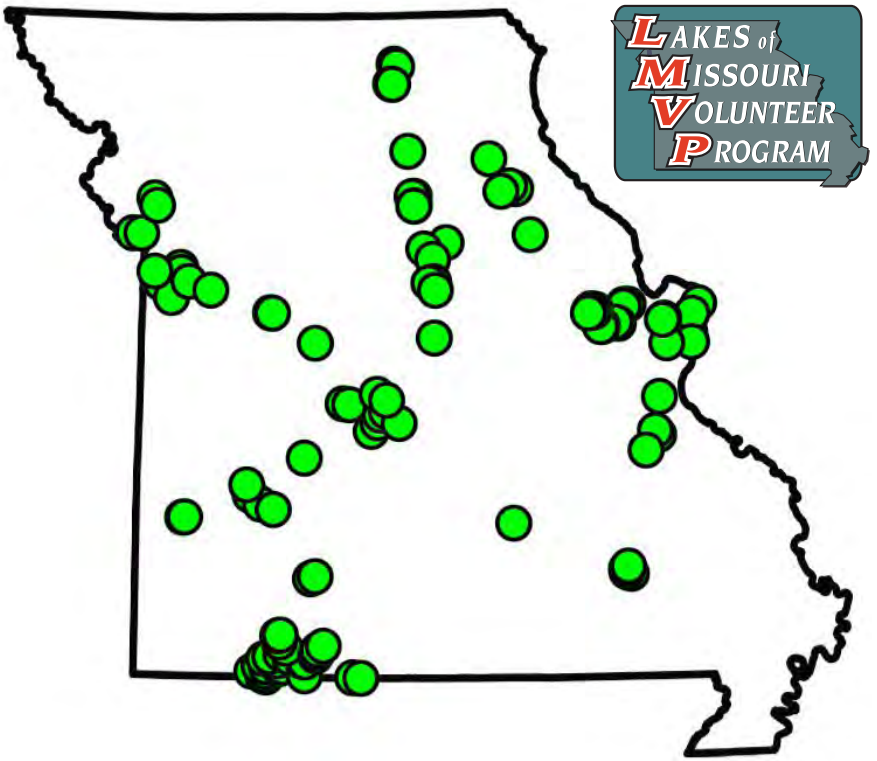
The Lakes of Missouri Volunteer Program

2020 LAKE REPORT

WWW.LMVP.ORG

A summary of 2020 water quality data

Lake Sites Monitored in 2020



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-14

Cover: Greg Hoeltzel displays his temperature/depth profile device attached to his anchor rope.

Data are available at LMVP.org

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Above: Eric, Reggie and Juliana MacEwen prepare to sample in 2020.

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.

Above: Tim Davis prepares chlorophyll filters at Lake of the Ozarks.

How We've Grown

Since the LMVP's start in 1992, we have been focused on several key water quality metrics, namely temperature, water clarity, nutrients (total phosphorus and total nitrogen), chlorophyll, and suspended sediment. In the last 5 years, we have expanded quite a bit. While our focus is still on measuring algae and what controls it, we are now looking at lakes even more closely.

Beginning in 2015, we started measuring cyanotoxins. These toxins, created by bluegreen algae (or cyanobacteria) have become more prevalent in many areas across the globe.

In 2017 we began measuring temperature at depth, allowing us to track the thermocline. The thermocline is important because it often defines the lower limit in the lake that can sustain life. In most Missouri lakes, there is little to no oxygen below the thermocline during summer. The area above the thermocline also broadly defines the vertical range of algae in our lakes.

2019 brought the addition of nitrate and ammonium. By measuring these forms of nitrogen, we will better understand the sources and biological availability of a nutrient crucial to the growth of algae. This year (2021), we will begin looking at total dissolved nitrogen to help us further refine our examination of nitrogen.

We appreciate the flexibility of our volunteers as we grow our program to meet today's demands and generate data to answer tomorrow's questions.

Above: Julie Youmans returns from sampling Phillips Lake in Boone County.

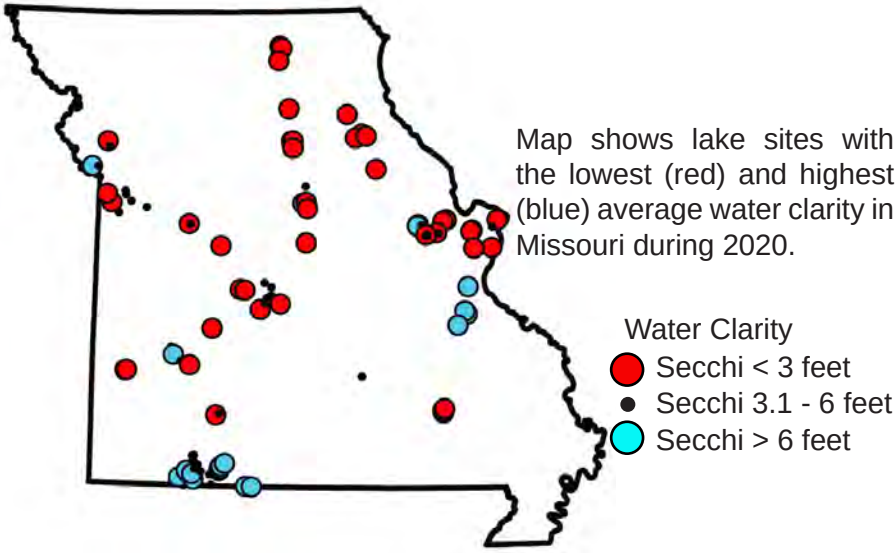
Water Clarity

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.

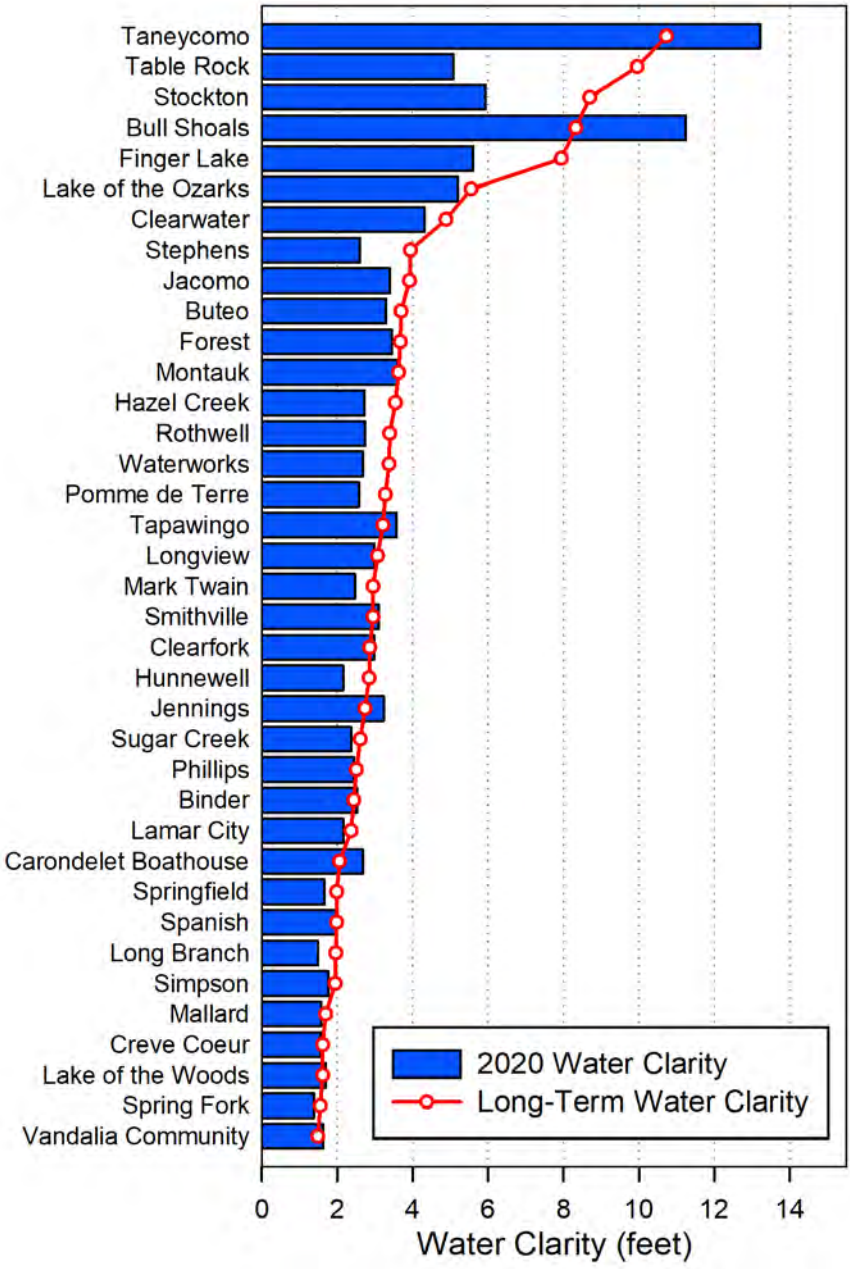
Missouri lakes historically, on average, have about 3 feet of clarity near the dam, and clarity decreases with distance from the dam. In 2020, the average LMVP volunteer-measured lake water clarity was 4.6 feet and our water clarity measurements ranged from 4 inches to 25 feet.

Above: Julie Youmans measures water clarity using a Secchi disk.



Map shows lake sites with the lowest (red) and highest (blue) average water clarity in Missouri during 2020.

Average water clarity values for 37 public lakes monitored (at or near the dam) by LMVP volunteers in 2020 (bars). Long-term lake values shown in red.



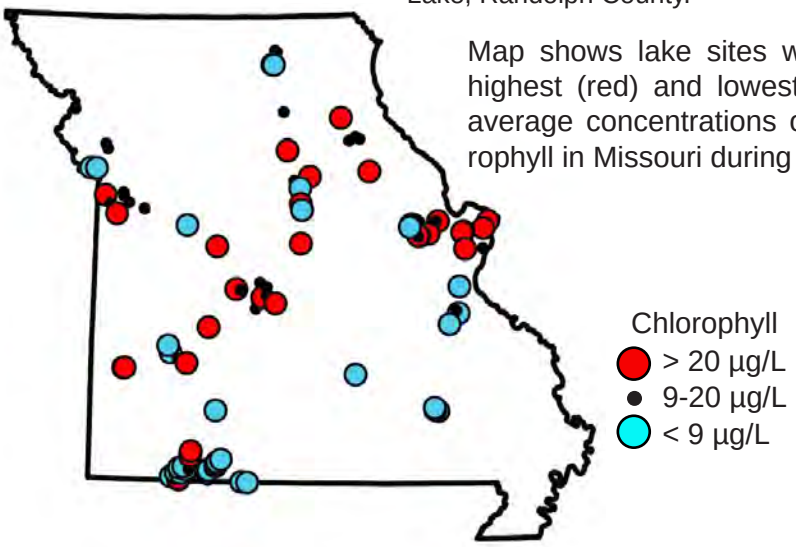
Chlorophyll

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.

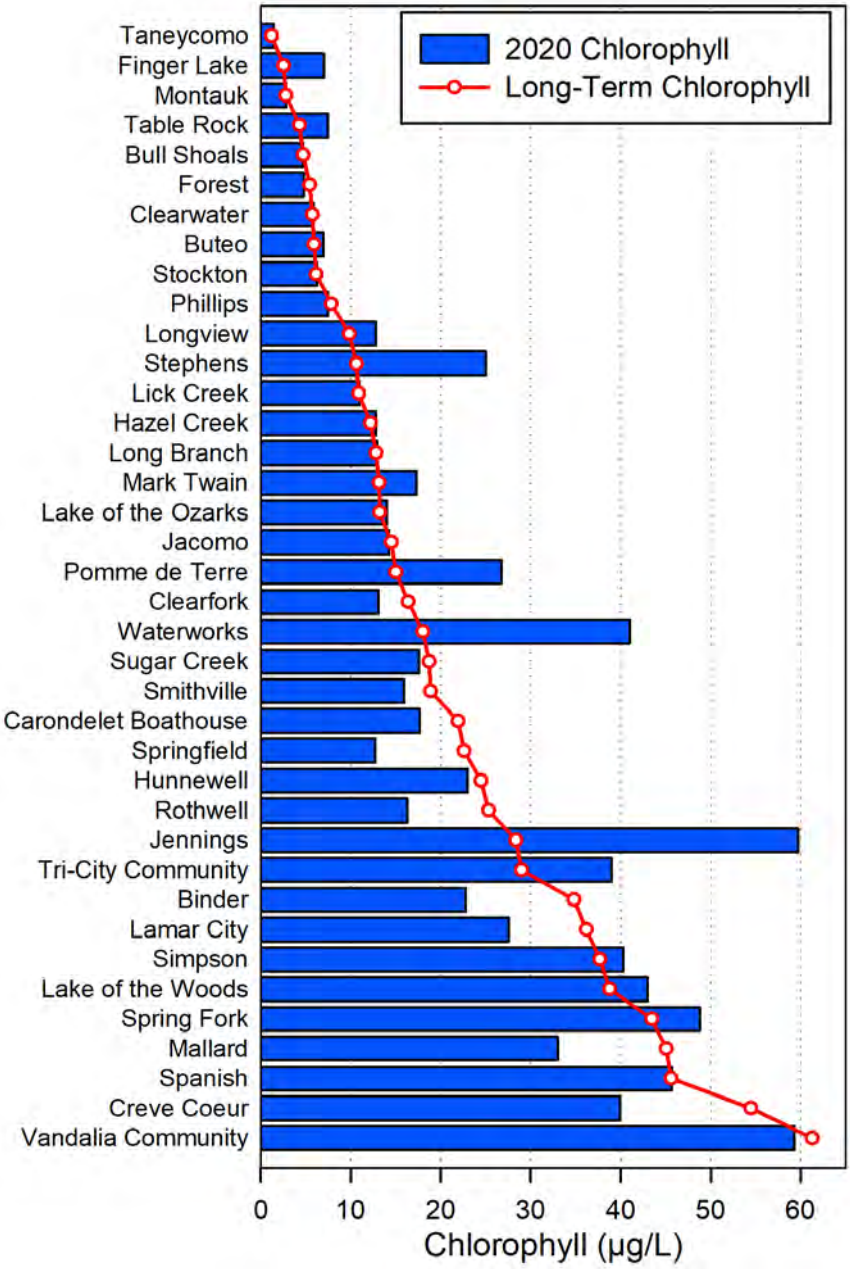
On average, Missouri lakes have 21 µg/L of chlorophyll at the dam. The average 2020 LMVP chlorophyll value was 18.0 µg/L, with individual values ranging from 0.2 to 385.0 µg/L.

Above: Algae bloom on Sugar Creek Lake, Randolph County.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of chlorophyll in Missouri during 2020.

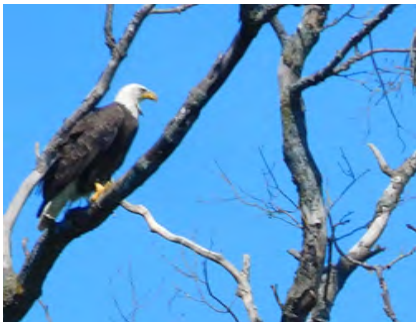
Average Chlorophyll values for 39 public lakes monitored (at or near the dam) by LMVP volunteers in 2020 (bars). Long-term lake values shown in red.



Total Phosphorus

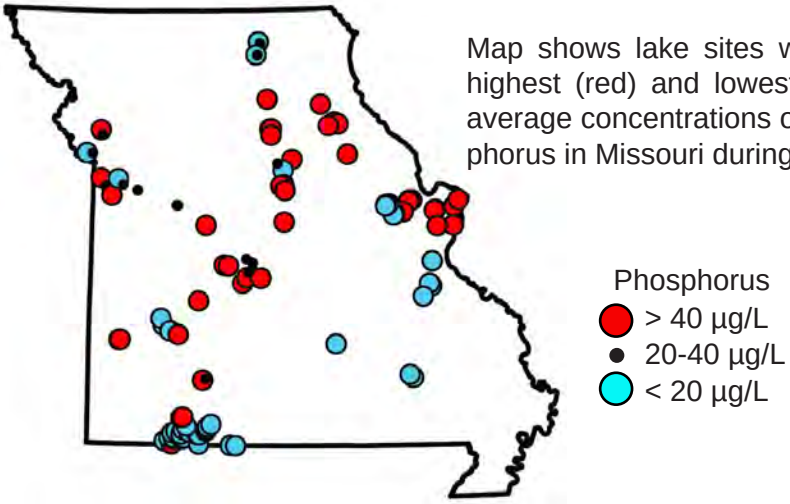
Phosphorus is a naturally occurring element and a required nutrient for life. In Missouri lakes, the amount of algae a lake can support is often controlled by the phosphorus concentrations in the water. Missouri lakes vary in terms of phosphorus levels, with some lake sites having single digit values 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.



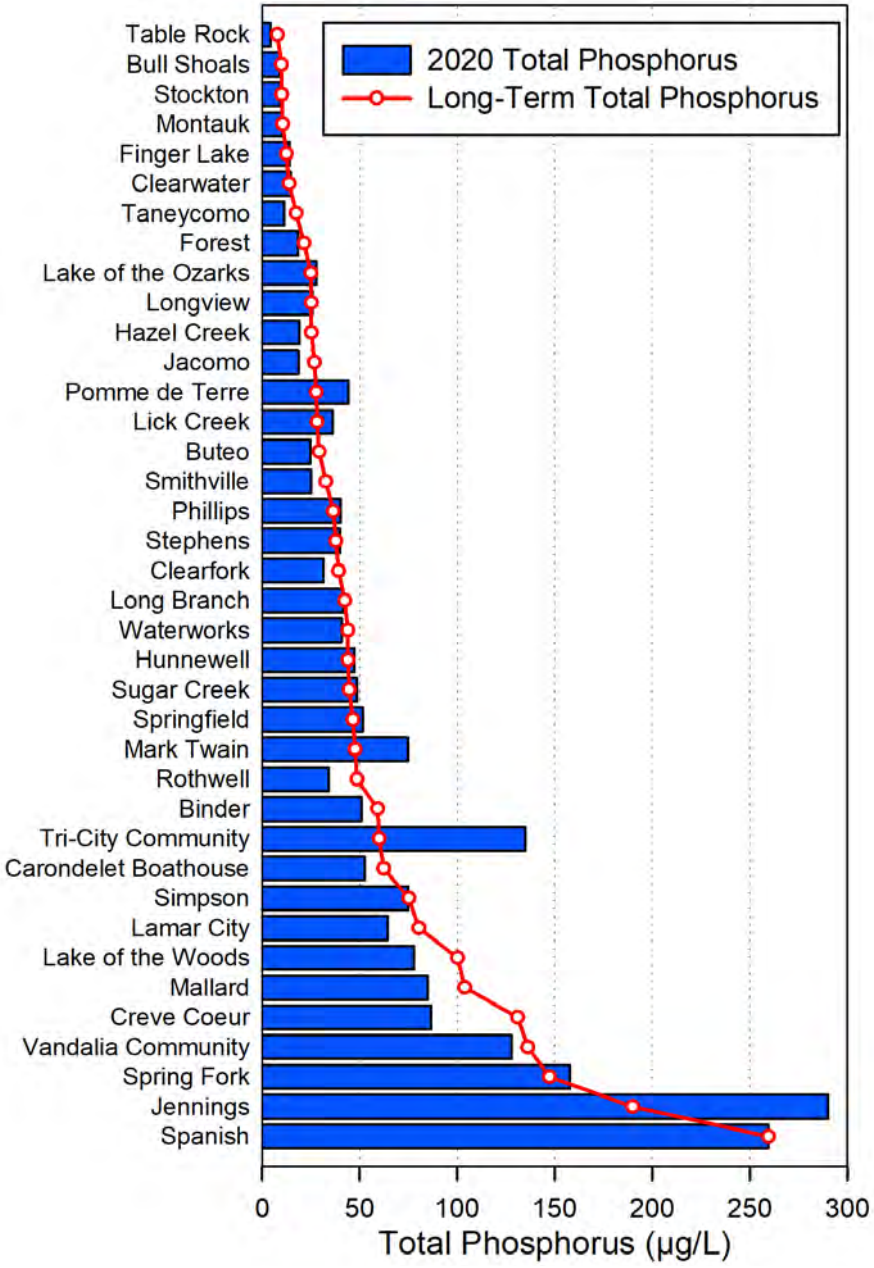
Above: A bald eagle watches as Frank Fillo and Lynn Fair monitor Sugar Creek Lake in Randolph County.

Long-term data from 167 lakes indicate the average Missouri lake phosphorus concentration is 58 µg/L near the dam. The 2020 LMVP average was 42 µg/L. Individual values ranged from 1 to 437 µg/L.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of phosphorus in Missouri during 2020.

Average Total Phosphorus values for 39 public lakes monitored (at or near the dam) by LMVP volunteers in 2020 (bars). Long-term lake values shown in red.



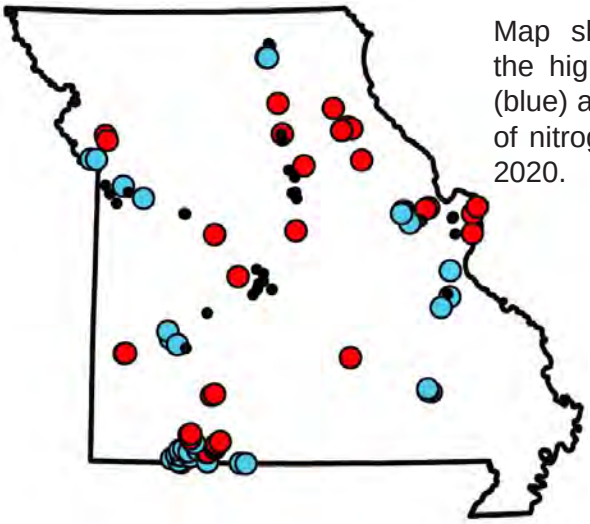
Total Nitrogen

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.

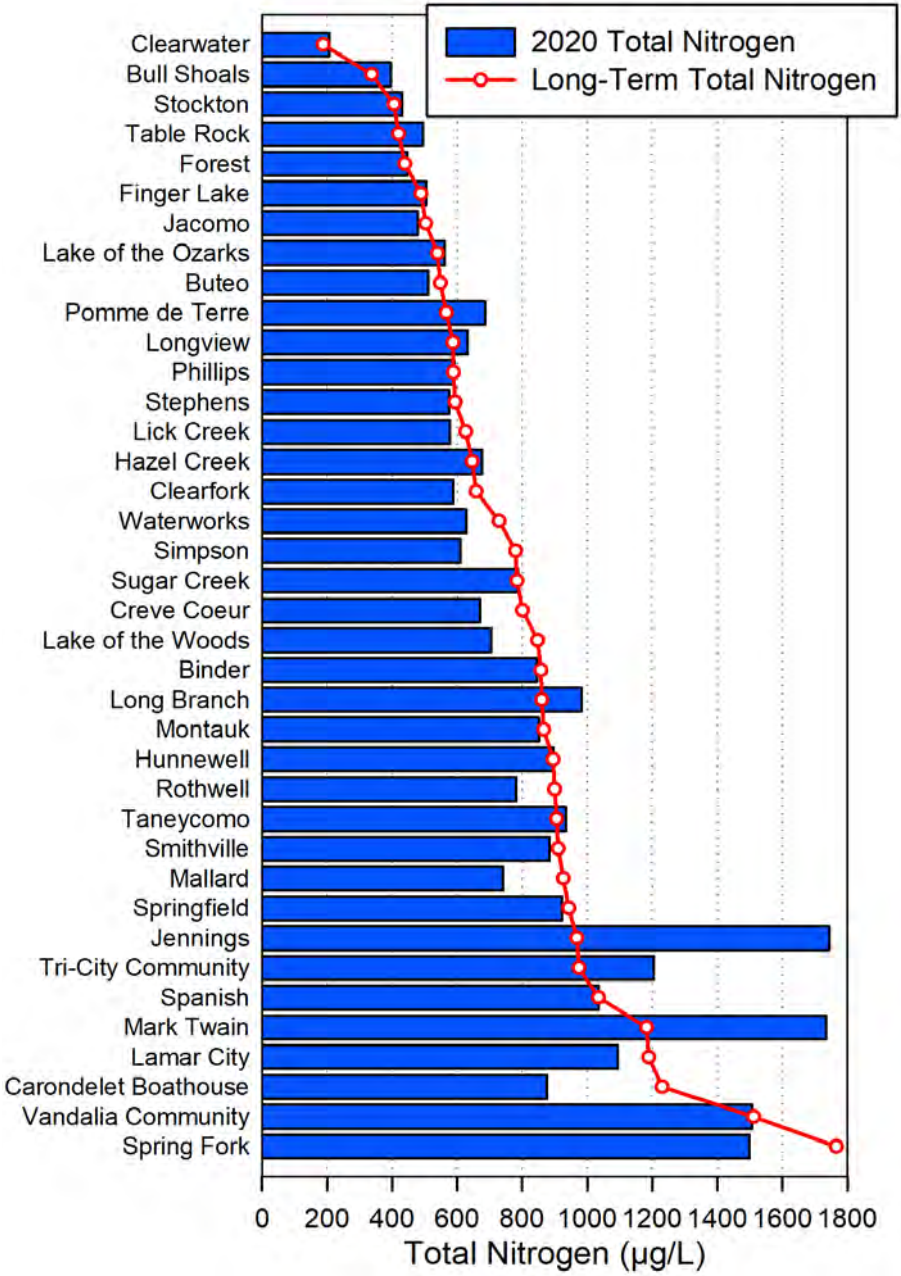
The long-term average near-dam nitrogen concentration for 167 Missouri lakes is 800 µg/L. The LMVP 2020 average nitrogen value was 712 µg/L, with individual values ranging from 125 to 3980 µg/L.

Above: Sampling supplies loaded and ready in Don and Caroline Toole's boat at Lake of the Ozarks.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of nitrogen in Missouri during 2020.

Average Total Nitrogen values for 39 public lakes monitored (at or near the dam) by LMVP volunteers in 2020 (bars). Long-term lake values shown in red.



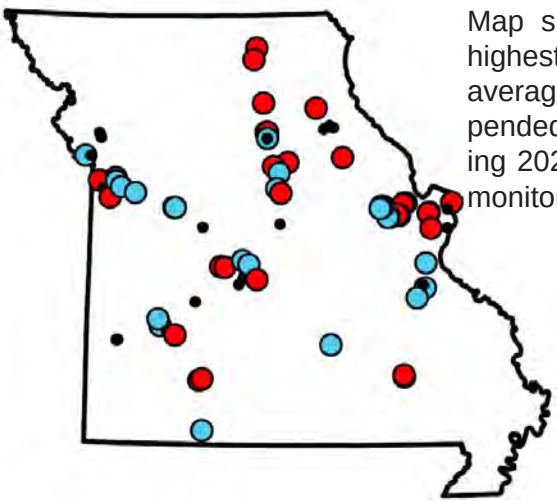
Suspended Sediment

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 2020 LMVP average was 4.6 mg/L with observed values ranging from 0.1 to 259.0 mg/L.

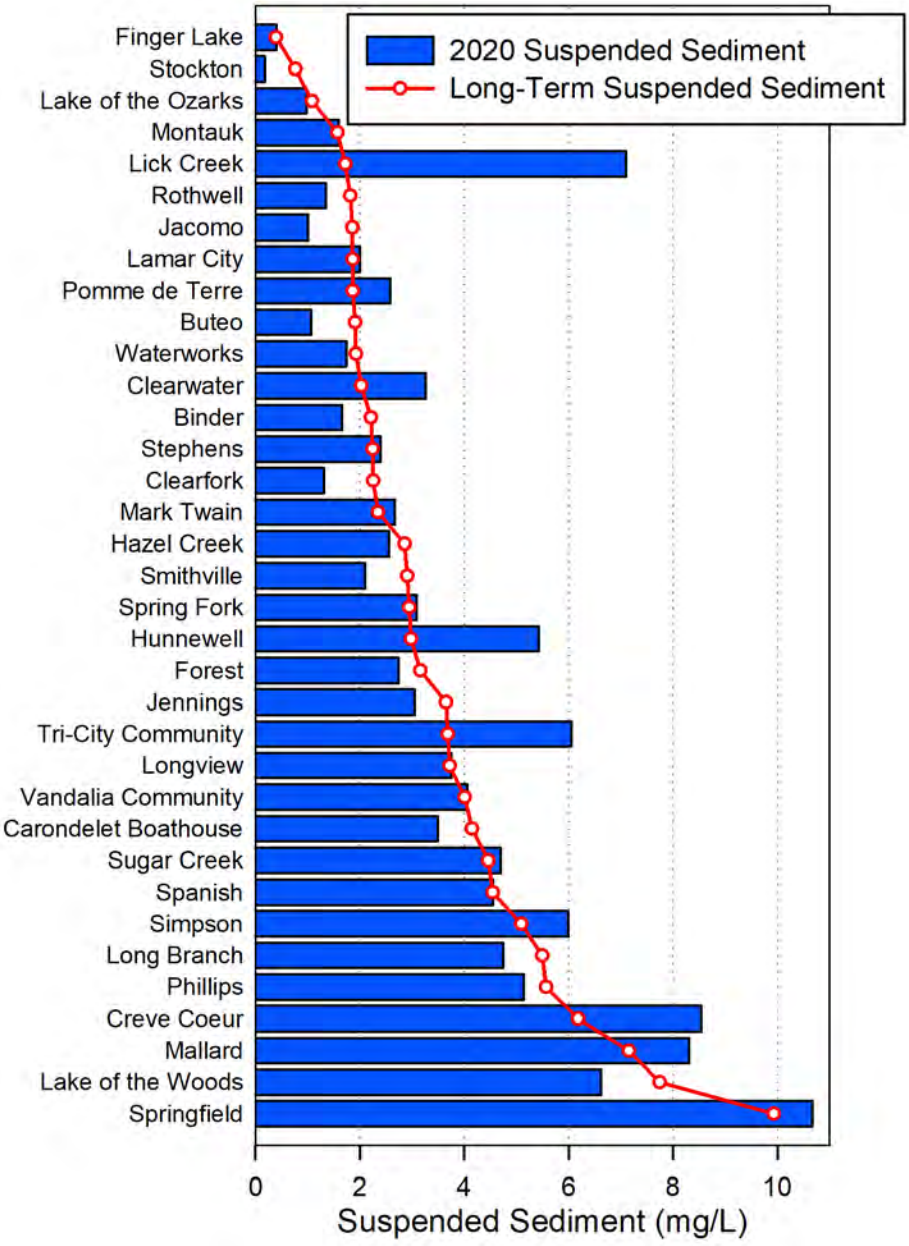
Above: Volunteer Rob Speer shows how he repaired a broken vacuum pump using a spatula and a bottle cap.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of suspended sediment in Missouri during 2020. Note: not all lake sites monitor suspended sediment.

Suspended Sediment
- > 4 mg/L
- 1.6-4 mg/L
- < 1.6 µg/L

Average Suspended sediment values for 35 public lakes monitored (at or near the dam) by LMVP volunteers in 2020 (bars). Long-term lake values shown in red.



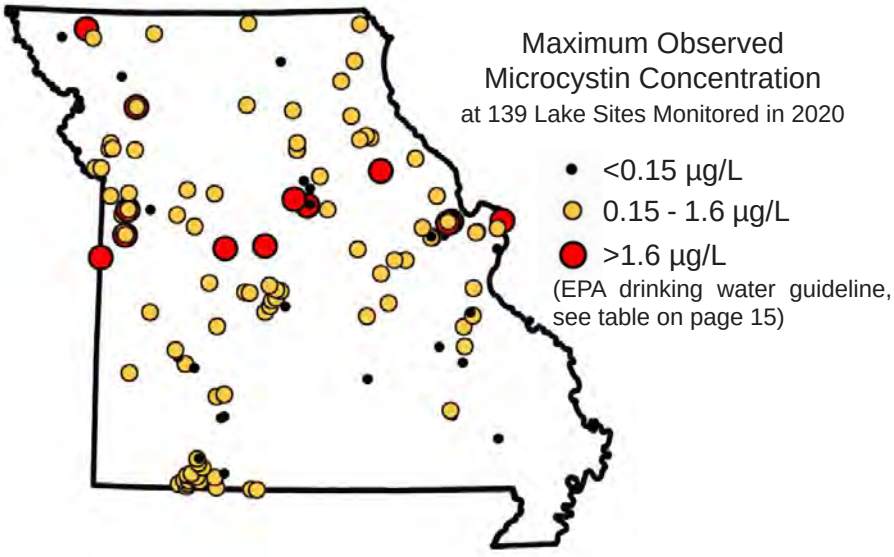
Algal Toxins in Missouri

In 2020, 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 2020. 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 childrend and adults. 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 2020. In 2020, only 1 lake 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

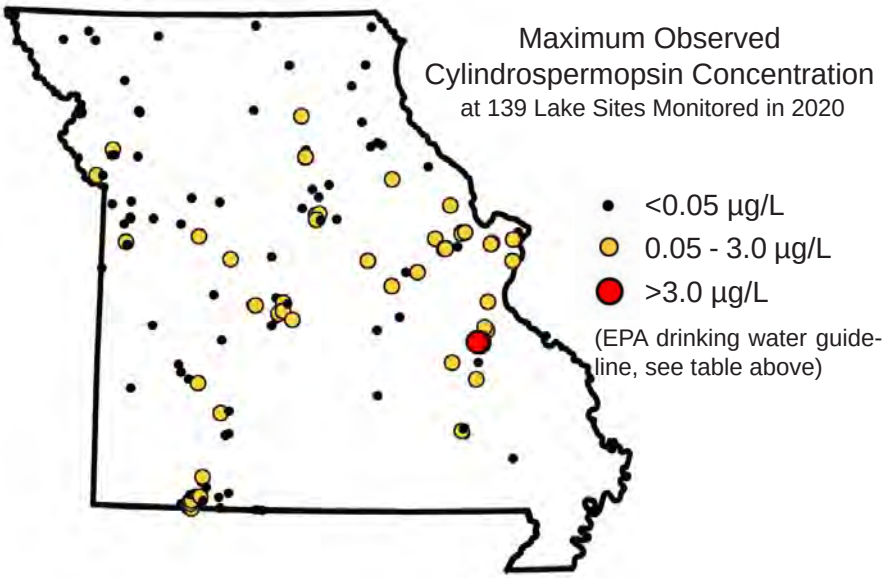
	Recreational Exposure	Drinking Water	
Microcystin:	8.0 µg/L	Bottle-fed infants and pre-school children	0.3 µg/L
		School-age children and adults	1.6 µg/L
Cylindrospermopsin:	15.0 µg/L	Bottle-fed infants and pre-school children	0.7 µg/L
		School-age children and adults	3.0 µg/L

Opposite: Maximum microcystin concentration measured at 139 lake sites.

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

Below: Maximum cylindrospermopsin concentration measured at 139 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), goose poop, freshwater jellyfish, and much more.

Above: Madison Sieg looks at the bridge over Flat Creek at Table Rock Lake. The lake was 15 feet above normal pool and the volunteers had to put down their bimini top to pass under the bridge. David Casaletto 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: Mary Hillinger about to take a Secchi Reading on Table Rock Lake

Back cover: Foggy day at Lake of the Ozarks. Gary Krizanich photo.

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