

AERATION CONCEPTS

Oxygen is the single most important water quality parameter. There are many ways to aerate a water body. Most of the available devices used today are covered here. Each system has its time and place as a management tool.

The main objective to using an aeration system is to provide sufficient dissolved oxygen to the water. The sufficient amount varies from pond to pond or lake to lake. Much of it centers around the biological oxygen demand (B.O.D.) and water temperature. All of the living organisms in an aquatic ecosystem need oxygen. Although fish consume oxygen from the water column, their excrement asserts a higher B.O.D. As faeces and other organic litter builds up on the bottom it forms a high organic sediment. Micro-organisms, on the bottom of the pond, feed upon this organic matter and subsequently use up the available oxygen. During night time hours plants and algae further reduce the available oxygen.

Many people ask the question, why was my pond or lake crystal clear and free of weeds and algae, 20 years ago. The answer to that question is lengthy, most likely nutrient loading is the cause. Decayed weeds, algae, goose manure, and expanding human population contribute to the cause. As more people build homes in a watershed, (all the surrounding land that empties its surface water into a water body), they create erosion problems, and add fertilizers to their lawns. Septic systems fail over time, and leech nutrients into the watershed. These are just a few of the ways a lake or pond can be impacted.

PROLONG THE LIFE OF YOUR LAKE

As man's activities bring more and more nutrients into ponds and lakes, the natural production of oxygen and nature's cleansing action have not been able to keep up with the increase. Although added nutrients have increased the aging of ponds and lakes, the use of forced air aeration has proved effective in prolonging their natural life cycles.

By supplying your water with greater amounts of oxygen, aeration systems can slow down the natural aging process. Increased plant growth resulting from greater amounts of nutrients cause ponds and lakes to use more oxygen in the decomposition of dead plant life. If the bacteria breaking down the organic matter use too much of the water's oxygen then there will not be enough oxygen for fish life. A proper aeration system provides adequate oxygen for both the increase in decomposition and for fish life.

USE NATURE'S CLEANSING ACTION

Aeration takes advantage of nature's own beneficial cleansing process. The only difference is that the natural action is accelerated. The aeration system is based upon the principal of inversion, the complete rolling over of a body of water. Inversion is the natural cleansing action of a water body. This process takes place in the spring and fall when the cooler surface water is heavier than the bottom water and sinks. This is nature's own way of providing oxygen to the water at the bottom and thus removing toxic gases. As more nutrients enter the water, this natural twice a year process is not capable of keeping up with the increase. As the water is inverted oxygen is pulled to the bottom and toxic gases are blown away at the surface. Again, dissolved oxygen at the bottom is the single most important water quality parameter.

Aeration systems rely on the same principals of turn over but on a continuous basis. As bubbles rise from the diffuser, bottom water is pulled to the surface. Surface water then replaces the bottom water. Ideally you should turn over the entire water body 2-5 times a day. Since a single diffuser can only turn over so much water in a 24 hour period, multiple diffusers are used. The number of diffusers that should be used is dependent on the volume of water, water depth, how many times a day the water must turn over, and the type of diffuser that is being used. Goal: Maintain at least 5 ppm oxygen at the bottom sediment layer on a continuous basis.

Diffused aeration systems are utilized a majority of the time when this is the objective. The reason for this lies in the fact that more water, per horse power, can be turned over more economically with diffusers. Fountains use much more horse power when trying to accomplish the same goal. Diffused aeration does not have moving parts or electrical cables in the water. Therefore, they are safe. They also do not create obstacles on the water and are out of site, except for the bubbling action.

Aeration, when used as a management tool is a long range continuous process. Many years of neglect create an unhealthy pond or lake. Aeration must overcome years of organic and

nutrient loading and in many instances deal with present loading. The turn around will be gradual. It helps to implement a watershed program that limits present and future loading. This is not easy, but many private individuals and communities have successfully done so.

PREVENT FISH KILLS

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 and algae add oxygen to the water as a by-product of photosynthesis. At night or in the winter if the ice is snow covered respiration of fish, algae and bacteria continues to remove oxygen from the water. If the oxygen concentration gets too low either in summer or winter you can have a fish kill.

MAINTAIN LARGER AND HEALTHIER FISH POPULATIONS

With an adequate supply of oxygen in the bottom waters, larger and healthier fish populations can be supported. The area for fish survival is essentially increased. Harmful substances on the bottom that were dangerous to fish are released into the atmosphere. Aerobic bacteria, micro-organisms, invertebrates and aquatic insects that are made possible by getting oxygen to the bottom, providing additional food for the fish and break down bottom organic accumulation.

IMPROVE WATER CLARITY

Often water is murky or discoloured by suspended organic particles or matter. By increasing the amount of oxygen in the water, aerobic bacteria will break down suspended organic particles which can result in increased water clarity.

REDUCE WEED & ALGAE NUTRIENTS

By providing oxygen to bottom waters, a more complete and rapid breakdown of dying vegetation occurs. The nutrients released by this process are then consumed by living organisms that provide an excellent food source for fish. This means less nutrients available for new weed and algae growth.

BIOLOGICAL PROCESS

Biological processes occur within a pond or lake. They are too vast to discuss all of them. Here are 2 of the most beneficial attributes of aeration.

Phosphorus, nitrogen, and carbon cause nuisance algae blooms. Very little phosphorus is needed to support nuisance algae growth. (.03 ppm total phosphorus). Once phosphates enter a pond they are almost impossible to remove. The best option is to bind up the phosphates. Aeration accomplishes this. Phosphates can be bound to cations (positively charged ions present in the water), only if sufficient oxygen is present (oxidation). Once bound to the cations, the phosphorus is precipitated out of the water column and into the bottom sediment. The phosphorus is unavailable for algae growth as long as oxygen levels are sustained.

Microscopic organisms, predominantly bacteria, decompose organic matter and use available phosphorus for energy and reproduction. They will accomplish these feats aerobically (in the presence of oxygen). Without oxygen, anaerobic bacteria produce hydrogen sulfide (rotten egg smell), methane and ammonia. All of which are unhealthy to living organisms. Bacteria also are important in converting nitrogen ammonia to nitrate. The safe form of nitrogen.

BIO-AUGMENTATION

Enzymes can be added to accelerate the digestion of organic material and digest nutrients essential for undesirable algae growth. Beneficial bacteria are added to a pond in powder, packets, or liquid form. Upon contact with the water, bacteria come to life. They help

decompose waste products and assimilate nutrients by converting this material to other bacteria through the process of growth and reproduction. Bacteria then become the food source for other aquatic organisms. They are the beginning of the food chain. Enzymes are used to facilitate the growth of bacteria and aid in the breakdown of organic materials.

ELIMINATES ODOR

By adding adequate air to the bottom waters, decaying organic matter gases can be gassed off. The stagnant rotting egg odours found in many ponds and lakes can be completely eliminated.

MOSQUITO CONTROL

Mosquitoes prefer stagnant water. Aeration will also increase fish and other invertebrates that feed on mosquito larva.

