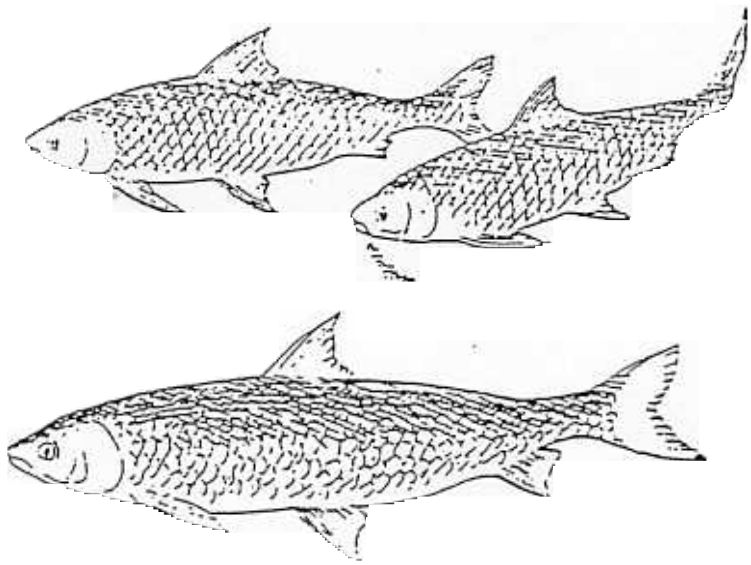
A NEW YORK PONDOWNERS GUIDE TO THE USE OF TRIPLOID GRASS CARP



WHAT IS A GRASS CARP ?

The grass carp *(Ctenopharyngodon idella)* is one of the largest members of the minnow family, commonly reaching weights in excess of 25 pounds. Native to the rivers of eastern China and the Soviet Union, it has been introduced into over 50 countries worldwide due to its uncanny ability to control a wide variety of aquatic plant species. Although grass carp are related to both common carp and goldfish, distinct differences exist both in appearance and feeding habits. Grass carp lack the barbels and spiny dorsal and anal fin rays characteristic of goldfish and common carp, bearing a closer resemblance to a large creek chub or common shiner. Coloration of the fish ranges from dark grey to golden brown on the back, blending to white on the belly. Grass carp feed strictly by grazing on aquatic vegetation and do not share the bottom feeding habits typical of common carp and goldfish.

Although fertile (diploid) grass carp have seen widespread use abroad, the majority of states in the U.S. presently prohibit the fish due to concerns over the potential impact they may have on sensitive aquatic habitats should uncontrolled reproducing populations of the fish become established. **Use of diploid grass carp is prohibited in New York State!**

WHAT IS A TRIPLOID GRASS CARP ?

In 1983, U.S. grass carp producers began production of a sterile (triploid) form of grass carp, mitigating the reproductive concerns associated with the diploid fish. Triploid grass carp are created through shocking grass carp eggs immediately after fertilization with either hot or cold water. This temperature shock results in the retention of an extra chromosome set, rendering the fish incapable of producing viable young. With the exception of this extra chromosome set, triploid grass are identical to their diploid counterparts. **Triploid grass carp are the only form of grass carp legal in New York State!**

POLICY AND PROCEDURES PERTAINING TO THE USE OF TRIPLOID GRASS CARP IN NEW YORK

STATEMENT OF POLICY

It will be the policy of the New York State Department of Environmental Conservation, Division of Fish and Wildlife to approve and issue permits for stocking of up to 15 United States Fish and Wildlife Service certified triploid grass carp per surface acre for aquatic plant management purposes in ponds five (5) acres or less in size which lie wholly within the boundaries of lands privately owned or leased by the individual making or authorizing such treatments if:

a. Aquatic plants targeted for control significantly impair the intended use(s) of the pond.

b. The subject pond harbors no species of wildlife, fish, shellfish or crustacea identified by the Department as being endangered, threatened or special concern or any species of plant identified as being endangered, threatened or rare.

c. The subject pond is not contiguous to or part of a New York State regulated freshwater wetland.

d. The subject pond is not an impoundment or natural pond on a permanent stream or a source of a permanent stream as designated by the most recent United States Geologic Survey (USGS) or New York State Department of Transportation (DOT) quadrangle covering the permit application site.

e. At least two (2) years have elapsed since the last stocking of triploid grass carp, unless it can be demonstrated that a significant portion of the permitted fish were subject to mortality within the stocked pond.

Permit applications for waters other than those meeting these criteria, including waters greater than five (5) acres will not be acted upon until evaluated on a site-specific basis in accordance with the State Environmental Quality Review Act (SEQRA) and guidelines established by NYSDEC Division of Fish and Wildlife.

NYSDEC DIVISION OF FISH AND WILDLIFE
TRIPLOID GRASS CARP STOCKING RECOMMENDATIONS

Triploid grass carp are a new and exciting aquatic vegetation control option available to New York pondowners. However, as with any method of vegetation control, triploid grass carp must be used properly to achieve optimal results. The following stocking recommendations should assist you in getting the most out of the fish you purchase.

AQUATIC PLANT PREFERENCES OF TRIPLOID GRASS CARP

Triploid grass carp have distinct feeding preferences, preferring tender, succulent plant species over those that are tough and fibrous. Triploid grass carp will not control emergent species such as cattail or bulrush or floating leaved species such as water shield or water lily. Even among preferred submergent plant species, selectivity and consumption rate varies widely according to a vast array of factors including water temperature, dissolved oxygen and presence or absence of attached algae.

TRIPLOID GRASS CARP STOCKING RATES

Triploid grass carp are extremely potent plant consumers, capable of eradicating all plants from a pond for periods exceeding 10 years if overstocked. Besides the obvious impact such complete plant removal will have on vegetation dependant fish and wildlife, total devegetation can also result in the development of severe algae blooms, foul smells and an overall decline in water clarity in a pond. To minimize or prevent these adverse impacts, plant populations should be maintained at approximately 20-30% of the pond's surface area.

Due to various factors that impact triploid grass carp feeding, it is impossible to precisely predict the exact number of fish to stock in any one situation to achieve the 20-30% plant coverage target. The only way to prevent excessive plant control is through use of an incremental approach. This approach involves the stocking of triploid grass carp at the stocking rates suggested below, a two year waiting period for the fish to achieve maximal control, and subsequent additions of fish in small increments at two year intervals until plant populations are reduced to the 20-30% threshold. Remember, be patient, plant control with triploid grass carp is a slow process, but once control is achieved, it will last a number of years. If more rapid control is desired, other plant control methods such as mechanical harvesting or chemical applications can be integrated with triploid grass carp use.

Recommended Initial Triploid Grass Carp Stocking Rates

Average Plant Density	Stocking Rate (Number Per Acre)
Low	5
Medium	10
High	15

TIME OF STOCKING

Plant control with triploid grass carp is most successful when the fish are stocked just as plants begin growing in the pond (late spring). Stocking of fish during the late summer, when the pond is already clogged with vegetation often leads to unsatisfactory results. The late summer conditions of high water temperature and low dissolved oxygen typical in weedy ponds during this period can result in a substantial loss of grass carp.

PROCEDURES FOR OBTAINING A PERMIT TO STOCK TRIPLOID GRASS CARP

Individuals desiring to stock triploid grass carp in New York must first obtain a triploid grass carp stocking permit from the Department of Environmental Conservation (DEC). Stocking permit applications can be obtained at any Regional Bureau of Fisheries office. Procedures for obtaining a stocking permit in waters either meeting the listed criteria or approved after SEQRA review are as follows:

1. Applicant or representative of applicant should completely fill out the permit application and return it to the Regional Fisheries Manager covering the region in which the stocking will occur.

2 Regional Division of Fish and Wildlife staff will review the application and verify that it meets the stocking criteria listed above.

3. Approved applicants will receive three copies of a stocking permit along with a listing of approved triploid grass carp suppliers. Permit conditions will be listed on or attached to the permit.

4. Permit will authorize the purchase and stocking of up to 15 triploid grass carp per pond acre. Triploid grass carp may only by purchased from approved suppliers possessing a valid permit to import and sell triploid grass carp in New York state.

5. At the time of purchase, the permit holder must provide all three copies of the stocking permit to the selected approved triploid grass carp supplier. The supplier will fill in the appropriate information on the bottom of the permit, keep one copy for his records, send one copy to the DEC office listed on the permit, and provide the buyer with a copy of the permit.

6. Stocking permits will expire on November 30 of the calendar year of issue.

7 If a stocking permit is not approved, the applicant will receive a letter describing the reason(s) for permit denial.

ENVIRONMENTAL CONSERVATION LAW
OF
THE STATE OF NEW YORK

Section 11-0507(1)

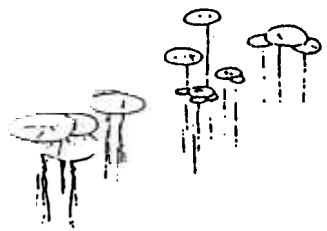
Fish or fish eggs shall not be placed in any water of the state unless a permit is first obtained from the department; but no permit shall be required to place fish or fish eggs in an aquarium.

Section 11-1703(6)

No person shall import, export, own, possess, acquire or dispose of live piranha fish (Serrasalmus, Rooseveltiella or Pyrocentrus), grass carp *(Ctenopharyngodon idella)* or hybrid grass carp within the state without a license or permit issued at the discretion of the department for scientific, biological or exhibition purposes.

AQUATIC PLANTS COMMON TO NEW YORK PONDS KNOWN TO BE CONTROLLED BY TRIPLOID GRASS CARP

Duckweed *Lemna spp.*
These tiny free-floating plant bodies have a single root that dangles in the water. Several plants often are attached together. These are among the smallest of flowering plants. Flowers are borne on edges. This plant reproduces rapidly by plant division, often forming a floating mat over a considerable area of a pond.



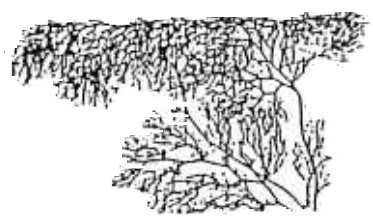
Muskgrass, or stonewort, algae have the appearance of flowering plants. They occur in hard water in limestone areas; they are often rough and gritty to the touch, and give off an ill-smelling skunk-like odor when crushed.

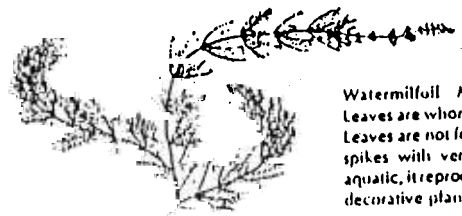
Muskgrass algae are upright plants with stems and whorled branches. Each joint of the stem consists of a single cell. Even-length branches are clustered at each joint. They reproduce by spores borne in cases near the branch tips.

SUBMERGENTS

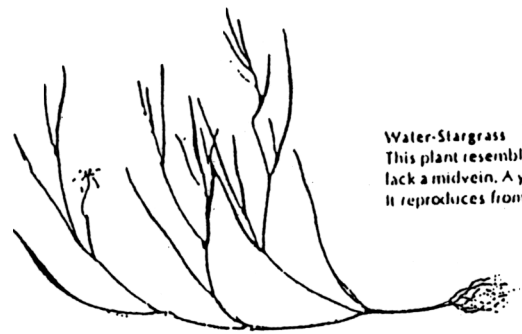
Submergents are aquatic plants, usually rooted on the bottom, whose stems and leaves are almost always entirely beneath the surface.

Bladderwort *Utricularia spp.*
Unique characteristics are tiny oval bladders borne near the base of the finely divided leaves. Plants lack true roots and may float free beneath the surface. They are found in cold, acid water and reproduce by winter buds. Flowers are yellow or purple, depending on the species.

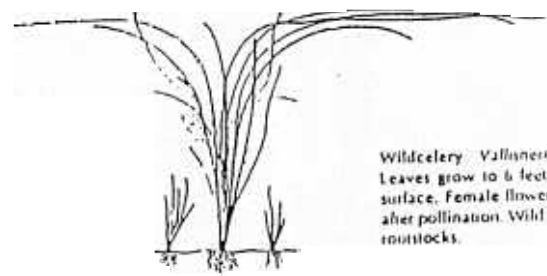




Watermilfoil *Myriophyllum spp*
Leaves are whorled on a stem, and pinnately divided, as a feather. Leaves are not forked as in coontail. Flowers develop on terminal spikes with very short leaves surrounding them. A perennial aquatic, it reproduces by plant fragments. It is commonly used as a decorative plant in aquarium shops.



Water-Stargrass *Heteranthera dubia*
This plant resembles some narrow-leaved pondweeds but leaves lack a midvein. A yellow, star-like flower appears on the terminal. It reproduces from plant fragments.



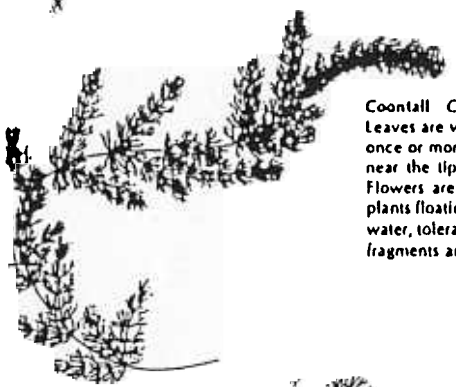
Wildcelery *Vallisneria americana*
Leaves grow to 6 feet long, ribbon-like, with tips that float on surface. Female flowers are on long stalks that float, but retract after pollination. Wild celery plants reproduce mainly by buds on rootstocks.

PLANT ILLUSTRATIONS AND DESCRIPTIONS REPRODUCED FROM:

Aquatic Plants – Management and Control
Special Circular 222
Penn State University
College of Agriculture Extension Service
University Park, Pennsylvania

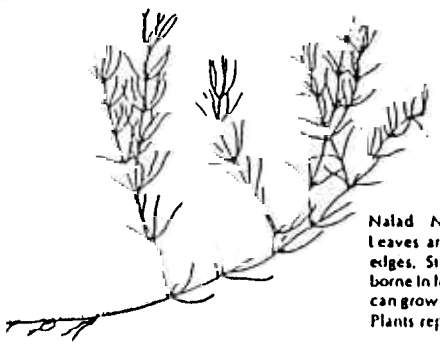
AQUATIC PLANTS COMMON TO NEW YORK PONDS KNOWN TO BE CONTROLLED BY TRIPLOID GRASS CARP

Common Elodea *Elodea canadensis*
Leaves are densely whorled or opposite on the stem. They are common plants used in home aquaria. Flowers inconspicuously rise to the surface on thin tubes, then withdraw. These plants reproduce from fragments and rarely set seed.



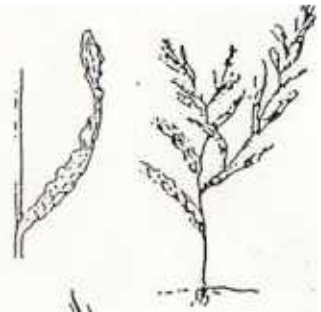
Coontail *Ceratophyllum demersum*
Leaves are whorled at each joint. The leaflets, which are forked once or more, have toothed edges. Leaves are densely crowded near the tip of the stem, giving an appearance of a coontail. Flowers are inconspicuous. Roots may be absent, leaving the plants floating beneath the water surface. They are found in hard water, tolerate fluctuating water levels, and reproduce from plant fragments and winter buds.

Fanwort *Cabomba caroliniana*
Leaves are opposite or whorled and fan-shaped. Forked leaflets are wider at tip than at the base. Some plants may have small floating leaves. Plants have a gelatinous slime. Inconspicuous flowers are white to lavender. This species also reproduces by plant fragments. They are common aquarium plants introduced from the south.

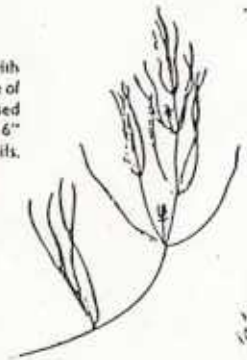


Naiad *Najas spp.*
Leaves are whorled or opposite, very narrow, and toothed on edges. Stems are much branched. Inconspicuous flowers are borne in leaf axils. Plants need less light than most aquatics so they can grow in deep water, but commonly found at 1 to 4 foot depth. Plants reproduce by seeds.

Pondweed, Curly *Potamogeton crispus*
Leaves are alternate, with finely toothed, crinkled, or puckered edges. There are no floating leaves on this pondweed. Flowers and seeds are in a spike at the tip which extends above water for fertilization. They are found in fertile, hard water and reproduce by seeds and winter buds. The plant was introduced from Europe.



Pondweed, Leafy *Potamogeton foliosus*
Several species of pondweed have narrow, grass-like leaves with sides essentially parallel. In some species the sheath at the base of the leaf, seed shape, and other botanical characteristics are used to identify the species. Leafy pondweed has leaves about 1/16" wide, without a sheath at base. Flowers and seeds are in leaf axils. Leafy pondweed reproduces by winter buds and seeds.

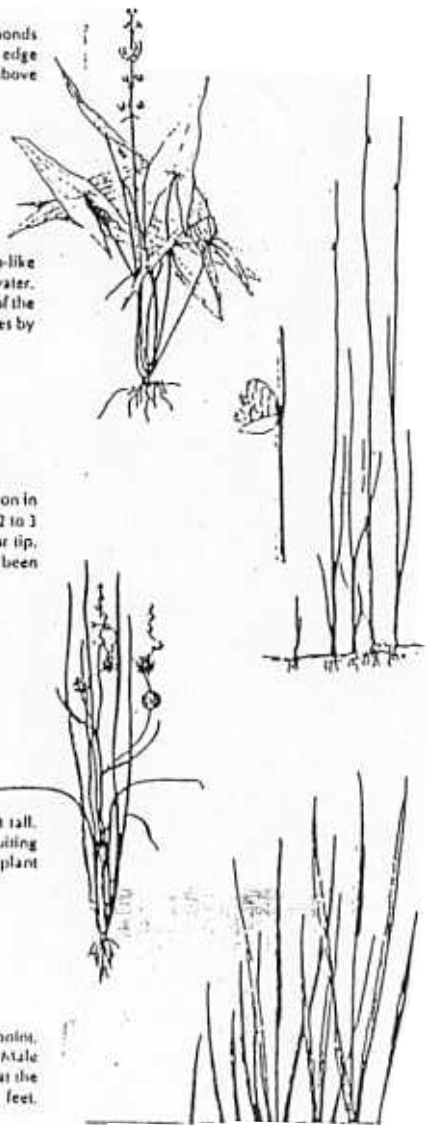


Pondweed, Sago *Potamogeton pectinatus*
Leaves are fine, thread-like, and they spread as a fan. Stems usually are multi-branched. Leaves have a sheathed base. Flowers and seeds are borne on a terminal spike. Tubers grow from horizontal rootstocks. There are no floating leaves on this pondweed. Plants reproduce by tubers and seeds.

Pondweed, Floating *Potamogeton natans*
Two types of leaves are common. Underwater leaves are narrow, grass-like, and appear as stalks. Floating leaves are oval to heart-shaped each with a notched base. Flowers and seeds are borne on a terminal spike. Plants reproduce by tubers, seeds, and winter buds.

EMERGENTS

Emergents are aquatic plants of the shallows or margins of ponds and lakes. They root in soil and may grow from the water's edge into water several feet deep. Stems and leaves emerge above water.

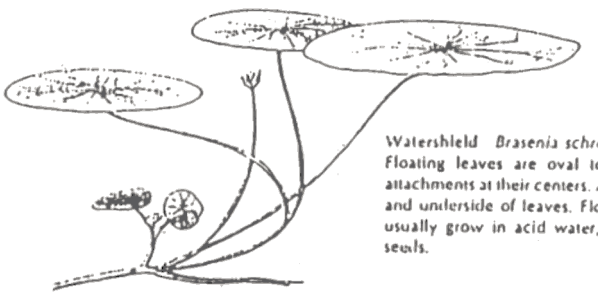


Arrowhead *Sagittaria spp.*
Leaves are usually arrow-shaped, but tongue-like and ribbon-like leaves occur, especially at the base of the plant or underwater. Flowers are white, 3-petaled, whorled, and grow on the tip of the stalk. Fruits are tightly-packed balls of seeds. Plant reproduces by rootstocks and seeds.

Bulrush *Scirpus americanus*
Rootstocks give rise to stems that are triangular in cross section in this species, but round in some bulrushes. Height is usually 2 to 3 feet. Flowers and seeds are borne in spikes along stem near tip. These plants may form dense stands after they have been established for several years.

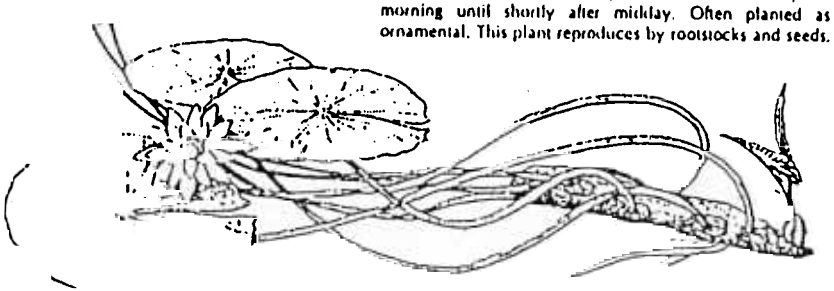
Burreed *Sparganium eurycarpum*
Leaves are long, erect, ribbon-like, and usually 1 to 3 feet tall. Stems bear male flowers at tip, and female flowers below. Fruiting heads are one-inch round balls and contain many seeds. The plant reproduces by seeds and from rootstocks.

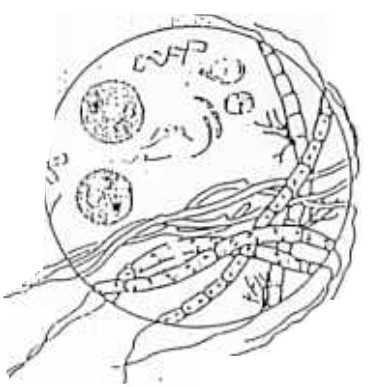
Cattail *Typha latifolia*
Leaves reach to 6 feet tall, are ribbon like, and taper to a point. Flowers occur on stalks which are taller than the leaves. Male flowers are at the tip; female flowers below. Cattails grow at the water's edge but are commonly found at depths of 3 to 4 feet. Plants reproduce from thick rootstocks and seeds.



Watershield *Brasenia schreberi*
Floating leaves are oval to elliptical, entire, and have stem attachments at their centers. A gelatinous coating occurs on stems and underside of leaves. Flowers are dull-red to purple. Plants usually grow in acid water, and reproduce by rootstocks and seeds.

White Waterlily *Nymphaea odorata*
Floating round leaves grow up to 10 inches, are split to the stem at the center, and are often purple beneath. Flowers are showy, usually white but sometimes pink. Flowers remain open from morning until shortly after midday. Often planted as an ornamental. This plant reproduces by rootstocks and seeds.



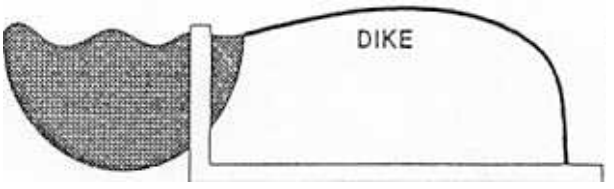


John P. Cahill
Commissioner

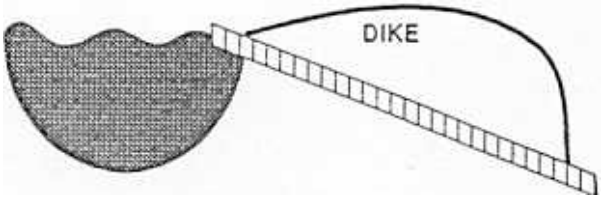
POND SPILLWAY TYPES

If the pond has an outlet, please circle the spillway that most closely resembles your pond.

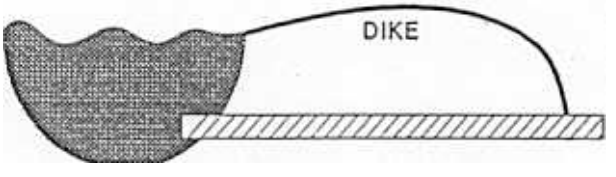
A. VERTICAL SPILLWAY



B. SURFACE PIPE SPILLWAY



C. DROP INLET PIPE SPILLWAY



D. The outlet is an earthen depression, ditch or channel which does **not** flow all year.

If the other requirements for a permit are met, modifications (screening) can be done to the spillway to prevent fish from escaping. A permit will **not** be issued until these modifications are made.

If the outlet drains into a ditch that flows all year, a tributary, or stream, a photograph of the screened outlet is required.

Grass Carp——— What the Textbooks Say:

Grass carp is a fish that eats certain varieties of vegetation and can reduce the levels of nuisance vegetation in lakes.

PRINCIPLE:

Grass carp (Ctenopharyngodon idella, or white amur) physically remove vegetation from lakes. Beyond removing the nutrients entrapped within the plant, the grass carp does not reduce nutrient levels, or afford any control of the source of these nutrients.

Grass carp are an exotic species and are seldom permitted in New York State; originally, they were imported to Arkansas and Alabama from Malaysia in 1963. The carp, less than one half a pound in weight and 8' to I I " in length (although less than one foot may be preyed upon by largemouth bass), are stocked at a rate of about 15-40 per acre of surface area. They can grow up to 6 pounds per year, and may ultimately consume 20-100 % of their body weight each day in vegetation. Grass carp have been reported weighing over 100 pounds in intensive culture operations in Europe. However, the largest fish ever reported in the United States has been closer to 50 pounds.

The fish will selectively feed on particular types of plants; although the carp are reported to have particular favorites among the plant species, these preferences may be a function of specific lake conditions, and eating habits may not be reproducible from lake to lake. In general, most grass carp prefer species of Hydrilla, Potamogeton, Ceratophyllum, Najas, Elodea and some filamentous algae, while some specific plants, such as Myriophyllum spicatum. and Potamogeton natans, are considered less palatable. However, in many cases, the grass carp will consume these less desired plant species in the absence of their favorites.

APPLICABILITY:

As of 1987, 22 states allow triploid (sterile) carp only, with three states (including New York) allowing triploid carp on an experimental basis only. Five states allow either triploid or diploid (non-sterile) carp, and 23 states have banned the use of sterile and non-sterile carp for any purpose.

Grass carp have the potential to eradicate all vegetation in lakes, and can escape downstream to other waterbodies and induce unwanted vegetation control or eradication. Grass carp have a strong tendency to follow flowing water, and can reproduce in inlet and outlet streams. Unless these streams are adequately screened, the fish are likely to move out of the lake. Not only is the investment in fish lost, but the nuisance weeds remain in the lake, and the carp may destroy desirable aquatic plants in the streams.

In states which allow their use, grass carp are restricted to lakes with no sustainable outflow, to reduce the possibility of escape, and to maximize the control of vegetation within the target lake. However, fish cannot be expected to control weeds at a specific part of a lake, such as a beach or an individual dock. Since fish have access to the entire lake, grass carp treatment is necessarily a full-lake treatment.

Vegetation control with grass carp is necessarily slow, but could be effective over a long period of time. If only sterile carp are used, the time required for the carp to effectively control vegetation will depend on the density of vegetation, stocking rate, and growth rate of the carp.

POTENTIAL SIDE EFFECTS:

Grass carp do not meet any of the criteria for an "ideal" candidate for introduction to an aquatic system (Li and Moyle, 1981): they do not coadapt with other aquatic species, do not have a narrow niche, are not easily controlled after escape, and are not free from exotic diseases and parasites. These claims, however, can be disputed in experiments conducted in New York State, where it has been found that properly stocked grass carp may coexist with other fish species and have not been shown to carry any diseases or parasites problematic to native fish populations.

Continued on page five

Grass Carp- continued from page three

The most significant drawback of using grass carp is the potential for complete eradication of vegetation. A complete removal of all types of vegetation may occur after the grass carp have exhausted the supply of target plants, and would have severe detrimental effects on the plant community and entire ecosystem. At the other extreme, understocking or insufficient consumption of vegetation may result in the control or eradication of non-target plants, since the eating habits of grass carp are not completely predictable. In the absence of competitive native species, this could allow the exotic target plants to dominate the plant community. Destruction of either native or exotic species could also have significant effects on the aquatic animals whose habitat (niche) is based on these plants. Altering fish habitats could have severe effects on zooplankton and phytoplankton populations.

Eutrophic conditions could be enhanced through a number of mechanisms. More than 50 % of the ingested plant material could be reintroduced through excretion by the carp, primarily as particulate organic matter and urinary nitrogen. This nutrient recycling could stimulate algae blooms and oxygen depletion. Algae blooms may also result from the actual removal of rooted plants, since these plants may compete with algae for available nutrients. Even if the nutrient levels remain constant, algae populations may be enhanced due to the greater availability of these nutrients.

As an exotic, non-native fish species, grass carp may also introduce exotic diseases or parasites to a lake. Cestodes, a type of parasitic tapeworm, or flatworm, has been found in lakes in which grass carp were introduced. With the use of praziquantel ($C_{19}H_{24}N_2O_2$), a compound used to treat parasitic worms in both aquatic and terrestrial animals, infestation can be minimized. However, since cestodes (also carried by golden shiners and mosquito fish) have not been reported to cause any problems for native fish species in New York, praziquantel has not been used outside of fish hatcheries. It is unclear what affect praziquantel may have on humans or other aquatic animals or organisms if either the small carp are consumed by predatory fish or humans, or if any byproducts of the praziquantel are excreted.

Grass carp offer one of the least expensive lake management techniques for controlling nuisance aquatic vegetation. Costs are a function of vegetation density and stocking rate, and usually run from $50 to $100 per acre. These costs can be amortized over several years, since the grass carp application requires only capital expenses.

WHAT ELSE THERE IS TO KNOW:

As discussed in Chapter 1, **Diet for a Small Lake**, physical control techniques, for the most part, can be considered Type A systems, designed by humans and following man-made laws. The ultimate fate of the ecosystem is determined by the effect the technique has on the ecosystem, and the operation of the control technique and, to a certain extent, the effect of the technique can be easily predicted.

Chemical control methods can be considered Type B systems, designed by humans and conforming to natural law. Although the chemical and, therefore, its characteristics are man-made, the fate of the chemicals, and the resulting ecosystem changes, cannot be controlled by man.

Biological control techniques are most like Type C systems, neither designed by, nor conforming to, man-made laws. Once grass carp are introduced into a lake, the fate of the carp, the target vegetation, and the entire ecosystem are outside the influence of man. By and large, Type C systems are much more difficult to understand and control than Type B systems, which are more difficult to control than Type A systems.

Physical methods for controlling nuisance vegetation, such as harvesting, are fairly well understood. For the most part, effectiveness and side effects are well known and can be predicted for many different applications. Chemical control methods, such as herbicide treatment, are less well understood, but have been investigated extensively for many years. While there may not be a complete understanding of the long-term effects of chemical treatments, cause-and-effect relationships can be predicted in many circumstances.