

Watching the Lakes Breathe

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For many of us around here, the valley bottom lakes are really important to our sense of this place we call the Seeley-Swan. The lakes are part of the beauty, they provide important habitat for fish and wildlife, they provide a key source of drinking water, and they are an engine of the local economy. So it makes sense that volunteers, students, and agency folks are working to understand how they work and to keep them clean and clear. Volunteers regularly monitor the clarity of the water with simple and relatively inexpensive methods. Periodically, when time and funding allow, we also measure nutrients (nitrogen and phosphorous that act as fertilizer) and oxygen dissolved in the water as more complete indicators of lake health and how they may be changing.

Dissolved oxygen is a particularly interesting measure, not just because it tells us a lot about the health of the lake, but because it's fascinating to see what happens in the lake through time. Here's a little background.

Freely available oxygen is critical for respiration in most life forms (though there are bacteria that can thrive without it). We obviously require oxygen to breathe and support the critical process of respiration, turning food into energy, carbon dioxide and waste in our bodies (anybody remember the Krebs's or Citric Acid Cycle?). In the water, animals (like fish and insects) require dissolved oxygen and simply "breathe" through gills to do the same thing. In a lake, dissolved oxygen comes from photosynthesis of aquatic plants and algae, and from diffusion into the water from the air. Some of that oxygen is used for respiration by plants and animals and some is used by bacteria in the decomposition of all the organic material (dead plants and animals) that has been produced in the lake or flushed into it from the watershed, over many years. In general the oxygen used up by decomposition, mostly in the sediments at the bottom of the lake, is way more than the oxygen used for respiration by fish and plants.

Depending on the health of the lake, there can be so much decomposition that the amount of oxygen in deeper waters declines to low levels or even goes to nothing. This process has been made famous by the "dead zone" that occurs in the Gulf Mexico off the mouth of the Mississippi River. There is just so much organic material flushed in from the River or produced in the ocean from all the nutrients coming out of the River that all the oxygen is used up. This is obviously not a good thing for fish, shell fish and other organisms that used to live in that area, and as a Nation we are now spending millions of \$\$ each year to try to clean up the Mississippi River watershed.

Measuring the amount of oxygen in our lakes can tell us a lot about that process and the health of our lakes and their watersheds. In the summer (and winter) the lakes use up more oxygen than they produce from photosynthesis. And, because the lake can be cut off from the air above by ice or by thermal stratification (warm water layered over cold water in the summer), the amount of dissolved oxygen can decline. When our volunteers measured the

amount of oxygen dissolved in Seeley and Salmon lakes in the past, they saw a lot of oxygen in the spring after ice off when the lake is mixing vigorously because of wind and no thermal layering. As the lakes began to warm and stratify, the oxygen in deep water started to decline. In each case our lakes formed small dead zones late in the summer. A then, the oxygen went up quickly in the fall when the lake cooled, layering broke down and mixing started up again. It's as though we were watching the lake breathe, taking a deep breath in the spring, holding it and losing oxygen to respiration and decomposition of organic material during the summer, and then exhaling and taking another deep breath in the fall. By measuring how deep these breaths are, how much oxygen is used up each summer, we can get a measure of how the lake is doing. If it runs out of oxygen too soon or for too long, it's not good for the lake or the fish and other organisms that depend on it.... hold your breath for a long time and you sort of get the picture.

We can't afford to measure dissolved oxygen in all the lakes every year, but with the help from volunteers and some funding from the Seeley Lake Community Foundation we can do it periodically to help keep track of what's going on. The folks in the Swan are doing the same thing on Swan Lake. It's fascinating and also telling us a lot about how the lakes are doing.

If you would like to learn more our lakes or the monitoring done on them check it out at:
<https://crcmt.org/watermonitoring.html>