

POND AERATION: THEORY OF OPERATION

Natural Water Mixing

Pond water, deeper than six to eight feet, rolls and mixes naturally by the wind only during early spring and late fall when the water is a uniform temperature top to bottom. When the water rapidly warms in spring, it weighs less and floats on top of the cooler and heavier water below. Swimmers, that feel colder water several feet below the surface, point out that the warmer water is not mixing with the deeper cold layers. Lack of surface waters mixing into the depths does not provide oxygen to the bottom water where the greatest oxygen demand occurs.

Oxygen Demand

Decomposing bacteria, bottom processing worms and many types of benthic animals consume large amounts of oxygen (up to 85%-95%) mostly during the warm seasons for the breakdown of organics (dead algae, plants, leaves, etc.) in the muck at the pond bottom. It may take several years of the muck layer to accumulate deep enough for oxygen starvation to occur; but eventually the muck builds on the bottom greater than the available oxygen supply to decompose it. Oxygen loss causes all the beneficial "critters" to suffocate and die to be replaced by anaerobic bacteria which require no oxygen, decompose 20 – 30 times slower and produce methane gas, acids, nitrite, and hydrogen sulfide that is black and smells like rotten eggs or septic. Anaerobic decomposition causes fast muck buildup to fill in the pond basin. Also, phosphorus, the main plant food, is unlocked from the mud when sediments are anaerobic and black. Released phosphorus feeds all the new plant growth which usually causes problems.

Aeration Affects

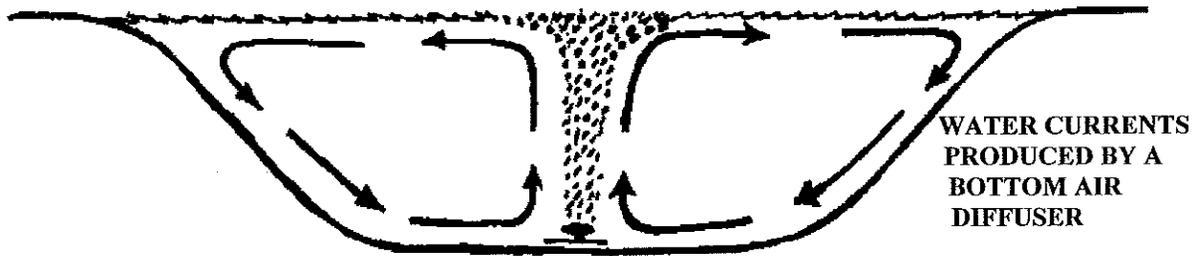
Aeration, by bubbling air from the bottom, pulls bad, cold, bottom water to the surface where it is warmed and oxygenated by trillions of microscopic plants (phytoplankton). The warmed and oxygenated water is returned to the bottom to maintain and speed the decomposition of bottom muck by bacteria, small worms, and animals. Extra animal life on the pond bottom also grows more and larger fish.

Operation of the aeration/diffuser in winter will keep an area ice free so light can penetrate and keep the micro algae alive and producing lots of oxygen. Without light under the ice, all the micro algae die and no oxygen is produced and relatively soon everything dies. If the pond can be kept 20% - 40% clear of snow, the aeration does not have to be run during winter.

Pond Management

After several years of diffuser aeration a large amount of muck on the pond bottom will disappear and less algae and plant growth should be evident. Each year your pond accumulates more nutrients. Decomposition of the organic muck leaves the nutrients or plant foods still in the system! Accumulation rate of nutrients is dependant on each pond location and watershed. Nutrients can only be reduced by removing plants after they have absorbed the nutrients for their growth. Each year, as much as feasible, filamentous algae and/or rooted plants should be removed from the pond. Removing tree leaves and agricultural residue

BEFORE they rot up in the pond also keeps nutrients out of the pond basin. New ponds will stay young and healthier longer when they aerated and plant growth is removed each year. Pond aging is based on the amount of nutrients that have been accumulated in the pond basin. Remember the plants in your pond are being fed by the accumulated and recycling nutrients, especially phosphorus.



BOTTOM DIFFUSED AERATOR operated by on-shore based continuous duty air compressor. Small air bubbles rise from bottom to surface at one ft/sec to:

- Mixes large amounts of water which destratifies thermal layers, to produce fairly uniform temperatures – top to bottom
- Releases gases of hydrogen, methane, hydrogen sulfide, carbon dioxide
- Oxygen from micro-algae and larger plants reoxygenates water
- Reduces certain plant nutrients: phosphorus, iron, manganese
- Reduces anaerobic organic decomposition, i.e. black sediments
- Keeps or returns pond to hard bottom (minimum organic muck buildup)
- Increases water clarity
- Reduces some algae types esp. calm water filamentous types
- Reduces blue green algae scum's/films of July and August
- Encourages growth of rooted vegetation, competition to filamentous algae and micro-algae
- Increases bottom organisms (fish food) who process leaves and organics
- Increases fish poundage and their health in the pond
- Reduces chance of oxygen losses and fish kills, esp. from turnovers
- Warms all bottom areas to speed decomposition rates of muck

MANAGEMENT STRATEGIES WHEN AERATING

- Yearly, remove excess growing plants and algae to reduce nutrients and chemicals from pond
- Quick removal of tree leaves and agri-residue before the sink to bottom
- Reduce or stop fertilizer use near pond
- Aquascaping: using beneficial plants to compete with nuisance plants
- White Amur (grass carp) to help thin but not eliminate all rooted plants
- Use a high efficiency bubbler that moves lots of water per hour; low = 3,000 gph, high = 240,000 gph
- Reduce excessive plant growth in deeper water with Aquashade, some rooted plants beneficial. Aquashade can limit depth of growth based on conc.
- Less frequent mixing required in new ponds: more mixing required in older nutrient rich ponds. Based on aerator efficiency (gallons per hour) and oxygen demand of pond (amount of organics and muck in bottom): Average Pond: completely mix – 1 – 4 times/wk Apr-May; 4 – 14 times/ wk Jun, July, Aug; 1 – 4 times/wk Sep – Oct. Pond mixes naturally – Mar, early Apr, Nov, & Dec.