The Lakes of Missouri Volunteer Program

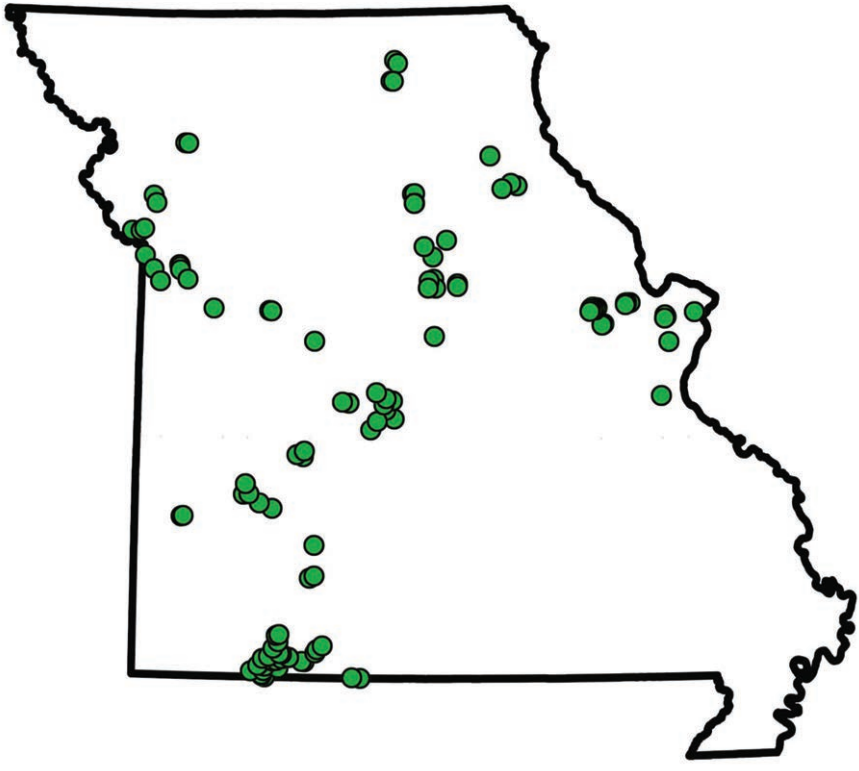
2017 LAKE REPORT

LAKES of MISSOURI VOLUNTEER PROGRAM

WWW.LMVP.ORG

A summary of 2017 water quality data

Lake Sites Monitored in 2017



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 G17-NPS-04

Cover photo: Bob Virag measures water clarity at Creve Coeur Lake in St. Louis County.

Data are available at LMVP.org

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Creeping water primrose on a lake in Moniteau County, Missouri. This non-native plant can form mats that completely cover the surface of a lake.

About the LMVP

The Lakes of Missouri Volunteer Program (LMVP) enlists volunteer monitors 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 25 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.

From left to right: Trenton Sayles, Partrick Sayles, Addisen McNally and Patrick McNally process water samples at Barry Harbor in Kansas City.

Cylindrospermopsin

Under the right conditions, the amount of algae in a lake can increase dramatically, causing a bloom. Not only can this can be unsightly, it can be dangerous. Some algal species produce toxins that can be harmful to humans and wildlife.

Since 2015, many LMVP volunteers have been monitoring our lakes so we may measure the most common toxin, microcystin.

Beginning in 2017, we are looking at an additional algal toxin. Cylindrospermopsin, like microcystin, is a hepatotoxin, meaning it affects the liver. The EPA recommends cylindrospermopsin levels in finished drinking water be below 0.7 µg/L (micrograms per liter or parts per billion) to protect bottle-fed infants and pre-school children. EPA's recommended recreational exposure criteria (e.g. swimming) is 8 µg/L.

While not as prevalent as microcystin, cylindrospermopsin was found in many U.S. lakes (including 6 in Missouri) during the EPA's 2007 survey of the nation's lakes.

Our 2017 results are summarized on pages 14-15, but concentrations were low throughout the season.

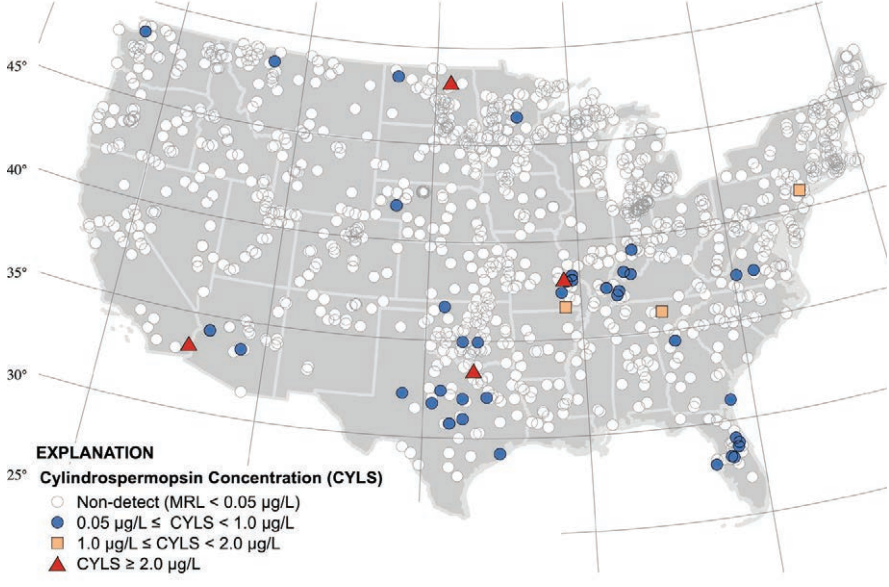
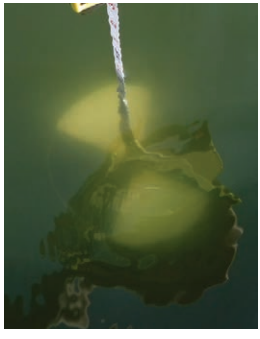


Image source: K. Loftin, J. Graham, E. Hilborn, S. Lehmann, M. Meyer, J. Dietze, C. Griffith. 2016. Cyanotoxins in inland laks of the United States: Occurrence and potential recreational health risks in the EPA National Lakes Assessment 2007. Harmful Algae, Vol 56, pp 77-90.

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.

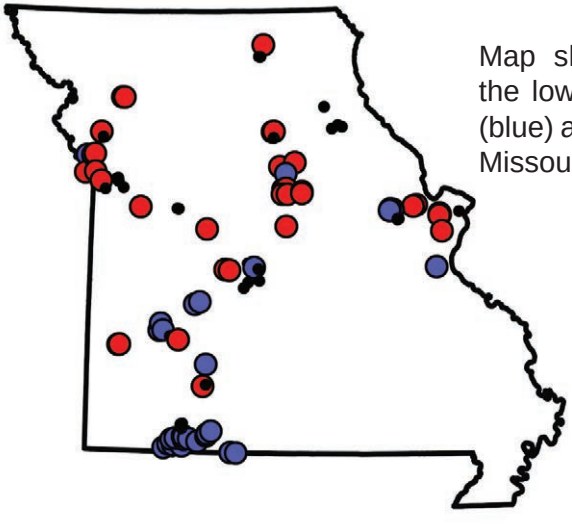
Water clarity is measured in lakes using the Secchi disk. This weighted disk has alternating black and white quadrants on its surface and is lowered into the water until it is no longer visible. This depth is recorded as the Secchi depth. The Secchi disk is the standard tool for lake water clarity measurement. The simplicity, low cost, and portability of the Secchi disk have ensured its continued use for 150 years.



A Secchi disk in a Missouri lake.

Water Clarity in Missouri Lakes

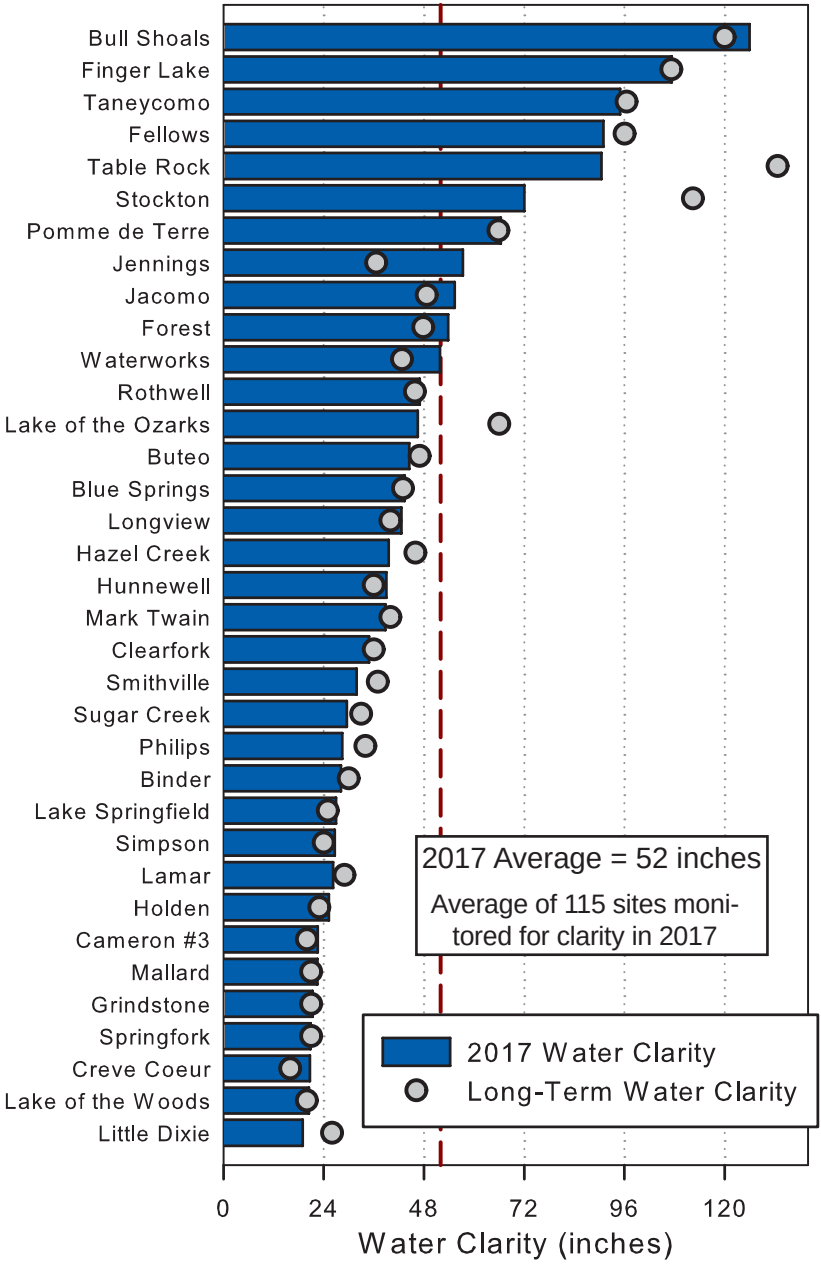
Missouri lakes historically, on average, have about 35 inches of clarity near the dam, and clarity decreases with distance from the dam. In 2017, the average LMVP volunteer-measured lake water clarity was 50 inches. Water clarity in Missouri reservoirs ranged from 204 to 6 inches in 2017.



Map shows lake sites with the lowest (red) and highest (blue) average water clarity in Missouri during 2017.

Water Clarity
- Secchi < 30”
- Secchi 30” - 59”
- Secchi > 60”

Average water clarity values for 35 public lakes monitored by LMVP volunteers in 2017 (bars). Long-term lake values shown as dots.



Chlorophyll

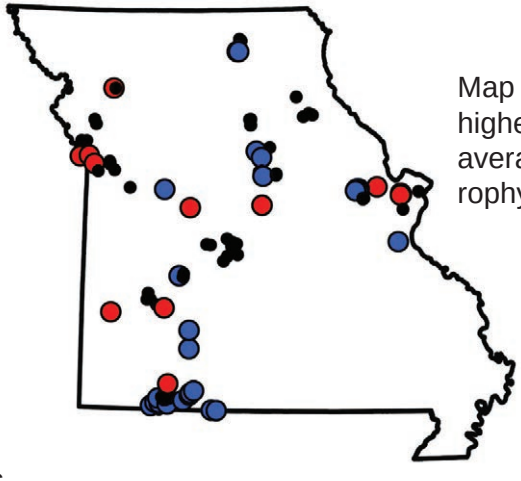
Algae are tiny plant-like organisms found in lakes (and nearly everywhere else). Algae use the sun's energy to convert CO_2 and nutrients into carbohydrates via photosynthesis. We estimate the amount of algae present by measuring the presence of the photosynthetic pigment, chlorophyll.

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 it is essential to aquatic life that algae be present, too much 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 life will suffer as a result.

Chlorophyll In Missouri Lakes

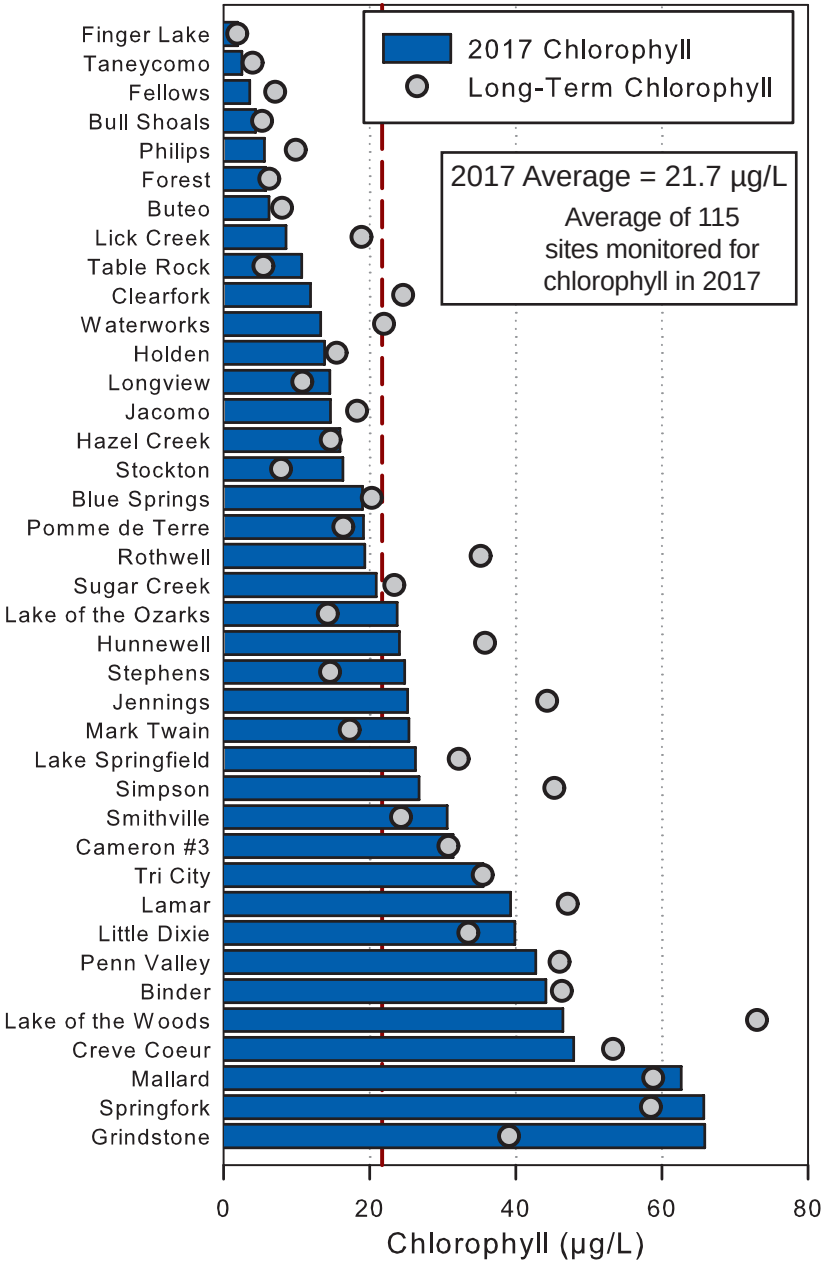
On average, Missouri lakes have 21 µg/L of chlorophyll at the dam. The average 2017 LMVP chlorophyll value was 18.8 µg/L, with individual values ranging from 0.3 to 163.5 µg/L.

Chuck Gatschenberger prepares a filter for chlorophyll analysis.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of chlorophyll in Missouri during 2017.

Average Chlorophyll values for 39 public lakes monitored by LMVP volunteers in 2017 (bars). Long-term lake values shown as dots.



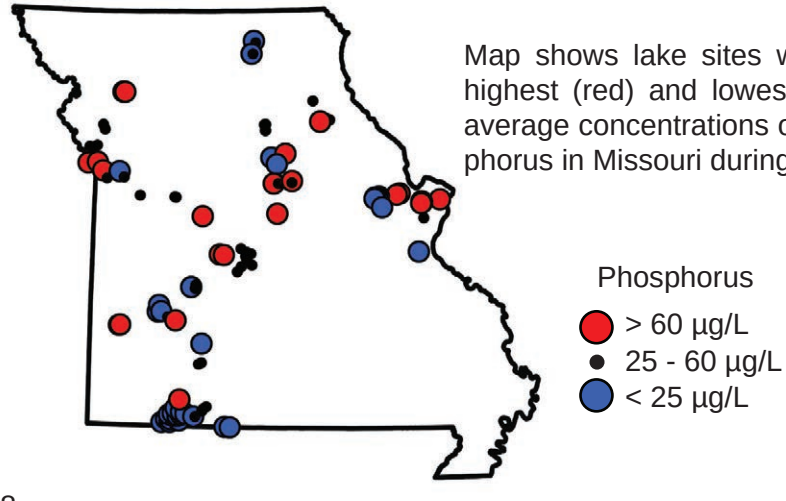
Total Phosphorus

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 problem algal levels that reduce recreational opportunities and are detrimental to other aquatic life.

Fish kill in a Boone County Lake, likely caused by excess algae (MDC photo).

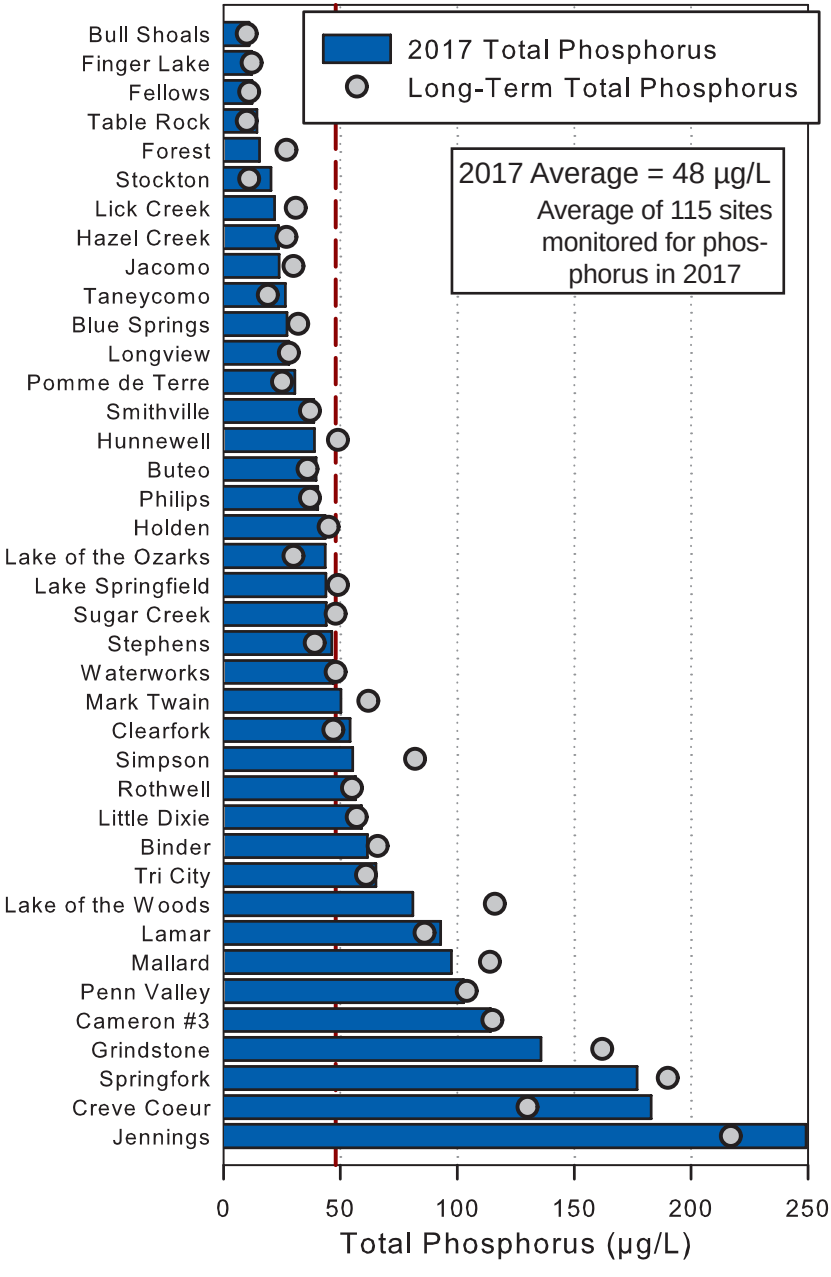
The best approach to managing phosphorus and the excess algal growth associated with it is to keep the phosphorus on the landscape and out of the lake. Wise applications of fertilizers to terrestrial systems, reductions of phosphorus in sewage effluent, proper maintenance of septic systems and management 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 2017 LMVP average was 49 µg/L. Individual values ranged from 5 to 407 µg/L.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of phosphorus in Missouri during 2017.

Average Total Phosphorus values for 39 public lakes monitored by LMVP volunteers in 2017 (bars). Long-term lake values shown as dots.

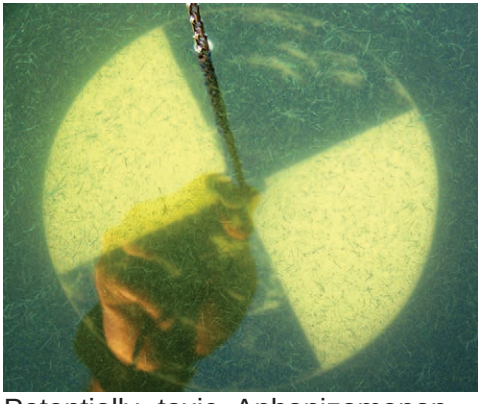


Total Nitrogen

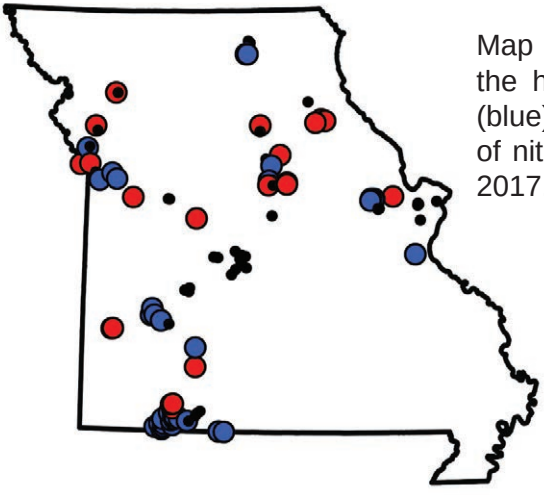
Nitrogen, like phosphorus, is a naturally-occurring element and a required nutrient for algae. Because algae require roughly twenty times more nitrogen than phosphorus, nitrogen can limit algal growth even though it is present in higher concentrations.

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.

The long-term average near-dam nitrogen concentration for 167 Missouri lakes is 800 µg/L. The LMVP 2017 average nitrogen value was 767 µg/L, with individual values ranging from 250 to 5170 µg/L.

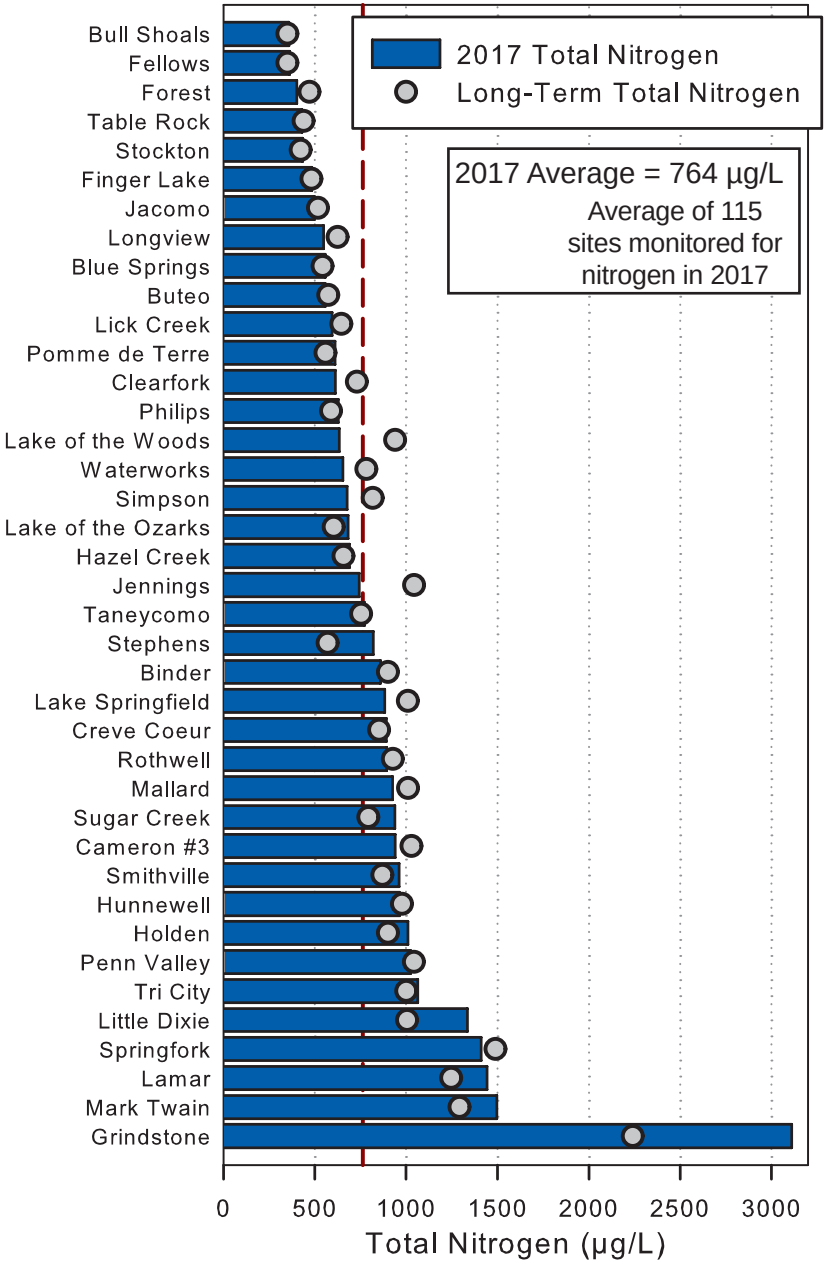


Potentially toxic Aphanizomenon bloom in a Boone County lake.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of nitrogen in Missouri during 2017.

Average Total Nitrogen values for 39 public lakes monitored by LMVP volunteers in 2017 (bars). Long-term lake values shown as dots.



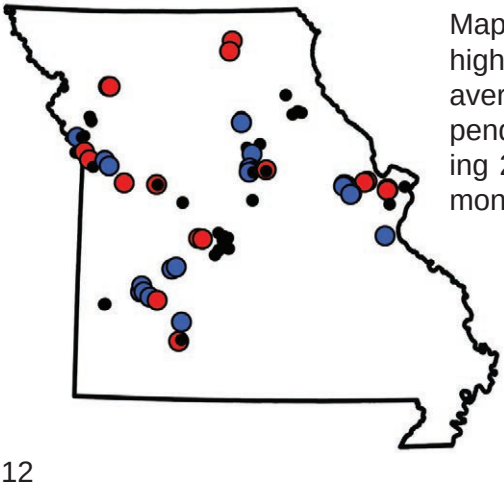
Suspended Sediment

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 existing valleys, reservoirs are much more susceptible to filling in than natural lakes.

Chuck Gatschenberger prepares a filter for suspended sediment analysis

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.

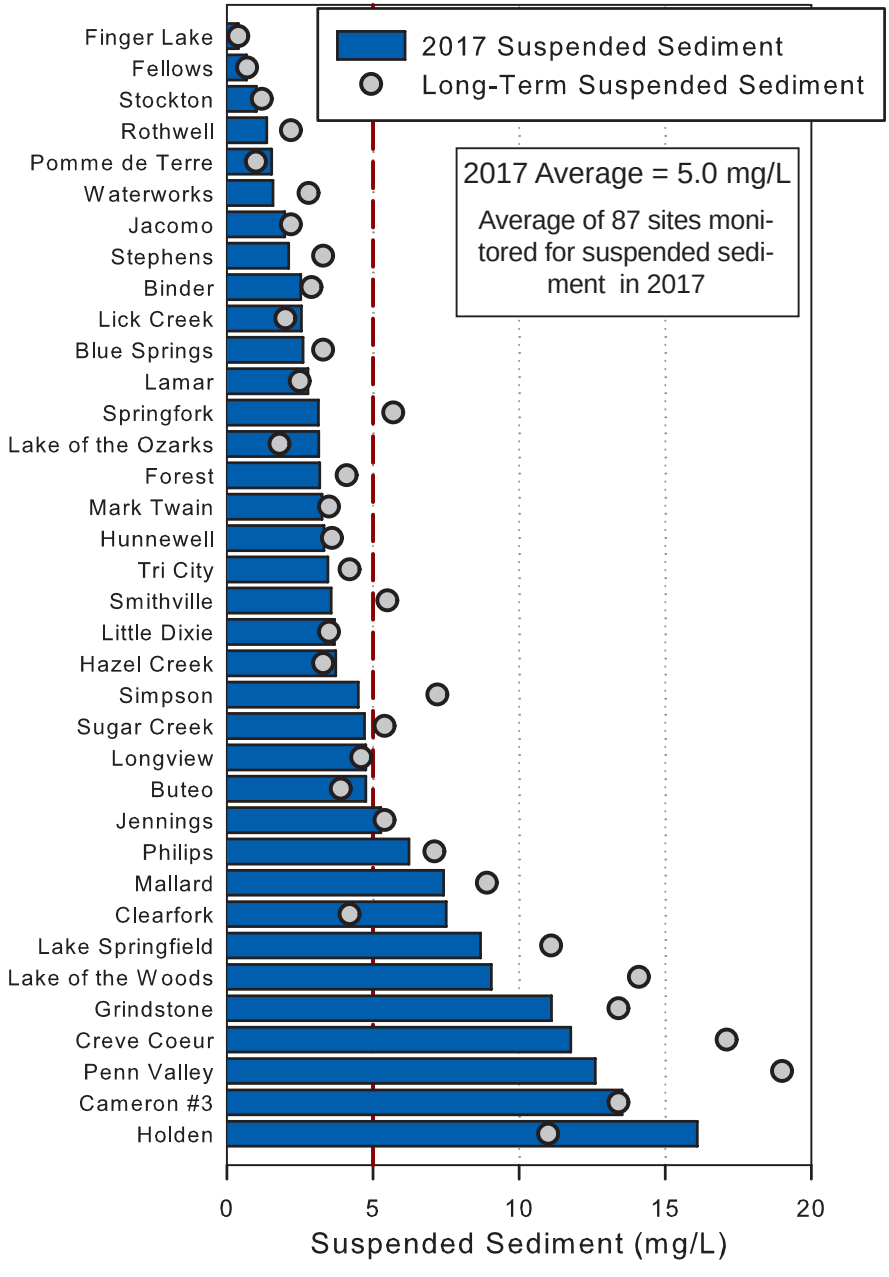
The long-term average Missouri near-dam suspended sediment value is 3.1 mg/L. The 2017 LMVP average was 5.0 mg/L with observed values ranging from 0.1 to 70.8 mg/L.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of suspended sediment in Missouri during 2016. Note: not all lake sites monitor suspended sediment.

Suspended Sediment
- > 6.5 mg/L
- 2.2 - 6.5 mg/L
- < 2.2 mg/L

Average Suspended sediment values for 36 public lakes monitored by LMVP volunteers in 2017 (bars). Long-term lake values shown as dots.



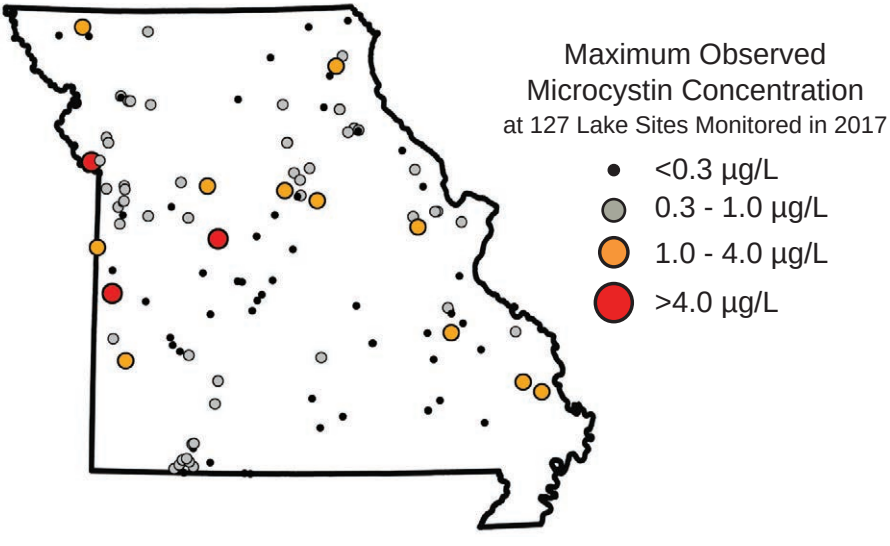
Algal Toxins in Missouri

In 2017, LMVP volunteers and employees of the University of Missouri Limnology Laboratory monitored 127 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 left shows the maximum microcystin value observed at each of the lake sites in Missouri during 2017. A small black dot means that all samples from that particular lake had very low or undetectable concentrations of microcystin. Large red circles mean that at least one observation had a concentration greater than 4 µg/L.

The map at the bottom of the opposite page shows maximum observed cylindrospermopsin concentrations during 2017. Cylindrospermopsin concentrations statewide were low in 2017. No monitored lake site had a concentration exceeding 0.40 µg/L.

Only 3 lake sites monitored in 2017 exceeded EPA draft recreational exposure criteria for microcystin (see table, opposite page). No monitored sites had cylindrospermopsin levels of concern. Toxin levels can vary greatly from one season to the next, so if you see suspicous 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 Draft Recommended Microcystin and Cylindrospermopsin Criteria

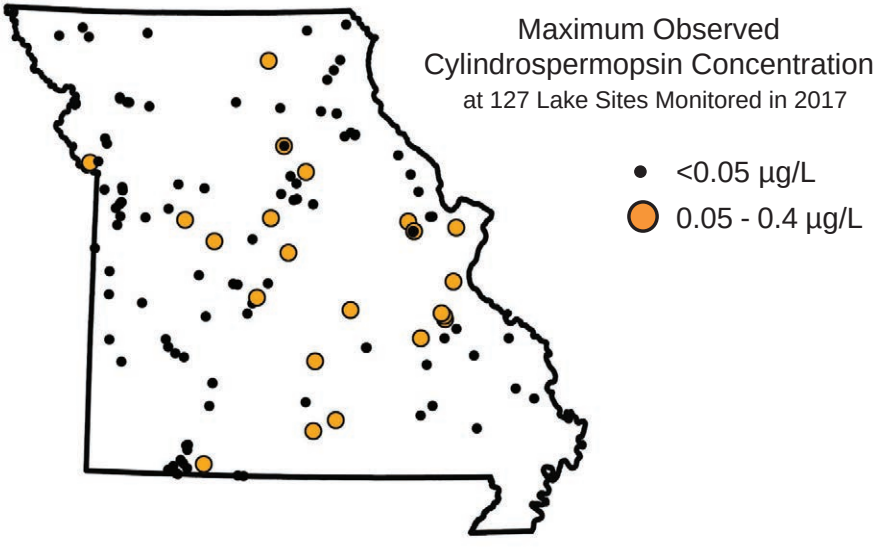
	Recreational Exposure	Drinking Water	
Microcystin:	4.0 µg/L	Bottle-fed infants and pre-school children	0.3 µg/L
		School-age children and adults	1.6 µg/L
Cylindrospermopsin:	8.0 µg/L	Bottle-fed infants and pre-school children	0.7 µg/L
		School-age children and adults	3.0 µg/L

Opposite: Maximum microcystin concentration measured at 127 lake sites in 2017

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

Below: Maximum cylindrospermopsin concentration measured at 127 lake sites in 2017

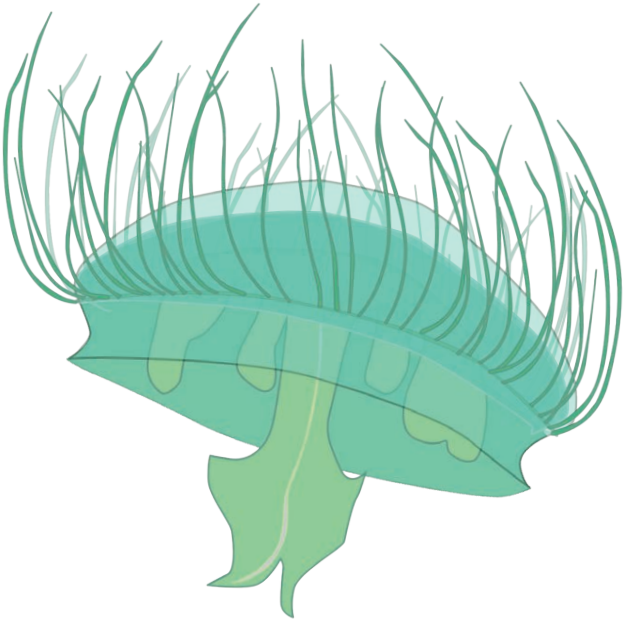
Algal toxin monitoring was made possible thanks to a joint effort between
- *Missouri Department of Health and Senior Services.*
- *Missouri Department of Natural Resources*
- *University of Missouri*



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.



The freshwater jellyfish, Craspedacusta sowerbyi, can be found throughout Missouri. They spend much of their lives as polyps attached to the bottom but an enviromental trigger can prompt them to enter the medusa phase. If you see one, there are likely many more around.

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 a water sample.
- Record observations about wave conditions .
- Process water for nutrient analysis.
- Filter measured water volumes for chlorophyll and suspended sediment analysis.
- Preserve and store all processed samples.

Larry Triplett samples Lake of the Ozarks at the 61 Mile Marker from his personal watercraft.

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