

ALGAL BLOOMS- CAUSES, PREVENTION AND REMEDIATION IN THE FRESHWATER ENVIRONMENT

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Introduction

A small amount of controlled algal growth in a pond is rarely problematic, and can be beneficial in utilizing fish wastes and providing an alternative food source. However, the majority of freshwater pond systems will encounter problems with blooms of massive numbers of algae at some stage. These blooms can be highly persistent in some systems with profound aesthetic effects on the feature. More seriously, they can have grave implications for fish health and pose a potential risk to humans. There have been a number of companion, farm and wild animal deaths associated with exposure to toxic blue-green algae.

Algal types

Algae are primitive plants, lacking the specialized reproductive structures and defined root, stem and leaf systems of higher plants. They are diverse- some groups having closer evolutionary relationships with fungi and bacteria than other algae. The main group likely to occur in a freshwater pond are the Green algae (*Chlorophyta*) which comprise single-celled and filamentous algae. Single celled algae such as *Chlamydomonas sp.* can result in the commonly seen 'green water' conditions. Filamentous algae such as *Cladophora sp.* form weed-like masses attached to rocks, gravel and other plants –commonly called 'blanketweed'. Another problem group are the Blue-Green algae (*e.g. Anabaena sp.*). They can be found in suspension, as surface scum or as a slimy coating attached to rocks and other submerged objects. They can discolour the whole water body and are capable of producing dangerous toxins.

Causes

Excessive algal growth is caused by many factors but the basic necessities for plant growth underlie all cases;

- Sunlight- A necessity for algal photosynthesis. Any pond receiving large amounts of direct sunlight is at risk. A shallow pond depth increases the risk due to the penetration of UV rays to more of the water body.
- Nutrients- For algal and other plant growth to occur there is a requirement for nutrients, in particular, nitrogen and phosphorous. Nutrients could enter the system via a number of routes; metabolic/ faecal wastes from pond occupants, uneaten feed, garden/ agricultural fertilizer run-off etc.
- Temperature- Increased water temperature allows a higher multiplication rate of the algal population.

Effects

An algal bloom affects the aquatic environment in many ways. Whilst algae produce oxygen from photosynthesis during daylight, they consume oxygen and produce carbon dioxide from respiration overnight- resulting in low dissolved oxygen levels (exacerbated during warmer water temperatures). Severe blooms can result in early morning hypoxia in fish – lethargy, gasping at the surface and water inlets and potentially sudden death.

In poorly buffered water (water with low carbonate hardness or 'alkalinity') these changes in dissolved gases can cause dangerous pH fluctuations. Overnight, increased CO₂ production lowers the pH, and during the day the removal of CO₂ increases pH. Significant changes can result in lethargy, skin/ gill damage, increased toxicity of dissolved compounds, and blood acidosis/ alkalosis leading to mortalities.

Large scale algal die-offs increase rotting organic material within the pond, causing a massive increase in the biological oxygen demand of the system. This results in a potentially fatal lowering of oxygen levels in addition to further fouling the water. Certain algal species, (e.g. some Blue-Green algae) can produce specific toxins dangerous to both mammals and fish.

Prevention

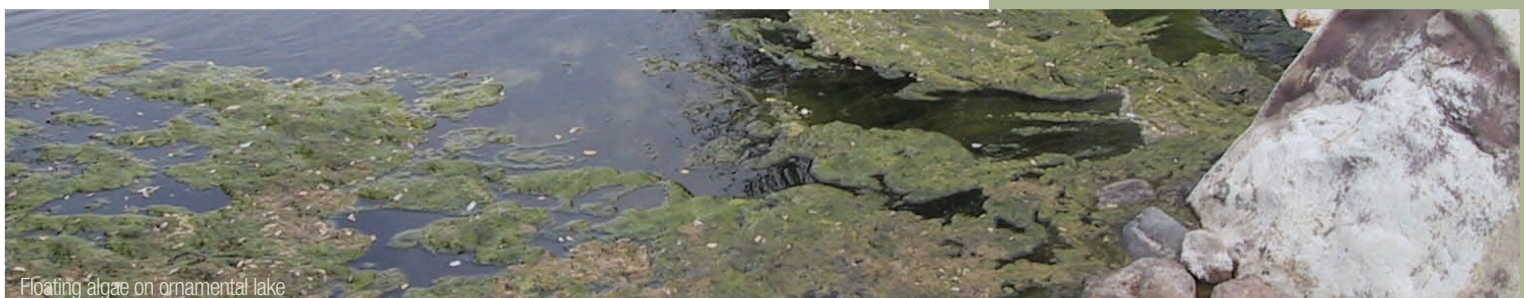
Attempting control by repetitive use of herbicidal chemicals alone is likely to result in failure after the treatment is washed out of the system, with a recurrence of problems and the potential for resistant populations of algae. Chemical treatments should be used with caution, only after other remedial actions have been taken. A methodical investigation of the system is necessary; to identify potential underlying causes and to provide a long term solution.

- Sunlight- Assess the siting and exposure of the pond. Ideally 60% of the water surface should be shaded from direct sunlight, possibly through the use of exterior shading or surface plants such as pond lilies (or artificial plants in a Koi system). Some pond treatments act by adding dyes to the water thus filtering some of the sunlight- but their use is not always effective.
- Nutrients- Remove sources of excessive pond fertilisation e.g. garden fertiliser run-off, overhanging vegetation that drops decaying material etc. Avoid high stocking densities and ideally, add a filtration system. Water quality should be regularly monitored including nitrate and phosphorous levels. An effective biofilter will control nitrogenous waste levels and a well planted pond (or the use of a vegetable/ reed filter) can reduce the phosphorous available to the algae.
- Temperature- Adequate shading and water depth may limit temperature increases.

Once these factors have been addressed, then commercially available products can be considered if there is an ongoing problem. A well maintained UV clarifier unit combined with filtration is the best way of eliminating 'green water' and suspended Blue-Green algae. Barley straw can be effective in ponds too large for a UV unit - its aerobic decomposition can inhibit algal growth for up to 6 months. Care must be taken in its correct usage- quantities, siting, etc.

Blanketweed is troublesome and any treatment should initially involve the manual removal of as much material as possible and creating environmental conditions unfavourable for growth. Although likely to kill beneficial plants, there are herbicides effective against blanketweed but the resulting decaying material must be removed. Barley straw is less effective against blanketweed but can have some success. There are numerous electronic and magnetic devices claiming to control blanketweed however their efficacy is variable. Products involving the release of copper are best avoided due to potentially toxic effects on fish.

Editors Note: A number of links to sites covering some of the issues discussed here are available from our website www.wmenews.com.



Floating algae on ornamental lake