

# Why Aeration Is Important

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## **I n s p i r e d   B y   N a t u r e**

*Aeration is an important part of many lake management and restoration efforts. Naturally, most ponds will undergo two stratification periods annually. Stratification creates two distinct layers of water that are separated by a transitional layer (thermocline). Because of the density differences between the layers, the lower layer (hypolimnion) is isolated from nearly all input of atmospheric oxygen while stratification persists. Without aeration, many ponds will develop an oxygen-deprived hypolimnion throughout the summer. The same ponds may also run the risk of oxygen depletion under periods of extended ice cover. Ponds that undergo periods of oxygen depletion may be influenced to different degrees ranging from a decline in ecosystem efficiency to the extreme of experiencing episodes of fish kills. By disrupting the pond's stratification, the pond's ecosystem is supplied with adequate oxygen, preventing the suffocating effect that would have otherwise occurred.*

Aeration is also an important tool for reducing the accumulation of organic muck that builds up on the pond bottom. Under low oxygen conditions, decomposition takes place at a much slower rate than under oxygenated conditions. As a result, organic material is decomposed at a very slow rate, in fact, usually slower than the rate that new organic material is being created. The end result...a pond that is rapidly becoming shallower as it fills with organic material. Simultaneously, gases bubble up from the muck, producing the foul rotten egg smell. Proper aeration can actually reverse the build-up of organics in the short-term (natural succession dictates that a pond will naturally fill in) and eliminate the foul odors as a result of the accelerated decomposition of organic material under oxygenated conditions.

Aeration is also instrumental in managing nutrients. Under anaerobic conditions, phosphorous compounds become soluble allowing the phosphorous to be assimilated by other organisms (i.e. Algae). However, by maintaining an adequate supply of oxygen in the can be retained in the sediments where it is unavailable for algae growth.

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## No Aeration

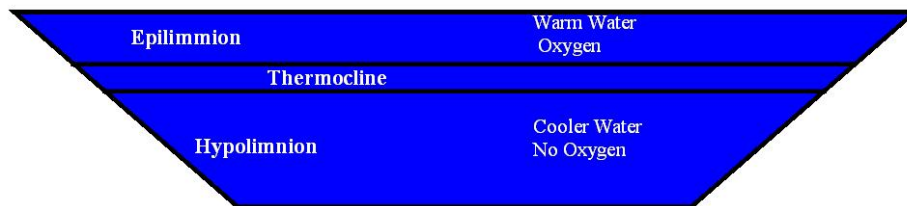


Figure 1. Many ponds will become stratified throughout the summer, causing three different layers to form. The epilimnion is the upper, oxygenated layer while the hypolimnion is the lower oxygen depleted layer. The thermocline is the transitional area between the two layers where water temperature can change rapidly.

## Surface Aeration

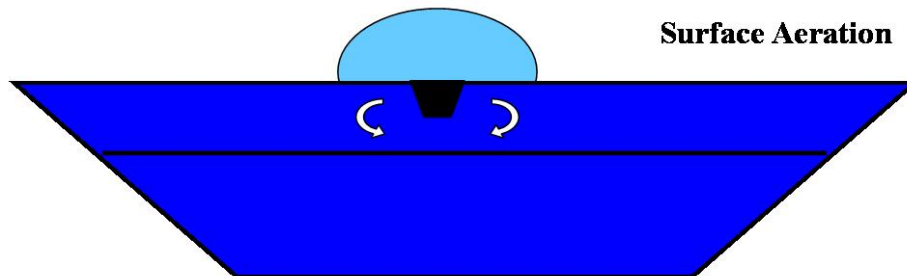


Figure 2. Most surface aerators only circulate the upper layers on water, As a result the lower layers still remain oxygen depleted.

## Bottom Aeration

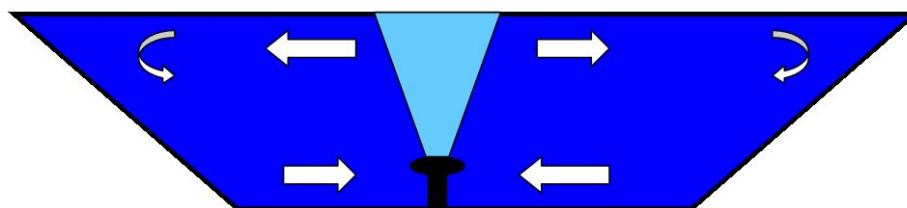


Figure 3. When installed properly bottom aeration disrupts the stratification providing oxygen and circulation throughout the pond.

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### What types of aeration are available?

Although there are many variations in the types of aeration systems available, most can be classified as either surface or bottom aeration. Surface aeration systems, such as fountains and agitators, work by pumping water into the air or by mixing surface water. These surface aerators can operate effectively in ponds less than eight feet deep, but are typically ineffective at aerating deeper bodies of water. Efficiency is also sacrificed in fountain systems as a result of having to pump water into the air. Maintenance also tends to be higher on these units and issues of safety arise with the need to run electric lines through the water. Although the fountains may be aesthetically pleasing, owners must also deal with the inconvenience of the floating unit, which may restrict water usage in certain situations.

Bottom aeration is the second category of aeration devices. Although design and materials vary, most bottom aerators incorporate the same principle; releasing compressed air or oxygen through a diffuser located near the bottom of the pond (use of pure oxygen is not usually practical or necessary in most pond situations). The greatest advantage of bottom aeration over other types is that the positioning of the aerator allows for the oxygenation of the entire water column. As the bubble plume rises through the water column, it also moves a column of water with it. This water movement disrupts the stratification and creates uniform oxygen concentrations throughout the pond. In addition, bottom aerators operate efficiently, present few safety hazards, and pose little concern for water recreation.

The critical difference between bottom aerators arises from the type of diffuser used. Much emphasis is placed on the efficiency at which oxygen from the air bubbles diffuses into the water column. Although an important consideration in some aquatic applications, it is not a great concern for pond management. However, it is important to note that

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smaller diameter bubbles produce better oxygen diffusion, but more importantly, move a greater volume of water within the bubble plume. By maximizing water circulation within the pond, the oxygen that diffuses into the upper layer of the pond from the atmosphere and from photosynthesis, gets mixed with the anaerobic waters in the hypolimnion. The result is a uniformly aerated pond that is operating efficiently and is aesthetically pleasing.

Proper aeration can make considerable improvements in a pond ecosystem. By circulating water within the pond, stratification is eliminated and dissolved oxygen levels rebound. Higher oxygen levels yield greater biotic growth, including fish growth. However, aeration is just one of the tools needed for holistic pond management. To maintain a balanced ecosystem, other tools including beneficial microbes and physical removal need to be used in conjunction with aeration. Implementing this multi-faceted approach allows managers to work with Mother Nature to meet their goals.

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