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Control Methods For Aquatic Plants in Ponds and Lakes

L. A. Helfrich, Extension Specialist, Fisheries and Wildlife Sciences, Virginia Tech
R.J. Neves, Extension Specialist, Fisheries and Wildlife Sciences, Virginia Tech
G. Libey, Extension Specialist, Fisheries and Wildlife Sciences, Virginia Tech
T. Newcomb, Extension Specialist, Fisheries and Wildlife Sciences, Virginia Tech

Aquatic plants growing in ponds and lakes are beneficial for fish and wildlife. They provide food, dissolved oxygen, and spawning and nesting habitat for fish and waterfowl. Aquatic plants can trap excessive nutrients and detoxify chemicals. Aquatic wildflowers such as the water lily are sold and planted to provide floral beauty to garden ponds.

However, dense growths (over 25% of the surface area) of algae and other water plants can seriously interfere with pond recreation and threaten aquatic life. Water plants can restrict swimming, boating, fishing, and other water sports. Water plants can impart unpleasant taste (musty flavor), decaying vegetation emits offensive odors (rotten egg smell), and algae can discolor pond waters. Dense growths of plants can cause night time oxygen depletion and fish kills. Green plants produce oxygen in sunlight, but they consume oxygen at night. Decomposing water weeds can deplete the oxygen supply, resulting in sport fish kills from suffocation. Dense plant growths can provide too much cover, preventing predation, and leading to stunted (small-sized) sportfish populations.

Water Weed Problems:

- Restricted recreation
- Fish kills
- Fish flavor problems
- Pond water odor problems
- Drinking water taste problem
- Stunted fish growth

Prevention and Watershed Management

Prevention is the best way to reduce aquatic plant problems. It is cheaper and easier to prevent weed growth than to control weeds in your pond. Constructing ponds with steep slopes that drop quickly into deep water can prevent weeds from rooting. Construction of a sediment basin upstream of a pond or lake will trap out soil and maintain pond depth. Soil erosion and fertilizer runoff (including livestock wastes) are the two major causes of water weeds. Soil erosion magnifies the weed problems. Eroded soil particles not only make the pond shallower and allow rooted weeds to quickly invade, but soil particles also transport fertilizer (adsorbed nitrogen and phosphorus) that further stimulates weed growth.

Wise land use practices such as contour plowing, no-till farming, strip cropping, protecting shelter belts, and excluding livestock from the pond will significantly reduce water weed problems. All animal wastes and fertilizers should be diverted around ponds using a grass-lined diversion ditch. The recommendation to fertilize ponds directly in order to stimulate algae growth, block out sunlight, and shade out rooted aquatic plants is unwise. This treatment simply exchanges one problem (rooted weeds) for another (algae), which may be worse, and

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algae can seldom be sustained long enough by fertilizer for shading to be effective. This results in a pond enriched with fertilizer that stimulates algae and rooted weeds. The feeding of sport fish is generally unnecessary and can exacerbate weed problems. Important water weed prevention methods include the following:

Aquatic Plant Prevention Strategies:

- Prevent soil erosion
- Use strip cropping and contour farming
- Prevent fertilizer runoff
- Avoid adding grass clippings to ponds
- Minimize feeding fish and ducks
- Fence livestock from ponds
- Prevent animal waste and fertilizer runoff
- Prevent overgrazing
- Steep pond banks (3:1 slope)

Why do I have an excess of aquatic plants?

- Shallow water
- Clear water
- Excess fertility (nutrients)
- Fast reproduction
- Invasion of exotic weeds

Aquatic Plant Control Methods

Selection of the best treatment or combination of treatments depends on the species of water plant, the extent of the problem, economic considerations, local environmental conditions, and pond uses. First, be sure that you have an aquatic plant problem. Some aquatic plant growths are minor and temporary, and do not require costly weed control actions, thereby saving you worry, time, and money. If aquatic plants cover more than 25% of the pond surface area, you should consider implementing weed control. Second, different types of weeds (algae, floating-leaf weeds, emergent weeds, and submersed weeds) require different treatments (Shelton and Murphy 1989). Depending on the type of weed and the severity of the problem, one or a combination of the following control methods can be very effective:

Aquatic Plant Control Methods

- Dredge and deepen the pond
- Harvest (manual or mechanical removal) weeds
- Manipulate water levels
- Shade, dye
- Install pond bottom liners
- Use biological controls
- Use chemical controls

Dredging and Deepening

Removing pond bottom sediments and building steep pond bank slopes (3:1 slope) are effective ways to control rooted aquatic plant in shallow ponds. Dredging reduces aquatic plant problems directly by removing the plants, bottom sediment, and associated nutrients. Dredging and deepening shallow shoreline areas limits weed growth indirectly by exposing a soil layer that may be nutrient-poor or impervious to plant roots, and by decreasing the amount of sunlight available to plant life.

Dredging can be conducted on dry sediments, after the pond has been drained, or underwater. Hydraulic dredging is normally too expensive for use in small ponds, but draglines can be used for underwater pond dredging. On drained pond bottoms, dry-land excavation machinery such as bulldozers can be used. Although digging and removing bottom sediments by hand is hard work, it represents a simple, economical, and efficient alternative to mechanical dredging. The dredge spoils should be moved below the pond basin to prevent soil runoff back into the pond.

Water Level Management

Lowering the water level of a pond can be an easy way to control nuisance aquatic plants. Pond drawdown, particularly during the winter months, exposes weeds to harsh conditions including freezing, dessication (drying out), strong wind action, and bottom sediment compaction. In addition, frost heaving of the bottom sediments uproots the weeds and aids in their destruction. To insure effective over-winter control, the bottom muds should freeze to a depth of 4 inches for several weeks or longer.

Overwinter drawdown is especially effective against cattails, but some weed species are not controlled by this method. Vegetation exposed by lowering the water level should be collected and removed from the pond basin, or the rotting plants will contribute nutrients that promote new growths when the water level is raised. In ponds without drains, water pumps can be used to manage the water levels. This method is also often used to restore a stunted fish population, by forcing small bluegill out into the open water where they are more easily preyed upon by bass.

Harvesting

Physical removal of waterweeds from ponds is a good control technique. Harvesting of aquatic plants consists of three essential steps. These are (1) cutting or uprooting the weeds, (2) collecting the cut weeds, and (3) removing the weeds from the pond. Harvesting can be accomplished with simple hand tools and physical labor or with the help of cutting machines. Whole plant removal generally is better than cutting because some plants can reproduce from cuttings.

In shallow shoreline areas, weeds can be pulled by hand, cut by sickle, dug out with a hoe, and removed from the water with rakes or forks. In large ponds, a variety of commercial powered cutting machines are available. Some cutting blades can be mounted on the bow of a motor boat.

The success of any harvesting operation depends on the prompt and complete removal of all cut weeds. Haphazard or partial removal of the cut weeds can increase the problem, since each unremoved plant fragment has the potential to form a new weed. Also, cut plants left in the water will decay and release nutrients that stimulate future weed growths. Decomposing plants left in the pond use oxygen and can cause fish kills. Harvesting provides immediate relief from nuisance plant growths and does not endanger fish life.

Shading and Chemical Dyes

Limiting the amount of sunlight available to aquatic plants by floating black plastic sheeting on the water surface or by using dark-colored dyes has been effective in controlling waterweeds. Black plastic sheeting attached to styrofoam floats serves as a floating shade which can be moved easily from one place to another for spot treatment of nuisance water plants in small areas. The floating black plastic raft should remain in one place for a month to be effective. This technique is ideal for weed control around boat docks, fishing piers, and swimming beaches.

Commercially available nontoxic water dyes (nigrosine, analine, and aqua-shade) can be used to color the water in order to reduce light penetration and shade out nuisance plants. To be effective, the dyes must persist for several weeks. For the best results, this technique should be used in early spring at the start of the growing season before the waterweeds have had a chance to establish themselves. Applying fertilizers to create an algae bloom to shade pond weeds is not recommended. This technique is more likely to increase the water weed problem and may result in toxic blooms of blue-green algae.

Pond Bottom Lining

Covering the bottom sediments of small ponds with either plastic sheeting, a layer of mineral soils (sand, gravel, clay) or both of these materials is an effective waterweed control technique. Perforated black plastic sheeting covered with a blanket of sand or gravel provides a relatively cheap alternative to dredging. These coverings limit the exchange of nutrients from the bottom muds to aquatic plants and inhibit the establishment of rooted waterweeds. In addition, sediment covers provide a firm stable bottom which can minimize water loss.

Plastic sheeting (4 mil or thicker) should be evenly weighted and perforated with small holes to permit the escape of gases produced by decomposition and to prevent ballooning. If only a mineral soil blanket is used to cover the bottom sediments, a 6- to 8-inch layer often is necessary. Covering the pond or lake bottom sediment with a layer of sand, gravel, or another mineral soil has proven less effective than using plastic sheeting in combination with mineral soil. Black plastic sheeting overlaid with several inches of mineral soil is recommended. Important wetland habitats, such as fish spawning or waterfowl nesting areas, should not be covered.

Biological Controls (Grass Carp)

Introducing animals and plants that eat or compete with waterweeds represents another control method. Herbivorous animals (those that eat plants) include a wide variety of insects, snails, crayfish, tadpoles, turtles, fish, ducks, geese, and swans which can be stocked in ponds to consume aquatic plants.

Of these, the triploid (sterile fish with 50% more chromosomes than normal) Chinese grass carp (*Ctenopharyngodon idella*) is a plant-eating fish that can be stocked in ponds to provide effective, economical plant control. The recommended stocking rate is about 12 fish

(stock large fish 9-12 inches in length) per surface acre. Ponds with very dense weeds may require more fish and those with less, fewer fish. These fish will try to migrate up or downstream out of your pond, so block fish passage out of the pond. Most states require a permit from the fish and game agency to import and stock these non-native fish. In Virginia, please call the Virginia Department of Game and Inland Fisheries at (804) 367-1000.

One problem with introducing grass carp and other herbivores into ponds for aquatic plant control is that their body wastes act as fertilizers and stimulate aquatic plant growth. Herbivorous animals, by recycling nutrients, may do more harm than good. Many different types of aquatic plants compete with one another for space, light, nutrients, and other critical factors. Therefore, it is sometimes possible to discourage the growth of nuisance aquatic plants by planting beneficial ones. Grass carp may eat beneficial as well as nuisance plants.

Check with your county Extension Agent before introducing animals or plants into your pond. Please note that the release of exotic (non-native) animals or plants into Virginia and other states without specific authorization is strictly forbidden by law. Some suppliers of triploid grass carp are as follows: Fish Wagon (870) 578-9501; Keo Fish Farm, Lonoke, Arkansas (501) 842-2872;J. M. Malone Fish Farm, Lonoke, Arkansas (501) 676-2800

Chemical Control

Herbicides (plant poisons) are commonly used to manage land and water plants. Herbicides are relatively easy to apply and may be the only practical method of control in some situations. However, the treatment of weed-infested waters with herbicides must be used with caution. Herbicides can be toxic to fish and other aquatic life. Their use requires the treated water to be restricted from drinking, livestock watering, swimming, fish production, irrigation, and other uses until safe levels of the herbicide are reached. Most herbicides are short-lived (10 days or less), but others are persistent (30-90 day withdrawal from use).

Herbicide treatment can be costly, and may provide only short-term relief from the real problem, usually fertile waters. It is important to understand that when waterweeds are killed by chemicals, they rot and release their contained nutrients (fertilizers) into the pond water. These nutrients are then available to stimulate future weed growth, often requiring more treatments.

Disadvantages of Herbicides:

- Toxic
- Fish kills
- Expensive
- Water-use restrictions
- Retreatment necessary
- Taste problems
- Odor problems

Of approximately 4,000 herbicides registered by the U.S. Environmental Protection Agency (EPA), only about 50 can be legally used in aquatic systems in Virginia (Helfrich et al. l996).

Common Aquatic Plant Herbicides:

- Chelated Copper Compounds
- Fluridone (Sonar)
- 2,4-D
- Glyphosate (Rodeo, Pondmaster)
- Diquat
- Endothall (Aquathol, Hydrothol)

Aquatic herbicides vary in effectiveness (depending on the weed species), toxicity, and water-use restrictions. Selection of which herbicide to apply depends largely on the identification of the aquatic plant to be treated (Murphy and Shelton 1996). For example, algae (filamentous and single cell) problems are typically treated with herbicides containing copper. Submersed plants (coontail, elodea, and pondweed) are often treated with Fluridone and Diquat. Floating plants (duckweed) can be treated with Fluridone or Diquat. Emergent plants (cattail and bullrushes) are effectively treated with Glyphosate (Rodeo, Pondmaster). The relative effectiveness of aquatic herbicides on different species of water weeds is provided in Table 1, and water-use restrictions are provided in Table 2.

Endothall compounds (Aquathol and Hydrothol) are registered by the EPA as aquatic herbicides, but they are relatively toxic to fish at rates near those needed to kill water weeds. The Hydrothol formulation is the most risky to use in fish ponds. Endothall cannot be used in irrigation water, livestock water, or in food crop or food fish areas without water-use restrictions (Table 2).

Fortunately, there are a number of other less toxic, but effective, herbicides that are registered for use in aquatic systems. The five types of herbicides most commonly used in ponds and lakes include chelated copper, fluridone, glyphosate, 2, 4-D and diquat.

Chelated copper compounds are used to control algae, not rooted aquatic plants. Most algae species are effectively controlled by these herbicides. However, copper is a toxic metal that is long-lived (persistent) in the environment. Copper can be toxic to fish and aquatic animals at concentrations near levels used to control algae, especially in soft water. Copper toxicity increases as water hardness decreases. Copper sulfate is not as safe to use as chelated

copper compounds, and it should not be used in soft waters (alkalinity values less than 50 mg/L). No water-use restrictions are associated with copper compounds, although they may be lethal to sheep (please check the label before applying any herbicides)

Fluridone (Sonar) is one of the safest of the registered herbicides to use in fish ponds. It is expensive and will not kill algae, but effectively controls submersed aquatic plants. It is a persistent, slow-acting herbicide. Sonar residue may persist for a period of 2 to 12 months, and results may take 30 to 90 days to be noticeable. Do not use Sonar-treated water for crop irrigation for 30 days after application. There are no restrictions for fishing, swimming, livestock, or human consumption.

Glyphosate (Rodeo) is best used for control of emergent and shoreline weeds such as cattail, reeds, rushes, smartweeds, and some floating-leaf plants like water lily and lotus. It is usually applied to the plant and not directly to the water. It is quickly bound to suspended particles and bottom sediments and is rapidly inactivated. It has no waiting period or withdrawal restrictions for irrigation water, livestock water, fish consumption, or swimming. Use only those glyphosate products labeled and specially formulated for aquatic systems. Some glyphosate products contain additives that are toxic to aquatic organisms.

2,4-D (Aquacide, Aqua-Cleer, Weedar, Weed-Rhap, Weedestroy) is effective for controlling submersed aquatic plants. These compounds rapidly and completely decompose in about 3 weeks. Toxicity of these herbicides increases as pH decreases. They are less effective at pHs greater than 8, and more toxic in acidic waters (pH<6). Depending on the formulation, 2,4-D can be highly toxic to rainbow trout. 2,4-D should not be used in water for irrigation, livestock, or domestic purposes.

Diquat (Reward, Aqua-Clear, Aqua-Quat, Watrol, Weedtrine) is a wide-spectrum herbicide that can be used to control algae and submersed weeds, but it is not especially effective on emergent weeds. A 14-day waiting period is required by law before diquat-treated water can be used for livestock consumption, crop irrigation, or drinking. There are no restrictions for fishing, but a 1-day waiting period is required before swimming. Diquat is rarely found in treated water after 10 days.

Fish kills may occur after herbicide application, even when the herbicide used is not directly toxic to fish. Fish die indirectly from suffocation, rather than herbicide poisoning, because masses of rotting water weeds killed by the herbicide decompose, and reduce oxygen levels.

When using herbicides, treat one-half (or less) of the lake at a time to allow fish freedom to move to untreated, oxygen-rich areas of the pond or lake. Apply herbicides during the spring when water temperatures are cooler and dissolved oxygen levels are higher than in summer. Some herbicides are not as toxic at colder temperatures. Apply in early spring when weeds are small and not well established, and when fewer weeds are present to decompose.

Application Timing:

- Early spring
- Actively growing
- Cool water
- Slow decay

Application rates in aquatic systems depend on a number of factors. Important considerations are extent of area treated, water depth, water temperature (stratification), water exchange (flow) rates, weed density, weed species, weather conditions, water clarity, and suspended particles.

Applying the right amount of herbicide is especially important to achieve good control, avoid nontarget toxicity, eliminate unnecessary expense, and comply with the legal requirements. After application of a herbicide, comply with the required waiting period before using water for irrigation, livestock watering, swimming, or fishing (Table 2).

Application Rates:

- Algae or rooted weeds
- Weed species
- Weed density
- Water temperature
- Turbidity
- Water depth
- Water exchange rate
- Weather

Caution must be taken to apply the right herbicide at the correct time, at the correct rate, and in accordance with label instructions. Chemicals that kill nuisance waterweeds may also kill beneficial water weeds and fish, disrupt aquatic food chains, or have other undesirable side effects. The user is responsible for the downstream effects of herbicide treatments on water supplies, fish, and other aquatic life. Always read and follow the label instructions carefully.

Aquatic plant treatments can be complex. Professional aquatic herbicide applicators can be employed to treat pond weed problems. Commercial applicators may be useful in selecting the right chemical, calculating the dosage rate, and safely applying the herbicide. Herbicide treatment should not be considered as a total cure for a pond weed problem. Rather, a combination of methods should be used and supplemented with chemical control agents.

Table 1. Relative effectiveness of aquatic herbicides for the control of selected water weeds (Helfrich et al. 1996).

Plant Species	Chelated Copper	Diquat	Endothal K	Fluridone	Glyphosate
Algae					
Filamentous	Good				
Chara	Good				
Nitella	Good				
Submersed Plants					
Bladderwort		Good		Excellent	
Coontail		Excellent	Excellent	Excellent	
Elodea		Excellent			
Watermilfoil		Excellent	Excellent	Good	
Parrotfeather		Excellent	Excellent	Good	
Hydrilla		Good	Good	Excellent	
Pondweed		Good	Excellent	Excellent	
Slender Naiad		Excellent	Excellent	Excellent	
Southern Naiad		Good	Poor	Good	
Floating Plants					
Duckweed		Excellent	Poor	Excellent	
Watermeal		Fair		Fair	
Emersed Plants					
Bullrush		Poor	Good	Excellent	
Cattail		Good	Fair	Excellent	Excellent
Spatterdock			Good	Excellent	Excellent
Water lily		Good	Excellent	Fair	
Watershield		Excellent		Fair	

Table 2. Waiting period (days) before using water after application of aquatic herbicides (Helfrich et al. 1996).

Herbicide	Irrigation	Fishing	Livestock	Swimming	Drinking
Fluridone (Sonar)	30	0	0	0	0
Glyphosate (Rodeo)	0	0	0	0	2
Chelated Copper	0	0	0	0	0
Diquat (Reward)	5	0	1	1	3
Endothal					
Aquathal K	14	3	14	1	< 25
Aquathal G	7	3	14	0	< 25

Suggested Readings

L. A. Helfrich, D. L. Weigmann, P. Hipkins, and B. Stinson. 1996. Pesticides and Aquatic Animals: A Guide to Reducing Impacts on Aquatic Systems. Virginia Cooperative Extension Publication 420-013, Blacksburg, VA

J. L. Shelton and T. R. Murphy. 1989. Aquatic Weed Management Control Methods. Southern Regional Aquaculture Center Publication Number 360.

T. R. Murphy and J. L. Shelton. 1996. Aquatic Weed Management: Herbicides. Southern Regional Aquaculture Center Publication Number 361.

Pest Management Guide For Horticultural And Forest Crops. Virgina Cooperative Extension Publication 456-017, Blacksburg, VA.

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Reviewed by Michelle Davis, research associate, Fisheries and Wildlife