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TRIPLOID GRASS CARP FOR BIOLOGICAL CONTROL OF AQUATIC VEGETATION IN TEXAS

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INTRODUCTION

Aquatic vegetation is a common problem in ponds, which can lead to low, dissolved oxygen fish kills, increased water evaporation, reduced access for recreation, reduced fish growth, and many other issues (Fig. 1). In addition to mechanical, physical, and chemical control options, biological control is an efficient, relatively inexpensive way to manage some nuisance aquatic vegetation populations. Traditionally, biological control is described as using a natural enemy to target a specific organism. For example: Releasing the Alligatorweed flea beetle (*Agasicles hygrophila*) to reduce Alligatorweed (*Alternanthera philoxeroides*) populations. Both organisms are native to South America and Alligatorweed is the only known host for the Alligatorweed flea beetle. Other biological control options include using fish species that are herbivores—meaning their diet consists of plant material. These fish species consume an array of palatable aquatic vegetation species, but they do not work for all species of aquatic plants.

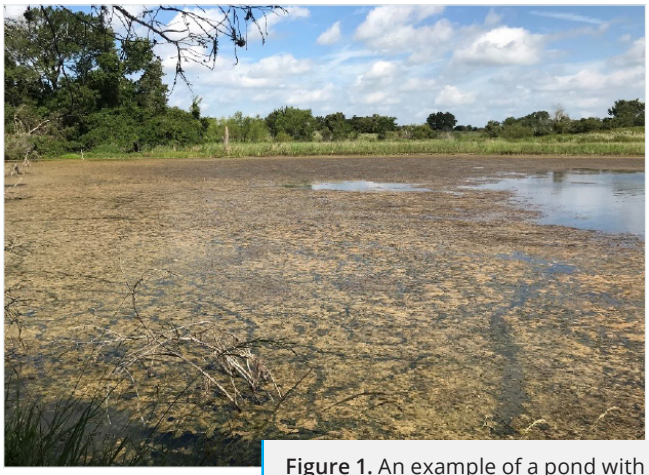

Figure 1. An example of a pond with severe aquatic vegetation growth.

There are no herbivorous fishes native to North America that are commonly used in or suited for pond management. However, triploid grass carp (*Ctenopharyngodon idella*) and tilapia (*Oreochromis* spp.) have been introduced and used as biological controls for aquatic vegetation management in much of the U.S., including Texas. While they have certain traits in common such as being freshwater species and herbivores, these fish are not interchangeable. Each species has different life cycles and feeding habits, which are important to consider before stocking. Furthermore, they each have their own regulations or permit requirements in response to potential environmental impacts, should they escape. This publication will explore background and considerations related to triploid grass carp. For more information on using tilapia for biological control, please see the Texas A&M AgriLife Extension Service publication: *Mozambique Tilapia for Biological Control of Aquatic Vegetation in Texas* (publication No. RWFM-PU-393).

Grass carp (Fig. 2), also known as white amur, are native to rivers that flow through Western Asia. Fish from natural populations in the wild are diploid (i.e., two sets of chromosomes) and will reproduce in flowing waters under ideal conditions. To create triploid grass carp, fertilized eggs of diploid grass carp are subjected to temperature or pressure shock, making the grass carp triploid (i.e., contains three sets of chromosomes versus two sets for diploids). This extra set of chromosomes makes triploid grass carp sterile— unlike their diploid counterparts—and ensures that if fish do escape into non-impounded waters, they will not reproduce.

Figure 2. Grass carp (*Ctenopharyngodon idella*).

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REGULATIONS

In Texas, only sterile triploid grass carp are allowed to be stocked after receiving approval and a permit from the Texas Parks & Wildlife Department (TPWD). Grass carp sold within the state are tested by the U.S. Fish & Wildlife Service to ensure they are triploid and can only be sold by certified vendors. Since grass carp are known to seek out flowing waters, the TPWD permit requires that there be a fish barrier installed on spillways and overflow pipes to limit grass carp escapes. Regardless of barrier, any escapement of grass carp is illegal due to potential impacts on native aquatic vegetation. Up to 10 grass carp per acre can be approved within a 1-year period—and if approved, all new permits holders will have up to 36 months to stock fish. Regulations can and do change, therefore it is recommended to stay current on regulations by visiting the TPWD Triploid Grass Carp Information and Permitting page at: *https://tpwd.texas.gov/landwater/water/habitats/private_water/gcarp_intro.phtml*.

STOCKING

Grass carp should be stocked in early spring after many aquatic plants have died back due to cold winter temperatures so they can consume new growth. Stocking before water temperatures reach 75 degrees F can also decrease stress effects from handling during transport. If large populations of aquatic vegetation are already present, grass carp may need to be combined with other control options, such as herbicide treatment or water draw down, to achieve results more quickly and to reduce the number of fish needed to be stocked to manage regrowth. Additionally, large aquatic vegetation infestations should be managed prior to stocking if dissolved oxygen concentrations are not acceptable for fish survival (>3 parts per million).

While general recommendations can be made, there is no stocking rate that can or should be applied to every situation, which may take more than 1 year to see results. Because grass carp are difficult to catch and remove once stocked, it is recommended to use a conservative approach when stocking. Lower densities can be stocked initially, and if needed, more fish can be stocked within the 36 month period as long as the maximum approved number is not exceeded. Grass carp should be 10 to 12 inches upon stocking to reduce losses due to unlawful escapement through outflows or predation from catfish and bass. For moderate aquatic vegetation infestations, 7 to 15 grass carp per acre may be needed to achieve control.

DIET

Grass carp diet and vegetation consumption rates can be greatly influenced by age and gender of the individual fish, along with site specific factors such as aquatic vegetation species, abundance, diversity, and placement in the water column. Feeding activity begins to slow down during cooling water temperatures and will eventually cease when water temperature is below 37 degrees F. Intense feeding will begin to occur once water temperature warms to 68 degrees F. If sufficient and desirable aquatic plants are present during these warmer conditions, grass carp can rapidly grow up to 2 pounds per month by eating 40 to 300 percent of their body weight per day. While they can grow to more than 60 pounds and live longer than 10 years, feeding decreases over time, and while still present in the pond, grass carp may not be an effective control measure 5 years or more after stocking. Therefore, grass carp may need to be re-stocked every 5 to 7 years if vegetation control is still desired and plants they consume are present. Consumption rates can also decrease as salinity increases and will completely stop at 9 parts per thousand (ppt).

Table 1. Preferred aquatic plant species by grass carp. Triploid grass carp will provide good to excellent control for these species of plants.

NON-NATIVE		NATIVE	
Hydrilla	(*Hydrilla verticillata*)	American pondweed	(*Potamogeton nodosus*)
Egeria	(*Egeria densa*)	Illinois pondweed	(*Potamogeton illinoensis*)
Elodea	(*Elodea canadensis*)	Southern naiad	(*Najas guadalupensis*)

Figure 3. Southern Naiad, also known as bushy pondweed, is a species that grass carp consume in large quantities and control well.

Figure 4. Hydrilla is an invasive species that grass carp consume in large quantities, but control can be difficult using grass carp alone due to the fast growth rate of hydrilla except for at higher stocking rates of grass carp.

Grass carp are most effective at controlling tender, submerged species of aquatic vegetation and a few small species of floating vegetation. They favor mostly soft vegetation with limp systems submerged in the water column (Table 1). They do not offer control for emergent plants they cannot reach, or tough, fibrous, woody or waxy species, and offer little to no control of filamentous algae or phytoplankton. Plant species with hard stems, stiff leaves, or spikey projections are not preferred by triploid grass carp—making them a less than desirable control option for those species. Coontail (*Ceratophyllum demersum*) and Watermilfoil (*Myriophyllum* spp.) are both examples of submerged aquatic vegetation that grass carp will not typically be effective controlling. For some species of vegetation, such as Coontail, which are not preferred food items, triploid grass carp can eventually offer good control, but typically only after they have eaten all of the more palatable vegetation within the pond.

While grass carp do prefer young growth of macroalgae, which is called Muskgrass (*Chara* spp.), they are not an effective control option for filamentous algae species and will generally only consume small amounts when they are noticeably young and small. Aquatic vegetation that grows mostly at or above the water's surface (e.g., water lilies or rushes) are generally not consumed by grass carp under normal conditions.

Figure 5. Coontail, also known as hornwort, is not a preferred food item for triploid grass carp due to the spikey or horn-like projection that can irritate their mouth and throat. Triploid grass carp can eventually offer good control of Coontail, but typically only after they have eaten all of the more palatable vegetation within the pond.

CONCLUSION

To determine if stocking triploid grass carp is the right choice, one must consider management goals, the species of plants to be controlled, if the plants are a preferred food of grass carp, and then weigh the advantages and disadvantages, such as cost and escapement of stocking a non-native species to control aquatic vegetation. When used correctly, triploid grass carp may offer more effective control over a longer period (at a lower cost) than chemical or physical control—making them the more economical choice compared to using chemicals. This type of control can be used alone or combined with another strategy (e.g., mechanical, physical, or chemical control) as part of an integrated pest management program. Remember: Plant identification is always the first step when determining effective control options. More aquatic vegetation control information and plant species identification can be found here: *https://aquaplant.tamu.edu/*.

OTHER RESOURCES

- *https://tpwd.texas.gov/landwater/water/habitats/private_water/gcarp_intro.phtml#purchase*
- *https://edis.ifas.ufl.edu/pdf%5CFA%5CFA04300.pdf*
- *https://fisheries.tamu.edu/files/2013/10/SRAC-Publication-No.-3600-Using-Grass-Carp-in-Aquaculture-and-in-Private-Impoundments.pdf*

Photos by: Peggy Romfh, Brittany Chesser, Todd Sink