

Arkansas Pond Bulletin

October 2023

Quick Hit: Pond Turnover

There may be no term in a pond-owner's dictionary that strikes fear quite like "turnover." What often drives this fear is a common association with fish mortalities, which can be catastrophic in both time and monetary investment lost. Another reason for concern is a level of uncertainty as to what a turnover actually is and what triggers it to begin.

A turnover is when temperature layers within a waterbody equalize and begin to mix. This is a natural process that, in Arkansas, occurs most noticeably each fall. Waterbodies that commonly freeze over during winter actually have two turnovers each year, once in spring and once in fall. The density of water changes relative to its temperature. Water is most dense at about 4°C (39°F), and it becomes less dense warmer or cooler from that point. Denser water sinks to the bottom of a waterbody and less dense water floats nearer the surface.

These thermal layers are very resistant to mixing and their biotic and abiotic characteristics can become increasingly different the longer they do not mix. Because Arkansas has a relatively long summer and relatively short winter, the fall turnover tends to mix layers of water that have spent a longer time separated and thus the changes during the event are more noticeable and potentially more severe. The surface layer is warm and contains most of the plankton, oxygen and living organisms. The bottom layer is cool and often, especially in deep ponds and lakes, can become very low in dissolved oxygen and very high in organic nutrients. Plants produce oxygen more efficiently when they are in warm, well-lit environments so plankton and macrophytes favor living in water near the surface. The oxygen they produce tends to stay near the surface and even enters the atmosphere when the surface water has reached its oxygen saturation limit. Because the surface and bottom layers do not mix, that oxygen rarely spreads to the bottom of deep ponds and lakes. Additionally, dead plankton, fish, leaves, and all manner of organic material that sinks to the bottom are initially decomposed by natural bacteria and microbes. These organisms consume oxygen doing their work and waterbodies loaded with organic waste can become hypoxic (low oxygen) to anoxic (no oxygen) near the bottom during summer. When mixing occurs in the fall, (1) oxygen that was concentrated near the surface is now diluted throughout the entire water column, (2) nutrients that were concentrated near the bottom get mixed throughout the water column, often decreasing water visibility/clarity and triggering a rush of decomposition that consumes oxygen, and (3) photosynthetic plankton tend to produce less oxygen due to reduced water clarity and increased difficulty staying at the ideal depth for light absorption. Whether a turnover is

potentially harmful to fish depends heavily on how fast the turnover occurs and how much oxygen demand the pond or lake has. Generally, a dramatic water cooling associated with strong storms with heavy wind and rain in October to early November can trigger potentially harmful turnovers. Ponds and lakes with thick algae blooms, heavy fish stocking, feeding, and/or fertilization programs, all of which increase oxygen demand, are at higher risk of fish health issues during turnovers. Shallow ponds and lakes tend to turnover more easily and earlier in the year, but they also tend to have less severe turnovers than deeper ponds and lakes. Gradual turnovers that occur slowly over several days to a week from slowly cooling temperatures are less troublesome, though even they can cause fish stress if oxygen becomes limiting.

Signs of turnover include a sudden change in the appearance of the water from clear or green to cloudy or tan/brown sometimes with dark gunky-particulates coming to the surface. A sulfurous odor can sometimes be detected during a turnover. You may notice numerous fish near the surface especially in the morning appearing to be slurping air. This latest sign is the most troubling as it indicates insufficient oxygen levels. The only rapid ways to resolve oxygen issues are activating an aeration system or pumping oxygenated water into the pond/lake. If these mechanisms are not already in-place when the issue is detected, it may already be too late to save many of the fish. Disruptions from turnovers, such as aesthetic appearance, fish catches and feeding activity, usually last about two weeks.

It is very common for pond owners experiencing fish kills during summer to assume a turnover is responsible because the symptoms often closely resemble characteristic signs of fall turnover. What often has occurred during a summer fish kill, is an oxygen depletion from a plankton bloom crash. The water changes appearance, the pond smells odd, and you see dark decaying particulates and struggling fish just like you do in the fall turnover, though the pond did not actually mix. Environmental changes, species cycling, disease among the plankton community, and accidental or over-use of chemicals/herbicides directly to the water or in runoff entering the water can cause bloom crashes that look very much like a turnover in the middle of summer.

Steps to prevent severe turnovers start at construction. Deeper ponds tend to be more prone to severe turnovers so limit depth to about 12 feet in Arkansas. Don't over-stock, over-feed, or over-fertilize as these increase the oxygen demand. You can completely prevent turnovers by installing and operating continuously a properly-sized diffused aeration system. These systems create bubble streams that oxygenate and mix ponds so that they never develop thermal layers. While expensive, these systems are tremendously beneficial to the pond and act as a defense against oxygen problems that could harm your fish. In northern Arkansas, these systems should be deactivated or the diffuser pads moved to shallow water, during winter to prevent super-cooling deeper

water. Central and southern parts of Arkansas should be able to run diffusers continuously throughout the year except for unusually cold/icy winters.

What to Watch Out for in October:

Cooling temperatures and increasing rainfall begins this month so prepare for turnovers. Severe turnovers can be triggered by a sudden and dramatic drop in temperature, usually associated with heavy wind and rainfall. If a turnover/oxygen-related fish kill occurs, the largest fish of each species will be the first to go, often grass carp followed by the largest bluegills, crappie, largemouth bass, and then catfish. Once a low-dissolved oxygen kill has begun, the only thing that can provide relief is aeration or flushing the pond with fresh oxygenated well water. Unless the pond owner already has sufficiently-sized emergency aeration or pumping equipment in place for this possibility, they will likely take too long to acquire it after the fact to make much difference. Encourage clients who have invested greatly in their fisheries (trophy bass and crappie ponds, for example) to consider installing aeration systems to prevent this from occurring in the first place. All we can do in most cases is assess the extent of the kill and recommend a restocking plan.

Pond Management Tasks for October:

Pond renovations and construction should be completed. Rainfall frequency is soon to increase so new, renovated, and depleted ponds will begin filling. Fertilization and feeding programs should be underway. Aquatic dye duration for weed/algae control will start to decline as rainfall increases. Continue herbicide applications for troublesome weeds. Fish stocking, especially forage fish like fathead minnow, golden shiner, and bluegill, can resume. Encourage clients to harvest largemouth bass (10-15 lbs/acre/yr for normal ponds, 25-35 lbs/acre/yr for bass-crowded or highly productive ponds). Harvest bluegill less than about 7 inches in length up to about 25 lbs/acre/yr. Aggressive harvest of all crappie caught, especially from ponds smaller than about 25 acres is encouraged. Continue mowing grass on dams and levees to keep brush and saplings from developing. Periodically inspect drains and spillways to clear debris and clogs. Continue daily operation of aerators. For diffused aeration systems that have not yet been activated, follow the startup schedule of: Day 1, run 30 minutes then turn it off the rest of the day. Day 2, run 1 hour. Day 3, run 2 hours. Day 4, run 4 hours. Continue doubling the run time each day until you are running 24 hrs/day and keep it on for the rest of the summer.

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