Butler County Stream Team
January News - 2013

Volunteer Stream Monitoring in Southwest Ohio
Next Sampling Day - January 12th

Consistent samplers: If you will be near the lab on Saturday, don't forget to pick up your free foldable cooler for samples.

Don't forget: New bottle procedure - We are moving to the use of *plastic sleeves rubberbanded to each bottle* for labels, instead of taped bottles with stick-on labels. **If you do not have preprinted labels, be sure to grab a bottle with a label in the sleeve.** If you have preprinted labels, you will have to fold or cut those labels to fit - sorry, next time we print labels we will use ones that fit the new sleeves!

Winter Fish Kills

A common sight today in residential developments is a retention basin, pond or lake. These basins exist because of regulations that strive to keep precipitation that falls on a site ***on that site***, rather than shunting it off as quickly as possible to a nearby stream, where it may contribute to downstream flooding during heavy rain events. That's a good thing! These basins also add a nice ambiance to the development ... who doesn't like a nice water body in their back yard? Right now, though, as our ponds lie under a layer of ice and snow, a dastardly scenario may be developing in basins that are not aerated. That leads us to this month's topic – winter fish kills.

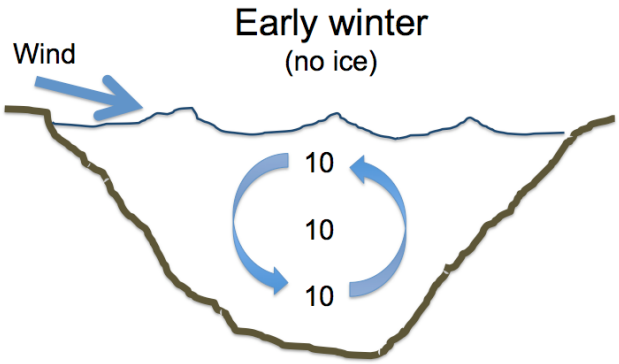
So what are winter fish kills, why do they occur, how are they different from summer fish kills, and what do they have to do with retention basins and ponds? In this region of Ohio winterkill is relatively uncommon because of our weather; they occur only when ponds stay frozen for prolonged periods of time. The reason they occur has to do with a decrease in oxygen level under

Volunteer Spotlight Susan and Nathaniel Coffin (and family)

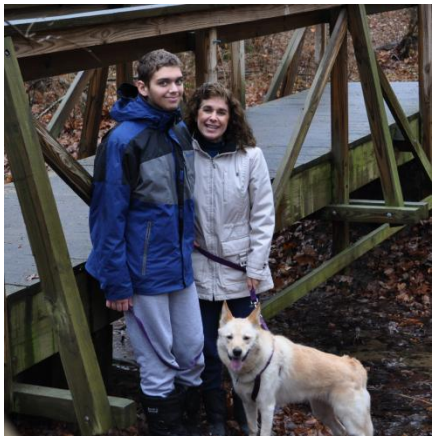
Before introducing you to Nathaniel and Susan, I (Donna) need to offer them an apology. Last month, when I listed volunteers who have been collecting samples or working in lab for 1, 3, and 5 years, I said Susan and Nathaniel had been volunteering for more than a year but were not active right now. How silly! They have not been working in lab recently but they are still collecting their 4 Oxford samples every month. I guess I was just so used to seeing you all being in lab that I forgot you also collect samples! So, my sincere apologies for that lapse! Our consistent samplers are really important to furnishing data that can be used to understand our local streams. So ... thanks Nathaniel and Susan!

the ice. And although snow and ice cover is the ultimate culprit in causing them, fish kills can be made more severe by the same phenomena that makes summer kills happen – high nutrient inputs, which lead to lots of aquatic plants and algae, which lead to lots of decomposition which uses up oxygen.

Winter, itself, does not affect oxygen levels in water much. Oxygen in un-aerated pools comes both from photosynthesis by aquatic plants and algae and interaction with the atmosphere. In the winter, some plants die off and one might think oxygen levels would decrease. However, remember that the animals living in a pond are ectotherms, or "cold-blooded"; when the water is cool, their metabolism slows down and they don't use as much oxygen. Many plants also keep photosynthesizing and producing oxygen if the pond is ice-free, just at a slower rate. Also, cooler water holds more oxygen, and with brisk winter winds, that oxygen is constantly replenished throughout unfrozen ponds. In the diagram below, notice that oxygen typically is about 10 parts per million in all levels of the pond (adapted from OSU Extension).



The problem occurs when a pond freezes over, especially if the ice is covered with snow. Then no sunlight reaches the aquatic plants, so all photosynthesis shuts down, and winds cannot replenish oxygen from the atmosphere. If ice and snow cover continue for a long time, especially if fish populations are abundant, oxygen levels decrease until they cannot support the fish population, as shown in the following diagrams (from OSU Extension).

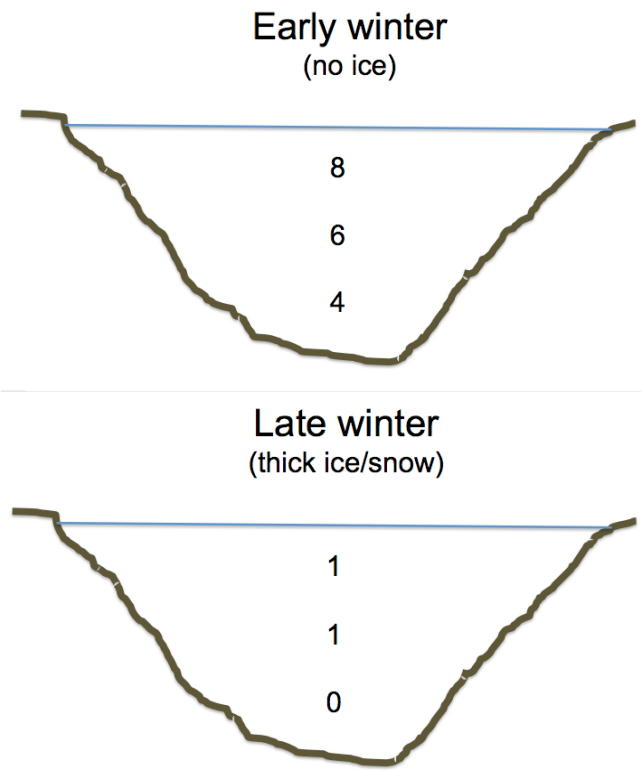


Nathaniel is 17 years old, a senior at Talawanda High School, and Susan is his mom, an Administrative Assistant for MU's Journalism Program. Nathaniel is a highest honors student at THS and competes on the Academic Challenge Team. He also is a member of the Cross Country, Diving & Track Teams and plays trombone in the high school Jazz Band. Wow! How do you find all that time, Nathaniel! Knowing all that, we are especially glad you find time for Stream Team!

Nathaniel is the sampler of the duo and Susan records the date and time on the bottles. Nathaniel gets his love for being outside, climbing trees & playing in streams, honestly; Susan remembers fondly playing in the creeks in Wilmington, Delaware where she grew up. She likes that sampling gets her "out into the woods/water each month allowing me to see the beauty of nature throughout the seasons."

It's a family affair ...

Nathaniel and Susan are not the only members of the Coffin family who have been volunteers with Stream Team. Jared & Ethan (Nathaniel's teenage brothers) helped in lab several months of 2012, and Sadie, a stray from the Trenton Shelter (in pic above) is a faithful member of the sampling crew. She likes to walk in the woods, dig in the dirt, and drink the stream water, even though Susan and Nathaniel have told her it doesn't meet clean drinking water standards! Given a few years, I would guess the fourth and youngest Coffin son will be joining us as well; at least we hope so!



Other factors that affect the occurrence and severity of winterkill include size of the water body and how much vegetative matter lies on the bottom. Obviously, the more water there is in a pond the more oxygen that water can hold. So small, shallow ponds are more likely to experience winter kills than those with a large volume of water. Shallow ponds also are more likely to have lots of aquatic plants that grow in the summer but die back in the fall and decompose over the winter. Ponds that receive lots of fertilizer are likely to have lots of algae, which do the same. Despite cold temperatures, microbes are busy decomposing organic matter all year long! Since these microbes are predominantly oxygen-lovers, if there is a lot of vegetative matter under the ice, they will use more oxygen than if there is little.

So what can be done to prevent winter fish kills? That is a complex problem. For instance, if you want your pond to have a healthy macroinvertebrate and amphibian population in the summer, you probably want aquatic plants to offer them habitat, even though it may contribute to winter fish kills. And if you really like catching fish from your pond, you may not want to limit the fish population; remember that fish use oxygen all winter, just like microbes. But some solutions do exist, depending on your budget and a little common sense.

It sounds like the family has lived in some interesting places. Nathaniel was born in Atlanta, Georgia, and lived in Danderyd, Sweden for a year before moving to Oxford, Ohio in 2002. We hope they will stay around and we can celebrate that 5-year volunteer mark sometime in the future! Thanks Coffin family! We appreciate your help!

How do aquatic "bugs" survive the winter?

By Amy Cameron

A wonderful thing about streams is that life is almost always present throughout each of the seasons. For macroinvertebrates, a changing season may represent a life cycle change. Since not all macro life cycles correspond to one another, life can be found in many different stages in a stream, depending on the season. What kind of macros can be found in the winter and what life stage are they in, you ask? Let's find out!

First let's talk about the life cycles of macroinvertebrates. There are two main types of life cycles that macros undergo, **complete** and **incomplete metamorphosis**, as shown in the picture below (from Water Facts). Most macros, such as the caddisfly, undergo complete metamorphosis, which consists of four stages: 1 -egg, 2 - larva, 3 - pupa, and 4 – adult, as shown in the outer circle below. Incomplete metamorphosis is comprised of three stages: 1 - egg, 2 - nymphs, and 3 adult, shown in the inner circle below. Macros such as the dragonfly and damselfly show incomplete metamorphosis, sometimes going through more than a dozen nymphal stages, looking more and more like adults with each molt.

First, aeration has been found to decrease multiple issues of retention basins; in the winter, aeration helps oxygen diffuse into the water by keeping an area unfrozen and by pushing oxygen into the water. Second, decreasing fertilizer runoff all year can help decrease algal growth all year, and, thus, decomposition by oxygen-scarfing microbes in the winter. Keeping the fish population medium to low by not overstocking can also help keep the demand for oxygen in the winter low. Another possibility, although not one of my favorites because of safety, is to remove snow from the ice so sunlight can filter through, enabling photosynthesis in plants growing underneath, which uses carbon dioxide and produces oxygen.

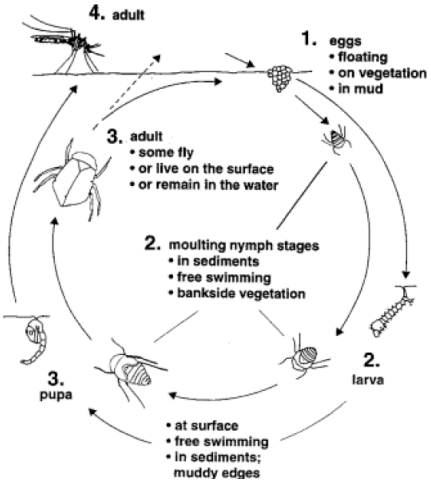
Finally, changing our opinion might be in order. Winter fish kills, although relatively rare in southwest Ohio, are normal. Animals living in our water bodies have adapted to these occurrences, and likely are more tolerant of such conditions than they may have been centuries ago; that's how evolution occurs. So although we can take common sense measures like decreasing fertilizer use and providing aeration, the fact is that winterkills will occasionally occur. ..... Maybe the best answer is just to clean up what Mother Nature gives us and thank her for giving us our beautiful lakes and ponds the rest of the year!

Enjoy the snow!

Data Analysis

This is the final edition of data analysis on the data through December 2011. Next month we will begin to take a closer look at some smaller questions and relationships ... is there anything you'd really like to know? If so, please contact Donna, Jeff W. or Penny (click on our names to email) with what you'd like to see us explore. We have some ideas, but would welcome yours!

The last overall patterns we have to explore are the seasonal trends of nutrients (nitrates and phosphorus), turbidity, conductivity and TDS, and pH. Last month we found that bacteria counts in our streams vary widely - average counts of both *E. coli* and total coliforms vary from around



Invertebrate life cycles can be further classified into **fast** or **slow** life cycles. Slow season life cycles usually occur in cooler streams in the winter months and are usually correlated to complete metamorphosis. Temperatures of the water affect the development rate of macros in that cooler temperatures normally slow metabolism and warmer temperatures speed up metabolism. A slow season macro, such as the mayfly, will grow as a larva over fall and winter and pupate or emerge as an adult in late winter.

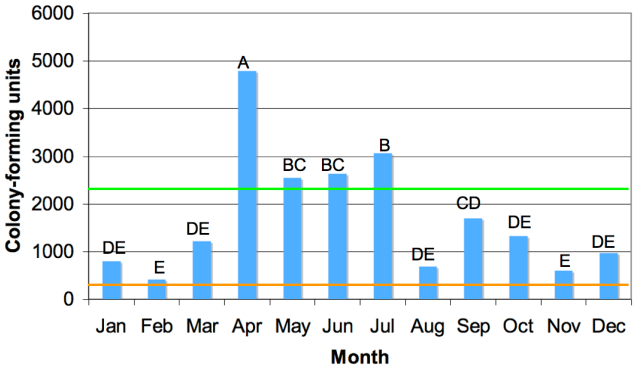
Macros that undergo a fast season life cycle usually will not be seen in the winter because their eggs undergo a long diapause (dormant) stage during winter, again due to a decreased metabolic rate in cooler waters. However, after the egg stage is complete and the waters warm, the macro will complete the larvae stage in a short two – three months to emerge as an adult in the summer.

Some macros, such as hellgrammites, do not have a life-cycle/season correlation. This is appropriately called a non-seasonal life cycle. There may be many reasons why this occurs, such as generation overlap or survival factors that are not seasonally dependant.

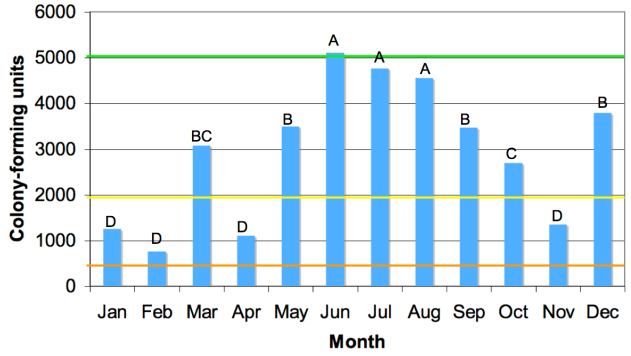
Though stream life may slow down a bit in the winter months, it can still be found. Since the macros are so important in stream ecosystems, Stream Team would be very interested in hearing from volunteers regarding macro and other stream life observations. While

500 CFU/100 mL to ten times that. Because counts are so variable, statistical differences among the months are not as strong as might be expected from the graphs below. (In the graph below, with letters this month, columns that do not share the same letter are not statistically significantly different.) However, the positive relationship between bacteria and seasonal temperature - that is, bacteria counts are higher in the summer when it is warmer and lower in winter when it's cooler - is apparent below.

E. coli



Total coliform bacteria



Turbidity

Turbidity is another measurement that is quite variable, with much of that variability assumed to be associated with rainfall. The graph below shows some difference between typically wetter months (Dec to June) and typically drier months (July to Aug). The peaks in March and June, however, are not well explained. A second analysis (2nd graph below), a linear regression of turbidity versus precipitation in the 24 hours before sampling, shows a significant but slight positive association; as precipitation increased from 0 to ~11 mm, average turbidity increased from ~0 to ~100 NTU.

observing, be sure to include the seasons and weather conditions to find any correlations. We look forward to hearing from you!

Mark Your Calendars!

Butler Soil and Water Conservation District's Annual Open House
Join the Conservation District to

Test Your Well Fair - Free for Butler County Residents
Bring a sample of your well water to:

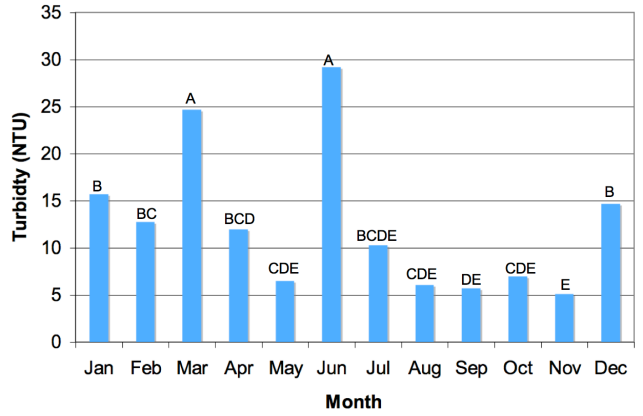
If you have ideas of things you'd like to see the Stream Team do, please let Donna know at mccollds@muohio.edu. For instance, if enough people are interested, we can open the lab up for macroinvertebrate identification again, or run another morning session to get people started knowing what bugs are in our streams.

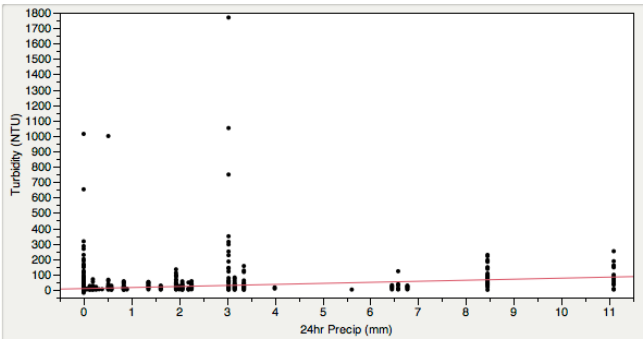
Lending Library Titles

We all have lots of books that we would love to share with someone who has similar interests. So we thought this might be a way to share them with people we know like streams! If you have books, DVDs or other things - especially about water - that you would like to contribute, feel free to bring them along anytime. Or, if there are particular books you would like us to buy, let us know and once a year or so we can add a few to our collection.

Here's our list to date:

*A Guide to Common Freshwater Invertebrates of North America
*A Guide to Ohio Streams
*After the Storm - DVD
*An Introduction to the World's Oceans
*Bugs of the Underworld: a fly fisher's guide to the natural history of aquatic insects (DVD - available on request)
*Exploring the World Ocean
*Fostering Sustainable Behavior: An introduction to community-based social marketing
*Guide to Aquatic Insects & Crustaceans
*Gulf Hypoxia: Action plan 2008
*Handbook for Developing Watershed Plans to Restore and Protect Our Waters





Since we collect data only once a month and don't purposely include wet and dry days, a lot of data are needed to show a significant relationship. So even though the relationship shown below is slight, it says something that we were able to capture that relationship. Further analyses that might help explain how turbidity varies include examining how land use or watershed size interact with each other and precipitation to change turbidity.

Nitrates

Average monthly nitrates vary from about 6 mg/L to over twice that at over 1.5 mg/L. While all averages fall under the human drinking water standard of 10 mg/L, unfortunately all months show nitrate levels above the maximum level for sensitive streams (yellow line below) and 3 months are over and one month right at the maximum suggested for all streams (orange line below). As has been noted before, we need to try to decrease those levels.

*Introductory Oceanography
*Life in the Soil: A guide for naturalists and gardeners
*Marine Ecology
*Migratory Shore and Upland Game Bird Management in North America
*Monitoring Guidance for Determining the Effectiveness of Nonpoint Source Controls
*Oceanography
*Ohio Vernal Pools: Diamonds in the Rough (DVD - available on request)
*Our Waters, Our Health
*Pond and Brook: A guide to nature in freshwater environments
*River of Words
*Stemming the Tide of Coastal Fish Habitat Loss
*Swamp and Bog: Trees, shrubs, and wildflowers of eastern freshwater wetlands
*The Colorado: A river at risk
*The Evolution of North America
*The Face of the Deep
*The Mill Creek: An Unnatural History of an Urban Stream
*Watersheds: A Practical Handbook for Healthy Water

River Reflections

In respect for our recent snowy weather, I wanted to share with you one of my favorite pictures from when my sons were little. This picture was taken at Hocking Hills State Park after a 2' snowfall and some really cold temperatures. I can still remember listening to the water gurgling INSIDE the 50' waterfall!!

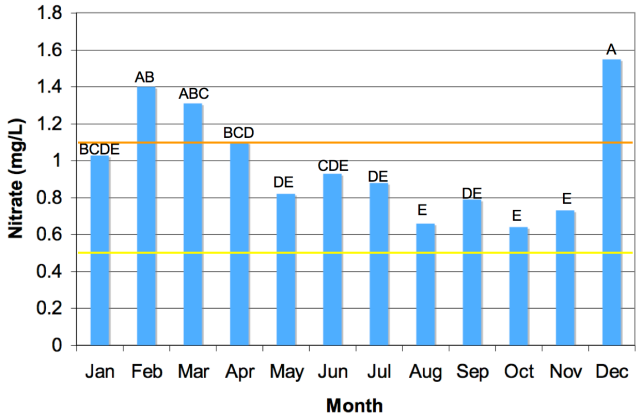
If you have a favorite picture that has anything to do with streams, PLEASE share with us! We'd love to show what you think is interesting, whether it's your sampling sites or some other favorite.

Crisis Spot

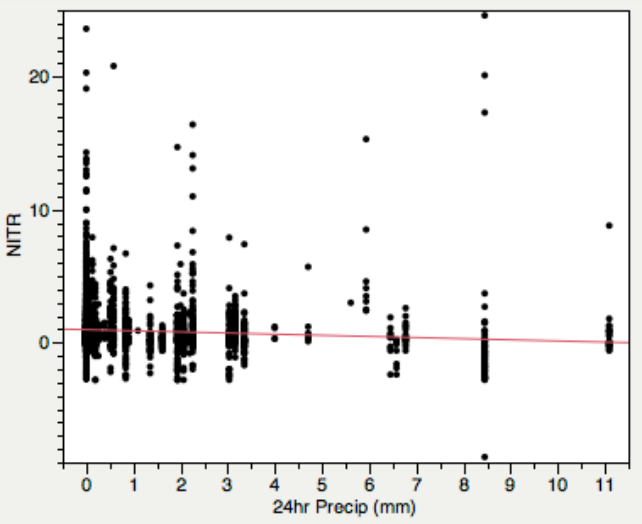
If you notice anything wrong as you collect your samples, please let us now. We may not be able to do anything, but you never know!

Crisis Spot emails can be sent to Donna McCollum at mccollds@miamioh.edu.

If you have any comments,



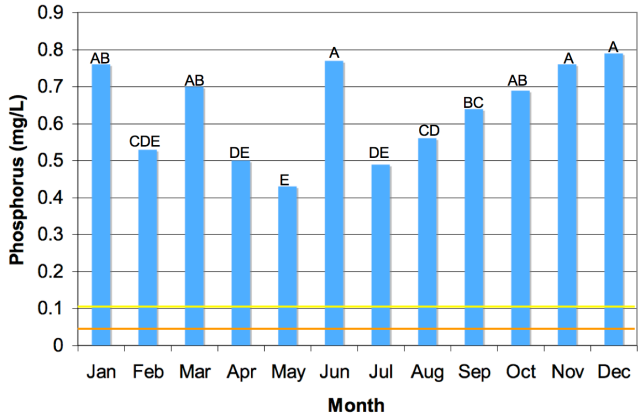
Another pattern apparent in the graph above is that nitrates are higher in our wetter months and lower in our drier months. However, when correlated with precipitation (below), there is a slight but significant negative association. Further exploration is needed to understand exactly what is happening seasonally with nitrates.



Phosphorus

Phosphorus is way over acceptable limits in all months. The orange line below is the recommended maximum for small streams, while the yellow line is the recommended maximum for larger rivers and for preventing eutrophication. Our monthly averages in Butler County streams are at least 10 times the small stream recommendation and 5 times the recommendation for all streams in all months.

concerns, or suggestions, please contact us at mccollds@miamioh.edu.

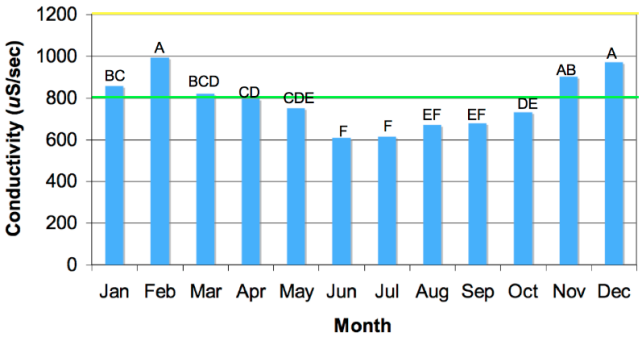


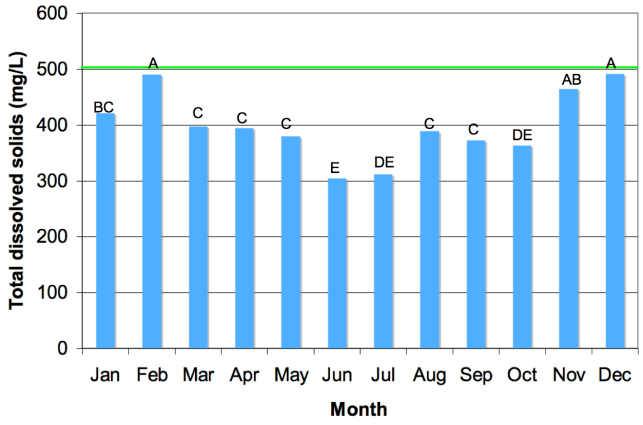
So what can you do to reduce phosphorus? One thing is, if you use fertilizer on your lawn, use one that is phosphorus-free. Lawn grasses rarely need extra phosphorus; phosphorus in your lawn is attached to soil particles, so it doesn't wash off like nitrate does. In addition, most phosphorus in the soil comes from decomposition of vegetative matter, like leaves and grass clippings. Unless you rake every bit of grass and leaves off your lawn, your lawn should not need additional phosphorus.

An additional action some homeowners can take is to check your septic system. Old, leaky septic systems are another big contributor to our phosphorus problem. Farmers can help by doing soil tests before fertilizing and adding phosphorus to their fertilization regime only when it is needed.

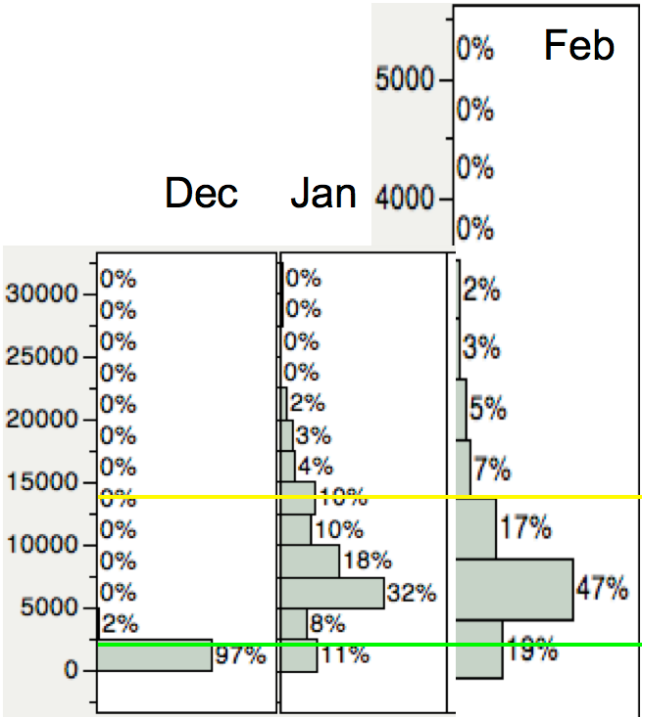
Conductivity and TDS

Conductivity and TDS currently have no standards for aquatic life use; their only limits are for water used for drinking or irrigation. Averages are shown below by the green lines and the human health maximum for conductivity by the yellow line.



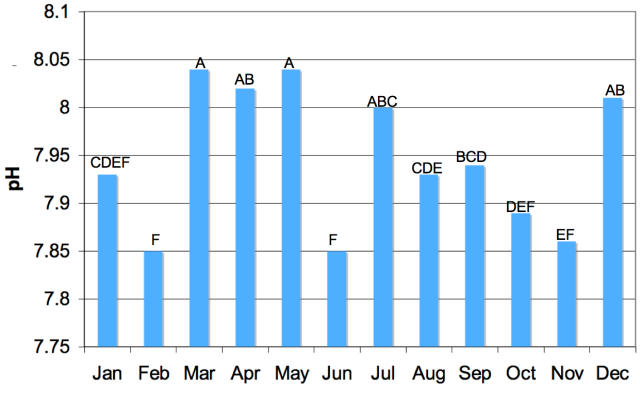


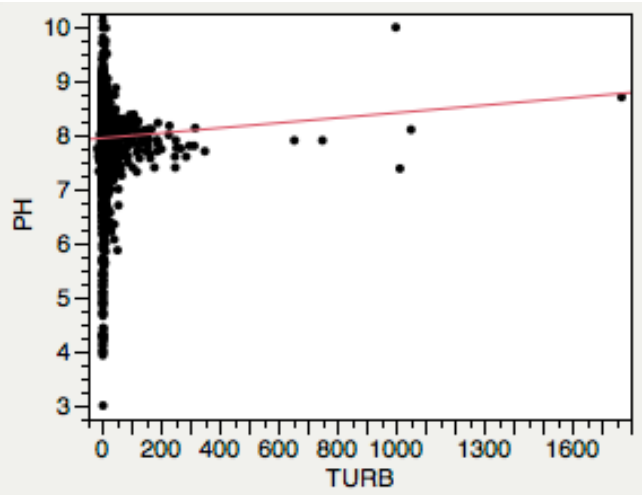
However, we should all stay tuned as scientists learn more about the effects of road salts on aquatic organisms. A recent study in New York showed considerable impact on fishes (LC_{50}) with exposures for one day to salt concentrations as low as 2,724 mg/L (green line in graph below). The highest tolerance for one-day salt levels in the six species they tested was ~14,000 mg/L (yellow below). In the following graphs, conductivity is shown in mg/L to the left of bars showing what percentages of the values we have collected fall in the range outlined by the bars. As you can see, about 3% of our data in December are above the lowest tolerance levels, while nearly 90% are above that limit in January and February. Even the most tolerant of the species investigated would have experienced levels that would kill half the population in over 14% of the samples we collected in January and February.



pH

All of our pH averages fall within the aquatic life use range of 6.5 to 9. However, they do show considerable monthly variation. Part of this variation is likely due to precipitation and its correlated higher turbidity. The graph below does suggest that pH is higher in months with higher precipitation. A significant positive relationship is also seen between pH and turbidity in the second graph below.





How does the Ohio EPA evaluate streams?

Basically, the EPA evaluates streams according to their primary uses into Aquatic Life Use (AQL) and Human Health (HH) categories. In Butler County, AQL standards are classified as Warmwater (most streams), Modified Warmwater (impaired streams) or Exceptional Warmwater (best) Habitat. HH standards are divided into water supply use (drinking, agricultural, or industrial) and recreational use (bathing, primary and secondary contact). Obviously, not all standards apply to our Stream Team samples; no one is drinking our stream water and we don't measure habitat or biota. OEPA standards are noted above where they are applicable.

Butler County Stream Team Monthly Newsletter

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