Managing Filamentous Algae in Ponds

Rossana Sallenave[1]

aces.nmsu.edu/pubs • Cooperative Extension Service • Guide W-103

The College of Agricultural, Consumer and Environmental Sciences is an engine for economic and community development in New Mexico, improving the lives of New Mexicans through academic, research, and extension programs.

All About Discovery!™
New Mexico State University
aces.nmsu.edu

What Are Filamentous Algae and What Problems Are Associated with Them?

Figure 1. **A bloom of planktonic algae, giving the pond a pea soup appearance.**

Algae are a natural and essential component of a healthy aquatic ecosystem, providing oxygen to the water and forming the base of the food chain. However, problems arise when an excess of nutrients causes algal blooms, or accumulations of filamentous algae, known as mats, moss, or scum. Filamentous algae are one of the most common aquatic plant problems faced by pond owners, particularly in the spring. Filamentous algae differ from free-floating, microscopic individual cells or planktonic algae (Figure 1) in that they form long chains of cells that look like threads or filaments (Figures 2 and 3). These filaments entwine and can form dense mats that look like wet wool, cotton, or slime. These algae first begin growing along the bottom of ponds where the water is shallow and light penetration is high, or on rocks or aquatic plants in the water. As the algae photosynthesize, oxygen is produced, and bubbles can become trapped in these mats, which then float up to the surface. There are several species of filamentous algae, including species of green algae and cyanobacteria (commonly referred to as blue-green algae), and mats often consist of more than one species.

These algal accumulations are unsightly; interfere with swimming, fishing, and other recreational activities; and may emit odor as they decay. Another major problem associated with excessive algal growth is a reduction in dissolved oxygen in the water. The three sources of dissolved oxygen in water are atmospheric diffusion, wind circulation (which increases surface diffusion), and photosynthesis of algae or submerged plants (which provides most of the oxygen). Algae produce oxygen through photosynthesis during the day, but they consume oxygen through respiration at night. On warm summer nights or during prolonged periods of cloudy weather with no wind, more oxygen may be consumed than produced, and levels can become severely depleted, which can lead to fish kills. This can also occur when large amounts of algae die off all at once, either naturally or after the application of an algaecide. Bacteria consume oxygen while decomposing the dead algae, which can result in dangerously low oxygen levels for fish.

[1]Extension Aquatic Ecology Specialist, Department of Extension Animal Sciences and Natural Resources, New Mexico State University.

Figure 2. **A surface accumulation of filamentous algae.**

Figure 3. **Wet wool appearance of filamentous algae.**

WHAT CAUSES ALGAL ACCUMULATIONS?

The cause of these algal accumulations is an overabundance of nutrients, particularly phosphorus and nitrogen, in the water. In some cases, nutrients are purposely added to fish ponds to fertilize them. Fertilizers will stimulate the growth of planktonic algae, which are eaten by microscopic animals called zooplankton and insects. These serve as food for such fish as bluegill or golden shiner, which in turn are eaten by larger predatory fish like bass. However, in many cases, the overabundance of nutrients is unintentional, and is caused by runoff from fertilized fields and wastes from livestock, pets, and wildlife such as geese and ducks. Another common source of nutrient enrichment in ponds is poorly functioning septic systems. Early and regular measures to control these nutrient inputs will help reduce the problems associated with these algae.

HOW CAN EXCESSIVE FILAMENTOUS ALGAE BE CONTROLLED?

Prevention

Preventing algal accumulations from occurring in the first place is preferable to and less costly than controlling them once they develop and become a problem. The key to effective, long-term control of algal blooms is limiting and reducing the input of nutrients into the pond from the previously mentioned sources.

An effective way to increase bank stability and reduce soil erosion and runoff of nutrients is by establishing and maintaining a buffer strip of undisturbed vegetation around the pond. Buffer strips are defined as vegetated transition zones between natural wetland areas, such as ponds, and adjacent areas that have been modified through human activities. The buffer strip should be at least 15 to 50 feet wide, and the width will depend on the condition of the buffer strip (how densely vegetated it is), the value of the pond, and the degree of modification and impact of the adjacent areas. In general, the width of the buffer strip can be smaller when the buffer is in good condition, the pond is of comparatively low functional value, and the adjacent land has a low potential for disturbance. Buffer sizes should be larger when buffers are in poor condition (disturbed soils, poorly vegetated), the pond is of high value, and the adjacent land has the potential to be modified or disturbed.

Another preventive measure that can be taken is to steepen the sides of the pond to help eliminate shallow water areas and prevent sunlight from reaching the bottom of the pond where filamentous algae first begin to grow. A 3:1 slope (for each 3 feet of distance from the shore there is a 1-foot drop) is recommended. This is usually not an option with existing ponds, and may not be possible if the pond is used for swimming or by young children. In general, ponds should be at least 3 feet deep to reduce the growth of bottom-growing algae and other potential aquatic plant weeds, and 6 to 7 feet deep if the pond contains fish that will overwinter there.

Proper aeration and good water flow are both helpful in maintaining a healthy aquatic ecosystem and reducing algal accumulations. Without proper circulation and exchange of water, ponds tend to become stagnant. Ponds with inlets and outlets will have fewer problems associated with algae or anoxic (absence of oxygen) conditions that can lead to fish kills.

It should be noted that nutrients are recycled in ponds, so even after excessive inputs of nutrients have been reduced, it can take a number of years for ponds to fully recover. However, unless long-term steps are taken to control and reduce the input of excessive nutrients, repeated mechanical control or multiple applications of chemicals will be necessary to control algal accumulations.

Cultural Control

Cultural control refers to strategies that can be used to alter the aquatic environment in such a way that filamentous algae lose their competitive advantage. One such strategy is called shading, which involves applying non-toxic, water-soluble dye (products such as Aquashade) to the water early in the growing season to control algae by blocking sunlight needed for growth. These dyes are inexpensive, but multiple applications may be necessary to maintain the required concentration. It is important that these dyes be applied early in the season before the algal blooms appear; once the algae reach the surface, the dye will have no effect. Dyes are not a form of chemical control because they have no herbicidal properties; they simply color the water.

Mechanical or Physical Control

Mechanical control involves physically removing the large clumps of filamentous algae using a rake or net. This method can be effective, but provides only short-term control and will need to be repeated throughout the peak growing season due to the rapid growth rate of the algae. The removed algae can be composted or used as garden mulch.

Chemical Control

Applying chemicals is another method to achieve short-term control of algae. However, there are several things to consider when using chemicals to control algal accumulations. If you use chemicals, it is very important to read and follow the label completely to learn about toxicity, use restrictions, application recommendations, and safety information. You should remember that pesticide labels are legally binding documents and must be followed. Pesticides are registered for specific uses and to control specific pest species. It is also important to apply the correct amount of the chemical, and a good estimate of the amount of water in the pond is necessary to do so. To calculate a pond's volume, multiply the surface area or acreage by the average depth. The most effect time to apply chemicals is when the algae are beginning to grow (spring) and not when the algae have become firmly established. Some chemicals work most effectively at temperatures above a certain threshold and may not provide good control at lower temperatures.

In addition, treating an entire pond with chemicals can result in fish kills, particularly if water temperatures exceed 70°F and the algal accumulations are so extensive that they cover over one third of the pond. Under these conditions, the decomposition of dead algae may use up all the oxygen, and the risk of a fish kill is high. If you decide to apply an algaecide and are concerned about the risk of a fish kill, do partial treatments to 25% of the pond's surface area, then wait two weeks before reapplying. Because of the rapid growth rate of many algal species, algaecides often do not provide seasonal control of algae. Reapplications may be necessary, but it is better to apply frequent small-scale treatments rather than wait until the algae cover large areas of the pond again. Finally, some herbicides are toxic to fish and other wildlife, and there is a risk of killing beneficial, non-target plant and animal species.

Copper-based algaecides

Copper sulfate is a commonly used algaecide, but it can be lethal to fish at concentrations necessary to achieve algal control. Trout, ornamental goldfish, and grass carp are particularly sensitive to copper sulfate, and alternative algaecides should be used in ponds stocked with these species. Copper is also toxic to invertebrates such as snails and zooplankton, which are important food sources for fish.

Both the toxicity and effectiveness of copper sulfate are largely determined by water alkalinity. Alkalinity is a measure of the acid-neutralizing (buffering) capacity of water and is usually expressed as the equivalent concentration (mg/L or ppm) of calcium carbonate. The greater the alkalinity of the water, the less toxic copper sulfate is to fish, and the greater the concentrations of the chemical that are needed for effective algal control. In soft water with low alkalinity (below 40 mg/L), the amount of copper sulfate needed to control algae can be toxic to fish. In hard, high-alkalinity water (>250–300 mg/L), the copper sulfate will bind to carbonate in the water and precipitate out, making it less effective for controlling algae. Before using any copper treatment, you should measure the total alkalinity of your water. You can purchase your own test kit, or send your water samples to a commercial laboratory for analysis. Copper sulfate also becomes more toxic to fish with increasing water temperatures. For this reason, it is recommended that copper sulfate treatments be avoided during the warm summer months. If necessary, no more than 25 to 30% of the pond should be treated at one time.

Other copper-based chemicals registered for algaecidal use in New Mexico include chelated copper formulations such as Captain, Clearigate, Cutrine Plus, Cutrine Ultra, and K-Tea. These buffered formulations are less toxic to fish, but should still be used cautiously if your pond is stocked with trout or goldfish.

Some species of mat-forming filamentous algae, particularly within the genus *Pithophora*, are not well controlled by copper sulfate. Whether this is because the genus is inherently tolerant to the algaecide or because the copper cannot penetrate the tight clumping of the filaments in the thick mats formed by *Pithophora*, it is very difficult to control. Mixing copper-based algaecides with diquat or endothall can provide partial, short-term control of *Pithophora*.

Other algaecides

Diquat dibromide (Reward, Weedtrine-D) is a contact herbicide that will control some but not all species of filamentous algae. In addition to some water use restrictions, this herbicide should not be used in muddy waters because the active ingredient in the herbicide will bind to clay particles and become inactive.

The amine salt formulation of endothall (Hydrothol 191) is a granular contact herbicide that is registered for algal control. This herbicide is highly toxic to fish and has water use restrictions associated with it. It is also severely irritating to skin and eyes and should be handled carefully.

Sodium carbonate peroxyhydrate (GreenClean, Phycomycin) is a fast-acting algaecide that breaks down to sodium carbonate and hydrogen peroxide in the presence of water. The hydrogen peroxide oxidizes and kills the algae, then breaks down to water and oxygen. As with most algaecides, control is most easily achieved when algae are not yet well established.

Flumioxazin is the active ingredient in the new aquatic herbicide Clipper that is registered for control of the filamentous algae *Pithophora* and *Cladophora*. It is considered to be slightly to moderately toxic to fish based on 96-hour acute toxicity studies. It is also marketed to control a wide variety of aquatic weeds, including Eurasian watermilfoil, duckweed, and watermeal.

For more information on which products are currently registered for control of algae in ponds in New Mexico, contact the New Mexico Department of Agriculture (http://www.nmda.nmsu.edu).

Biological Control

Some nuisance plants and animals can be effectively managed using biological controls, or the introduction of a natural predator or enemy to control abundances of the target pest species. Stocking triploid grass carp has been successfully

used to control aquatic weeds, but has been shown to be less effective against filamentous algae. These herbivorous fish consume other aquatic vegetation such as pondweeds and coontail much more readily, and may ignore the algae altogether if their preferred food items are available. In addition, grass carp need to be stocked at high densities to be effective against aquatic weeds. Grass carp can coexist with other fish species in the same pond provided the water conditions are acceptable. For example, grass carp prefer warmer water, while trout are a cold-water species. Trout will begin to become stressed if water temperatures in the pond reach the mid to high 60s, and if water temperatures drop below 50°F, grass carp will still survive but won't actively eat. Permits from the New Mexico Department of Game and Fish are needed to stock triploid grass carp in New Mexico.

SUMMARY

- Algae are a necessary component of any healthy natural pond ecosystem. However, excessive inputs of nutrients can lead to an overabundance of algae.
- Excessive growth of filamentous algae, referred to as mats, moss, or scum, is one of the most common problems encountered by pond owners.
- While mechanical and chemical means provide short-term control of algal outbreaks, the only way to ensure effective, long-term control is to treat the cause of the problem by reducing excessive nutrient inputs into the pond. Strategies to achieve this include limiting pet or livestock access to the pond, not feeding geese and ducks using the pond, maintaining buffer strips around the pond, and repairing improperly functioning septic systems. Adopting a watershed approach to the problem will lead to a healthier aquatic ecosystem with less likelihood of algal outbreaks.

Brand names appearing in publications are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. Persons using such products assume responsibility for their use in accordance with current label directions of the manufacturer.

The pesticide recommendations in this publication are provided only as a guide. The authors and New Mexico State University assume no liability resulting from their use. Please be aware that pesticide labels and registration can change at any time; by law, it is the applicator's responsibility to use pesticides ONLY according to the directions on the current label. Use pesticides selectively and carefully and follow recommended procedures for the safe storage and disposal of surplus pesticides and containers.

REFERENCES

Castelle, A.J., A.W. Johnson, and C. Connolly. 1994. Wetland and stream buffer size requirements: A review. *Journal of Environmental Quality*, 23, 878–882.

Cole, J.T., J.H. Baird, N.T. Basta, R.L. Huhnke, D.E. Storm, G.V. Johnson, M.E. Payton, M.D. Smolen, D.L. Martin, and J.C. Cole. 1997. Influence of buffers on pesticide and nutrient runoff from bermudagrass turf. *Journal of Environmental Quality*, 26, 1,589–1,598.

Hansen, J.A., P.G. Welsh, and J. Lipton. 2002. Relative sensitivity of bull trout *Salvelinus confluentus* and rainbow trout *Oncorhynchus mykiss* to acute copper toxicity. *Environmental Toxicology and Chemistry*, 21, 633–639.

Hansen, J.A., P.G. Welsh, J. Lipton, and D. Cacela. 2002. Effects of copper exposure on growth and survival of juvenile bull trout. *Transactions of the American Fisheries Society*, 131, 690–697.

Kammerer, S.J., and T.M. Ledson. 2001. Effects of water and copper complexes in combination with Reward. *Journal of Aquatic Plant Management*, 39, 53–55.

Lembi, C.A. 2000. Relative tolerance of mat-forming algae to copper. *Journal of Aquatic Plant Management*, 38, 68-–70.

Lynch, Jr., W.E. 2009. *Controlling filamentous algae in ponds* [Fact Sheet A-3-09]. Columbus: Ohio State University Extension.

Sallenave, R. 2011. Environmental issues surrounding turf-dominated urban landscapes. In S.T. Cockerham and B. Leinauer (Eds.), *Turfgrass water conservation*, 2nd ed. [University of California Agriculture and Natural Resources Publication 3523] (pp. 15–29). Richmond, CA: ANR Communication Services.

Straus, D.L., and C.S. Tucker. 1993. Acute toxicity of copper sulfate and chelated copper to channel catfish *Ictalurus punctatus*. *Journal of the World Aquaculture Society*, 24, 390–395.

Rossana Sallenave *is an Extension Aquatic Ecology Specialist at New Mexico State University. She earned her Ph.D. at the University of Guelph in Canada. Her research interests include aquatic ecology and ecotoxicology. Her Extension goals are to educate and assist New Mexicans on issues relating to watershed stewardship and aquatic ecosystem health.*

Revised December 2017 **Las Cruces, NM**