Management Plan for the Lake Wylie Marine Commission

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Introduction

This plan is prepared for the Lake Wylie Marine Commission and recommends management of a newly discovered hydrilla (Hydrilla verticillata) infestation using triploid (sterile) grass carp (Ctenopharyngodon idella) as the primary management tool. The Plan follows a general approach used to manage hydrilla in other Catawba River reservoirs (Mountain Island Lake as well as Lakes Norman and James).

The premise of this approach is that early use of a combination of herbicides for suppression followed by stocking appropriate densities of triploid grass carp will eliminate hydrilla stands before this plant can expand to catastrophic levels - which has occurred in reservoirs utilizing primarily herbicides for control. Because the grass carp prefers hydrilla, maintenance stockings will be continued for the indefinite future to prevent hydrilla from reestablishing. This Plan will be carefully coordinated with state natural resource agencies and stakeholders. Native fish and triploid grass carp populations will be monitored to ensure the environmental sustainability of this approach.

The Plan reviews the history, biology, and use of triploid grass carp. The strengths, weaknesses, and tradeoffs of this method of control are discussed using a review of the scientific literature. Management recommendations using triploid grass carp in Lake Wylie are then presented. Because healthy triploid grass carp of proper size are critical to success (Kirk 1992), a contract developed by the South Carolina Department of Natural Resources is included as a go-by. It is strongly recommended that this contract be properly modified and reviewed by the Commission's attorney and that a competent fisheries biologist be present to insure compliance with this contract when fish are delivered. The next section is a Management Plan, in a similar format to the Lake Murray, South Carolina Plan. This Plan, when approved by the permitting authorities, can be posted on the Lake Wylie Marine Commission website. Lastly, a time line or sequence of events details the major events required to implement the Management Plan.

Background

The grass carp, a large minnow native to eastern Asia, is widely cultured for food and was introduced into the United States in the 1960's to control aquatic vegetation. The development of the sterile or triploid grass carp during the 1980's caused renewed interest in this species as an aquatic plant management tool (Sutton 1985; Wattendorf and Anderson 1987; Allen and Wattendorf 1987; Bain et al. 1990).

Grass carp prefer soft vegetation in the water column such as hydrilla. Stocking rates vary widely (2 to 500 per vegetated hectare) depending upon location and type of aquatic vegetation (Stocker and Hagstrom 1985; Bates and Webb 1986; Bonar et al. 1993). In general, the longer the growing season, the lower the stocking rate (Wiley et al. 1984). Stocking models have been developed to assist managers in determining stocking rates (Miller and Decell 1984; Swanson and Bergerson 1988). It was not until the 1990's that aging and assessment techniques were developed for large systems which allowed use of population models (Kirk et al. 1992; Morrow and Kirk 1995; Morrow et al. 1997; Kirk et al. 2000). Population models enhance the management potential of the fish by predicting population declines over time.

Environmental concerns have restricted the use of triploid grass carp in some open reservoir systems (Bain 1993). Therefore, potential impacts of triploid grass carp must be clearly understood and tradeoffs evaluated (Noble et al. 1986; Bain 1993). With a few exceptions, managers have been unable to regulate the degree of control resulting in either no control or total elimination of all submersed vegetation (Sutton 1977; Leslie et al. 1987; Kirk 1992; Hanlon et al. 2000). Weather and nutrient related factors, such as increased turbidity or scouring, often affected plant growth and confounded the efficacy of grass carp. Reduced plant growth and existing grass carp densities caused unexpected declines in both target and non target vegetation (Canfield et al. 1983; Maceina et al. 1992). However, if overstocked, the negative effects of overstocking may be reversible since studies in South Carolina suggest that most (about 95%) of triploid grass carp die before age 10 (Kirk and Socha 2003).

Another potential problem is that of emigration; adult grass carp tend to make long movements and can potentially leave a reservoir system (Bain et al. 1990). However, some studies (e. g., Foltz et al. 1996; Kirk et al. 2001) suggest that triploid grass carp moved to stands of hydrilla and remain there. Regardless of contradictions in the literature, the potential for grass carp to forage on non-target vegetation far from release sites (Bain 1993) remains an issue in reservoirs.

Cost of control is a factor and triploid grass carp are much less expensive than either herbicide application or mechanical control using a harvester. In the Santee Cooper reservoirs, triploid grass carp stocked at 15 fish per vegetated acre controlled hydrilla over 10 years at an annual cost per acre of about $10.00 (Kirk and Henderson 2006). Herbicides cost at least $500.00 to $800.00 per acre per year (and may require two applications per year at this cost) and mechanical harvesting costs potentially double that of herbicides. In addition, herbicides may have water use restrictions and harvested hydrilla presents a disposal problem.

Before using triploid grass carp in reservoirs, public support and a thorough appreciation of its biology and potential impacts are required (Bain 1993). Triploid grass carp frequently are incrementally stocked with the goal of achieving control of several years later (Wiley et al. 1984; Sutton and Vandiver 1986; Leslie et al. 1987; Bain 1993). This approach was used in the Santee Cooper reservoirs of South Carolina. A total of 768,500 triploid grass carp were stocked incrementally from 1989 to 1996. Hydrilla declined dramatically, from its maximum coverage during 1994 to remnant stands by 1996 (Kirk et al. 2000; Kirk and Henderson 2006). Hydrilla - which formerly infested 48,000 acres - has been controlled for the 10 years (Kirk and Henderson 2006) without restocking.

Hydrilla can be an exceptionally aggressive and persistent invader and should be eliminated rather than be managed at a targeted level. Further, the record of managing hydrilla in large systems using methods other than primarily triploid grass carp has not been good. More specifically, hydrilla management in the Carolinas and Florida using chemicals, insects, and winter draw downs (individually or in some combination) has frequently failed. Aquatic plant managers in Florida are finding increasing resistance to herbicides such as Sonar® and, due to financial considerations, are looking to alternative

management approaches. Millions of dollars worth of herbicides have unsuccessfully been applied to control hydrilla in nearby Lake Gaston – a 20,000 acre reservoir on the North Carolina - Virginia border. Attempts to control hydrilla with herbicides and winter draw downs were unsuccessful in Lake Murray, South Carolina and triploid grass carp were ultimately employed for control. Likewise, herbicide applications in the Santee Cooper system, South Carolina were unable to prevent the establishment and spread of hydrilla. After 6 years of applications costing $12,000,000, the decision was made to use triploid grass carp as a control agent (Kirk and Henderson 2006). Recent news releases suggest that a hydrilla infestations in Lakes Austin and Conroe, Texas were not controlled by herbicides and required heavy (about 50/acre) triploid grass carp stockings.

Recommended Management Approach for Lake Wylie

Because of cost and efficacy problems associated with other control methods, triploid grass carp should be the primary management tool to control hydrilla in Lake Wylie. A slightly different approach is recommended from the one implemented recently in Lake Norman. In Lake Norman, abut 400 acres of hydrilla had become established. Herbicides were used on exposed stands of hydrilla and an initial stocking rate of 15 fish per vegetated acre was implemented; additional incremental stockings were planned if hydrilla coverage expanded. This stocking rate (15 / vegetated acre) rapidly controlled hydrilla and a follow up strategy of maintaining approximately 4,000 fish or one triploid grass carp per every 8 surface acres- to prevent regrowth from the tuber bank – was implemented.

Lake Wylie is different in that several patches of hydrilla totaling about 90 acres have been located, and the true extent of the infestations remains uncertain. If hydrilla coverage was less, for example 50 acres, then a whole system approach would be recommended. Hydrilla suppression using appropriate herbicides followed by a minimum reservoir - wide stocking would be employed. This stocking density has not been solidly established in the scientific literature, but experiences in South Carolina and Lake Norman suggest that one fish for every 8 surface acres of the reservoir should control hydrilla. Using this experience as a guide, a stocking that maintains at least 1,680 triploid grass carp could be initiated during the Spring of 2009. However, since hydrilla coverage remains somewhat uncertain and has been estimated at 90 acres, stocking 20

triploid grass carp per vegetated acre, or 1800 fish, represents a more certain approach to eliminating hydrilla. Lake Wylie should be carefully monitored for additional patches of hydrilla. Additional stockings of 20 fish per vegetated acre and herbicide treatments will be required if hydrilla coverage expands. In summary, the Plan recommends stocking which ever is greater: 20 triploid grass carp per surface acre of hydrilla or one grass carp 8 surface acres. Once hydrilla is eliminated, the long term goal is to maintain a population of one fish per 8 surface acres or 1,680 fish indefinitely to prevent regrowth of hydrilla. Table 1 provides a sequence of events.

Triploid grass carp must be collected to monitor population trends to ensure a population sufficient to graze back regrowth and to eliminate malicious introductions. Skilled bowfishers have repeatedly been found to be the most cost-efficient collection technique (Kirk et al 1992; Morrow et al 1997). A total of 50 fish periodically collected during the Fall should be used to develop mortality estimates and track the population.

One final element of managing hydrilla in Lake Wylie is the monitoring of native fish populations using routine electrofishing. Duke Energy conducts such fisheries surveys to support hydropower operation and licensing requirements required by the federal government. State natural resource agencies likewise conduct periodic monitoring in Lake Wylie - and together, these two agencies can monitor the native fish community. The Lake Wylie Marine Commission should monitor triploid grass carp densities and coordinate with both Duke Energy and state natural resource agencies in order to manage hydrilla in an environmentally responsible manner.

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Lake Wylie Hydrilla Management Plan

Time Line and Sequence of Events

Season	2007	2008	2009	2010	2011	2012	2013	2014	2015
Fall	1	1	1	1	1	1	1	1	1
Winter	2,7	2	2	2					
Spring	3,8	3,4,8	3,4,8	3,4,8	3,4,8	3,4,6,8	3,4,6,8	3,4,6,8	3,4,6,8
Summer					5		5		

1. Estimate hydrilla coverage.
2. Order triploid grass carp.
3. Evaluate fisheries data for potential impacts of triploid grass carp.
4. Stock triploid grass carp.
5. Collect triploid grass carp, estimate mortality, and project population trends.
6. Possible restocking of triploid grass carp to meet management objectives.
7. Obtain management plan approval and identify funding sources.
8. Spring electrofishing to monitor the native fish population

Recommended Lake Wylie Management Plan

This plan can be placed on the Lake Wylie Marine Commission Web Site when approved.

1. Problem plant species: hydrilla.
2. Infestation coverage: 90 acres based upon a survey completed during October, 2008.
3. Management objectives
    a. Reduce hydrilla growth lake-wide and prevent the spread of hydrilla to other systems.
    b. Achieve measurable reduction of hydrilla within two or three years and once hydrilla has been controlled, prevent it from reestablishing.
    c. Control hydrilla by using a low enough density of triploid grass carp that potentially other forms of native vegetation can become established.
4. Selected control method
    a. Triploid (sterile) grass carp used lake wide for long-term control.
    b. Registered and properly applied herbicides should be used for initial suppression and by home owners for spot treatments.
5. Area to which treatment is to be applied: triploid grass carp will be released from boat ramps near the greatest concentration of hydrilla.
6. Rate of control agent to be applied: Triploid grass carp will be stocked at a rate of 20 per vegetated acre of hydrilla or one fish per every 8 surface acres, which ever is greater Stockings will be incremental and yearly for at least 4 years. Should hydrilla be controlled before 4 years, token stockings will still be made in order to achieve at least four age classes in Lake Wylie.
7. Method of application of control agent: stock triploid (sterile) grass carp using standard techniques listed in the contract with the vendors of triploid grass carp.

8. Timing and sequence of control application: when permitted by appropriate state regulatory agencies, triploid grass carp will be released during the Spring (March – May) of 2009 and yearly at the same time for at least the next three years. RESULTS FROM TRIPLOID GRASS CARP MAY NOT BE EVIDENT FOR TWO OR MORE YEARS. After hydrilla has been controlled, follow on stocking, currently estimated at maintaining triploid grass carp stocking densities of approximately 1 fish per every 8 surface acres of Lake Wylie will be continued using mortality estimates derived from the population and population models.
9. Other control specifications
    a. Triploid grass carp will be a minimum of 12 inches total length. All shipments will be examined for condition and length specified in the contract with the vendor.
    b. Private entities are encouraged not to stock additional triploid grass carp but they may used registered and appropriately applied herbicides for spot treatments.
10. Entity to apply control agent
    a. Triploid grass carp will be applied by the commercial vendor supervised by the LakeWylie Marine Commission, funding agency, or individuals designated by the Lake Wylie Marine Commission.
    b. Registered herbicides must be applied by licensed applicators in accordance with label instructions.
11. Long-term management strategy
    a. Manage hydrilla's potential adverse impacts to the Lake Wylie ecosystem using primarily triploid grass carp after initial suppression using approved herbicides.
    b. Maintain or enhance native aquatic vegetation by maintaining the lowest possible stocking rates of triploid grass carp, especially once major stands of hydrilla have been controlled.

c. Seek to prevent further introduction and distribution of problem aquatic species through public education and enforcement of existing laws and regulations.
d. Periodically revise management plans and strategy as new environmental data becomes available.
e. Plan for long-term control of hydrilla, once control has been achieved, by maintaining very low densities of triploid grass carp. Stockings will be determined from mortality estimates generated from triploid grass carp collected on Lake Wylie and the use of age-structure population models developed for fisheries.