THE LAKES OF MISSOURI VOLUNTEER PROGRAM

2015 DATA REPORT

A summary of 2015 water quality data from the Lakes of Missouri Volunteer Program

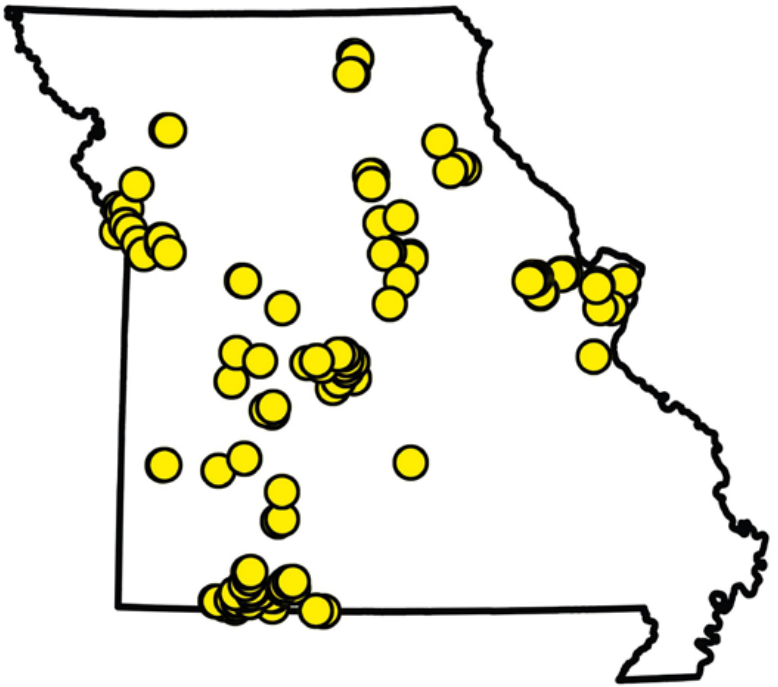
WWW.LMVP.ORG

Cover: Bob Steiert measures water clarity at Lake Jacomo using a Secchi disk.

Right: Duckweed on Lake Taneycomo. Tony Thorpe photos.

Below: The 120 sample sites monitored by LMVP volunteers in 2015

2015 LMVP SITES



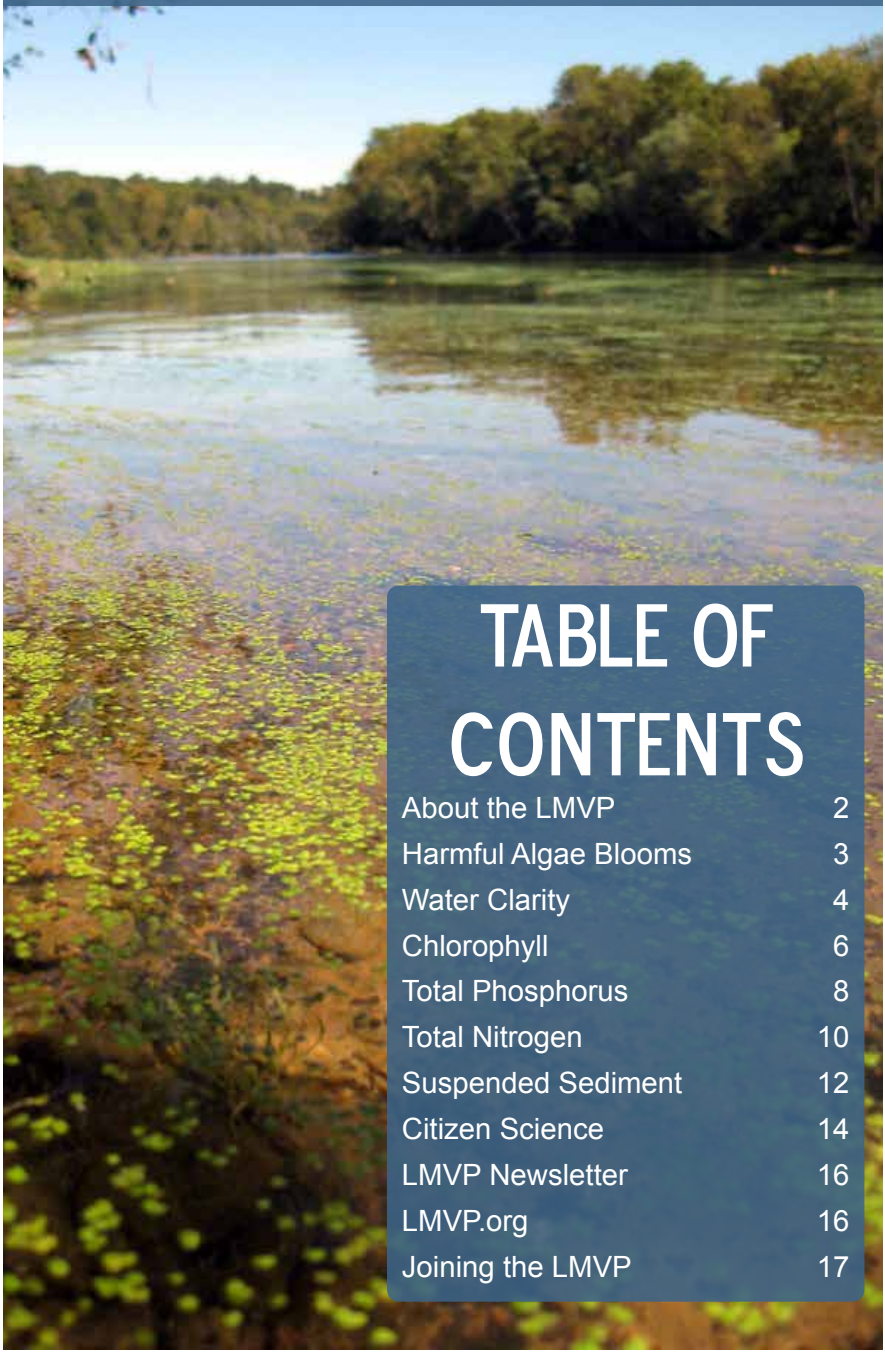
Lakes of Missouri Volunteer Program

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 Subgrant G16-NPS-02

DATA AVAILABLE AT LMVP.ORG



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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 (Obrecht et al. 1998) 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.

From left: Chris Edmondson, Erika Wright and Tom Clark sample Buteo Lake in Knob Noster State Park. Tony Thorpe photo.

HARMFUL ALGAE BLOOMS

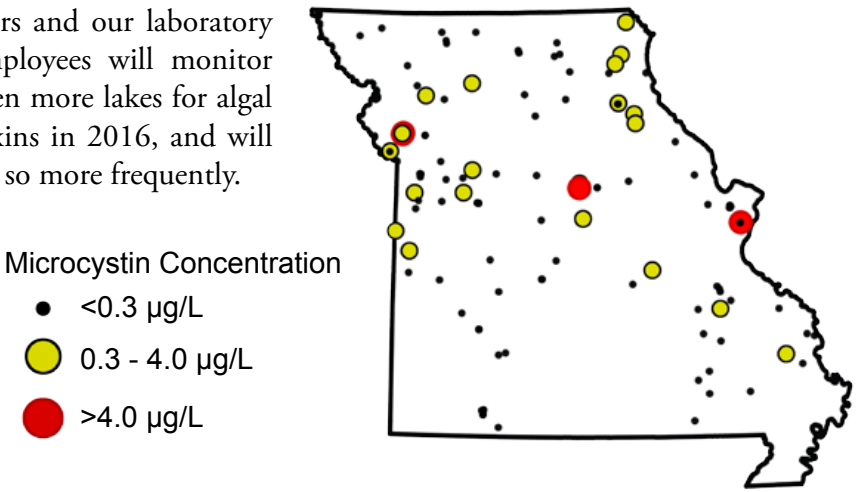
In summer 2015, the Lakes of Missouri Volunteer Program began monitoring some lakes for the blue-green algal toxin, microcystin. We also enlisted our laboratory sampling crew to monitor an additional 75 lakes throughout the state. These additional lakes were sampled once, during July and August. The combined results from both sampling efforts are shown in the map below.

Ryan Reece collects a sample for algal toxin analysis at Buteo Lake

More than 60% of the 2015 Missouri samples had no toxin or extremely low toxin levels (less than 0.3 µg/L).

Missouri has not yet established the toxin concentrations at which health advisories should be posted, but our neighboring state of Kansas will issue a Public Health Watch when concentrations are over 4 ug/L and Public Health Warnings at 20 µg/L. While three Missouri lakes had toxin levels high enough to trigger a Kansas Public Health Watch, no lakes had toxin levels high enough to trigger a Kansas Public Health Warning. For more information visit LMVP.org/bluegreen.

Thanks to help from the Missouri Department of Health and Senior Services, LMVP volunteers and our laboratory employees will monitor even more lakes for algal toxins in 2016, and will do so more frequently.



WATER CLARITY

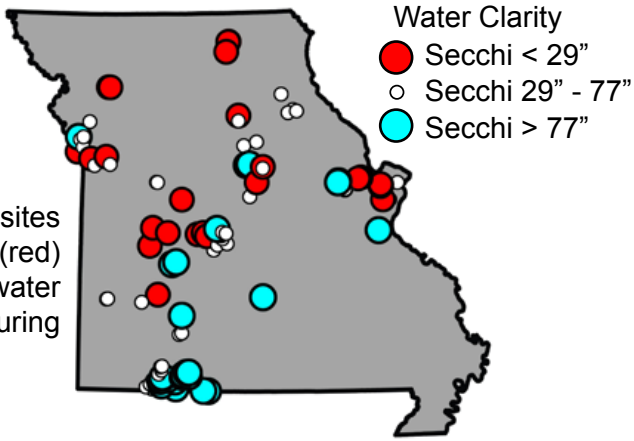
Erika Wright measures water clarity at Buteo Lake in Knob Noster State Park. Tony Thorpe photo.

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.

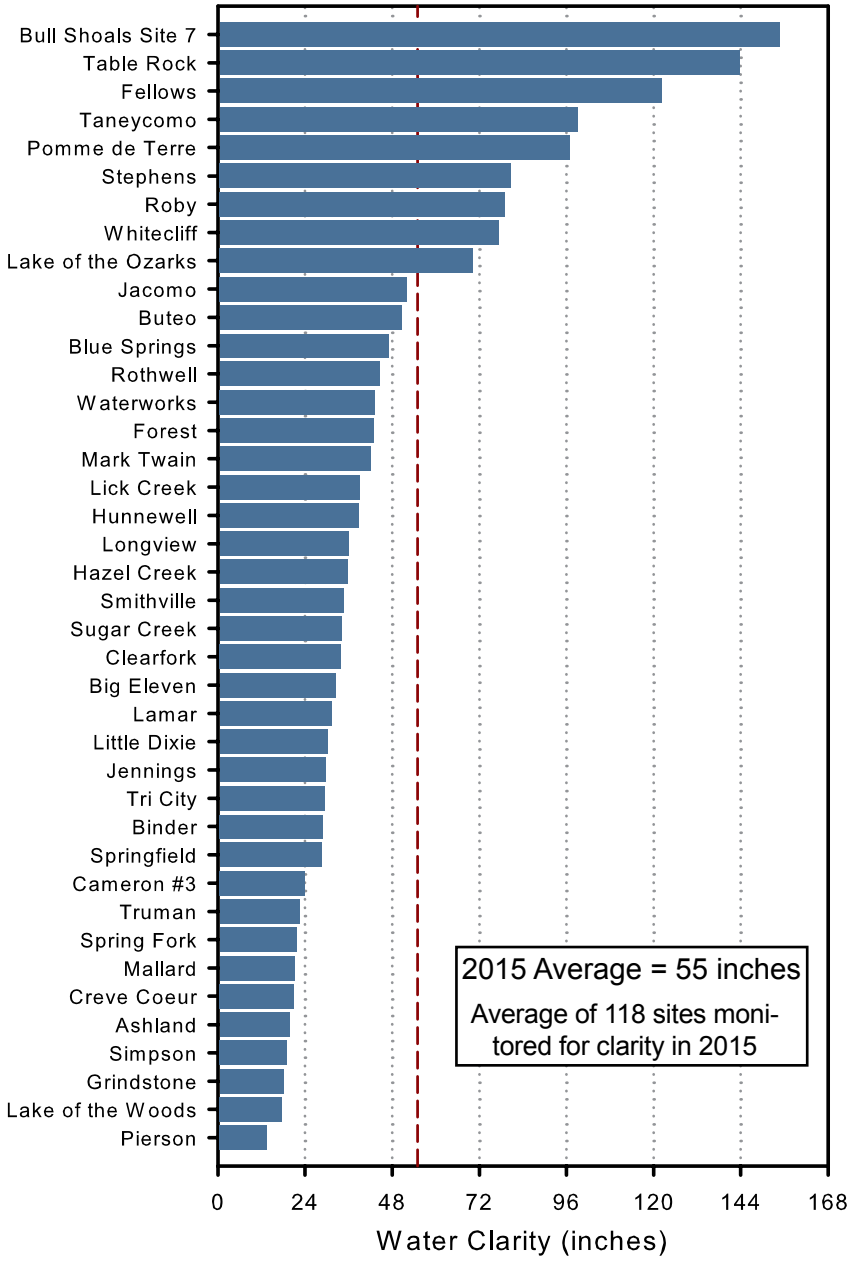
Water Clarity in Missouri Lakes

Missouri lakes have, on average, have about 35 inches of clarity near the dam, and clarity decreases with distance from the dam. In 2015, the average LMVP volunteer-measured lake water clarity was 55 inches. Missouri's clearest water quality reading (276 inches) and its murkiest (6 inches) both came from Table Rock Lake in 2015.



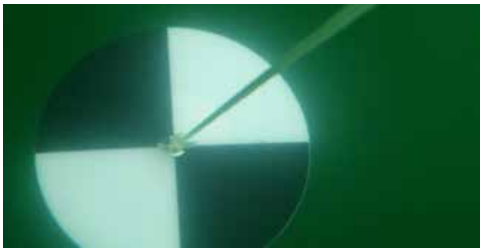
Map shows lake sites with the lowest (red) and highest (blue) water clarity in Missouri during 2015.

Average Secchi values for 40 public lakes monitored by LMVP volunteers in 2015.



CHLOROPHYLL

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



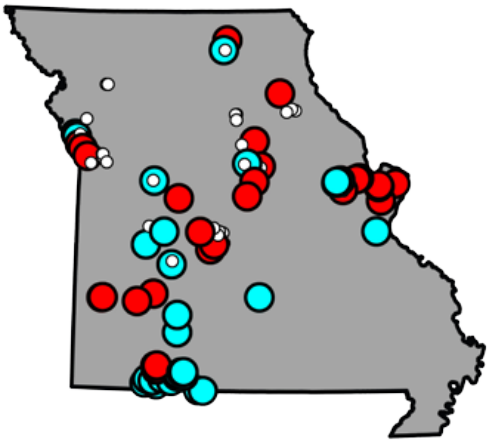
The chlorophyll in algae cells is responsible for the green color in lakes. Linda Kittle photo.

Other organisms, like zooplankton, mussels, and certain fishes, consume algae. These first-order consumers 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, oxygen levels will vary widely between day and night during a bloom, and other aquatic life will suffer as a result.

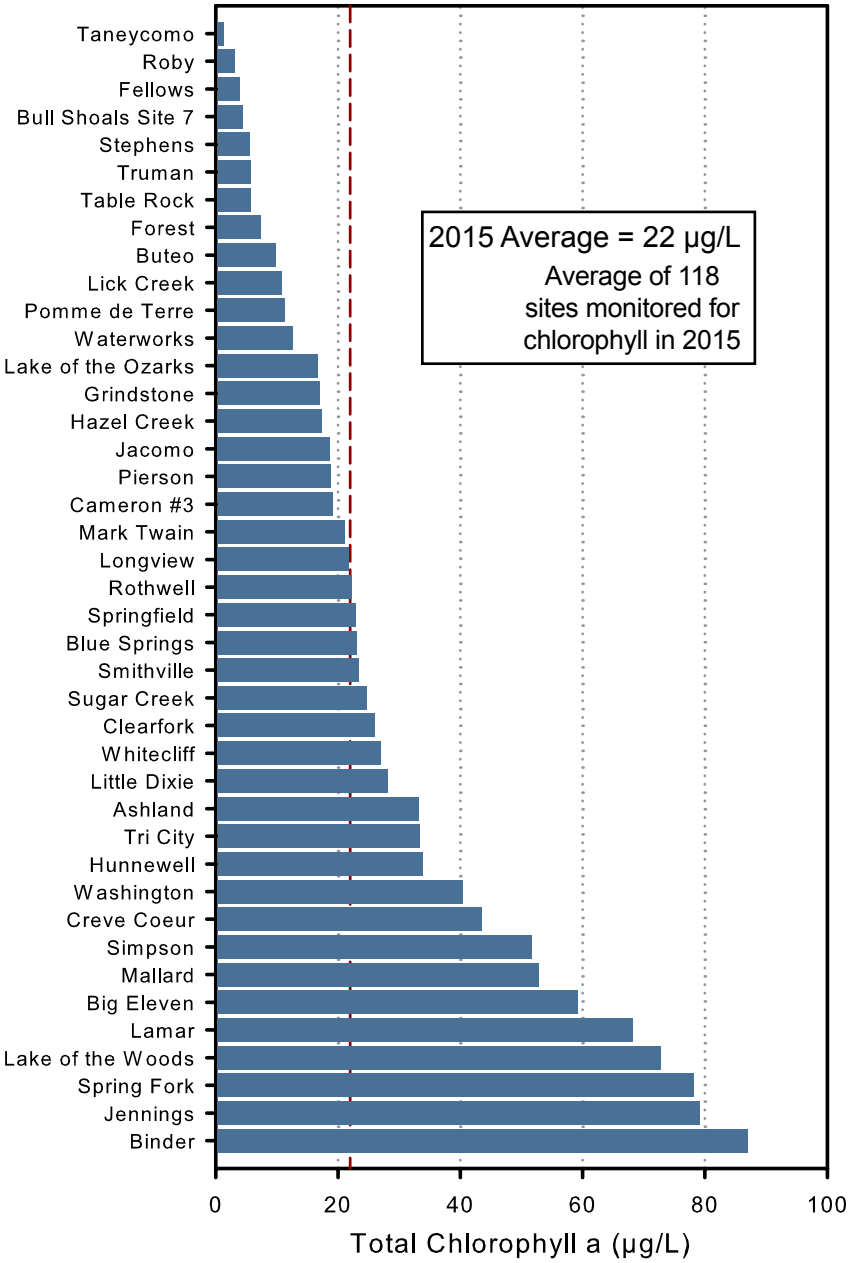
Chlorophyll In Missouri Lakes

On average, Missouri lakes have 21 µg/L of chlorophyll at the dam. The average 2015 LMVP chlorophyll value was 22 µg/L, with individual values ranging from 0.2 to 323 µg/L.

Map shows lake sites with the highest (red) and lowest (blue) concentrations of chlorophyll in Missouri during 2015.



Average Chlorophyll values for 41 public lakes monitored by LMVP volunteers in 2015.



TOTAL PHOSPHORUS

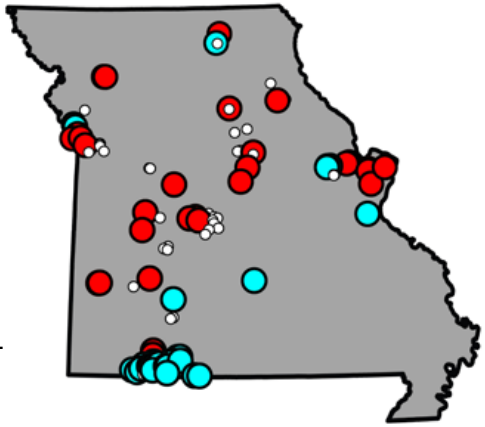
Too much phosphorus in a lake usually means an overabundance of algae.

Phosphorus is a naturally-ocurring 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.

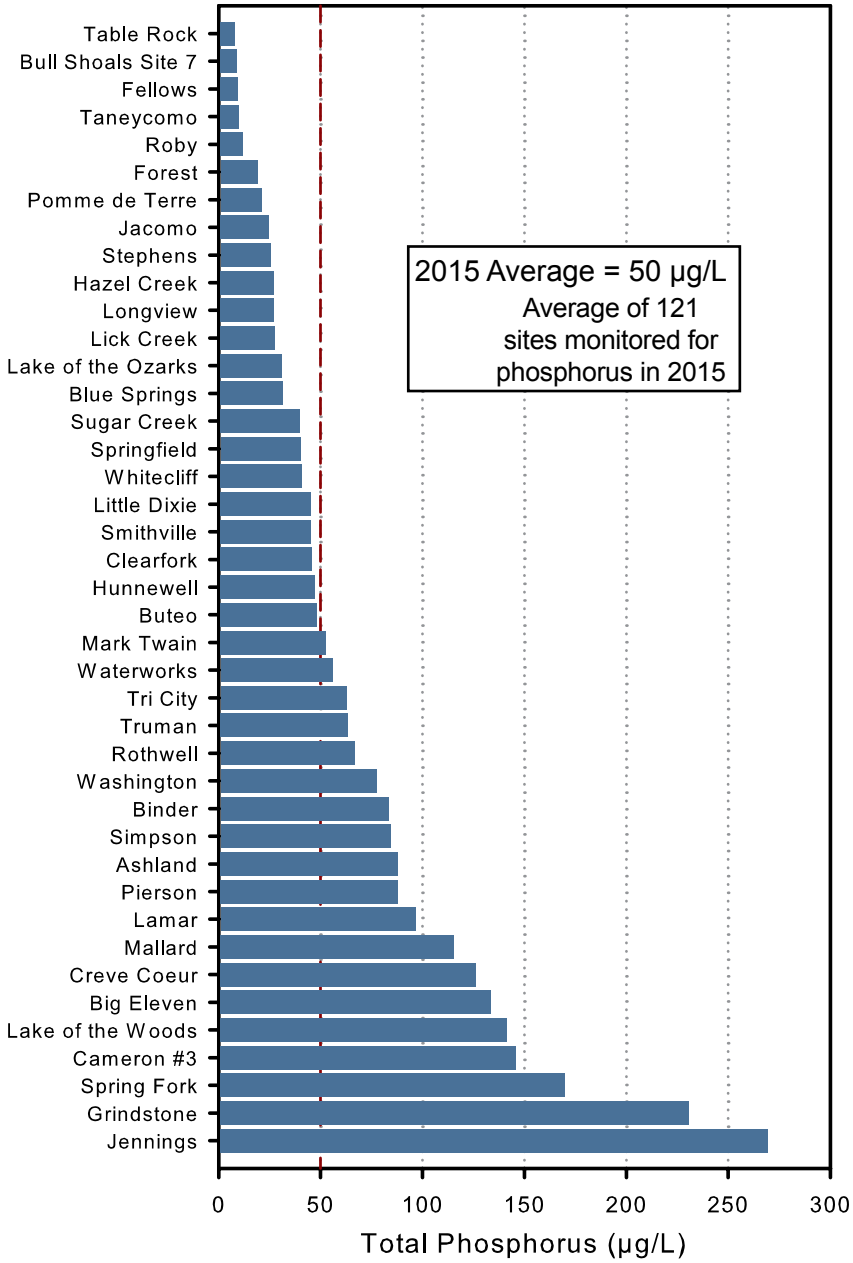
The best approach to managing phosphorus and the excess algal growth associated with it is to keep the phosphorus on the landscape and out of the lake. Wise applications of fertilizers to terrestrial systems, reductions of phosphorus in sewage effluent, proper maintenance of septic systems and management 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 2015 LMVP average was 50 µg/L. Individual values ranged from 3 to 361 µg/L.

Map shows lake sites with the highest (red) and lowest (blue) concentrations of phosphorus in Missouri during 2015.



Average Total Phosphorus values for 41 public lakes monitored by LMVP volunteers in 2015.



TOTAL NITROGEN

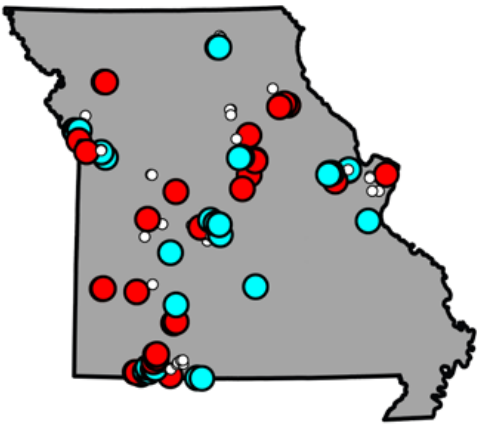
Nitrogen, like phosphorus, is a naturally-occurring element and a required nutrient for algae. Because algae require roughly twenty times more nitrogen than phosphorus, nitrogen can limit algal growth even though it is present in higher concentrations.

The LMVP volunteer's home laboratory. Beti Pearson photo

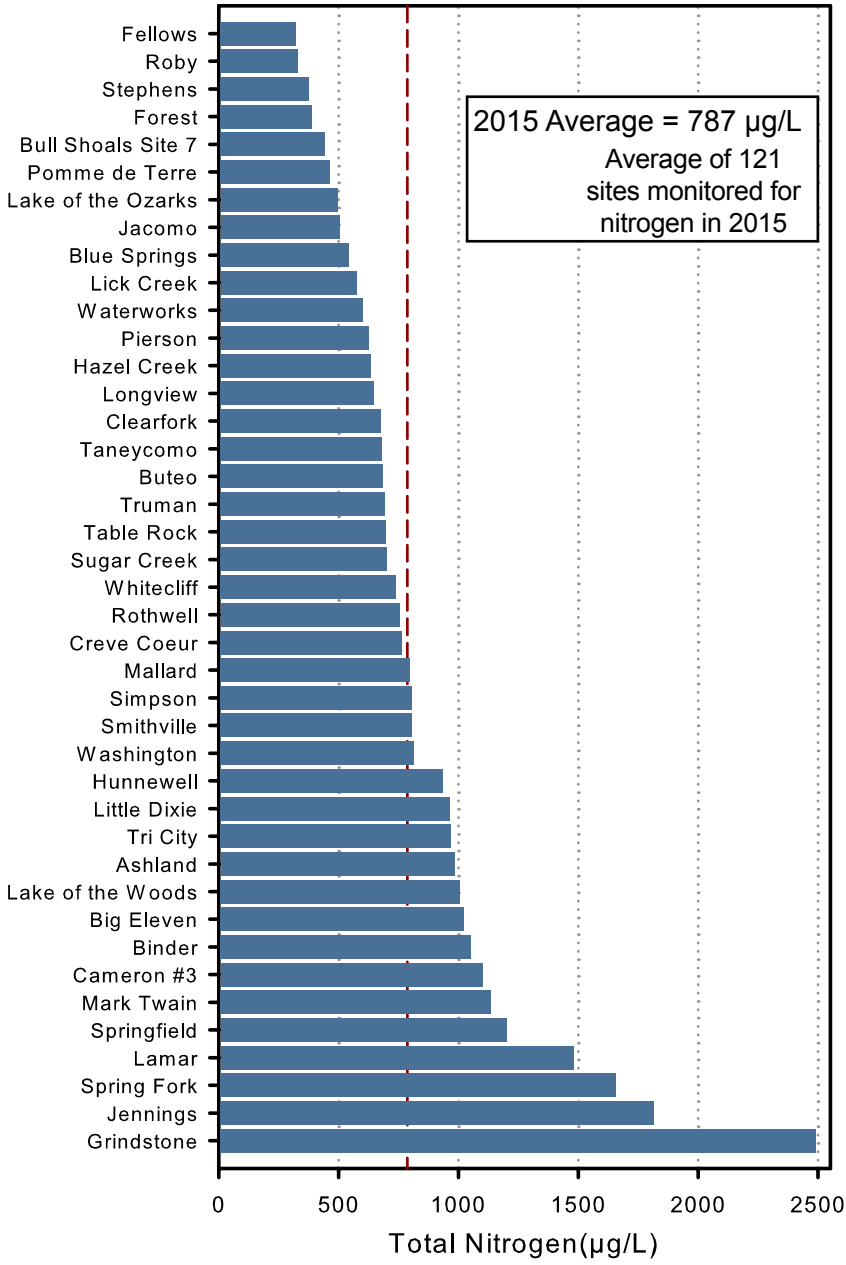
Sources of excess phosphorus also apply to nitrogen. However, nitrogen doesn't bind to soil particles as strongly as phosphorus, so eroded soil entering a lake will have less of an effect on nitrogen values than on phosphorus. Secondly, nitrogen has a gas phase while phosphorus does not. This means nitrogen 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 was 800 µg/L. The LMVP 2015 average nitrogen value was 787 µg/L, with individual values ranging from 230 to 5260 µg/L.

Map shows lake sites with the highest (red) and lowest (blue) concentrations of phosphorus in Missouri during 2015.



Average Total Nitrogen values for 41 public lakes monitored by LMVP volunteers in 2015.



SUSPENDED SEDIMENT

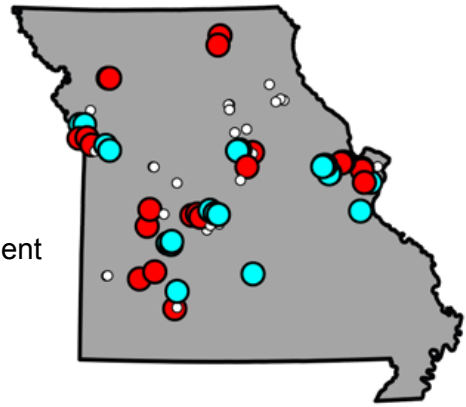
Suspended sediment in a Missouri pond. Tony Thorpe photo.

Missouri lakes can appear blue, green, or brown. The green color is from algae, the brown color is from 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.

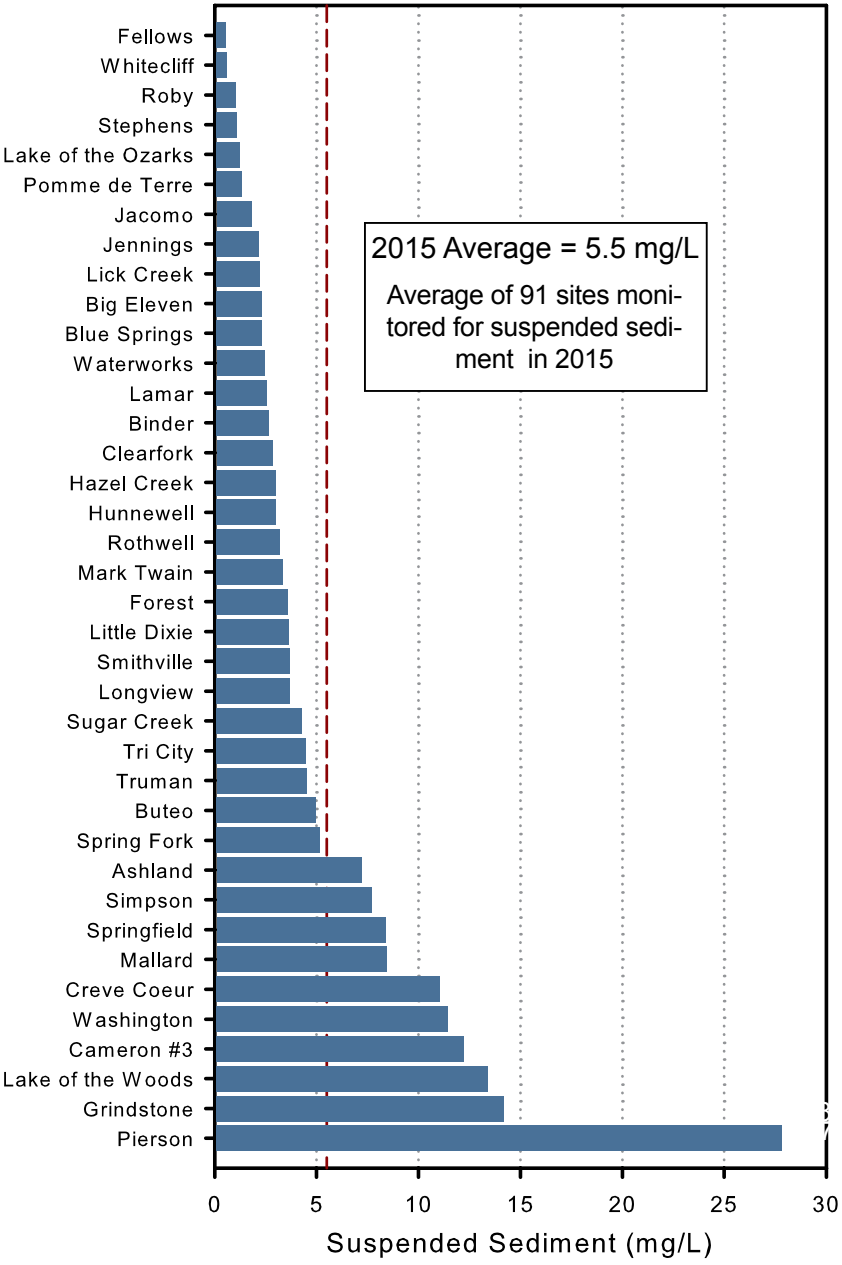
Suspended sediment will block light and can inhibit algae growth. Because phosphorus binds so readily to sediment, sediment washing into the lake will bring phosphorus with it. The best way to deal with suspended sediment is to keep the soil on the ground in the watershed with erosion control measures. 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 2015 LMVP average was 5.5 mg/L with observed values ranging from 0.6 to 31.6 mg/L.

Map shows lake sites with the highest (red) and lowest (blue) concentrations of suspended sediment in Missouri during 2015. Note: not all lake sites monitor suspended sediment.



Average Suspended sediment values for 38 public lakes monitored by LMVP volunteers in 2015.



CITIZEN SCIENCE

The LMVP is part of a larger movement often referred to as citizen science. Generally, a citizen scientist is a someone engaging in science when it isn't their job to do so, and therefore is not getting paid for it. Commonly, citizen scientists record information about natural events and report those observations to professional scientists. Across the country, citizen scientists are counting wildlife, tracking asteroids, measuring rainfall, and monitoring water quality.

Above: Bob Steiert measures water clarity at Lake Jacomo using a Secchi disk. TonyThorpe photo

History of Citizen Science

While the term "citizen science" is rather new, the notion of citizen science is not. Thousands of years ago, Babylonian citizen scientists tracked astronomical events to assign order to the chaos of the heavens. Japanese citizen scientists built a climatological record, predating the invention of the thermometer by 800 years, simply by recording the dates that the cherry trees blossomed. To build a model that would allow farmers to predict seasonal locust infestations Chinese citizen scientists monitored and recorded locust arrival dates for 1,200 years. Austrian grape harvest data from more than 500 years ago serve as another climatological record. By enlisting the help of citizens, these early monitoring programs allowed analytical eyes to be cast across time and space at grand scales.

Citizen Science Lake Monitoring in the USA

Volunteer lake water quality monitoring programs have existed in the United States at the statewide scale since 1971. The LMVP started 21 years later, in 1992. About half of the states in the country have no statewide volunteer lake monitoring program at all, instead having several unconnected regional or lake-specific monitoring programs. These programs all enlist citizens to observe and record the state of their environment, not unlike those Babylonian astronomers or Chinese farmers.

Above: Steve Kittle measures water clarity in Fellows Lake. Linda Kittle photo.

By documenting the condition of our lakes, we increase the likelihood that we will notice water quality declines before they are irreversible. We can measure the positive effects of improved lake and watershed management practices. We have baseline data that help us understand our Missouri lakes, how they function and what affects their water quality. We depend on citizen scientists to help us to do the work.

Below: Carol Pollard measures water clarity at Lick Creek Lake in Boone County. Tony Thorpe photo

LMVP NEWSLETTER

The Water Line is the 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 blue-green algae, fish kills, lake foam and much more.

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!

Like us on Facebook, too!

Above: Tony Thorpe measures water clarity at Lick Creek Lake. Carol Pollard photo.

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

Above: Ryan Reece records lake observations at Lake Buteo. Tony Thorpe photo

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LAKES of MISSOURI VOLUNTEER PROGRAM

Many volunteers use kayaks for lake monitoring. These versatile, human-powered watercraft are especially useful for small lakes and allow the user to be very close to the water. Beti Pearson photo.

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