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# SUMMER KILLS IN FISH PONDS AND ITS PREVENTION MEASURES

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Temperature is the primary factor that influences the metabolism of many organisms. So many metabolic activities are temperature regulated. Sometimes reactions will have negative impacts too. Thermoregulation is one of the most critical metabolic processes by which an organism controls its internal temperature. Fish have many mechanisms for regulating their temperature; based on this mechanism, fishes are classified as ectothermic, using their environmental temperature to manage their body temperature, but some fish are endothermic, having the metabolic ability to handle temperature internally. Poikilothermic fish are ectotherms that do not control their body temperature; their core body temperature conforms to ambient temperature. Eurythermal fish have evolved to survive in a wide range of environmental temperatures, but stenothermic fishes are very poor tolerant to stay in a narrow range of temperatures. Enzymes can degrade and deactivate; organs can fail, which finally leads to the organism's death.

Understanding thermoregulation for fish species is particularly important when considering implications for climate change.

Mortality of fish in the cultural pond is a natural process, and frequent noticing of the dead fish along the dikes of the pond areas is not unusual. Natural causes may include predation, old age, minor disease outbreaks, handling, spawning, and environmental stresses. However, if you find large numbers of dead fish at one time, we need to think about it. Unfortunately, by the time dying fish are observed, it is often too late to stop the fish kill; however, to prevent fish kills, understanding the causes is necessary.

## Oxygen-Related Fish Kills

The decline in Dissolved oxygen levels in aquatic ponds is the most common cause of fish kills is suffocation. Algae and aquatic plants produce the most dissolved oxygen through

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a biological process called photosynthesis. Another side, a lesser but also important source of oxygen in water is diffusion from the atmosphere, enhanced by wind-induced surface water turbulence, called artificial aeration. During the night hours, oxygen is utilised for respiration by plants, animals, and bacteria during organic material decomposition. When more oxygen is consumed by the aquatic organisms than produced, oxygen levels can be depleted, leading to fish kills. Ponds suitable for supporting fish should have a minimum oxygen level close to optimal levels required by the fish. Tropical fish require oxygen levels of 5 ppm (parts per million), and temperate fishes require around 6.5 ppm to maintain good health. A sign of oxygen stress is fish gulping for air at the surface, particularly in the early morning. Larger fish will die first since they have greater oxygen demands than smaller ones. When water temperature increases, the solubility of gases decreases. So water temperature plays a crucial role in dissolved oxygen solubility. The following are scenarios that can lead to oxygen depletion and fish kills unless precautions are taken.

$$Temperature \frac{1}{\text{Diffusion of gases}}$$

## Summer Kills in Fish Ponds

## Excessive Vegetation in Culture Ponds

Fish ponds covered by larger aquatic plants for more than 60 to 80% with shallow water levels may have the highest number of summer kills. Under these conditions, problems can arise after long periods of hot, cloudy, still, (windless) weather conditions at which water temperatures rise above 85°F (29°C). High temperatures will limit the oxygen to dissolve into the water, cloudy skies prevent plants from producing sufficient oxygen through photosynthesis, and calm winds stop the turbulence and mix atmospheric oxygen into surface layers of water. Ponds can usually withstand several consecutive hot days and nights, but oxygen levels may decline to levels lethal to fish if these conditions persist. Larger fish typically die first because their oxygen requirements are greater than those of smaller fish.

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**Figure 1:** Excessive vegetation in culture ponds

## Phytoplankton Crash

Eutrophicated ponds often produce dense blooms of microscopic algae (called phytoplankton), giving them a deep green coloured appearance. A sudden drop of phytoplankton can occur due to following consecutive days of cloudy, hot, windless conditions. When an algal bloom "crash" occurs, the water will appear to have turned black or clear overnight suddenly.

**Figure 2:** Fish mortality due to the depletion of Dissolved Oxygen

The sudden die-off of algae will result in a rapid decline in dissolved oxygen as bacteria decompose the dead algae by consuming the oxygen. This can lead to deficient levels of dissolved oxygen, which can result in fish kills.

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## Stratification

Other than the above said reasons, the cause of fish kills during summer months could be overuse of herbicide leading to massive death of either algae or aquatic weeds. Pond owners often wait until their ponds are overrun with aquatic plants or algae before starting any control practices. When all the vegetation is treated simultaneously with a herbicide/algaecide, a massive die-off of the foliage will occur shortly after the treatment. If this happens, bacteria will immediately start the decomposition by breaking down the dead plant materials, which rapidly reduces the dissolved oxygen levels. Still, no longer oxygen is being produced by the plants/algae that were killed by the herbicide/algaecide. Under these stressful conditions, oxygen consumption far outpaces oxygen production, and levels decline rapidly, leading to fish kills.

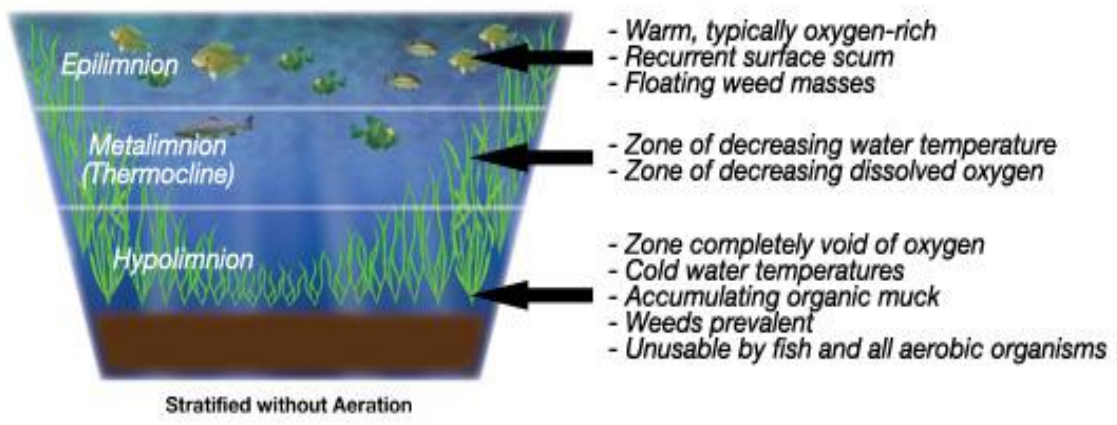


**Figure: 3** Thermal stratification in fish ponds

## Premature Turnover Following Heavy Rains

During summer, many ponds deeper than 8 to 10 feet tend to stratify, resulting in a warmer, lighter, more oxygenated upper layer on top and a colder, denser one at the bottom layer. This stratification will break down naturally in the fall of temperature. The increasingly cooler, denser water of the upper layer begins to sink due to its density. They are mixing the entire water column results in the lowest chances of oxygen diffusion into water. Over the course of the summer, large amounts of organic matter can accumulate in the deeper areas of stratified ponds. After completion of the summer, oxygen in this bottom layer will be used up by this organic material decomposition. Premature mixing of these stratified layers can occur

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during the summer after heavy cold rain. Oxygen-poor bottom layers mix with upper layers, resulting in critically low oxygen levels throughout the water column, fish starts suffocation and possible fish kills.

## How to prevent Summer Fish Kills?

In all cases described above, Dissolved oxygen depletion is the prime most cause of fish kills. Preventing oxygen depletion is difficult, but proper pond management and construction can help to prevent fish kills. The following suggestions will help.

- ✓ Installing an aeration system to circulate and aerate oxygen-deficient water is recommended. So many types of aerators are available in the markets, including fountains and pump-operated bubblers or diffusers aerators. For effective, bubbler/diffuser systems must be turned on early in the spring and run nonstop all summer until temperatures begin to cool. If you opt for the diffuser-type of the aerator, keep it at least one feet above the pond bottom; otherwise, this will stir up organic materials and leads to increased oxygen consumption as bacteria break down the material. Aeration also speeds up the decay of organic matter, which helps reduce toxic gasses.

**Figure-4** Paddlewheel type Aerator

- ✓ The paddle wheel type aerator is especially effective because it moves a large amount of water by its rotating fan mechanism. During scorching weather, check your pond regularly in at early morning for signals of any stressed fish. If you observe fish

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gulping at the surface during early morning hours, immediately stop feeding them and start aeration.

- ✓ Cultural methods, such as the addition of fresh water and deepening shallow water areas of ponds (when possible) to limit aquatic vegetation growth and increase water volume, are also recommended.
- ✓ The recommended slope of the pond is 3:1 (for every 3 feet of distance from the shore, there is a 1-foot drop).
- ✓ Limit animal waste from entering the pond to prevent excess organic matter accumulation; extra organic matter can utilise oxygen for bacterial breakdown.
- ✓ Do not allow livestock to wade in the pond.
- ✓ Don't allow the aquatic weeds from accumulating to excessive levels since they will use up large amounts of oxygen when they decompose. So many methods are there to remove these plants, like mechanical, cultural, and chemical methods. If a herbicide application is necessary, treat not more than 25 % of the pond at a time with a 10 to 14 days gap between treatments to prevent oxygen depletion.

## Conclusion

During the summer session, excessive aquatic vegetation in the cultural pond may influence the dissolved oxygen levels, which triggers the suffocation of fish and finally leads to the mortality of fishes. In the water compartment, such as alteration of water quality (Temperature, Dissolved oxygen and pH) in the aquatic system may directly or indirectly influence the aquatic species. Better pond management is foremost essential to prevent summer kills to a certain extent.

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