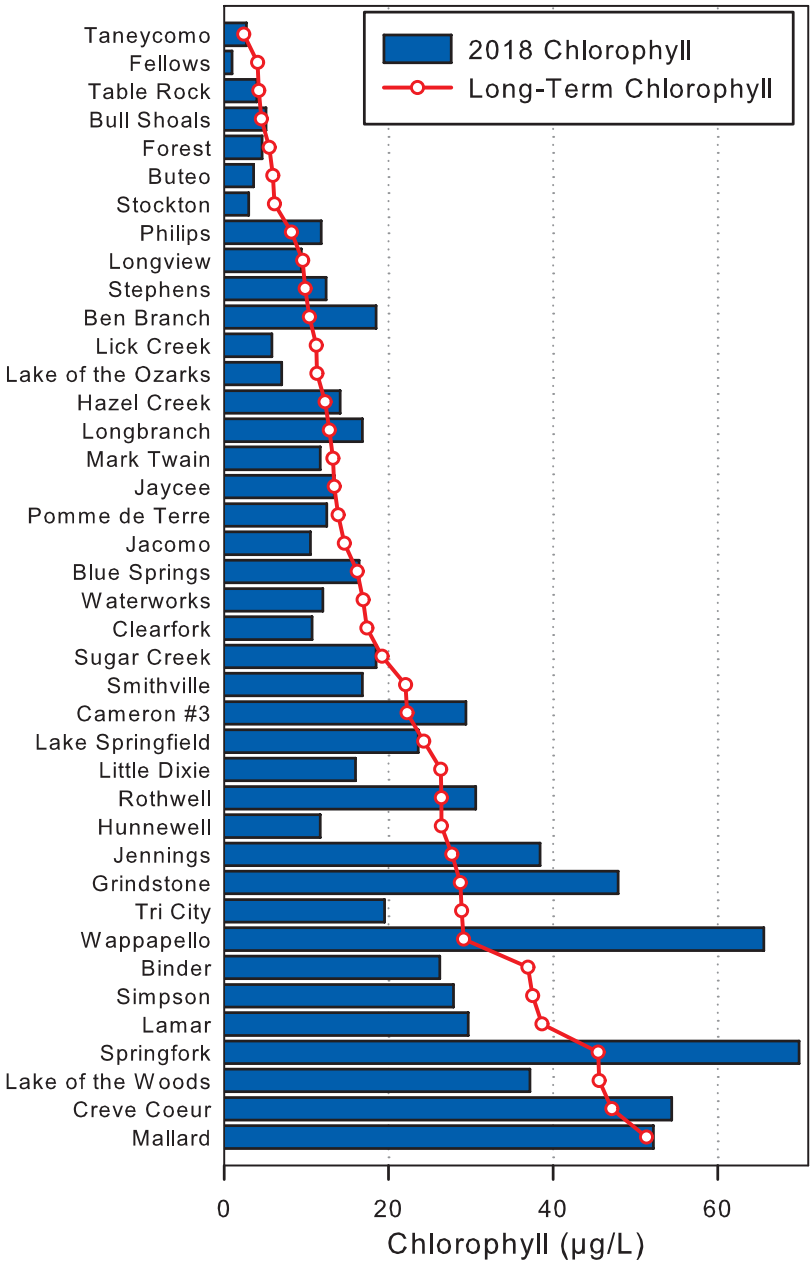
On average, Missouri lakes have 21 µg/L of chlorophyll at the dam. The average 2018 LMVP chlorophyll value was 17.6 µg/L, with individual values ranging from 0.2 to 169.3 µg/L.

Sue Stillwell prepares a filter for chlorophyll analysis.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of chlorophyll in Missouri during 2018.

Average Chlorophyll values for 40 public lakes monitored (at or near the dam) by LMVP volunteers in 2018 (bars). Long-term lake values shown in red.

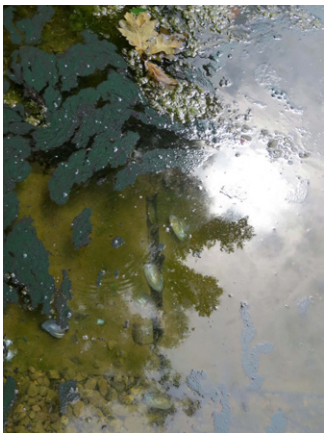


Total Phosphorus

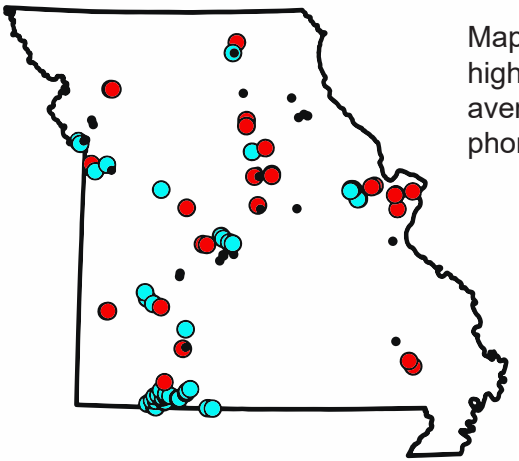
Phosphorus is a naturally occurring element and a required nutrient for life. In Missouri lakes, the amount of algae a lake can support is often controlled by the phosphorus concentrations in the water. Missouri lakes vary in terms of phosphorus levels, with some lake sites having single digit values 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 2018 LMVP average was 39 µg/L. Individual values ranged from 4 to 664 µg/L.

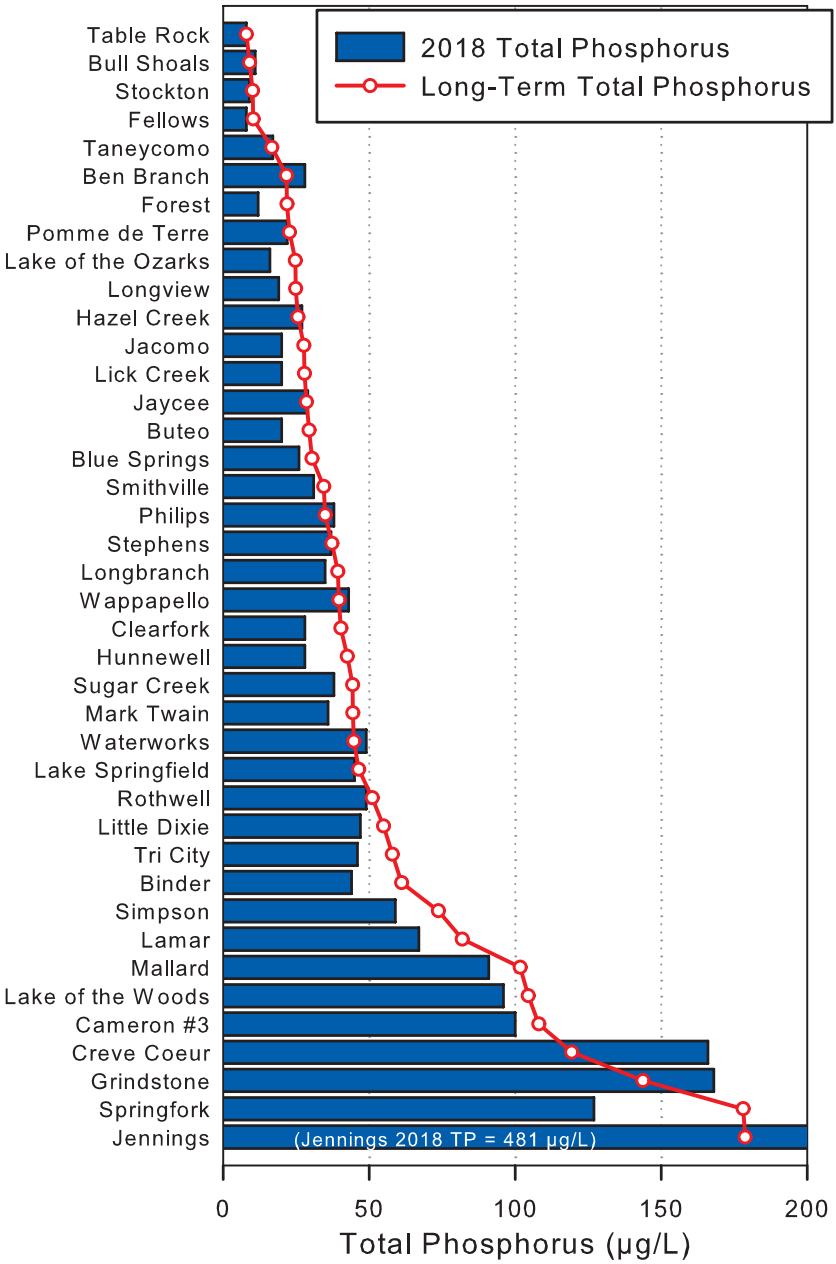


Algae bloom in a Warren County lake. (Bob Goulding photo)



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of phosphorus in Missouri during 2018.

Average Total Phosphorus values for 40 public lakes monitored (at or near the dam) by LMVP volunteers in 2018 (bars). Long-term lake values shown in red.



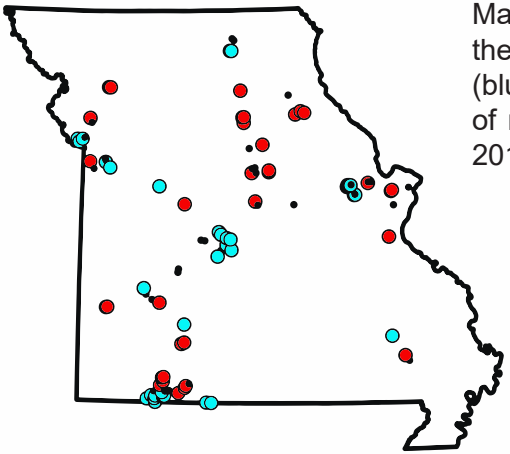
Total Nitrogen

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.

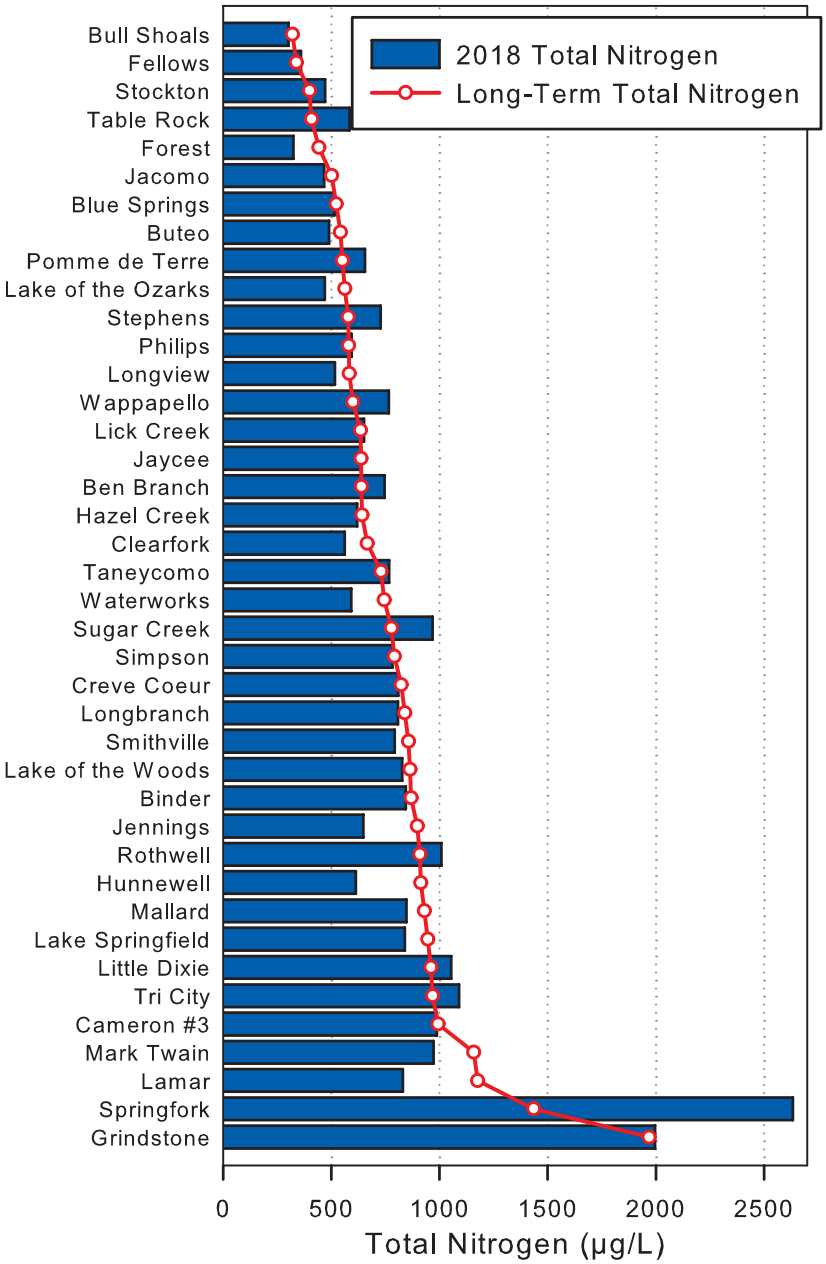
Two Missouri residents enjoy a day at the lake. (Dan Obrecht photo)

The long-term average near-dam nitrogen concentration for 167 Missouri lakes is 800 µg/L. The LMVP 2018 average nitrogen value was 700 µg/L, with individual values ranging from 180 to 5080 µg/L.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of nitrogen in Missouri during 2018.

Average Total Nitrogen values for 40 public lakes monitored (at or near the dam) by LMVP volunteers in 2018 (bars). Long-term lake values shown in red.



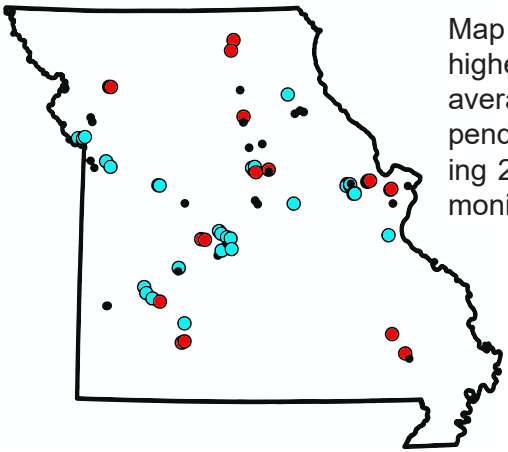
Suspended Sediment

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.

Heather Allen filters lake water for suspended sediment analysis. (Eric Limanen photo)

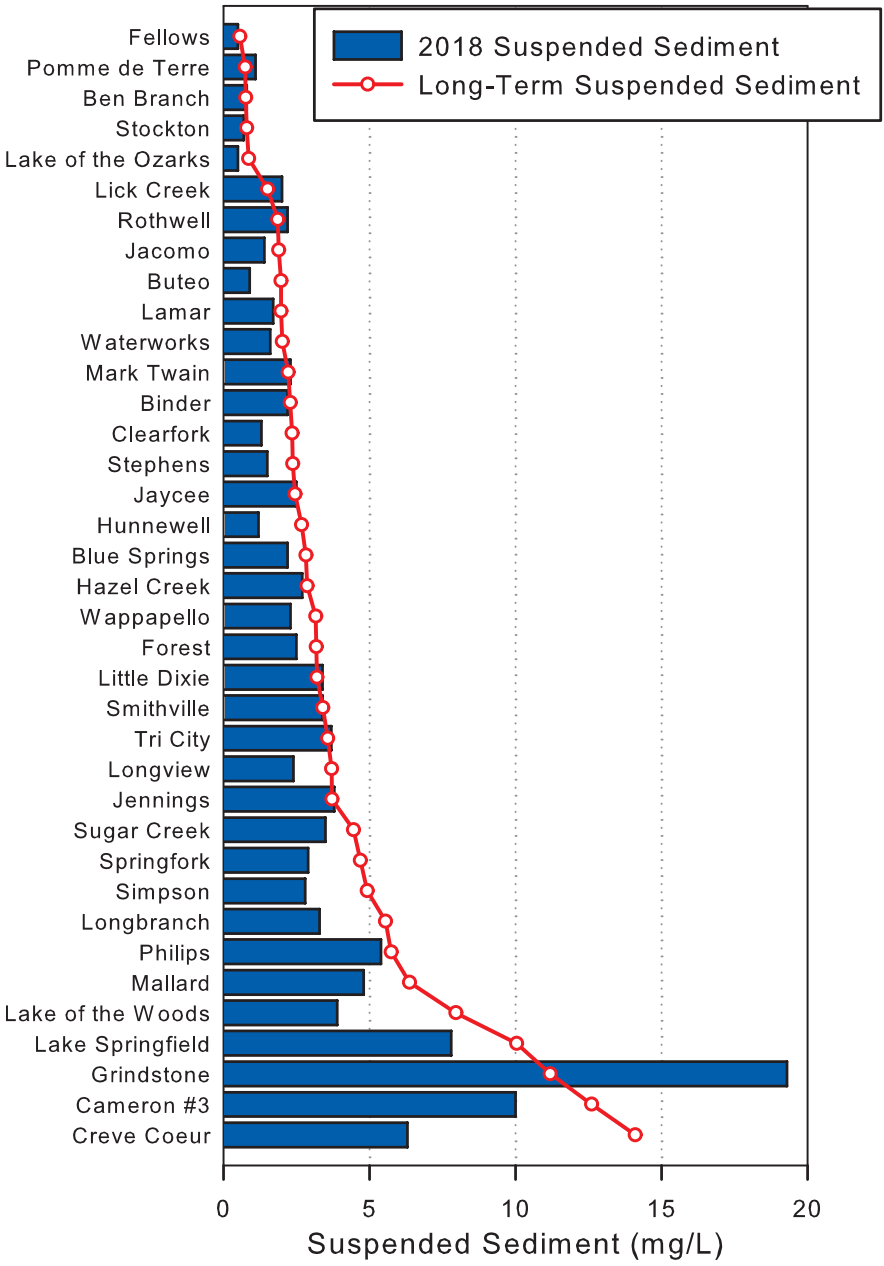
Suspended sediment will block light entering the water and because phosphorus binds so readily to sediment, any sediment washing into the lake will bring additional nutrients. The best way to deal with suspended sediment is to keep the soil on the ground in the watershed with erosion control measures. 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 2018 LMVP average was 3.6 mg/L with observed values ranging from 0.1 to 46.4 mg/L.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of suspended sediment in Missouri during 2018. Note: not all lake sites monitor suspended sediment.

Average Suspended sediment values for 37 public lakes monitored (at or near the dam) by LMVP volunteers in 2018 (bars). Long-term lake values shown in red.



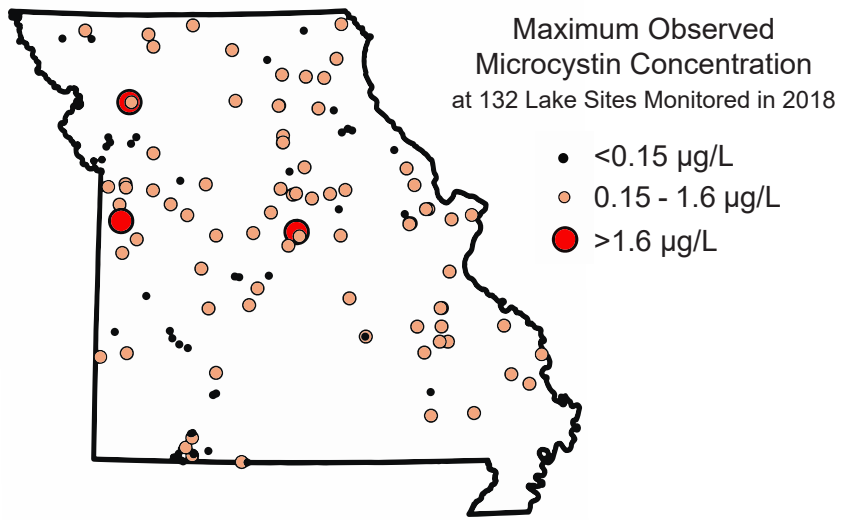
Algal Toxins in Missouri

In 2018, LMVP volunteers and employees of the University of Missouri Limnology Laboratory monitored 132 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 2018. 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 draft recommended recreational exposure level of 8.0 µg/L.

The map on the opposite page similarly shows maximum observed cylindrospermopsin concentrations during 2018. Cylindrospermopsin was more prevalent and concentrations were higher in 2018 than in 2017. The highest concentration observed in 2018 was 5.15 µg/L. That is ten times higher than in 2017, but still below the EPA revised recommeded recreational exposure value of 15.0 µg/L.

Toxin levels can vary greatly from one season 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 Revised Recommended Microcystin and Cylindrospermopsin Criteria

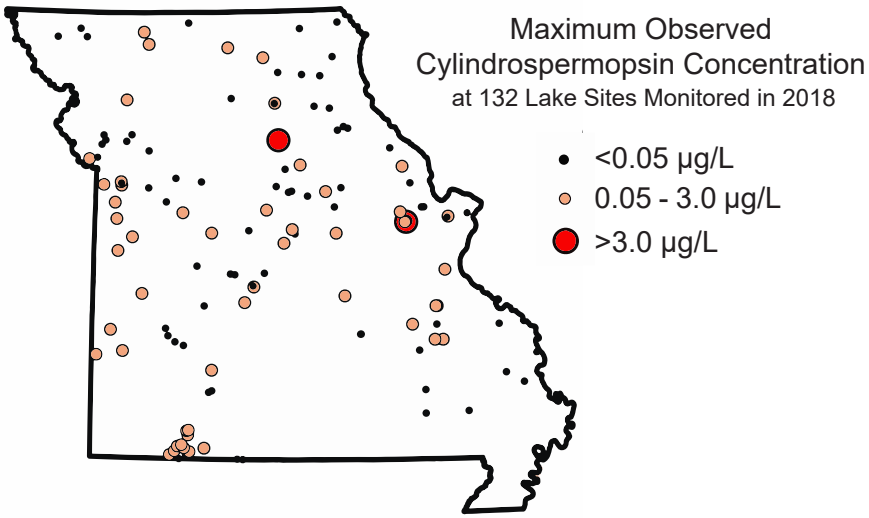
	Recreational Exposure	Drinking Water	
Microcystin:	8.0 µg/L	Bottle-fed infants and pre-school children	0.3 µg/L
		School-age children and adults	1.6 µg/L
Cylindrospermopsin:	15.0 µg/L	Bottle-fed infants and pre-school children	0.7 µg/L
		School-age children and adults	3.0 µg/L

Opposite: Maximum microcystin concentration measured at 132 lake sites in 2017

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

Below: Maximum cylindrospermopsin concentration measured at 132 lake sites in 2018

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.

Caroline Toole measures temperature at Lake of the Ozarks in Camden County. (Don Toole 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.

Photo: Beti Pearson pauses for a photo before collecting a sample at Pomme de Terre Lake. (Beti Pearson photo)

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