

Biological Control of Aquatic Weeds

Although many organisms feed on aquatic weeds, only herbivorous fish have proven both effective and relatively easy to obtain for aquatic weed control in South Carolina. Various herbaceous fish species, including Tilapia species, various strains of the common carp and grass carp have been recommended for aquatic weed control. Aquatic weed identification is still required for biological control since each fish species selectively controls certain weed species while having no preference for other plants.

Tilapia

Tilapia are tropical fish that resemble our native sunfish and can control certain aquatic vegetation. Two species of tilapia are recommended for aquatic weed control.

Blue tilapia feed entirely on algae (both planktonic and filamentous) but do not readily consume submerged vascular plants. Redbelly tilapia feed primarily on submerged vascular plants rather than algae, but most pond managers prefer triploid grass carp for control since grass carp offer multiple year control and are easier to manage. Because tilapia are tropical fish, they cannot survive normal winter water temperatures in most of South Carolina. Annual restocking is generally necessary unless a warm water supply (such as thermal spring or power plant cooling reservoir) is available as a refuge where the fish can overwinter. Tilapia are stocked at a rate of 200 to 400 fish per acre in the spring. The higher rate has been demonstrated to achieve faster control in approximately one month. Tilapia do reproduce and their offspring also assist in the control of aquatic plants.

Tilapia are an excellent foodfish and resemble a two-pound bream when fully grown. In Texas, tilapia are stocked to give an extra forage base in trophy bass management. If properly acclimated, tilapia can survive and grow in water ranging from fresh to full strength ocean water.



Tilapia are recommended for aquatic weed control.
W. Cory Heaton, ©2015, Clemson Extension

Common Carp

Various strains of common carp, especially Israeli carp, have been recommended for filamentous algae control. These long-lived carp control filamentous algae by feeding in the pond bottom and breaking off the algae as it begins to grow. Their feeding habit in the pond bottom can have detrimental effects on ponds by causing muddy water. There is no predictive method to gauge whether ponds will become muddy or not. Since there are other biological and chemical control alternatives available, along with potential muddy pond problems; managers are advised to consider other control methods.

Grass Carp: Sometimes referred to as white amur, grass carp were introduced to the United States in the 1960s. There was great debate among fisheries biologists about the ecological damage that a reproducing population of grass carp would have on natural fisheries habitats, so grass carp use has been restricted, particularly in natural public water bodies.



W. Cory Heaton, ©2015, Clemson Extension

The stocking of grass carp has been restricted due to the possible ecological damage it could have on natural fish habitats.

W. Cory Heaton, ©2015, Clemson Extension

Triploid Grass Carp: In the early 1980s, biologists artificially produced a grass carp that is incapable of reproduction. Just after fertilization eggs are put under specific temperature or pressure regimens which cause fish to develop an extra set of chromosomes (triploid). These fish are sterile, and there is no danger of these fish reproducing if they escape. Triploid grass carp became widely used as a method of aquatic weed control. In 1984, the South Carolina legislature legalized the stocking of triploid grass carp from certified dealers in private and public waters in South Carolina. Only government agencies may stock triploid grass carp in public waters, after thorough studies and public input have been received.

Triploid grass carp can consume more than their own body weight of fresh vegetation in a single day and grow to more than 50 pounds. Grass carp feed largely on soft-stemmed submersed weeds (such as hydrilla, pondweed, spikerush and naiads) and are recommended primarily for control of these aquatic weeds. Triploid grass carp will also control

filamentous algae, when the fish are small. As the fish grow their ability to control filamentous algae diminishes, so approximately six months of control should be expected from fish stocked at 10 inches long. Grass carp feed on duckweed and various harder stemmed aquatic vegetation types but generally do not provide satisfactory control of these species. Grass carp are selective feeders. When more than one noxious plant species is present; the carp will feed almost exclusively on the more preferred plant species before targeting the other available aquatic plant species.

Ponds that are seriously impacted by noxious aquatic plant species (high plant biomass) should be managed to reduce the plant biomass either through the application of selected aquatic herbicides or by other methods (draw-down, mechanical removal, etc.) prior to stocking grass carp. Grass carp have some tolerance to brackish water, but should not be stocked in water with a salinity greater than 10 parts per thousand (10,000 parts per million).

Stocking: Most submerged aquatic weeds can be controlled with a stocking rate of 20 to 25 triploid grass carp per acre of vegetation. If only a portion of the pond has an aquatic weed problem, the stocking rate is based on the infected area only and not the entire pond. If there are no aquatic weed problems in a pond, a general recommendation is to stock 5-10 triploid grass carp per acre. This will actively prevent the growth of aquatic weeds before problems start. Grass carp can give up to 10 years of weed control, but one commonly recommended management plan assumes a five year control period with a supplemental restocking of 20% of the initial stocking rate each year. It should be emphasized that even though grass carp will eat a particular plant, they may not control that plant unless fish are stocked in sufficient numbers and preferable plants are not available.

Grass carp should be stocked in the spring for best results. South Carolina's aquatic plants begin growth from late March to April. Fish should be stocked at this time to allow them to aggressively feed on tender, young plant growth. Since the fish's metabolism increases with rising water temperatures, they grow at an accelerated rate and quickly reach a size that eliminates many potential grass carp predator problems.

Grass carp are sensitive to many water quality parameters. Hauling and stocking in the spring reduces stress due to adverse water quality conditions during summer and winter.

Grass carp are mainly herbivores but will consume insects, invertebrates, and other game fish food organisms. There is no documentation that indicates grass carp are serious predators of other fish species. Grass carp do exhibit minor competition with typical bass/bluegill populations for food - therefore, some competition between species does exist.

Grass carp will consume floating pelleted fish food. In ponds where supplemental feedings of bream or channel catfish are desired, you may want to consider other aquatic weed control options.

Predators: The pond owner/manager should take a few precautions when stocking. If predators are present, larger triploid grass carp (a minimum of 10-12 inches in length) should be stocked to reduce loss due to bass predation.

The following is a list of potential grass carp predators that can seriously reduce or eliminate all grass carp:

1. Man
2. Largemouth bass, bowfin, etc.
3. Osprey, herons, etc.
4. Otters
5. Alligators

The impact of predators on young grass carp is one of the major reasons aquatic weed control is not successful when using grass carp as a weed control method. Grass carp prefer shallow water for feeding and can easily be seen swimming in small groups or individually at the surface of the pond. Failure to observe these behaviors can indicate poor or no grass carp survival. Effective weed control should be evident 6 to 12 months after initial stocking.

Grass carp are a riverine fish and will migrate from a pond if the opportunity is there. They can and will leave a pond via the emergency spillway or large concrete surface overflow systems during peak rain "events". Any overflow deeper than three inches will encourage the loss of grass carp.

Pond systems that utilize emergency spillways or large surface overflow systems should use a barrier to prevent escapement. The most successful fish

barrier designs incorporate horizontal steel bars, which have a one inch space between bars. Care should be taken to keep the barrier clear of debris during high water periods. Failure to provide maintenance on the barrier at this time could result in its complete failure or could seriously damage the pond's dam.

Species Controlled: Grass carp can effectively control aquatic vegetation, particularly submerged vegetation. The key to using grass carp is to stock the proper number based on their vegetation preferences, the biomass of the target weeds and the pond coverage of the plants. Grass carp are especially advantageous because they: 1) eliminate chemical treatments that could involve water use restrictions; 2) are relatively inexpensive, if amortized over the multiple year control period; and 3) are easy to use since they usually do not have to be handled. Biological aquatic weed control is slower than chemical or mechanical control, but stocking is easier for pond managers who do not have the equipment or training for mechanical control or most chemical applications. Biological control is also generally considered more environmentally-friendly by the public.

The South Carolina Department of Natural Resources (SC DNR) now requires a free of charge permit to stock tilapia and triploid grass carp for aquatic weed control in private ponds in South Carolina. You can obtain a permit from SC DNR at 803-734-3891 or from registered dealers in South Carolina. The short permit can be FAXed (803-734-4748) for a rapid turn around. A permit number from SC DNR is required prior to stocking tilapia and triploid grass carp. Public water bodies may not be stocked by private citizens.

The following is a list of aquatic plant species commonly found in South Carolina's waters that grass carp will feed on:

Preferred Plants

Bladderwort
Coontail
Egeria
Fanwort
Hydrilla
Naiad sp.
Potamogeton sp.
Slender spikerush
Elodea

Non-Preferred Plants

Alligatorweed
Cattails
Duckweed
Lyngbya algae
Parrot's feather
Pennywort
Pithophora algae
Water hyacinth
Water lilies
Water lotus

Watermeal
Water milfoil
Water primrose
Watershield

Carp will consume plants on the non-preferred list if other more desired plant species are not available. Control of those "non-preferred" plant species may be incomplete or take longer for desired control levels.

Effectiveness of Grass Carp for Control of Aquatic Weeds in Ponds

Species Usually Controlled ¹	Species Sometimes Controlled ²	Species Not Usually Controlled ²
American elodea	Aquatic grasses	Alligatorweed
Bladderwort	Duckweed ⁴	Bulrushes
Brazilian elodea	Eurasian watermilfoil ³	Cattails
Coontail	Mosquito fern (<i>Azolla</i>)	Eelgrass (<i>Vallisneria</i>)
Creeping rush	Waterfern (<i>Salvinia</i>)	Filamentous algae ⁴
Fanwort	Watermeal ⁴	Lotus
Hydrilla	Water pennywort	Maidencane
Muskgrass (<i>Chara</i>)		Reeds (<i>Phragmites</i>)
Naiad		Rushes
Parrotfeather		Smartweed
Pondweed		Spikerushes
Proliferating spikerush		Stonewort (<i>Nitella</i>)
Watermilfoil ³		Torpedograss
Widgeongrass		Waterhyacinths
		Waterlilies
		Watershield (<i>Brasenia</i>)

¹All of these species are submersed plants.

²All of these species are floating, floating-leaved, or emergent plants, except Eurasian watermilfoil, stonewort, and filamentous algae. Most of these plants have rather tough, woody stems that cannot be eaten.

³The watermilfoils, particularly Eurasian watermilfoil, are less preferred than many of the other submersed plants and often are not readily eaten until more preferred species have been consumed.

⁴There is some confusion as to how effective grass carp are on these weeds. Small fish stocked in very high numbers (50 to 70 per acre) often are effective. The gill rakers of older fish are spaced too far apart to strain out these plants from the water effectively, and thus the fish usually look for more suitable plants. Submersed aquatic macrophytes frequently are heavily encrusted with algae and often resemble mats of filamentous algae. The fish readily consume these algae-covered plants. This probably has led to the conclusion that the fish are effective on filamentous algae.

Reviewed by W. Cory Heaton, Agriculture & Natural Resources Agent, Clemson University 12/15. Originally prepared by Jack M. Whetstone, Clemson Extension Service & Mac Watson, SC Department of Natural Resources. (New 09/04.)

This information is supplied with the understanding that no discrimination is intended and no endorsement of brand names or registered trademarks by the Clemson University Cooperative Extension Service is implied, nor is any discrimination intended by the exclusion of products or manufacturers not named. All recommendations are for South Carolina conditions and may not apply to other areas. Use pesticides only according to the directions on the label. All recommendations for pesticide use are for South Carolina only and were legal at the time of publication, but the status of registration and use patterns are subject to change by action of state and federal regulatory agencies. Follow all directions, precautions and restrictions that are listed.