OXYGEN IN PONDS

It's that time of year again. Phone calls with concerns about either stressed or dead fish have become plentiful lately. Here is some information to help you understand some of the dynamics of oxygen or lack of it in ponds, in order to try and avoid some problems.

How do you recognize oxygen depletion? First of all, you should observe the pond immediately before daylight. Fish will be seen on the surface gulping for oxygen. If disturbed by a loud noise, they dive but immediately return to the surface. If the oxygen content is not low enough to kill fish, fish at the surface in early morning will return to deeper water as the oxygen builds up during the day through photosynthesis. In fed ponds, fish often give warning signs of low oxygen by not eating. Oxygen levels lower than 3 ppm in the upper 2 feet should cause concern. Many fish will die if oxygen content is below 0.5 ppm for very long.

Oxygen in ponds comes from two sources – photosynthesis and diffusion from the air. The most important source is photosynthesis, which is the process plants use for manufacturing food. In the presence of sunlight, plants (especially algae) add oxygen to water as a by-product of photosynthesis. At night, no oxygen is produced, but respiration of algae, fish, bacteria and other pond dwellers continue to remove oxygen from the water. Most of the time there is a desirable balance between how much oxygen is produced and how much is used. However, under some conditions the balance can be upset, and the oxygen concentration becomes low enough to stress or kill fish.

The most common oxygen problem occurs when consumption by respiration exceeds the amount of oxygen produced through photosynthesis and diffusion from the air. Algae grow in large quantities as a result of heavy fish feeding. As the quantity of algae increases, it accumulates closer and closer to the surface to gather sunlight and increasingly shades the lower depths. As a result, most of the oxygen is produced near the surface, leaving a large volume of water below the first 2 to 4 feet deficient in oxygen production. Eventually, oxygen produced during the day is less than the demand for oxygen during the night, resulting in possible death or undesirable stress on fish. This situation may be especially acute after several consecutive cloudy days.

If you have experienced excessive filamentous algae growth in your pond this year, consider fertilizing earlier next year. A good plankton bloom established and maintained can shade the pond bottom and prevent growth of unwanted filamentous algae. Stock 15 Chinese grass carp per acre in your pond as well. They can be a tremendous help in keeping algae and aquatic weeds reduced in ponds.

Another type of oxygen depletion occurs when algae die suddenly. When algae die, not only does the pond lose it source of oxygen, but the decaying algae use considerable amounts of oxygen. All causes of sudden algae die-offs are not fully understood, but it is known that die-offs can occur after pond treatments with certain chemicals and herbicides.

Predicting natural algae die-offs is difficult. However, they are often associated with surface algae scums and very heavy algal "blooms". When a die-off occurs, the green water often becomes streaked with gray, black or brown. The color of the water may eventually become totally brown, gray, black, milky or clear. A distinct foul smell may also be noticeable.

The third and most serious kind of oxygen depletion is referred to as a “turn-over”. During hot summer weather, surface water becomes less dense as it absorbs heat and it floats over a cooler, more dense layer of water. All the oxygen is produced in the warmer layer and the two layers may not mix for weeks at a time, especially in deep-water ponds. Eventually, all the oxygen is used up in the lower, cooler layer. A cool snap or a thunderstorm with wind and hard rain can cool the warm surface water, making it heavy enough to sink and mix with the oxygen-deficient bottom layer. The net result is a dilution of the oxygen and an increase in the demand for oxygen from dissolved minerals and decaying organic matter. To complicate these problems, the algae usually die at the same time. “Turn-overs” cause the most catastrophic fish kills in ponds of any oxygen-related problems.

What should be done if signs of oxygen depletion are observed? Immediate action must be taken. Stop feeding until good water quality is restored. Flush the pond with fresh aerated water from a well or another pond. If an irrigation pump is available, pump water from the upper 2 feet, aim the exhaust parallel to the bank and establish a circular motion around the pond. Back a tractor-powered rotary grass cutter into the pond and stir the water with the blades. A boat motor can help in a small pond. Add 6 to 8 pounds each of potassium permanganate and superphosphate per acre. The potassium permanganate helps reduce some of the organic matter and the superphosphate will stimulate the growth of planktonic algae in the water.

After the emergency has passed, the pond management program should be reviewed and the cause of the oxygen depletion eliminated. Prevention of such situations through proper management is the only permanent solution.

Thomas K. Hill*ProfessorUniversity of Tennessee*