NEWSLETTER OF THE LAKES OF MISSOURI VOLUNTEER PROGRAM

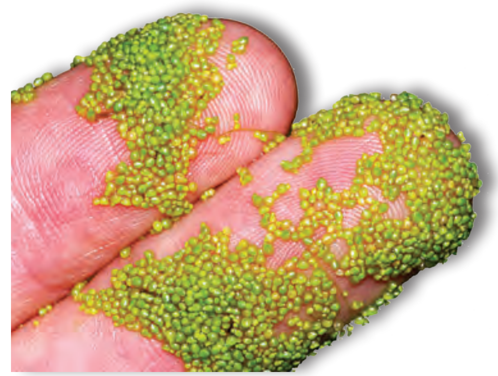
The Water Line

Volume 14 Number 1

A (very) Brief Introduction to Aquatic Plants

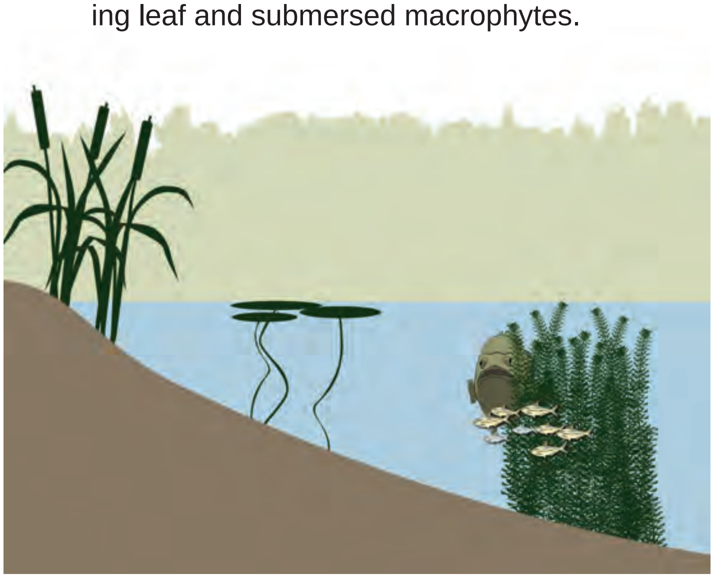
The Lakes of Missouri Volunteer Program devotes a lot of time to discussing, controlling and measuring algae in lakes. In our zeal for all things algae, we tend to overlook the other green nutrient-consumers in lakes, namely the "higher order" aquatic plants, or macrophytes. This article is a brief look at some types of aquatic plants we find in Missouri.

First up are the free-floating plants. Thanks to their rapid growth rate, free-floating plants can quickly cover the entire surface of a lake or pond. In this group, watermeal, duckweed and water fern are common in Missouri. These plants are typically viewed as a nuisance by lake users, and managers work hard to eradicate them. Watermeal is similar in shape to duckweed, though individual plants are much smaller and have no hanging roots. Water fern has hanging roots, can be green or red in appearance, and has multiple small overlapping leaves. Both water fern and duckweed are capable of taking nitrogen from the atmosphere and converting it into usable nutrient form (nitrate). Like soybeans and clover on land, water fern and duckweed "fix nitrogen" thanks to a symbiotic relationship with blue-green algae (cyanobacteria). Because of this feature, rice farmers will often introduce these small aquatic plants to their paddies as a natural fertilizer source.



Watermeal is much smaller than duckweed and feels gritty to the touch

Three categories of rooted aquatic macrophytes. From left to right: emergent, floating leaf and submersed macrophytes.



Unlike the free-floating plants that pull other nutrients from the air and the water column, rooted aquatic plants primarily draw nutrients from the lake substrate via their roots. The location of the stems and leaves relative to the water further segregates the rooted aquatic plants into 3 subgroups: submersed, floating leaf, and emergent.

Submersed plants generally live under the water's surface. In some cases, sexual parts may break the surface for pollination, but the plants largely remain underwater. Examples of submersed plants include milfoil, naiad, coontail and pondweed.

Floating-leaf plants, such as water lily and lotus, have waxy, floating leaves that rest on the surface of the

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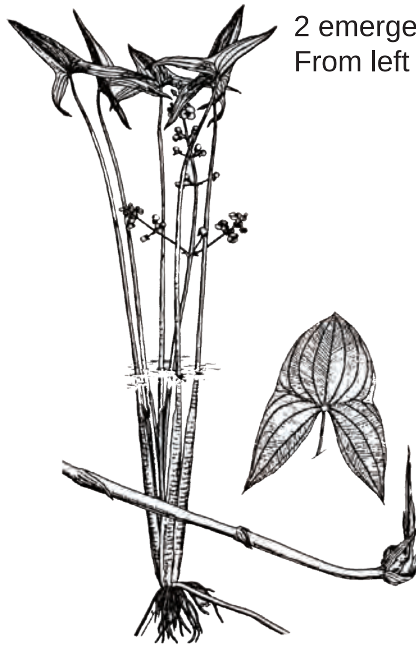
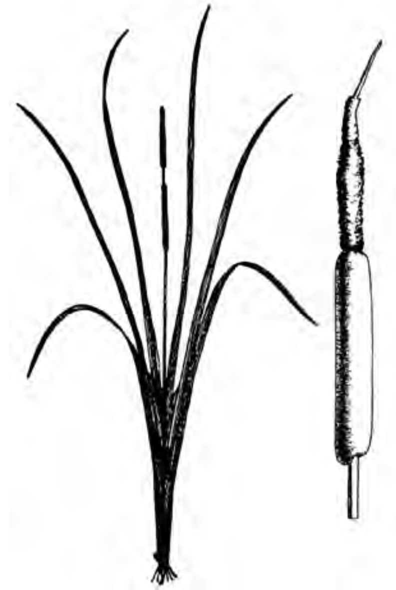
Water lilies and duckweed





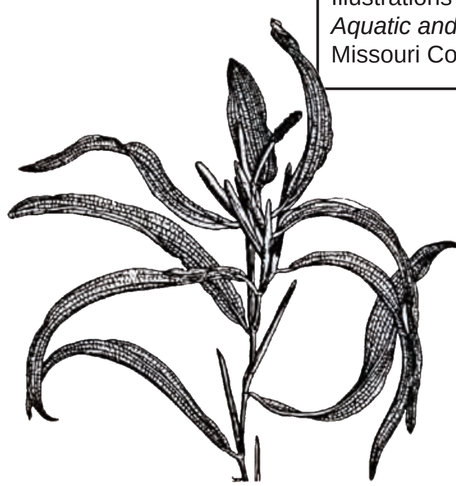
2 emergent plants
From left to right: Arrow-head and Cattail

water. All of the photosynthesis takes place on the upward-facing surface of the leaf, so the chloroplasts (part of a plant cell that contains chlorophyll) are concentrated here.

While rooted under water, emergent plants have leaves and/or stems that break through the surface. Pollination occurs above the water's surface for all emergent plants. Cattails and arrow-heads are familiar examples of emergent plants, as are many grass-like species (wild rice, rushes, sedges).

Aquatic plants can be annoying to people who are fishing or boating, but they are important to a healthy aquatic ecosystem. Small fish use aquatic plants as habitat to hide from predators. Naturally, predators like to hunt among aquatic plants, thus making "weed beds" prime fishing structures. Aquatic plants can consume nutrients and shade lake surfaces, thereby inhibiting algae growth. They can also be beautiful to look at. You can have too much of a good thing, though, and many aquatic plant species are capable of taking over a lake, making fishing, boating and swimming nearly impossible. In some situations, weed control becomes necessary. Then it's time to call in the professionals.

Illustrations from:
Aquatic and Wetland Plants of Missouri
Missouri Cooperative Fish and Wildlife Research Unit



3 submersed aquatic macrophytes
From left to right: Coontail, Pondweed, Milfoil

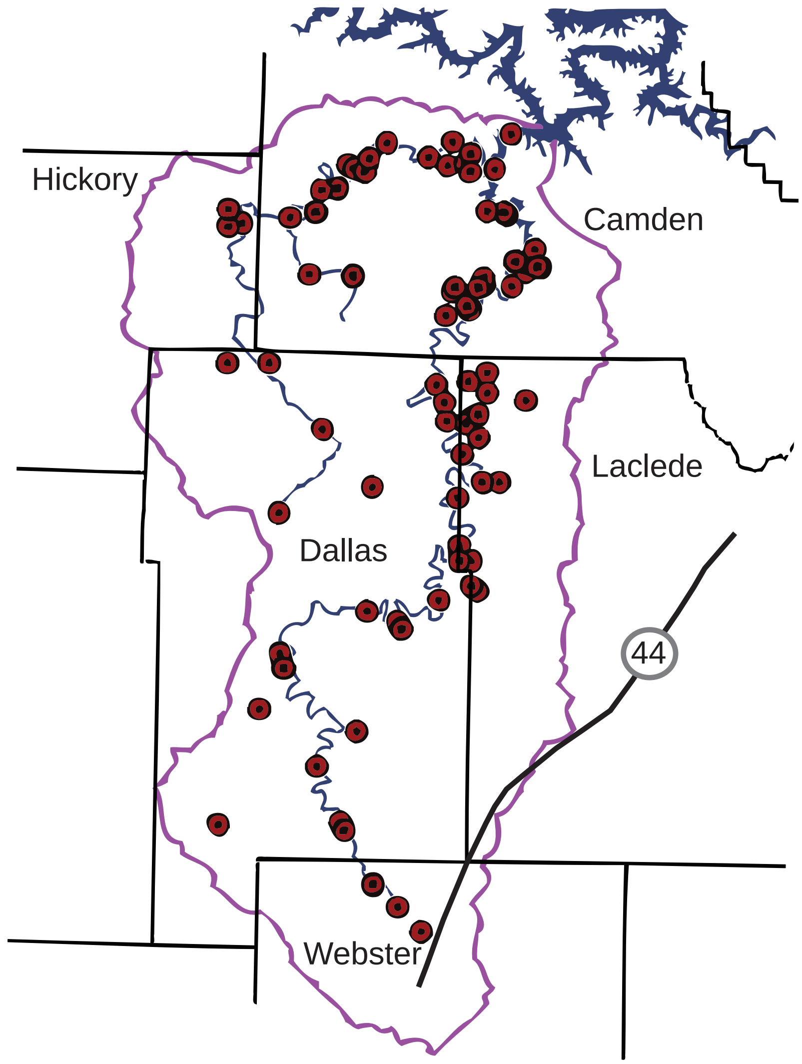
Niangua River Watershed Snapshot Sampling Event

On May 7, the LMVP conducted a watershed-wide, single day water sampling event. The goal of the event was to collect samples from the Niangua River, several of its tributaries and the Niangua Arm of the Lake of the Ozarks. That's too much ground for our little laboratory to cover, so we enlisted the eager help of more than 20 people to visit sites in 5 counties. By the end of the day, volunteers collected and we processed 85 samples from as far north as the Highway 5 bridge to as far south as Interstate 44. We had a "field office" in Camdenton and another at Bennett Spring State Park that served as drop-off points and processing laboratories.

Sampling the entire watershed at once will provide a "snapshot" of water quality, removing nearly all variability associated with time. The result will be a decent picture of the variability across the area and should help us to locate problem areas in the considerably large range of the Niangua watershed.

The snapshot sampling won't tell us what the typical water quality of the Niangua watershed is like, but we'll know pretty well what it was like on May 7, 2011.

A full report will follow soon. If you want to be notified when it's available, send an email to tony@LMVP.org.



85 Sample Sites in the Niangua River Watershed

About the Niangua River

The Niangua River flows northward from the city of Marshfield, just south of I-44, and runs for approximately 140 miles to the Osage Arm of Lake of the Ozarks. Many springs contribute water to the Niangua River, including Bennett Spring, which empties into the river about halfway along its course. In the last few miles before the river reaches the Lake of the Ozarks is Lake Niangua. Located at a bend in the river, Lake Niangua's Tunnel Dam provides hydroelectricity by discharging water 500 feet through a tunnel to a lower stretch of the Niangua. The Little Niangua River is the largest tributary of the Niangua, running nearly 60 miles before joining the Niangua Arm of the Lake of the Ozarks.

A Little Experiment:
Do suspended sediment values vary with volume?

Sample processing is one of the LMVP volunteer's most important duties. While some lake water is retained for nutrient analyses, the bulk of the volunteer-collected sample is passed through filters to allow analyses of particulate matter such as algae and sediment. The use of filters not only allows the particulate matter to be preserved through freeze-drying, as a bonus the filters take up much less space in the freezer than a two-liter sample bottle.

Most LMVP volunteers process two types of filters. The first filter type is for chlorophyll analysis and helps the LMVP estimate the amount of algae in the lake water (CHL, see Fall 2003 Water Line). The second filter is used to measure total suspended solids (TSS, see Winter 2003 Water Line). This analysis provides an estimate of the total amount of material in the water (TSS), as well as a break-down of how much of the material was inorganic sediment (referred to as ISS in the Data Report) and how much was organic material such as algae.

Because the method for chlorophyll analysis is quite sensitive, only a small amount of material needs to be retained on the filters for accurate measurements. The analytical method for TSS is less precise, so more material is required on the filter to ensure good results. This is why volunteers are instructed to pass twice the volume of water through the TSS filters (500 mL) than the chlorophyll filters (250 mL).

Occasionally, a TSS filter will become clogged before 500mL of water can pass through it, indicating a high concentration of particulate matter suspended in the lake. In these situations the volunteer is instructed to discard the filter and begin again using a new filter and a smaller volume of water. Other times the 500mL volume passes easily through the filter leaving little material. We wondered if TSS results might vary with the volume of water used to process the TSS filters, so this summer we conducted an informal experiment.

Three lakes were sampled by MU lab technicians with TSS filters being processed using different volumes of water (24 – 30 filters were processed for each lake, 6 for each water volume). The largest volume filtered for each lake was roughly the maximum amount that could be pulled through the filter without clogging.

The three lakes differed in TSS concentrations, with Little Dixie Lake having the lowest levels at around 5mg/L (see table). In contrast, Long Branch and Dairy lakes had substantially higher TSS concentrations at 24 and 29 mg/L, respectively. The lakes also differed in terms of the make-up of the TSS. In Little Dixie Lake the TSS was about 60% inorganic sediment and 40% organic matter. Long Branch Lake was dominated by inorganic sediment (80% of TSS) while Dairy Lake had slightly more organic matter than inorganic sediment (55% organic vs. 45% inorganic).

Filters were processed using four different volumes for Little Dixie Lake. Upon initial review, the results seem quite comparable, with average TSS values ranging between 4.9 – 5.4 mg/L. While the differences

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Little Dixie Lake				Long Branch Lake				Dairy Lake			
Vol.	TSS	ISS	OSS	Vol.	TSS	ISS	OSS	Vol.	TSS	ISS	OSS
300	4.9	3.4	1.4	100	21.8	16.5	5.3	50	23.1	8.6	13.8
500	5.2	3.6	1.6	200	23.0	18.3	4.7	100	23.1	10.3	13.0
700	5.4	3.3	2.1	300	22.7	18.1	4.6	150	29.9	13.9	13.7
900	5.3	3.3	2.0	400	24.2	19.5	4.7	200	29.8	13.4	12.9
				500	24.5	19.9	4.6	250	29.4	13.7	10.6

Data for 3 lakes are shown with volume of water filtered and corresponding values for total suspended Solids (TSS), inorganic suspended solids/sediment (ISS), organic suspended solids (OSS). To reduce error, six filters were processed for each lake and volume.

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were small, they were statistically significant. Differences in inorganic sediment concentrations were not statistically significant, indicating no notable change in concentration as volume varied. Organic matter did increase and the differences were significant. These results suggest that some of the organic matter in Little Dixie Lake was small enough to pass through the filters at low volumes. As filter volume increased the filters started to pack with material and more of the small organic particles were retained on the filter. This would explain the slight increases in both the organic matter and TSS values with volume.

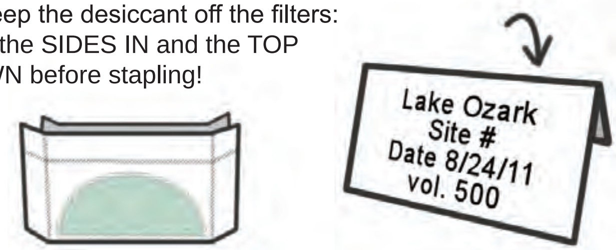
In Long Branch Lake the TSS concentrations generally increased as the volume of water filtered increased. TSS concentrations from filters with 500mL of water passed through them were 18% higher than concentrations from filters receiving 100mL. This significant increase in TSS was due to increased retention of inorganic sediment and not organic matter, which did not increase with volume. The increase in TSS and inorganic sediment values with volume tell us that as the filters packed, they were able to hold more of the smaller inorganic particles such as clays.

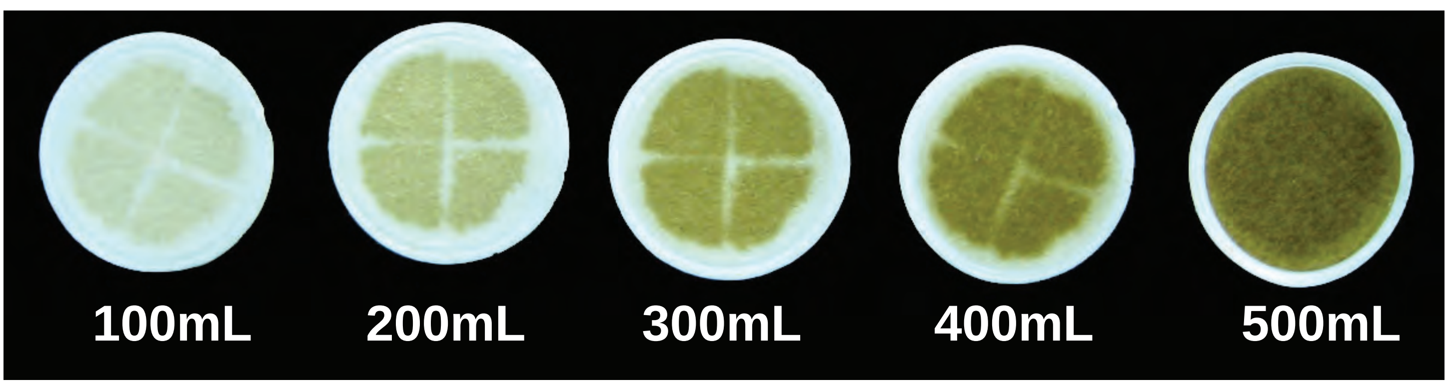
Results in Dairy Lake were similar to those in Long Branch Lake; the more water filtered, the higher the concentrations of TSS and inorganic sediment. Filters that received the maximum volumes had 27% more TSS and 59% more inorganic sediment than the filters that received the lowest volume. These differences were statistically significant, while variations in organic matter were not. As with Long Branch Lake, it seems the more material we packed onto the filters, the better the filters captured small inorganic particles that might otherwise have passed through.

We found that the volume of water filtered through TSS filters can influence the analytical results if there are small particles (<1.2µm) present in the lake water. Sometimes these small particles are in the form of algal cells (Little Dixie Lake) while other times the particles are mostly inorganic matter (Long Branch and Dairy lakes). Results suggest that the filter does not have to be packed to the point of clogging to attain a valid measurement. For example, in Little Dixie Lake a filtered volume of 700mL through the TSS filters led to the same results as 900mL.

Volunteers who experience TSS filter clogging should consider the amount of water that passed through the filter prior to clogging when choosing a volume for the new filter. For example, if the first filter clogged at 300mL, then 250mL should provide enough material for an accurate measurement without forcing the volunteer to spend extensive time filtering. However, it is important to remember to record the new volume on the data sheet and filter houses so we can make the appropriate adjustments in lab.

To keep the desiccant off the filters:
Fold the SIDES IN and the TOP DOWN before stapling!





Five TSS filters with different volumes of water filtered through them. By 500ml, these filters were nearly clogged. Note the “X” in the center of the filter began to fade at 400mL and is gone by the time the filter clogged at 500mL. In this case the TSS filters should be loaded between 300 and 400 mL.