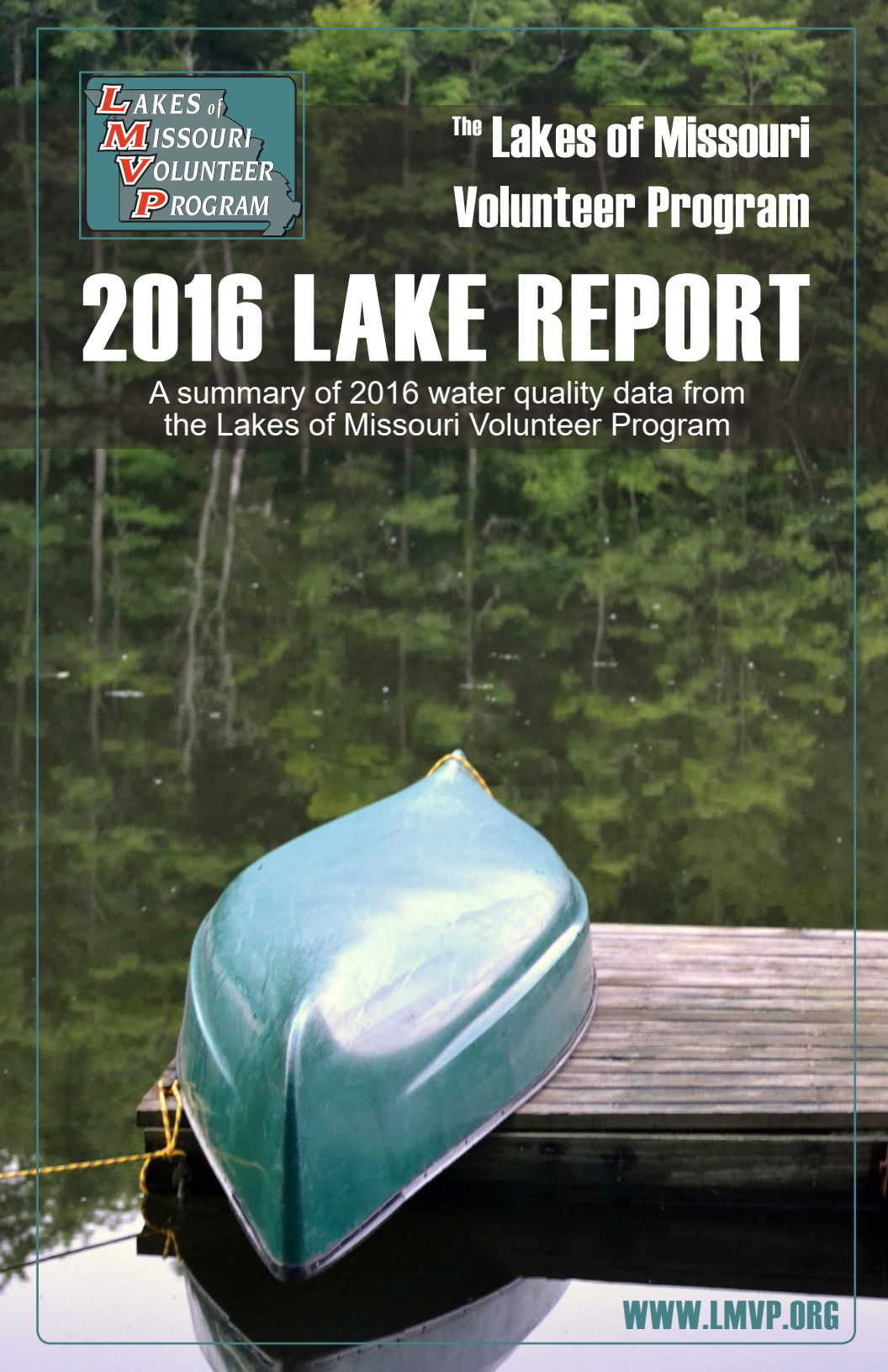


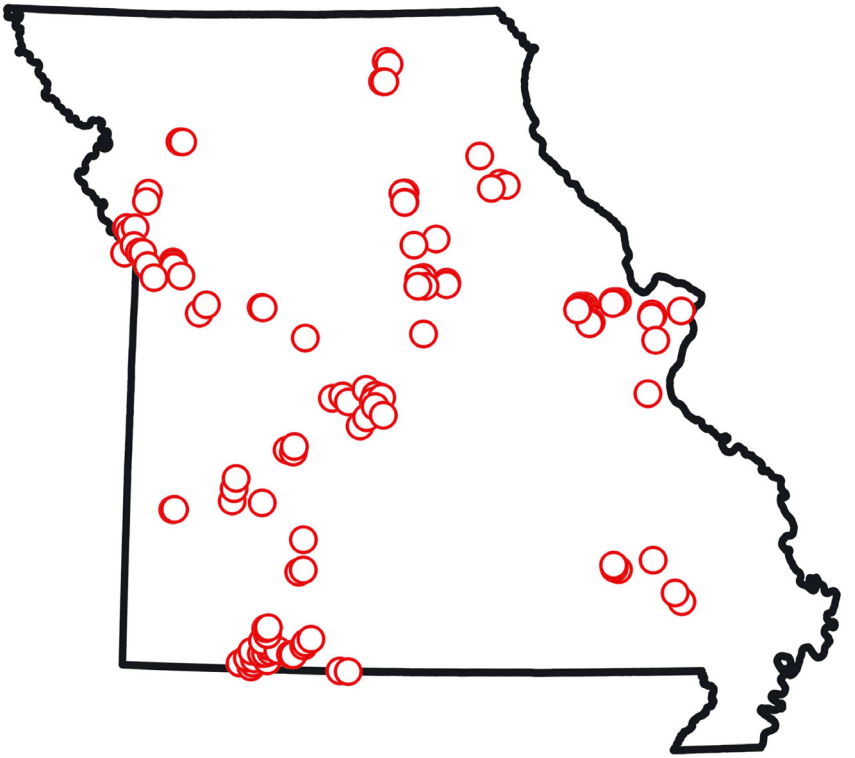
The Lakes of Missouri Volunteer Program

2016 LAKE REPORT

A summary of 2016 water quality data from the Lakes of Missouri Volunteer Program

WWW.LMVP.ORG

Lake Sites Monitored in 2016



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

Data are available at LMVP.org

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Above: Bryozoan colonies in a Missouri lake. Bryozoa are colonial animals that use tentacles to filter algae from the water. While each individual is approximately the thickness of a dime, colonies can grow larger than a watermelon.

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.

Left: Travis Robinett monitors algal toxins at Spring Valley Park Lake in Kansas City.

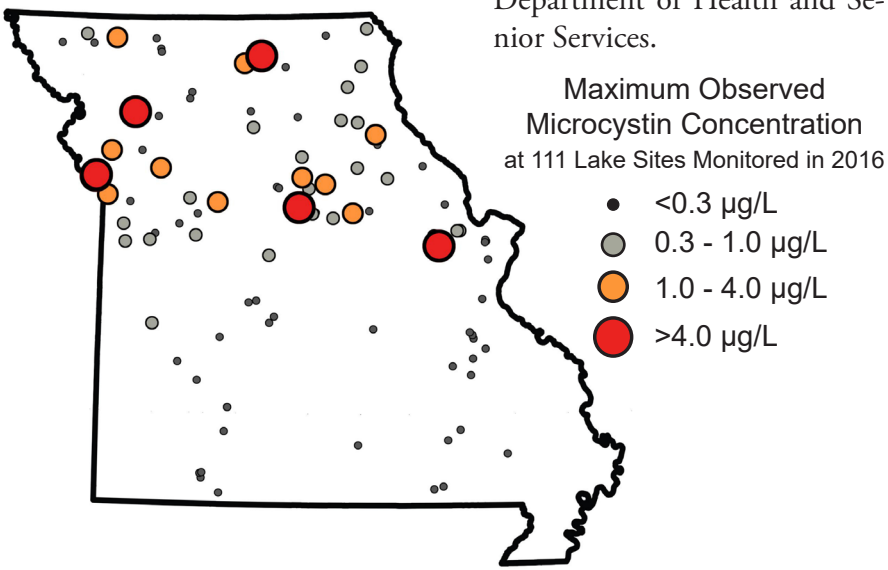
Harmful Algae Blooms

In 2016, LMVP volunteers and University of Missouri Limnology Laboratory employees monitored microcystin, the most common algal toxin, at 111 Missouri lake sites.

Above: A harmful algae bloom in a Boone County Lake.

The map below shows the maximum microcystin value observed at each of the lake sites in Missouri during 2016. A small black dot means that all samples from that particular lake had low or undetectable concentrations of microcystin. Large red circles mean that at least one observation had a concentration greater than 4 micrograms per liter (parts per billion). Notice that lakes in the northern portion of the state are more likely to have higher concentrations of the algal toxin than lakes to the south. We see a similar pattern in the distributions of phosphorus and algal biomass across the state. This distribution is largely related to the soils, topography (surface features) and land use in the regions.

This monitoring was made possible thanks to help from the Missouri Department of Health and Senior Services.



Water Clarity

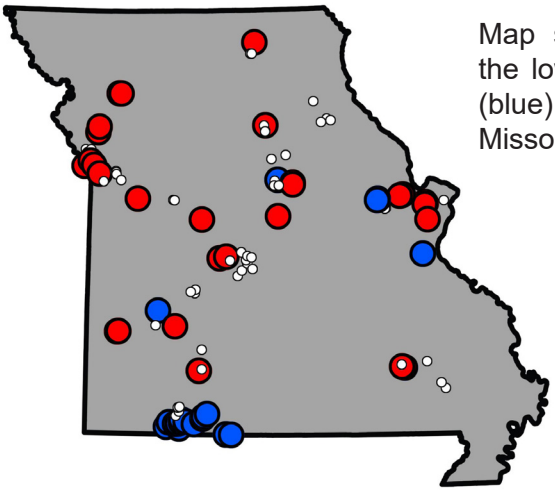
When we see murky water, we assume water quality is poor. Conversely, when we see clear water, we assume the water quality is good. Of course, water quality is not that simple, but monitoring water clarity is a good way to track the things that make water turbid. In Missouri, those things are usually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

A Secchi disk in a Missouri lake.

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

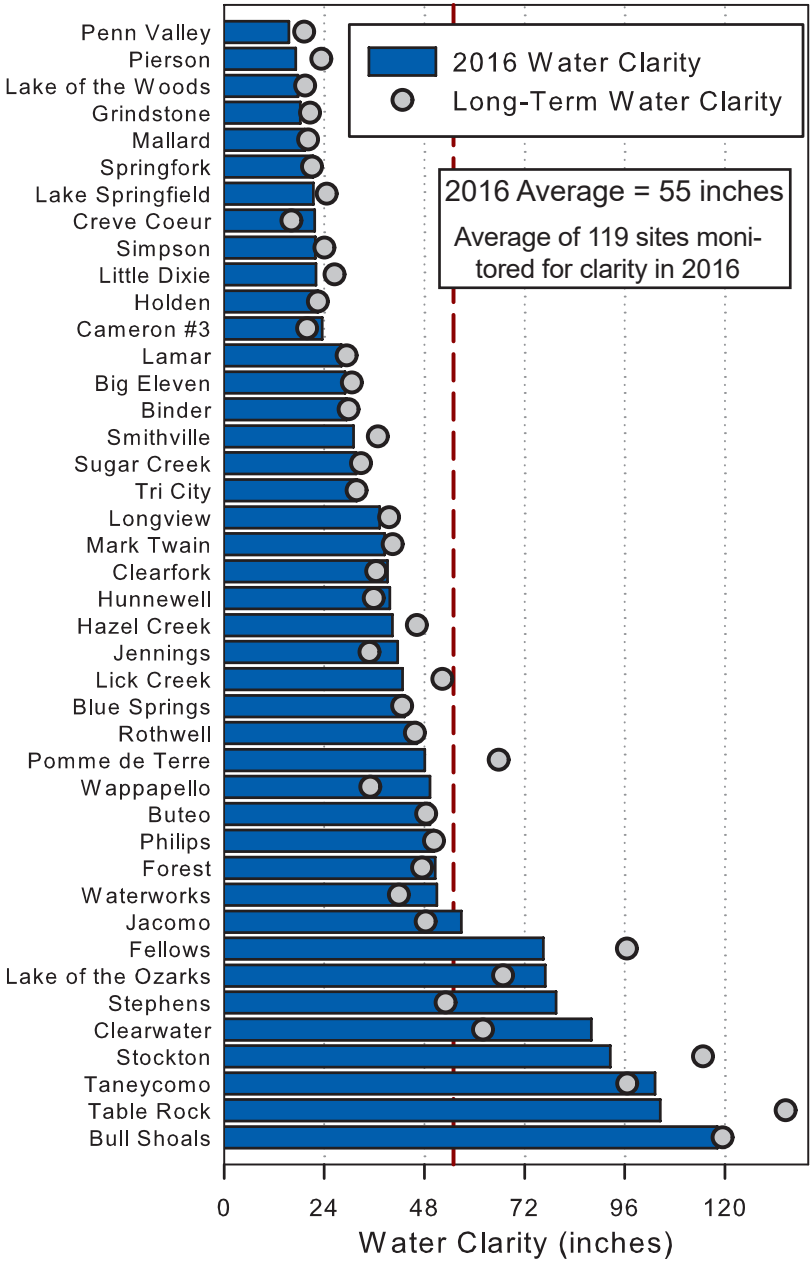
Missouri lakes historically, on average, have about 35 inches of clarity near the dam, and clarity decreases with distance from the dam. In 2016, the average LMVP volunteer-measured lake water clarity was 55 inches. Missouri's deepest water clarity reading in 2016 was 219 inches and its most shallow was 4 inches.



Map shows lake sites with the lowest (red) and highest (blue) average water clarity in Missouri during 2016.

Water Clarity
- Secchi < 29”
- Secchi 29” - 77”
- Secchi > 77”

Average water clarity values for 42 public lakes monitored by LMVP volunteers in 2016 (bars). Long-term lake values shown as dots.



Chlorophyll

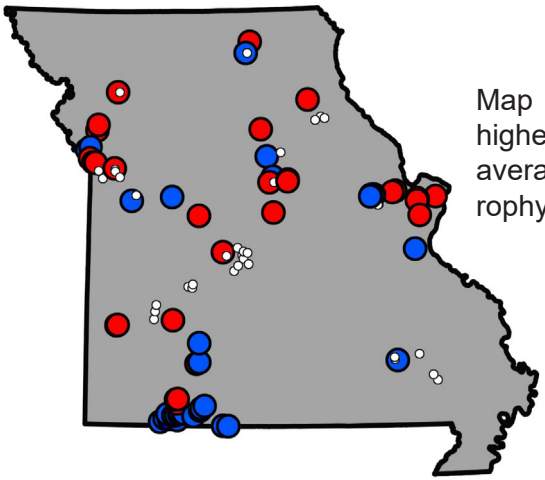
Algae are tiny plant-like organisms found in lakes (and just about everywhere else). Algae use the sun's energy to convert CO_2 and nutrients into carbohydrates via photosynthesis. We estimate the amount of algae present by measuring the presence of the photosynthetic pigment, chlorophyll.

Above: An algae bloom in a Boone County Lake.

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.

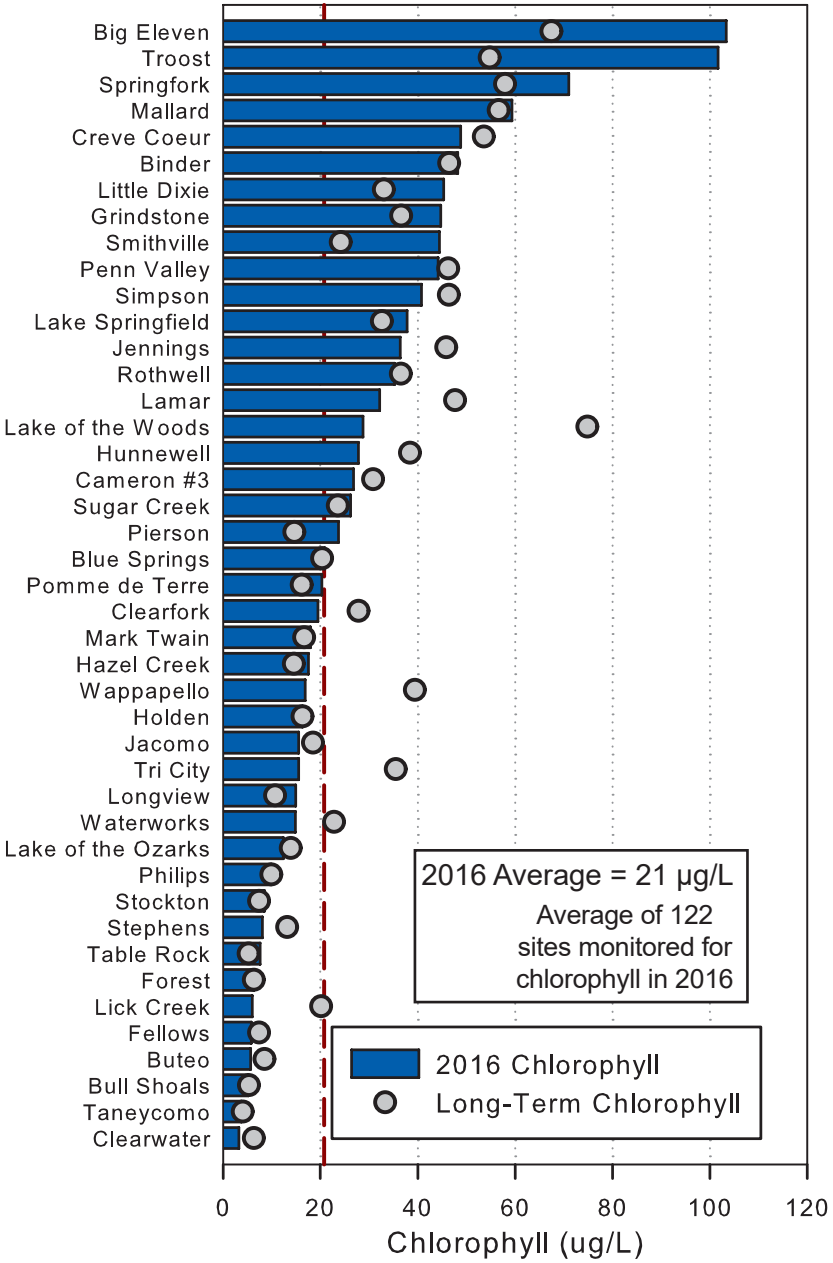
Chlorophyll In Missouri Lakes

On average, Missouri lakes have 21 µg/L of chlorophyll at the dam. The average 2016 LMVP chlorophyll value was 20.8 µg/L, with individual values ranging from 0.1 to 203.2 µg/L.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of chlorophyll in Missouri during 2016.

Average Chlorophyll values for 43 public lakes monitored by LMVP volunteers in 2016 (bars). Long-term lake values shown as dots.



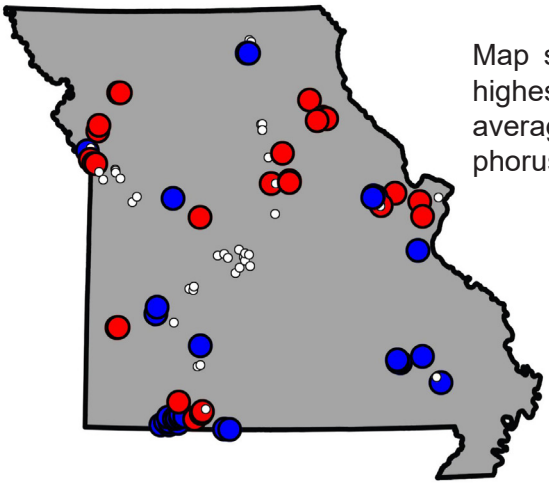
Total Phosphorus

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.

Above: An algae bloom in a Boone County Lake.

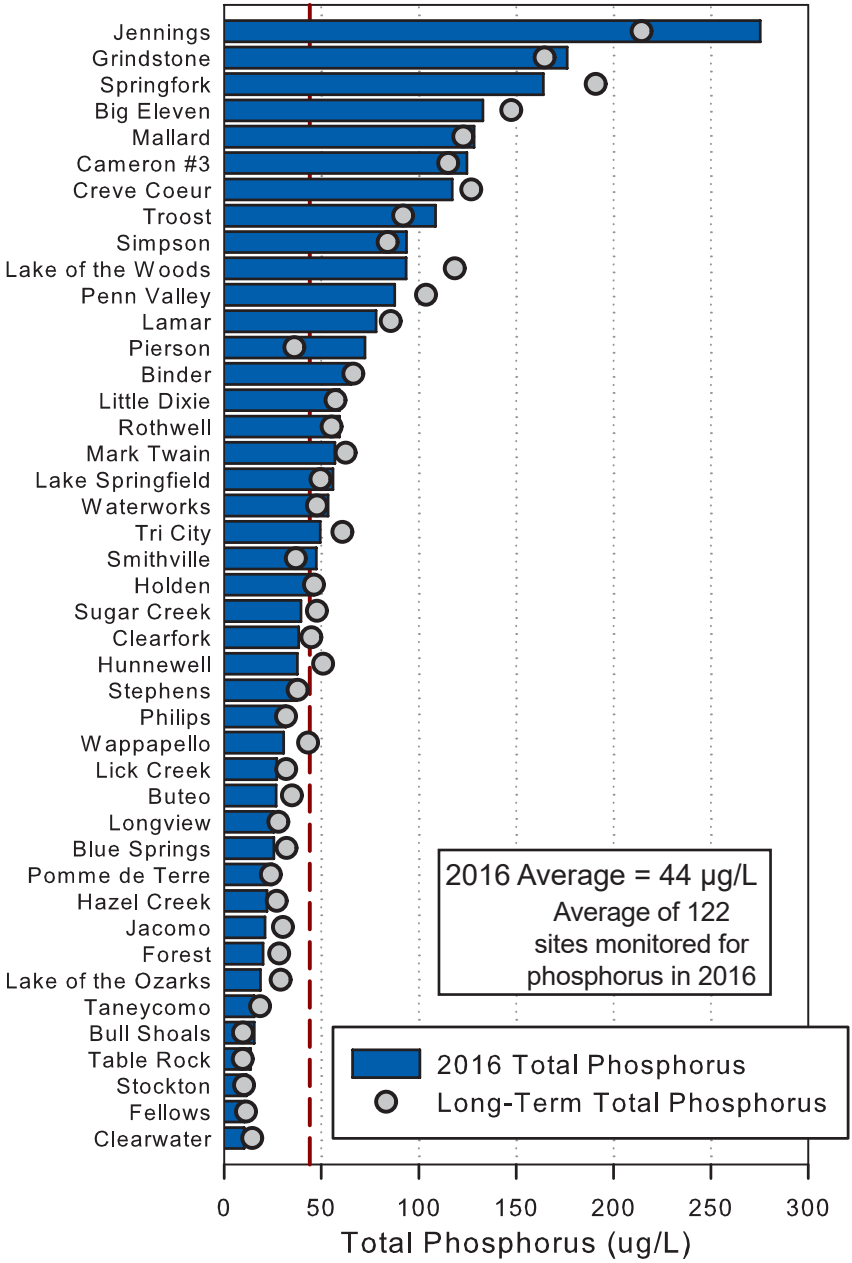
The best approach to managing phosphorus and the excess algal growth associated with it is to keep the phosphorus on the landscape and out of the lake. Wise applications of fertilizers to terrestrial systems, reductions of phosphorus in sewage effluent, proper maintenance of septic systems and management 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 2016 LMVP average was 44 µg/L. Individual values ranged from 3 to 424 µg/L.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of phosphorus in Missouri during 2016.

Average Total Phosphorus values for 43 public lakes monitored by LMVP volunteers in 2016 (bars). Long-term lake values shown as dots.



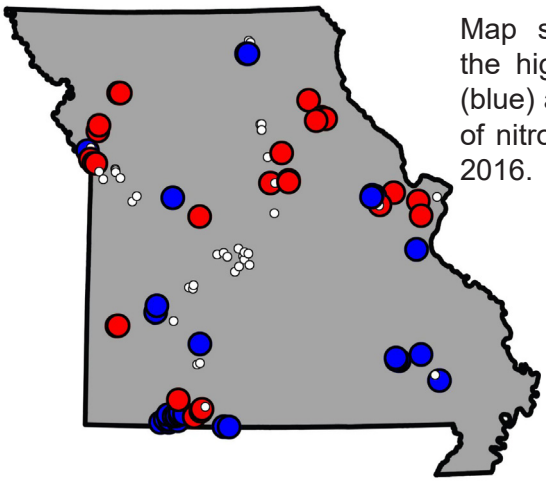
Total Nitrogen

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.

Filamentous green algae blooming on a Boone County lake.

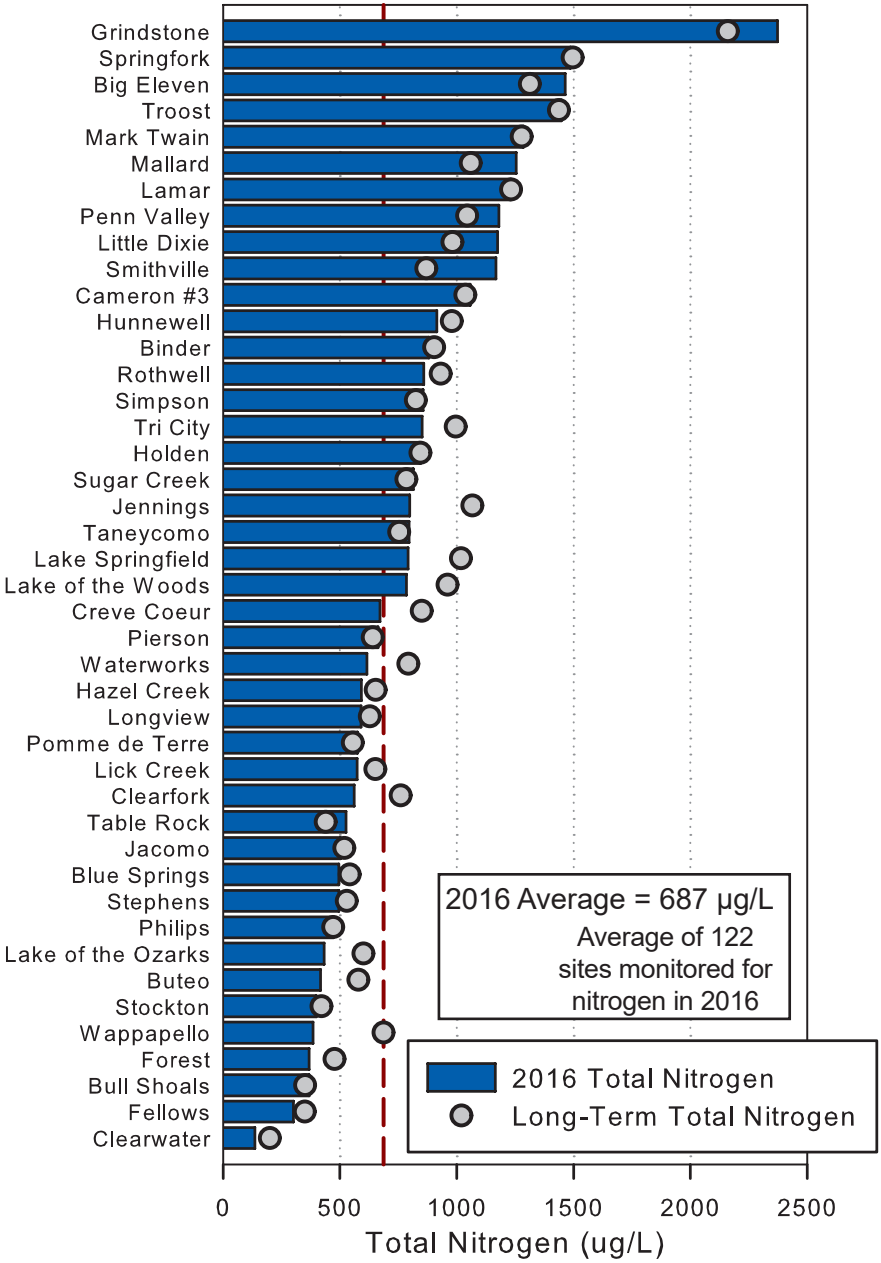
Sources of excess phosphorus also apply to nitrogen. However, nitrogen doesn't bind to soil particles as strongly as phosphorus, so eroded soil entering a lake will have less of an effect on nitrogen values than on phosphorus. Secondly, nitrogen has a gas phase while phosphorus does not. This means nitrogen 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 2016 average nitrogen value was 687 µg/L, with individual values ranging from 120 to 3750 µg/L.



Map shows lake sites with the highest (red) and lowest (blue) average concentrations of nitrogen in Missouri during 2016.

Average Total Nitrogen values for 43 public lakes monitored by LMVP volunteers in 2016 (bars). Long-term lake values shown as dots.



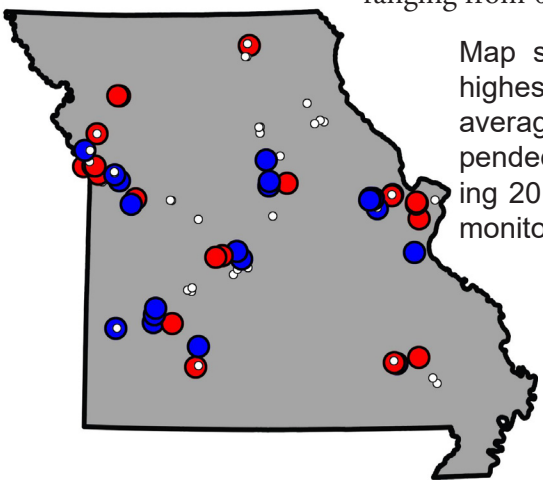
Suspended Sediment

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.

Sediment can be seen flowing northeast in this satellite photo of Mark Twain Lake.

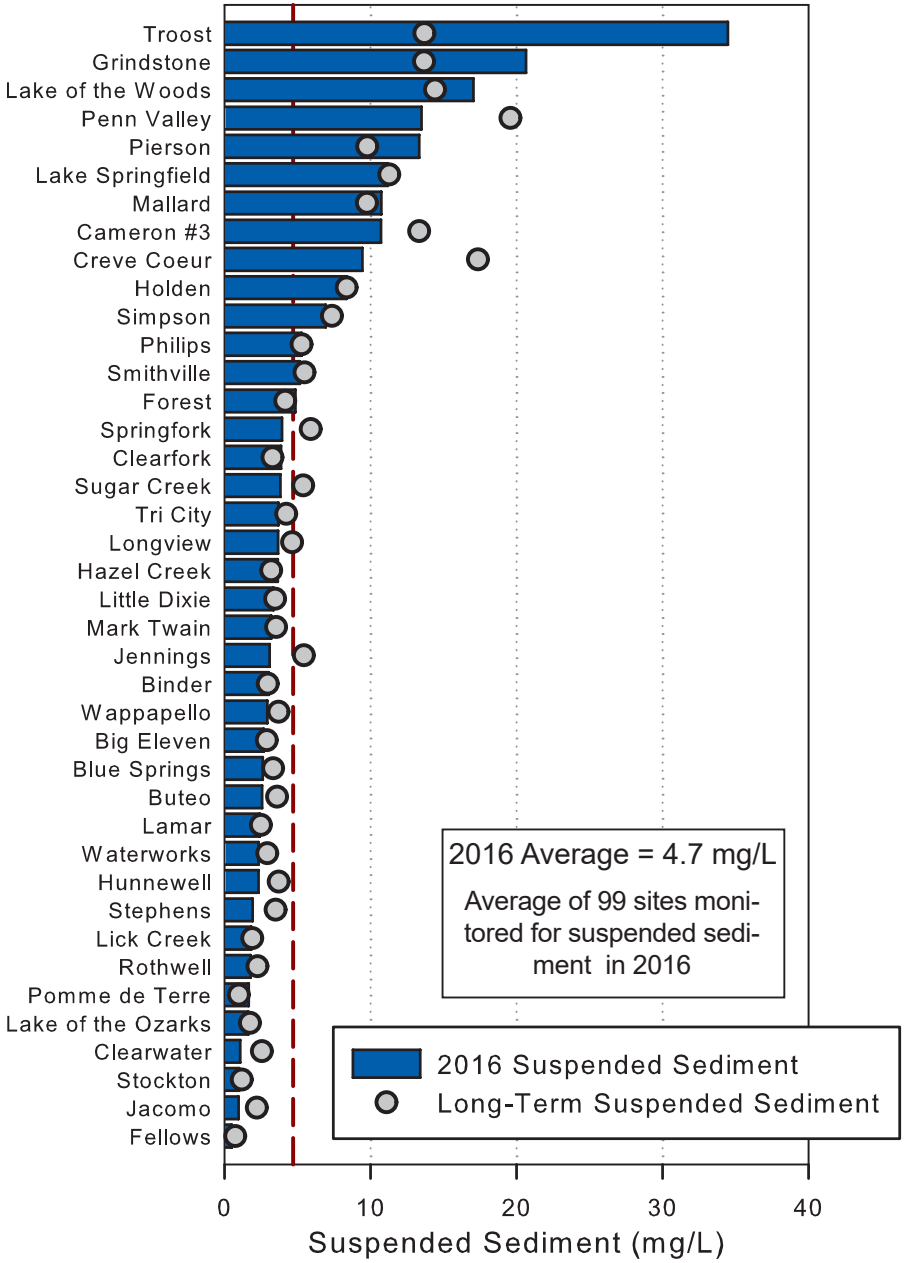
Suspended sediment will block light entering the water and because phosphorus binds so readily to sediment, any sediment washing into the lake will bring additional nutrients. The best way to deal with suspended sediment is to keep the soil on the ground in the watershed with erosion control measures. 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 2016 LMVP average was 4.7 mg/L with observed values ranging from 0.1 to 137.0 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.

Average Suspended sediment values for 40 public lakes monitored by LMVP volunteers in 2016 (bars). Long-term lake values shown as dots.



Zebra Mussels in Missouri

Zebra mussels are here. In addition to the Missouri, Mississippi, Osage and Meramec rivers, zebra mussels are also in several Missouri lakes (see next page for map).

Adult zebra mussel, approximately life-sized. Photo courtesy of the US Geological Survey

The potential environmental impacts of zebra mussels are huge. Entire ecosystems can be restructured as algae are pulled from the water column and their nutrients and energy (carbon) are deposited on the bottom.

In addition to the environmental impacts, there are serious economic ramifications amounting to hundreds of millions of dollars spent per year in the USA. A large portion of that money will be spent cleaning out the intake pipes at drinking water systems and hydroelectric dams, and the costs will be passed on to consumers. Boaters with docks on infested lakes will have to regularly clean out their motors or use a boat lift. Property values may take a hit. Beaches in some infested lakes have become covered with razor-sharp shells.

It will take a lot of work, but we can stop or slow the spread of zebra mussels in Missouri. Some private lakes have strict rules governing boat movement in and out of their lakes. Some have boat and equipment washing stations. This is the level of effort required. As citizens there are several things we can do to help. The Missouri Department of Conservation has a list of recommendations (see next page).

Zebra mussel shells at Lake of the Ozarks.

To prevent the spread of zebra mussels, please observe the following recommendations:

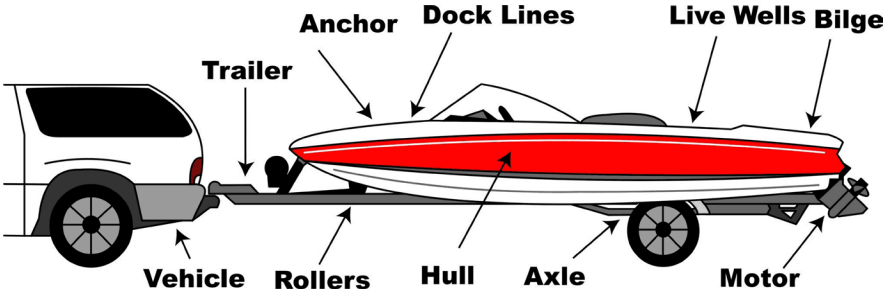
INSPECT your boat, trailer, and any parts or equipment that have been in contact with the water. This includes trailer wheels, trolling motor, anchor and rope, etc. Remove weeds and scrape off any mussels you see.

DRAIN water from the motor, live well, bilge etc.

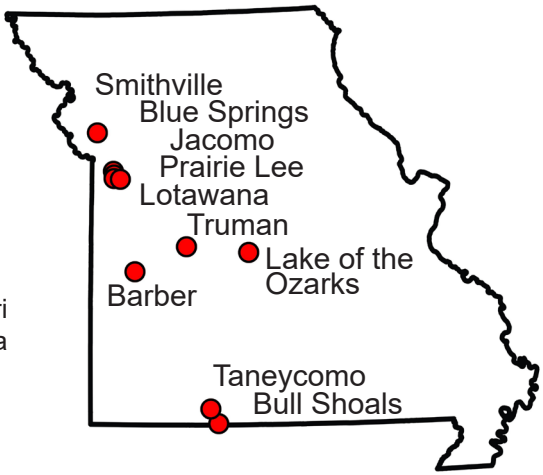
DUMP any leftover aquatic bait on shore.

RINSE your boat when you get home. High pressure water is best. You may need to go to a self service car wash to spray off any attached mussels.

DRY your boat, motor, trailer, etc. in the sun for five days.



Above: Where to check for zebra mussels on your boat. Illustration courtesy of California Department of Fish and Game.



Right: Currently 11 Missouri lakes have confirmed zebra mussel populations.

LMVP Newsletter

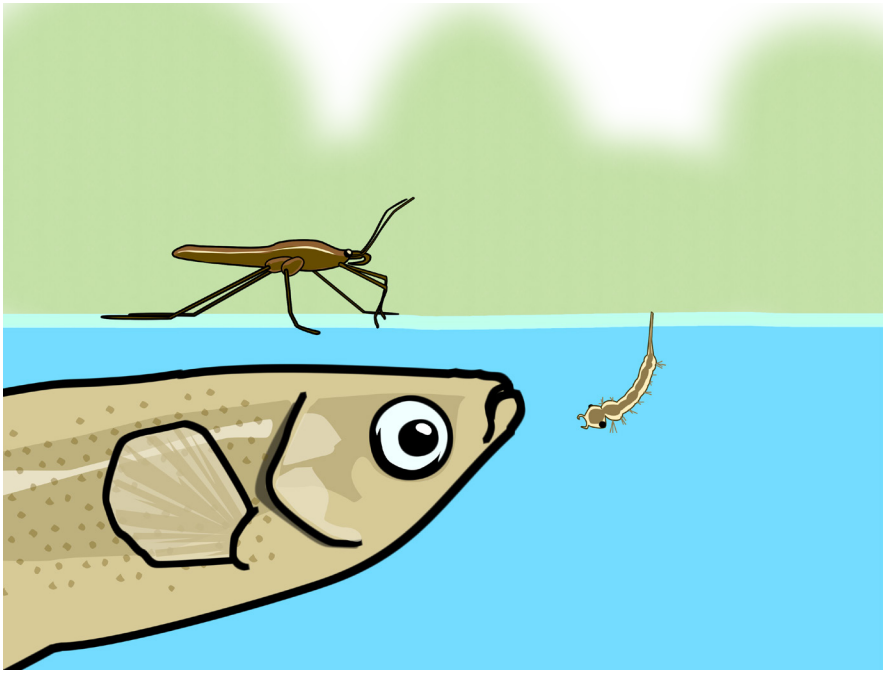
The Water Line is the email newsletter of the LMVP. To sign up, send an email to info@LMVP.org, or visit LMVP.org.

Issues of The Water Line discuss topics such as blue-green algae, fish kills, the surface microlayer 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!

While you're on the computer or your phone, give us a "Like" on Facebook!



Above: Learn about the "surface microlayer" at the LMVP website

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: Stuart Caswell monitors a private lake in Johnson County.

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