OHIO STATE UNIVERSITY EXTENSION

Your Pond Update

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Proactive Algae Management through Pond Destratification

As spring progresses, give a little thought to how internal nutrient cycling influences the water quality of ponds. Everything that grows within your pond will depend upon the presence of nutrients, mostly carbon (C), nitrogen (N), and phosphorus (P) (this is, of course, a bit of simplification; lots of other nutrients have roles to play too). Of these, available P is the rarest to freshwater, so it is what is termed limiting. In other words, within most freshwater systems, things are hungry for P, and the concentration of available P tends to thus be directly correlated to the amount of stuff that grows. Not all P is easily available to fuel biologic productivity; soluble forms tend to be more easily available.

It all starts with primary producers—the green stuff: plants and algae—that convert solar energy to biotic energy and are directly dependent upon nutrients to grow. Those producers are eaten by primary consumers: zooplankton, insect larvae, etc. Primary consumers are in turn eaten by consumers at higher trophic levels, including the game fishes that people value. If some percentage of energy is transferred up each trophic level, the ability of a pond to produce algae (especially diatoms and planktonic green algae) is directly proportional to its ability to produce fish (see, e.g., Chipps and Graeb 2010).

The aging process and other inconveniences

The aging process of ponds is called eutrophication, which literally means growing nutrient-rich. Because most Ohio ponds are not nutrient-poor, limiting nutrient enrichment helps to maintain a pond in a vibrant state of hypothetical "youth." Nutrient concentrations that are too high or in imbalanced ratios hasten a pond towards problems with "old age." High nutrient concentrations can lead to a dominance of coarse filamentous algae that are usually considered a nuisance within ponds, aren't readily consumed, and don't readily enter the food web to culminate in fish.

Remember, P is usually considered limiting to freshwater productivity. The ratio of N to P is also directly related to productivity; as P increases, the N:P ratio decreases. An N:P ratio around 20 or more is likely to produce the true algae (i.e., green algae and diatoms) that fuel the food web culminating in fish. As N:P ratios fall below 15, the system is increasingly likely to support blooms of cyanobacteria (i.e., blue-green algae). Because many cyanobacteria species can produce toxins (see, e.g., Braig et al. 2010), and almost nothing cares to eat them, they represent an energetic dead end to pond life; producing cyanobacteria/blue-green algae diverts energy away from the threads of the food web that result in fish growth.

As ponds age, they tend to accumulate nutrient-rich, organic muck in their bottom sediments. As spring progresses and surface waters warm, it can cause a pond to stratify (i.e., a warm, sun-heated surface-water mass sitting atop a cool bottom-water mass: see Lynch et al. 2001 for detail). With bottom waters isolated and directly interacting with accumulated sediments that have a high demand for oxygen, those bottom waters can enter a state called hypoxic (i.e., very low oxygen) or even anoxic (a total absence of dissolved oxygen). Unfortunately, P becomes more soluble in the absence of oxygen (see, e.g., Scheffer 1998; Kalff 2002) and can be liberated from nutrient-rich sediments to fuel nuisance algal blooms. This excessive productivity, in turn, increases biological oxygen demand creating a self-perpetuating feedback loop (figure 1).

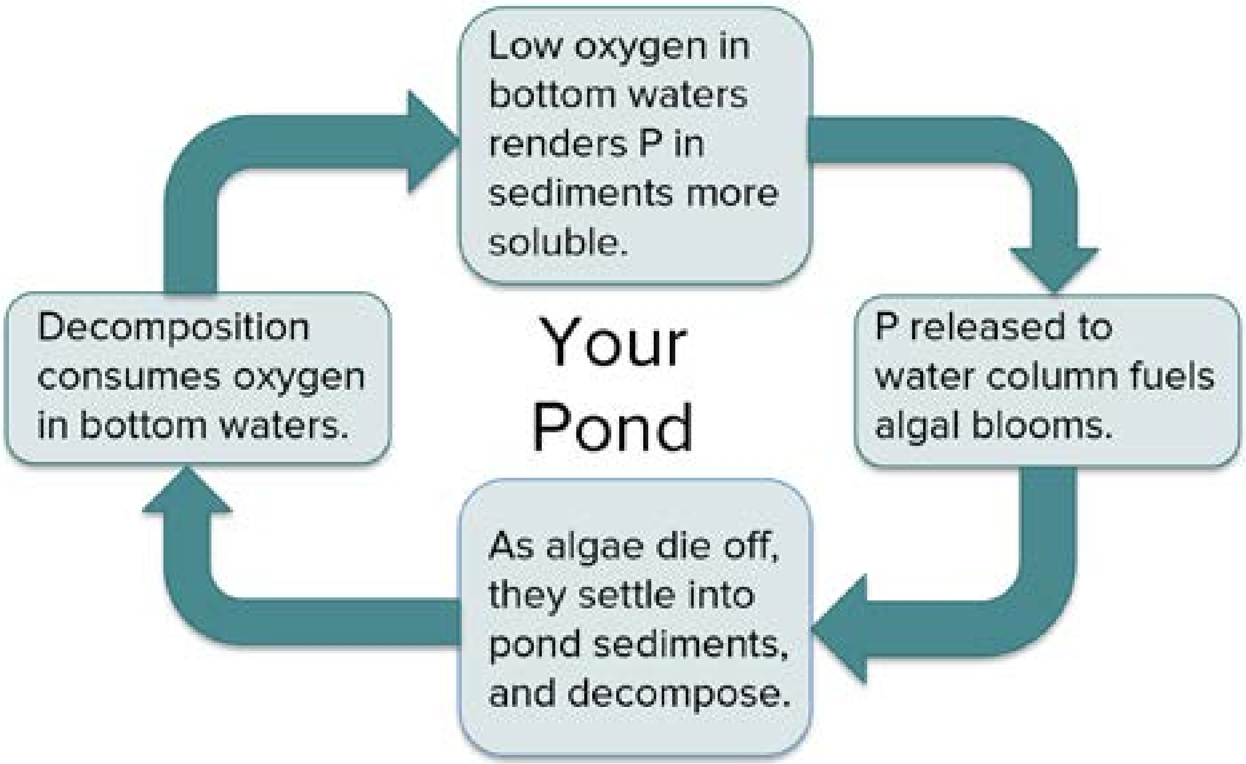

Figure 1. The phosphorus (P) feedback loop in a pond that lacks oxygen in its deep water.

Breaking the cycle

There is logic to managing stratification in managed aquatic systems, like human-made ponds. Yes, stratification is a natural process, and thermal stratification has some decided benefits in northern, low-productivity, natural waters that can retain deep-water oxygen throughout most years. However, in artificial ponds that have sufficient depth to stratify within Ohio, stratification almost always accompanies problems associated with low oxygen and nutrient release.

Disrupting stratification benefits a pond by preventing the isolation of bottom waters and allowing dissolved atmospheric oxygen to circulate throughout the water column, potentially right down to organic sediments. This helps keep excess P sequestered or efficiently processed. This also enhances the presence of aerobic nitrifying bacteria, shifting the N cycle towards benign nitrate and away from unionized ammonia and nitrite that are potentially harmful for fish. Both these chemical responses help keep N:P ratios in the healthily high range. The presence of beneficial aerobic bacteria also slows the accumulation of muck.

Of course, one of the most efficient tools to manage deep-water nutrient release by disrupting stratification is a program of diffuser aeration fit to your pond. I ordinarily recommend those systems be run 24 hours/day throughout the warm season: from spring through summer and into fall. The intent is to prevent stratification from ever setting up. If your objective for aerating is to manage the low-oxygen and nutrient problems associated with summer stratification, the system can be turned off around the time a natural fall turnover is expected (or, as alluded to with winter 2014's installment, the system can be repurposed/repositioned to erode winter ice).

Pond aerators should be brought online in spring. I ordinarily recommend you begin aerating right around the time stratification is expected to initially set up. That will vary some year to year. Beginning aeration by mid-May or even Memorial Day should keep most Ohio ponds more than adequately covered.

Some manufacturers publish spring start-up procedures for distribution with their diffuser units; if yours has, follow them. If not, while the pond's surface water is still within the 40s°F, you can probably fire it up, all go, right away. If you really want to play it safe, or once the surface temperature creeps towards the mid-50s°F, a gradual start-up procedure is a good idea. Many recommend starting by running the aerator 30 minutes the first day, 1 hour the second, 2 hours the third, and continuing to double the amount of time it runs each day until the unit is in operation a full 24 hours.

Managing nutrients via aeration is not a quick fix for an existing excessive growth of plants or algae. Feel free to use algaecides/herbicides that have been licensed for aquatic application as necessary to meet your management objectives (always follow those product labels!). However, with an effective nutrient management program implemented over time, you will ideally find yourself spending much less on chemical treatments for your pond.

As always, feel free to drop me a line or look to **ohioline.osu.edu/lines/ennr.html** with additional pond-management questions. ...And good luck out there!

References

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