Aquatic weeds are a serious problem for pond owners throughout Georgia. They restrict access to fishing areas, reduce fish harvest and decrease the usefulness, attractiveness and value of a pond. Herbicides, mechanical removal, water level changes, dyes, fertilization, proper pond construction, pond renovation and biological methods successfully control unwanted aquatic weed growth. The physical and chemical characteristics of the pond and the pond owner's objectives dictate which method is most appropriate. Pond owners are familiar with the traditional methods of aquatic weed control but not with the recently available option of biological control by using sterile triploid grass carp (Figure 1).

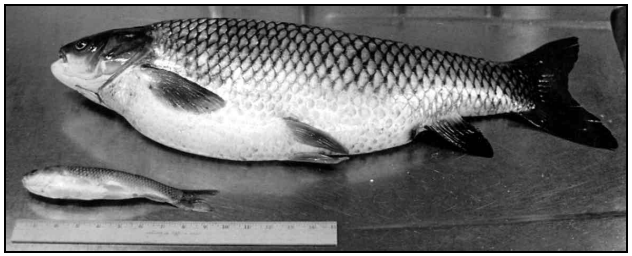

Figure 1. Nine-inch triploid grass carp stocked in a central Georgia pond with a heavy weed infestation grew to lengths of 29 inches and weights of almost 20 pounds in 16 months.

The grass carp (*Ctenopharyngodon idella*) occurs naturally in large rivers of eastern China and the former Soviet Union. The U.S. Bureau of Sport Fisheries and Wildlife introduced it into the United States in 1963 in cooperation with Auburn University. The feeding habits of the grass carp were well known; it was thought to have great potential as a biological weed-control agent. However, concerns existed about the grass carp reproducing in the wild and becoming an environmental nuisance, destroying valuable areas such as wetlands, swamps and waterfowl feeding grounds.

Because of these environmental concerns, early research focused on developing sterile populations. Attempts included producing single-gender populations, creating sterile hybrids and removing gonads. Success was limited because these methods were seldom 100 percent effective and verification of sterility was difficult. In the early 1980s researchers and commercial producers began treating eggs with heat, cold or pressure to inhibit the second maturation division in the fertilized egg. This produced fish with abnormal chromosome numbers. The normal diploid grass carp has a chromosome number (2N) of 48; the triploid grass carp has a chromosome number (3N) of 72. The extra chromosomes result in sterility. Unfortunately, not all treated eggs develop into fish with abnormal chromosome numbers. The early 1980s saw the development of a technique that uses an electronic particle size analyzer to identify carp as triploids or diploids. Georgia laws and regulations require each grass carp be verified and documented as a triploid.

FEEDING HABITS

Triploid and diploid grass carp seem to consume similar quantities of aquatic plants and to have similar feeding habits, preferring succulent young plants. Table 1 lists some common aquatic plants and rates them by grass carp feeding preferences. Grass carp will not control all types of aquatic weeds. Because of selective feeding habits, they can eliminate one plant species and make room for the expansion of others.

Table 1. Feeding preferences of grass carp on some common aquatic plants

HIGH	LOW
American elodea	Alligator weed
Hydrilla	Cattail
Musk-grass	Eel grass
Naiads	Maidencane
	Milfoil
	Parrot feather
MODERATE	Reeds
Bladderwort	Sedges
Coontail	Spatterdock
Duckweeds	Torpedo grass
Fanwort	Water hyacinth
Filamentous algae	Waterlily
Pondweeds	Watermeal
Water pennywort	Watershield
Water primrose	Yellow cowlily

STOCKING

If the grass carp is the preferred weed-control option, stocking proper numbers is important. Stocking rates of five to more than 200 fish per acre have been used depending on plant species, plant density and distribution, the size and age of the fish and the pond owner's objectives. Computer models can determine the appropriate stocking density by considering additional factors such as the amount of human activity around the pond, the desired level of control and grass carp feeding preferences. The numbers recommended are designed to provide a 75 percent to 90 percent reduction in target plant species in three to four years. In most situations, complete removal of aquatic vegetation is undesirable because it provides cover for small fishes and attachment surfaces for fish food organisms.

Grass carp stocking densities are based on the maximum expected weed coverage and the feeding preference ratings from Table 1. Stock 10, 15 or 20 fish per acre depending on whether the target weed species is high, moderate or low on the feeding preference list, respectively. A few examples best illustrate this stocking concept:

- **Example 1:** A March examination of a 10-acre pond finds 5 acres of naiads growing there. However, 3 of the remaining 5 acres are shallow, and the naiads are expected to spread to this area later in the growing season. Base the stocking rate on the maximum expected weed coverage (8 acres). Because naiads are high on the feeding preference list, stock a total of 80 fish (8 acres times 10 fish per acre).
- **Example 2:** A March examination of a 10-acre pond finds 5 acres covered in watermeal. Because watermeal is a floating plant, pond depth does not matter. The maximum expected weed coverage would be the entire 10 acres. Stock 200 fish (10 acres times 20 fish per acre).
- **Example 3:** A March examination of a 10-acre pond finds 1 acre infested with water primrose. Because water primrose grows only in shallow water (less than 2 feet deep), base the stocking rate on the area of the pond less than 2 feet deep. If 2 acres of the pond are less than two feet deep, stock 30 fish (2 acres times 15 fish per acre).

Grass carp could be stocked in weed-free ponds at low rates (five fish per acre) to prevent weeds from becoming established. However, the effectiveness of preventive stocking has not been determined. Generally, no fewer than 10 fish should ever be stocked, regardless of the pond size, because the loss of even a few fish could result in ineffective weed control.

Combining grass carp and other methods can reduce the number of fish and the time required to control aquatic weeds. For example, herbicides or mechanical removal can be used before fish introductions. If the established aquatic vegetation is removed, fewer fish can control the tender new growth.

Time of stocking affects the initial degree of weed control. Fishes are cold-blooded animals whose feeding rates and metabolism are influenced by water temperature. Grass carp feeding is greatest when the water temperature is between 70°F and 80°F and negligible when it is less than 50°F. Mortality associated with handling stress is less likely when the water temperature is cooler; therefore, fish stocked in late winter or early spring are more likely to survive. They will not begin feeding heavily until late spring or early summer, which is when most aquatic weeds begin growing in Georgia.

Because grass carp are attracted to currents, ponds with water flowing over spillways or through drains are not suitable without renovation. Cover horizontal drains with a fence or bars that allow free flow of water but prevent passage of grass carp. If barriers are placed over any drain structures, make sure they do not become clogged or blocked. Water could flow over emergency spillways and possibly wash out the spillway or dam.

Predatory fish, such as largemouth bass, eat grass carp. If used with existing fish populations, grass carp should be large enough to avoid being eaten by the average-size predator. A

largemouth bass 12 to 14 inches long can swallow a grass carp approximately 9 inches long. Even if predation is not a problem, the pond owner should consider using larger carp if they are available because they tend to survive handling and stocking better. Grass carp stocked with existing fish populations should be at least 8 inches long.

Grass carp do not reproduce in ponds; periodic restocking is required. The lifespan of the grass carp is between 10 and 15 years; triploid grass carp will provide effective vegetation control for eight to 10 years.

Grass carp grow rapidly in ponds that have preferred plant species. Nine to 11 inch fish stocked in the early spring can reach lengths of 25 inches or more and weights of 7 to 10 pounds by the end of the first year. Appropriate numbers of grass carp will eventually reduce the vegetation to the point that they eat new plant growth as it becomes available. The grass carp will survive and remain healthy but will not increase in size. Once stocked, grass carp are difficult to remove from a pond. They are almost impossible to remove by seining or angling. The only options are draining the pond or using toxicants such as rotenone.

PERMIT REQUIREMENTS

Only certain producers are authorized to sell grass carp in Georgia because they must confirm that each fish is a triploid. The Georgia Department of Natural Resources periodically examines shipments of grass carp to verify triploidy. If diploid fish are found, the person possessing or selling the fish is subject to serious legal action, including large fines and imprisonment, as well as having the stock destroyed.

Using grass carp in Georgia does not require a permit from the Georgia Department of Natural Resources if the pond owner meets the following criteria:

1. Sterile triploid grass carp are purchased from sources authorized by the Department of Natural Resources. A list of currently approved dealers is available from county Extension and Georgia Department of Natural Resources offices.
2. The pond owner retains the bill of sale as proof of legal purchase.
3. The pond is privately owned, that is, a body of water that is clearly and entirely within the title of one owner.
4. Fish cannot travel upstream or downstream directly into a body of water not owned by the pond owner.

If unsure the above criteria can be met, consult a Department of Natural Resources fisheries biologist at one of the offices listed at the end of this publication.

SOURCES OF FISH

Several approved dealers for triploid grass carp operate in Georgia. Prices vary considerably depending on availability, fish size, season and dealer. Contact several of the approved sources for the best price.

GEORGIA DEPARTMENT OF NATURAL RESOURCES FISHERIES OFFICES

State Office
Chief of Fisheries
2070 U.S. Highway 278
Social Circle, GA 30279
(404) 918-6406

District Offices
Bowens Mill District Office
1773-A Bowens Mill Highway
Fitzgerald, GA 31760
(912) 423-7211

Manchester District Office
601 Third Avenue
Manchester, GA 31816
(404) 846-8448

Metter District Office
Route 2, Box 4B
Metter, GA 30439
(912) 684-6424

Thomson District Office
142 Bob Kirk Road, NW
Thomson, GA 30824
(706) 595-5639

Regional Offices
Northwest Region I
312 North River St., NW
Calhoun, GA 30703-0519
(706) 629-1259

Northern Region II
2150 Dawsonville Highway
Gainesville, GA 30501
(404) 535-5498

East Central Region III
2123 U.S. Highway 278, SE
Social Circle, GA 30279
(706) 557-3039

West Central Region IV
Highway 341, South
Route 3, Box 75
Fort Valley, GA 31030
(912) 825-7841

Southwest Region VI
2024 Newton Road
Albany, GA 31701-3576
(912) 430-4526

South Central Region VI
108 Darling Avenue
Waycross, GA 31502-2089
(912) 285-6094

Coastal Region VII
Route 2, Box 219-R
Richmond Hill, GA 31324
(912) 727-2112

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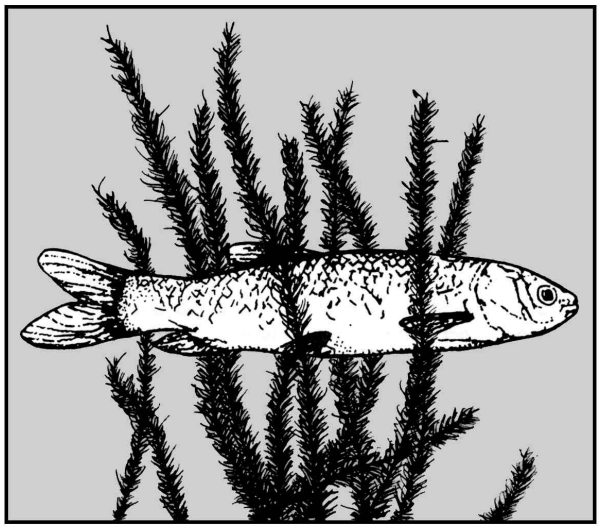
Gale A. Buchanan, Dean and Director

USE OF STERILE GRASS CARP TO CONTROL AQUATIC WEEDS



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Cooperative Extension Service

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