

Basics of Pond Aeration

Aeration is a fundamental management tool for fish culturists, commercial recreational or water garden pond owners, to provide a healthy environment and optimize fish growth. This is especially true during the warmer months of late summer and early fall. During this time, fish feeding rates tend to be at their highest and combined with high water temperatures and subsequent high respiration rates; pond oxygen levels may reach stressful levels. There are several conditions that contribute to low oxygen in all types of ponds and, fortunately these can be remediated by use of aerators.

A pond is a dynamic, living ecosystem with a variety of organisms which all interact and influence the daily oxygen budget. Plants, either microscopic phytoplankton or larger macrophytes are the primary source of oxygen through photosynthesis and are also major consumers of oxygen via respiration (see figure 1). Bacteria, zooplankton, insect and fish all respire and are dependent on plant photosynthesis and diffusion for their oxygen requirements. Fluctuations in key requirements of plant growth, sunlight, temperature and nutrients, will therefore impact oxygen concentrations. For example several cloudy days will reduce photosynthetic activity and resulting in lower oxygen concentrations. In addition, sub optimal nutrient levels equates to limited beneficial plant growth or the reverse situation with excessive nutrients (primarily from overfeeding) leads to dense plankton blooms which cause extreme ration rates and low oxygen situations.

As fall approaches, cool fronts can cause deeper ponds to turnover or destratify, resulting

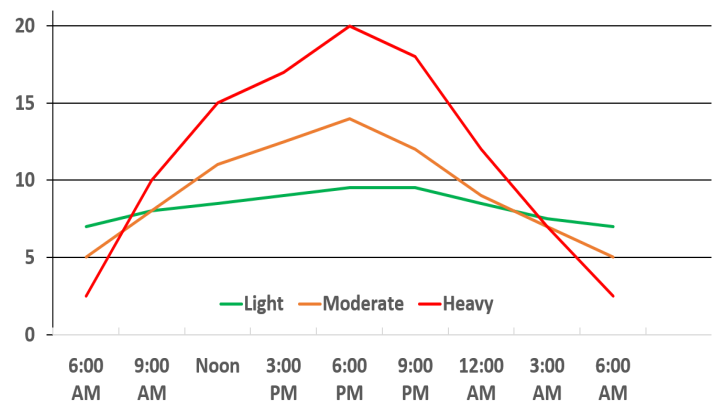


Figure 1. Daily oxygen (ppm) fluctuation in ponds due to photosynthesis and respiration of three varied densities of phytoplankton.

In mixing of the deeper and cooler, low oxygen water with the warmer and higher oxygenated surface waters. Depending on the volume of the deeper, low oxygen layer, destratification can result in a major reduction in oxygen levels causing fish stress and mortality unless proper aeration is used. Deeper ponds will often stratify and water quality may benefit from a destratifying type aerator such as a diffused air system or water blender. A diffused air system (See figure 2.) should not be placed on the pond bottom as this can stir and lift sediments releasing nutrients, potentially stimulating plant growth and increasing water turbidity.

The use of aerators are especially important in reducing low oxygen periods caused by heavy algae blooms induced by high nutrient inflows, feeding rates, plankton die-offs and pond turnovers. There are many types of aerators suitable both for recreational, hobby or aquaculture production ponds. These include the paddle-wheel aerator (See Figure 3), vertical pump



Figure 2. Diffused aeration in pond supplied by a regenerative blower.

Sprayer, propeller aspirator pump, and the diffused air system. These aerators are usually available in single phase or three phase electric floating models.

It is recommended that commercial aquaculture ponds have an electric aerator and access to an additional emergency aerator as a backup. These ponds with high fish stocking and feeding rates, generally require a minimum of 1-2 horsepower per surface acre. The paddlewheel is used as a standard in large commercial ponds because of its relative high oxygen transfer efficiency and ability to move large volumes of aerated water into the ponds. Vertical pump sprayer aerators (See figure 3.) that utilize a propeller to lift and aerate water are effective for smaller commercial ponds two acres or less. In cases of heavier than normal stocking and feeding rates, or ponds with, such as hybrid striped bass, a greater horse-



Figure 3. Electric paddlewheel aerator.

power rate per acre is recommended. It is important to consider factors other than motor size and fish production criteria when selecting aeration equipment. For example the depth of ponds will impact the effectiveness of an aerator. The water mixing ability of many of the type aerators discussed earlier are ideally limited to depths of five feet. Ponds with water depth greater than five to six feet present a challenge in water quality and aeration management, typically requiring a compressed air diffuser system or commercial water mixer.

Recreational ponds, with lower stocking rates and little or no supplemental feeding, may not exhibit low oxygen conditions as frequently as aquaculture ponds, and therefore, can use less horsepower per acre. However, these ponds can experience oxygen problems due to turnovers and plankton die-offs. In this case fish loss can occur directly from the lack of oxygen or from related stress induced parasitic or bacterial infections unless aeration is used. Vertical pump sprayers (See figure 4) which typically are available from 0.5. to 2 hp. and is a common choice for recreational ponds.

The use of shallow water pumps or flushing ponds with well water is sometimes used as a less expensive means to aerate small ponds compared to electric aerators. Actually, the reverse is true since pumping water or adding water through a sprinkler device provides very low oxygen transfer, well water is void oxygen to begin with, and pumping is less efficient in exposing water to the air, the fundamental process of aeration. The exception to this is in the case of water gardens, where healthy oxygen levels of five parts per million or higher, can be provided by an adequate population of aquatic plants and a simple pump driven water fall which provides opportunity for atmospheric oxygen to diffuse into the water.

Since the daily oxygen cycle of ponds results in lower concentrations during the nighttime hours, a common aeration strategy is the use of electric timers to automatically operate aerators during nighttime hours, e.g. midnight to 8 AM. This

has shown to be an effective method to maintain adequate oxygen concentrations, but does not eliminate need for routine visual inspection of timers to ensure proper time setting, and of the pond and fish activity. If pond mixing is the goal, then running the aerator continuously is recommended,

Pond shape can also impact the type and amount of aeration. Long narrow ponds can be difficult to aerate with one unit because the area of influence of an aerator is limited. In this case two or more aerators spaced equally apart may be required to adequately aerate and mix the pond.

The benefits of aeration have long been demonstrated in many pond applications and serves as a fundamental tool in water quality management. The relative low cost of aeration is well rewarded with enhanced water quality and improved habitat for the various aquatic life.

For more information on pond aeration see:

Jensen, G. L., J.D. Bankston, and J.W. Jensen. 1989. Pond Aeration. SRAC Factsheet 3700. <https://srac.tamu.edu/categories/view/39>

Andrew Lazur

lazur@umd.edu

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