Triploid (sterile) Grass Carp Management Plan for Smith Mountain Lake

Background: Since 2002, the Tri-County Lake Administrative Commission (TLAC) has managed a proactive and aggressive program to manage/control invasive aquatic vegetation species at Smith Mountain Lake (SML) through the use of both systemic and contact herbicides. This program has included annual monitoring and surveys. A moderate amount of aquatic vegetation growth is very beneficial to the environment, but invasive aquatic vegetation species negatively impact freshwater ecosystems by disturbing the environment and interfering with water uses.

Curlyleaf pondweed, an invasive submersed aquatic vegetation species was first identified in Smith Mountain Lake (SML) in 2002. In 2006, a more aggressive invasive species, Brazilian elodea, was found in the lake and in 2007, Hydrilla, one of the most aggressive invasive species was identified in the lake. In 2011, the acreage with Hydrilla infestations more than doubled. During the vegetation growing season in 2012, as the expansion clearly continued to increase, the Virginia Department of Game and Inland Fisheries (VDGIF) approved the use of triploid (sterile) grass carp as a part of SML's invasive aquatic vegetation species management program for 2013.

In the fall of 2012, TLAC hired SOLitude Lake Management to prepare a triploid (sterile) grass carp management plan proposal that would include options available for consideration of this program at SML and the details needed to assist in TLAC's decision-making. Portions of this document are taken from that proposal.

Goals and Objectives: The Tri-County Lake Administrative Commission's (TLAC) goals and objectives for the management of invasive aquatic vegetation species at SML has been to limit the species' impact on boating, swimming and aesthetics at the lake. The primary goal is to limit the invasive submersed aquatic vegetation canopy height to the point so that it does not compromise boating, swimming or aesthetics. The secondary goal is to avoid totally eradicating the native and nuisance submersed aquatic vegetation. Available funding shall be considered as TLAC annually determines the actions to be taken for the control and management of invasive aquatic vegetation at SML.

Overview of Invasive Aquatic Vegetation Species currently found at Smith Mountain Lake:
Hydrilla (Hydrilla verticillata), native to Asia, was first discovered in America in the 1960's. Since then it has spread rapidly throughout freshwater resources and has disrupted the natural balance of numerous water bodies. Hydrilla reproduces through fragmentation, tubers, turions and seed. Hydrilla's ability to spread rapidly is a major concern for freshwater systems and usually requires management once present in a water system. If left unmanaged, Hydrilla will have negative effects on boating, swimming and aesthetics at SML. Hydrilla grows in dense mats that are capable of establishing in water greater than 20 feet deep. Unmanaged Hydrilla will eventually choke out the perimeter of SML and create access issues for boaters, swimmers, and fishermen, while also diminishing aesthetic appeal.

Brazilian elodea (Egeria densa), native to Brazil, is an invasive plant that was introduced to America through the aquarium industry. Brazilian elodea can develop large mats that float to the surface. These mats will crowd out other native species that grow more slowly. This plant also interferes with boating, swimming and aesthetics. The negative impacts of this plant are similar to the negative impacts of Hydrilla. One plant can easily be dispersed over an entire body of water just from recreational disturbances.

Curlyleaf pondweed (Potamogeton crispus) is an early season plant, capable of growing in cold water and gaining an advantage over native vegetation species that start growing at warmer water temperatures. It grows in dense

mats, outcompeting and crowding out native plants. Once it dies, sections of the plant float to the surface and drift into shallow water forming mats that serve as a nutrient source for future algae and vegetation growth. These thick mats inhibit many recreational uses.

Control/Management Options: Only two viable options exist for the management of invasive aquatic vegetation in SML:

- **Herbicides** have been utilized at SML for the last ten (10) years. They have kept the invasive aquatic vegetation from topping out, but this is not a financially sustainable option. In 2012, the herbicide treatment costs alone exceeded $107,000.
- Stocking **triploid (sterile) grass carp** is a much more financially sustainable option which should, within just a few years, greatly impact the invasive aquatic vegetation species, keeping them from topping out and ultimately from reproducing at such a high rate. VDGIF has approved the use of this fish at SML.

TLAC will utilize an integrated management approach for the next few years with the stocking of triploid (sterile) grass carp as the primary method and utilization of herbicides only in situations where specific criteria is met.

Herbicide Treatment Considerations:
The preferred herbicide to be used in addition to triploid (sterile) grass carp for the first year or two to help contain the spread of invasive vegetation, will be contact herbicides. Herbicide use will inhibit the ability to measure the effectiveness of the grass carp and should be used sparingly. Herbicides will be considered when certain criteria are met. This criterion will include, but is not limited to:

- High traffic areas with invasive infestations (boating activities may cause the plants to fragment and spread more rapidly throughout the lake), and
- Large and dense stands of Hydrilla that are topping out and interfering with lake use

The grass carp should suppress the Hydrilla growth and prevent vegetation from exceeding acceptable growth levels. As the grass carp population is established and adjusts to meet the needs of the lake, the amount of topped out invasive submersed aquatic vegetation should be minimal.

Justification for Utilization of Sterile Grass Carp:
The grass carp is a large fish within the minnow family Cyprinidae. They are native to eastern Asia and were introduced into the United States in the 1960's to control aquatic vegetation. Triploid (sterile) grass carp are commonly stocked throughout the United States to control submersed aquatic vegetation and are federally regulated. They are herbaceous fish that prefer soft vegetation species.

Grass carp are the ideal management tool to meet the long-term aquatic vegetation management goals for SML. The ability of grass carp to control submersed vegetation in large freshwater systems is unmatched when looking to maintain control of vegetation over an extended time period.

Sterile Grass Carp Methodology:
Successful introduction of grass carp into the lakes with the intention to suppress invasive submersed aquatic vegetation growth without eradicating all submersed aquatic vegetation species is a gradual process. It is very important not to overstock the grass carp, therefore stocking a moderate number of fish the first 2-3 years is critical. Overstocking could result in eradication of all submersed vegetation. This process of determining the initial stocking rate takes many variables into consideration, including the number of vegetation acres, the plant canopy height, and vegetation density. It is important to increase the grass carp population over the course of multiple years to reduce the chances of overstocking.

Comparing submersed aquatic vegetation coverage data collected each year to past data is necessary in the process of accurately determining if the vegetation levels are increasing or decreasing. Factoring in the estimated submersed aquatic vegetation surface acres, canopy height and density along with the projected grass carp population will allow for the formulation of the next season's grass carp stocking needed to achieve the desired results.

At SML grass carp shall be stocked during the months of March and April. They are capable of handling significant water temperature fluctuations when being stocked, but it is important that the stocking process is as easy on the fish as possible and that fish are properly acclimated prior to being stocked. Biologists shall oversee this process to ensure that SML receives healthy fish and to ensure they are handled properly. Purchasing the fish from a reputable supplier who is diligent at properly handling the fish and reducing stress on the fish is important.

The most notable variables that influences stress levels are fish size, water temperature, water temperature fluctuations, handling during hauling, hauling distance and hauling density. Stocking 14+ inch fish is desired. These fish would weigh approximately 2 pounds and are ideal because the mortality rate will be low due to the lack of predators who can feed on such a large fish. Based on budget and fish availability, 12-14 inch grass carp could be stocked. These fish are still capable of providing good results and their mortality rated should be minimal. The 12-14 inch fish often range from 1-2 pounds, and because of this variance in weight the transportation costs can range significantly. These fish are large enough to avoid most predation, but they are not as good of an option as the 14+ inch fish and will be considered if the budget does not allow it or if 14+ inch grass carp are not available. If large fish availability is limited, the option to stock as many of the large carp as the supplier can provide and then meet the remainder of the stocking needs with the 12-14 inch fish should be considered. The bid should be awarded to the firm that can provide the optimal fish size for the best price that can properly handle such a large order without putting much stress on the fish.

The stocking rate shall be adjusted annually based on the submersed aquatic vegetation response to the grass carp introduction. The 2014 stocking rate will be determined in the fall/winter of 2013, after the completion and compilation of the monitoring data for that year's vegetation growing season. That information, along with data such as the increase or decrease in vegetation compared to the previous year, projected grass carp population considering predicted mortality rates, and environmental changes such as water clarity and water level fluctuations will be evaluated to determine the stocking rate on an annual basis.

Fishing for Grass Carp:
It is unlawful to fish for non-native fish, including triploid (sterile) grass carp in Virginia. Fishermen should be aware that "no possession (catch and release only)" applies to triploid (sterile) grass carp at SML. Information is available in VDGIF's 2012 Virginia Freshwater Fishing and Watercraft Owner's Guide.

Stocking Grass Carp:
Based on information collected through the monitoring and treatment programs, SOLitude Lake Management, TLAC's consultant, estimated that there are approximately 1,054 vegetated (non-native) acres in SML. Using a stocking rate of 5 – 6 fish per vegetated acre, the number of grass carp to be stocked in 2013 is 6,000 fish. This number is fairly conservative, with the goal of not overstocking the grass carp.

Stocking grass carp based on the vegetative acres is an accepted stocking strategy. This strategy often includes a stocking rate ranging from 1 fish up to 15 fish per vegetative acre depending on the density and goals. A stocking rate of 5 grass carp per vegetative acre is a conservative initial stocking rate. The stocking rate will be modified as needed in future years.

Grass carp shall be stocked in two or three locations in the lake. The stocking efforts shall be in the Blackwater River area since this is where the Hydrilla is well established. Stocking the carp in the locations that require the greatest need for control makes the most sense during the initial stocking.

Improbable Impacts:
Fishing: Grass carp should not have a significant negative impact on the success or health of SML's current fishery. This is because the vegetation levels within the lake are low both currently and historically. SML's fishery has had low amounts of proper cover throughout the existence of the fishery and the fishery has developed around an open water forage base. This allows SML to utilize grass carp without jeopardizing the productivity of the current fishery.

Algae: One potential risk sometimes associated with the eradication of submersed aquatic vegetation is the potential increase of in-water phosphate levels. This can be an issue particularly in shallow lakes. Excess phosphate levels often promote algae growth. Removing all of the submersed aquatic vegetation from SML would free nutrients that were previously utilized by the plants and would allow those nutrients to promote algae growth instead. Moderate algae growth can be very beneficial to the aquatic community, but over the course of the growing season, high phosphate levels can promote Cyanobacteria (blue-green algae) growth. Blue-green algae are undesired algae species that over time may have a negative impact if all of the vegetation was eradicated. TLAC's goal is to maintain moderate levels of non-invasive aquatic vegetation which will provide the nutrient load with an acceptable and manageable level. This will help sustain a healthy environment and as a result will reduce the potential for blue-green algae blooms. It is noted that there has been an increase in blue-green algae reports at SML in the past few years. Thus, if the reports of blue–green algae continue to increase in future years, there may not be a direct correlation to the introduction of the triploid (sterile) grass carp.

Determination of Effectiveness of Grass Carp and Future Stocking Rates:
Effectively monitoring the grass carp population will require a combination of two primary strategies: annual vegetation surveys and grass carp population predictions. The primary purpose of the vegetation monitoring is to determine the number of vegetative acres that require control along with the canopy height, density and species of the submersed aquatic vegetation. Once the vegetative acres, canopy height and density have been estimated, the population of grass carp required to control the current growth can be calculated. Factoring the current grass carp population and the projected mortality rate will provide the anticipated stocking needs for the next growing season.

Monitoring Strategies:
Implementing the best possible monitoring approach(es) is critical to the process of successfully implementing grass carp to control the invasive submersed aquatic vegetation. Monitoring efforts could be decreased as the invasive species stabilize at an acceptable level. The following monitoring strategies are expected to be utilized:

1. Continue the current 1700+ weed rake sampling survey, annually, or as needed. This process involves mapping the submersed aquatic vegetation throughout the lake using the current pre-established 1700+ waypoints weed rake sampling process to identify native, nuisance and invasive submersed aquatic vegetation species in the lake for the purpose of determining if the infestations are increasing or decreasing in density, canopy height and surface area. Consideration of collecting density, canopy height and size of bed data for all plant species will be considered. In previous years, this has only been done for the invasive species.
2. Monitor a selected number of areas of submersed aquatic vegetation using divers. The SML Association's Weed Monitoring Program includes divers who will be able to identify the species, what water depth the submersed aquatic vegetation is growing in, and estimate surface area, density and canopy height. This monitoring method can provide knowledge of the vegetation species growing in deeper water along with confirming the data collected through the other monitoring methods. Documenting findings using underwater photography will be helpful when possible.
3. Other visual and weed rake toss reviews may be performed throughout the season, either by TLAC staff and/or through the SMLA's Weed Monitoring Program, to collect additional data.
4. Continue the annual surveys of all previously identified locations of submersed aquatic vegetation.
5. Evaluating the impacts of the triploid (sterile) grass carp introduction to SML through fishery studies would be valuable. VDGIF has expressed interest in the possibility of performing some monitoring at SML for this purpose. This monitoring could include measuring the impacts on near-shore fish species using shoreline electrofishing in areas with and without invasive aquatic vegetation, gill net surveys for the open-water fish and tracking the movements and/or the growth of the grass carp. VDGIF may elect to perform any monitoring method(s) that they choose for the purpose of meeting the objectives of that Department. In the event that they choose not to do any of these studies, TLAC would welcome the possibility of another group or organization conducting this monitoring.

Many variables will influence the grass carp population required to meet TLAC's goals. Until the grass carp are stocked and their influence is observed, the actual grass carp population requirements and the stocking strategy

cannot be finalized. This Management Plan is an adaptive management approach and annual revisions are anticipated.

Outreach:
TLAC will continue to enhance its aquatic vegetation public outreach initiative begun in 2002. This program has been expanded to include presentations to local organizations and the preparation of new information/fact sheets for distribution. This program will emphasize use of the website, www.sml.us.com as a primary source for distributing up-to-date information.

2012 &2013 Timeline:

November 2012	Release RFP for grass carp stocking in 2013.
January 2013	Request official permit for grass carp stocking from VDGIF. Award the stocking contract to reserve the grass carp with the supplier.
March / April	Stock triploid grass carp.
July / August	TLAC Staff and SMLA volunteer weed monitoring as needed.
September 2013	Utilize SMLA volunteer divers for monitoring selected areas. Complete survey.
October / November 2013	Evaluate the grass carp population using the submersed aquatic vegetation monitoring data and determine the 2014 stocking rate.
November / December 2013	Release RFP for grass carp stocking in 2014.