OHIO STATE UNIVERSITY EXTENSION

Your Pond Update

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Your Pond (and Fish) Emerging from a Potent Winter

It's been too long since I've provided one of these articles. As always, please, feel free to drop me a line at any time with any of your pond, water, fish, or fisheries questions that you'd like to discuss in detail and that aren't addressed here...or if these articles are too long in coming for your tastes. I want to discuss fish kills with this installment, and more specifically, winter kill.

Many game fishes become stressed when dissolved oxygen (DO) concentration falls below 5 parts per million (ppm). Very few fish species can tolerate DO concentrations of 2 ppm or less. The vast majority of fish kills in Ohio ponds will be a result of the loss of DO from the water.

Dissolved oxygen enters aquatic systems by simple diffusion from the atmosphere and as a byproduct of photosynthesis (i.e., the process by which plants and algae use solar energy to synthesize sugars for their own energy). Most DO in the pond environment (perhaps as much as 70–90%) is likely to have originated in the activity of plants and algae under sunlight. Of course, respiration—by both animals and plants—consumes oxygen. Thus, photosynthesis decreases or ceases if sunlight is obscured and as the sun sets each evening; plants and algae are then consuming oxygen through respiration like everybody else.

Given their valuable function in producing oxygen, there is a value in managing an appropriate coverage of aquatic plants. Depending upon your management goals for the pond and its fishery, up to 20% of the surface area is probably appropriate. The presence of planktonic algae is a little too unpredictable, and planktonic algae populations can crash seasonally, suddenly depriving a pond of oxygen production. ...And filamentous algae simply tend to be a nuisance within ponds. A reasonable coverage of submerged plants both provides ponds with a more consistent source of DO and helps to suppress nuisance blooms of filamentous algae and duckweeds through competition for nutrients.

So here we are, two-thirds through one of the most wintery winters I can remember having come to our state. I usually describe winter fish kills as uncommon to Ohio. However, if there is a winter that's likely to produce an unusually large occurence of winter kill, it's this one: prolonged cold and an abnormally large amount of accumulating snowfall.

Cold water is actually better capable of holding DO than warm water. Of course, metabolism and biological oxygen demand decrease in cold water, but do not completely end. Fish still need to breathe within a healthy concentration of DO to survive. Of course, the greater the biomass of fish in your pond, the more DO they will need to sustain them all.

Problems arise when a pond's surface is completely sealed by ice, ending the diffusion of DO from the atmosphere. If that ice is opaque or if snow is allowed to accumulate on its surface, it limits or cuts off the penetration of sunlight to the plants and algae still present. The addition of DO to pond water through diffusion and photosynthesis ends; the consumption of oxygen, while slowed by cold, continues. If the situation is prolonged for long enough a time, the pond can deplete its DO supply and cause a fish kill (Figure 1).

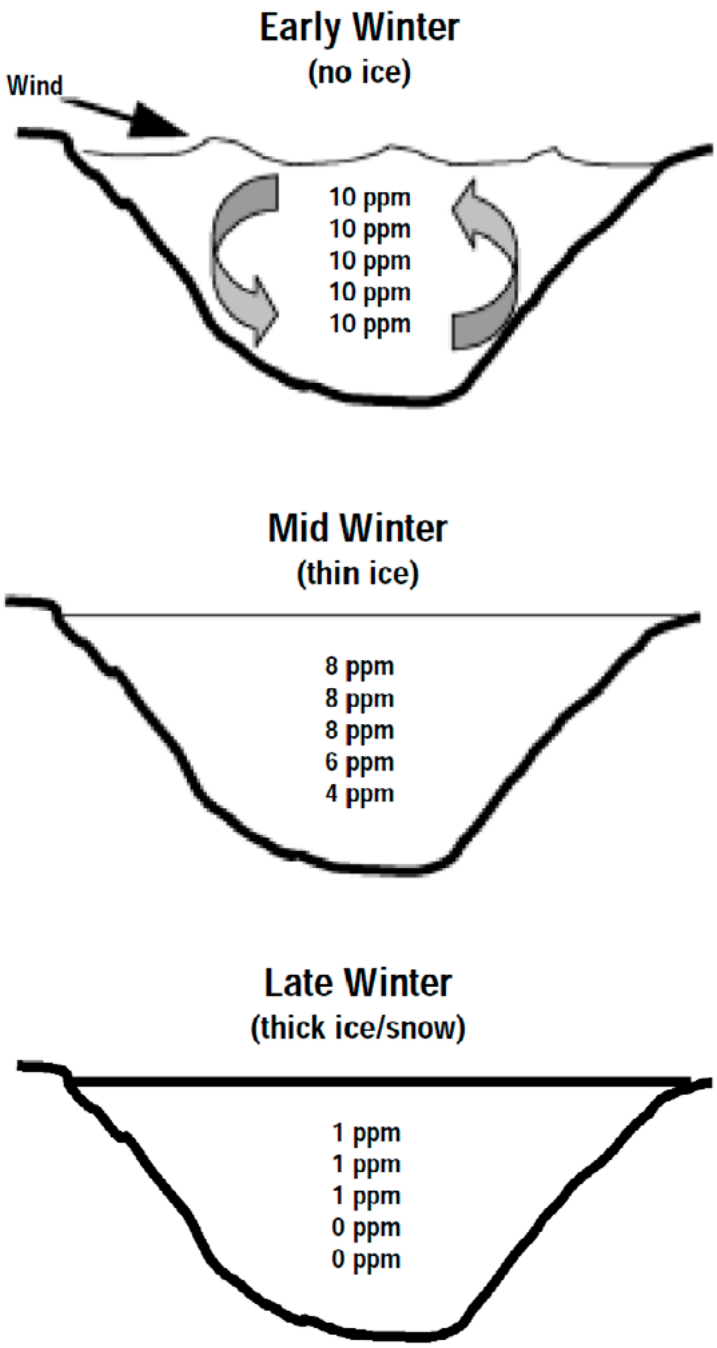

Figure 1. Oxygen depletion scenario during winter ice cover. Oxygen levels are expressed as parts per million (ppm) and show generalized levels and trends (Lynch and Norland 2001).

Ponds with a greater volume of water potentially hold a greater reservoir of DO and tend to be less susceptible to winter kill. (Austin et al. (1996) recommend that ponds be constructed with at least 25% of the area greater than 8' deep for most of Ohio and 10–12' in the north of the state.) Treating large areas of vegetation with herbicides or an excessive natural die off of aquatic plants in the summer before increases the amount of decomposing organic matter, increasing biological oxygen demand and making a pond more susceptible to winter kill. Maintaining an appropriate coverage of vegetation within a pond that has an appropriate expanse of deep water will have a natural resistance to winter kill; a shallow pond

that is choked with excessive vegetation will be much more susceptible to winter kill. As your pond thaws with the approaching spring, watch for signs of a winter fish kill. If you are unfortunate to experience one, know that you have some susceptibility and take actions to mitigate when bad winters are predicted in the future.

Aerating from spring, throughout the summer, and into autumn—in particular with a bottom-bubbler/diffuser or air lift—can help to sustain healthy DO levels throughout the warm season and improve resistant to winter kill. As winter approaches, suspending an air stone from a float approx. 2' below the water's surface, elevating your diffuser substantially off the bottom, or shifting your diffuser to a shallow area can help keep surface water moving to maintain or erode a hole in ice, allowing some surface agitation and diffusion of atmospheric oxygen.

If you ordinarily aerate with a diffuser from deep water, do not operate your aeration system from deep water for long periods of time under ice. Water is densest at 39°F. Thus, deep water (removed from the cold 32°F of surface ice) normally provides some warmer-water refuge for fish. Circulating the water column from deep water with a diffuser will force the ordinarily warmer water from the deep, circulate that water mass under the cold of ice, and bring it back down to depth, potentially super cooling the entire water column and stressing fish.

If maintaining an area of open water with aeration is not an option, you can reduce the risk of fish kill by simply removing snow from the ice's surface, allowing the penetration of sunlight to stimulate some photosynthesis and oxygen production. Plan to keep 25–50% of the pond's ice free of snow (the Ohio Department of Natural resources recommends snow removal from at least 30% as a rule of thumb: Austin et al. 1996).

Pick one management strategy or the other, not both. Aerated ice is not likely safe enough to support weight and allow snow removal. You can find more detailed advice in Lynch and Norland (2001).

Look for more pond-management fact sheets under the "Natural Resources" heading at ohioline.osu.edu/lines/ennr.html. ...And good luck out there!

References:

Austin, M., H. Devine, L. Goedde, M. Greenlee, T. Hall, L. Johnson, and P. Moser. 1996. Pond management handbook: a guide to managing ponds for fishing and attracting wildlife. Ohio Department of Natural Resources, Division of Wildlife, Columbus, OH.

Lynch, W. E. Jr. and E. R. Norland. 2001. Winter and summer fish kills in ponds: extension fact sheet A-8-01. Ohio State University Extension, Columbus, OH.

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