Title:

Evaluation of Grass Carp (Ctenopharyngodon idella) as a Biocontrol Agent for Giant Salvinia (Salvinia molesta)

Focus Categories:

Ecology, Invasive Species, Water Supply

Keywords:

Grass Carp (Ctenopharyngodon idella), Giant Salvinia (Salvinia molesta), Biocontrol, Invasive Species

Duration:

March 1, 2011 through February 28, 2012

Federal Fund Requested:

$4,136

Non-federal Matching Funds Pledged:

$13,736

Principal Investigator:

Michael Neisch
Graduate Assistant
Texas A&M University Department of Wildlife and Fisheries Sciences
111 Nagle Hall, 2258 TAMU, College Station, TX 77843-2258

Co-Principal Investigator:

Dr. Michael Masser
Professor & Extension Specialist
Texas A&M University Department of Wildlife and Fisheries Sciences
mmasser@nature.tamu.edu
(979) 845-7370
111 Nagle Hall, 2258 TAMU, College Station, TX 77843-2258

Congressional Districts:

Texas District 17
Texas District 26

Abstract

Giant salvinia (Salvinia molesta) is an invasive, introduced aquatic macrophyte that has quickly established itself in Texas waters. Listed as one of the most problematic aquatic plants by the state, giant salvinia is a floating weed capable of doubling in size in a week. It replaces native aquatic plants that provide food and habitat for invertebrates and fish and grows to such high densities that it blocks sunlight and reduces dissolved oxygen concentrations to dangerously low levels. Mats of giant salvinia become so thick that it is nearly impenetrable by boat and it easily clogs agricultural intake pipes for irrigation. First identified in 1998 in the Houston area, giant salvinia has since become established in Lake Conroe, Toledo Bend Reservoir, Caddo Lake, and at least 8 other Texas impoundments. This research will greatly aid in evaluating grass carp as a potential biocontrol mechanism for giant salvinia. They have the potential to be significantly less expensive, as well as requiring less maintenance and fewer ecological side effects than other control options.

Introduction

Giant salvinia (Salvinia molesta) is an invasive, introduced aquatic macrophyte that has quickly established itself in United States waters. Described as one of the most problematic aquatic plants by the U.S Geological Survey (USGS), giant salvinia is a floating weed capable of doubling in size weekly if environmental conditions are adequate. It replaces native aquatic plants that provide food and habitat for invertebrates and fish and grows to such high densities that it blocks sunlight and reduces dissolved oxygen concentrations to dangerously low levels. Mats of giant salvinia become so thick they are nearly impenetrable by boat and can easily clog agricultural intake pipes used for irrigation.

First identified in 1998 in the Houston area, giant salvinia has since become established in Lake Conroe, Toledo Bend Reservoir, Caddo Lake, and at least 8 other Texas impoundments. Current efforts to control giant salvinia include the use herbicides sprayed directly on the plant and salvinia weevils, a selective biocontrol introduced from the plants native range. While both methods of control have proven to be successful, they have their limits. Herbicide application is costly, time consuming and limited to the areas accessible by boat. The salvinia weevil has proven to be more efficient, but the insect has a hard time coping with Texas winters and must be restocked following the cold season.

Grass carp (Ctenopharyngodon idella), sometimes referred to as white amur, are an herbivorous fish frequently used as a biological control agent for nuisance aquatic vegetation. Previous research has shown that grass carp are effective at controlling many types of vegetation, including hydrilla, chara and several species of pondweed. Though they have been observed to consume giant salvinia, no studies have actually focused on the preference for or consumption rate of giant salvinia by grass carp.

Overarching Goal and Specific Objectives

In an effort to fill the knowledge gap, this research will study the effectiveness of grass carp as a control mechanism for giant salvinia. I will achieve this by accomplishing the following:

1. Determine the rate at which grass carp consume giant salvinia.
2. Determine the preference for giant salvinia as compared to other species of aquatic vegetation.

Methods

Research will be conducted at the Lewisville Aquatic Ecosystem Research Facility (LAERF) in Lewisville, TX in partnership with the U.S. Army Corps of Engineers. Established in 1990, LAERF was designed to support studies on biology, ecology, and management of aquatic plants. LAERF provides an intermediate scale research environment to bridge the gap between small-scale laboratory studies and large-scale field tests. The facility possess' 53 earthen and 21 lined ponds, 18 flowing water raceways, 3 large outdoor mesocosm facilities, a research greenhouse, and several laboratories to conduct research activities. For this experiment, the deep-water mesocosm system will be utilized, which consists of eighteen 14,000-L capacity fiberglass tanks measuring 2.5 m in diameter and 3 m deep. Each tank is supplied with filtered, alum-treated Lake Lewisville water from a lined water supply pond.

Three sizes of grass carp will be used, defined as small (8-10" length), medium (12-14" length) and large (+14"). Five fish will be stocked per tank, with four tanks per fish size, for a total of 12 tanks and 60 grass carp utilized.

The rate at which grass carp consume giant salvinia will be measured by introducing the plant into each tank and determining the amount of plant lost due to fish consumption. It will be possible to determine the rate, as kilograms per hour, that each size of grass carp consumes giant salvinia.

The preference for giant salvinia displayed by grass carp will be measured in a similar fashion to the consumption rate. Several species of aquatic vegetation will be introduced to the tanks, and using the consumption rate for each plant, it will be possible to determine the preference of grass carp. The plant with the highest consumption rate would be considered most preferred, the plant with the lowest consumption rate would be least preferred, and so forth.

Deliverables

This research will greatly aid in evaluating grass carp as a potential control mechanism for giant salvinia. They have the potential to be significantly less expensive, as well as requiring less maintenance and fewer ecological side effects than other control options.