Texas A&M AgriLife Extension Service
Texas Water Resources Institute

Quarterly Progress Report

Water Quality at Caddo Lake
Center for Invasive Species Eradication: Caddo Lake Giant Salvinia Eradication Project
USDA NRCS Agreement #: 68-7442-10-499
AgriLife Contact #: 07-428530

Quarter No. 13 From: 7.01.2013 Through: 9.30.2013

Abstract:

The **Center for Invasive Species Eradication** (CISE) has continued operations this quarter. The focus of operations this quarter has been on maintaining and growing weevil populations at the Caddo Lake Salvinia Weevil Rearing Facility and monitoring weevil activity on the Caddo Lake. On-lake weevil population surveys continued this quarter and showed a weevil density of 34 weevils per kilogram of wet salvinia when sampled in September. Efforts to obtain weevils from South America were put on hold as the search for a post-doc to conduct cold-tolerance studies continued. Chemical trials initiated in the previous quarter were also completed.

Education and outreach continues to be a focus of the project. The Extension Assistant at Caddo Lake spoke with several groups about the project, Caddo Lake and the perils of giant salvinia this quarter along with numerous visitors who stop by the weevil rearing facility. The giant salvinia situation this year has really sparked local interest in combating the plant; especially with biological control methods.

Overall Progress and Results by Task:

Task 1. Project Administration: Texas Water Resources Institute

Subtask 1.1: *Establish a Center for Invasive Species Eradication at Texas A&M University under the administrative leadership of Texas AgriLife Research and Texas AgriLife Extension Service to utilize funds provided through USDA Natural Resources Conservation Service to focus research and Extension educational programs on controlling invasive plant species.*

This action has been completed and the Center for Invasive Species Eradication is fully operational with personnel at TWRI handling day to day management activities.

Task 100% Complete

Subtask 1.2: *Provide fiscal oversight of funds, make funds allocations to scientists and Extension personnel, establish contracts and subcontracts as necessary, perform accounting functions*

Fiscal management is being carried out by TWRI personnel. Budgets and planned expenditures are continually being monitored to ensure that expenses are within the scope of the project and within the available budget.

As of September 5, 2013 a total of $662,857 has been spent on the project.

Task 86% Complete

Subtask 1.3: *Facilitate project and program discussions between AgriLife Research and Extension administration and NRCS administrative personnel to ensure that programmatic goals and objectives are met in a timely manner through this project.*

Work for this task has continued.

Task 90% Complete

Task 2. Project Coordination: Texas Water Resources Institute and other Agencies

Subtask 2.1: *Coordinate and facilitate meetings among project personnel to ensure research focus, maximum collaboration, educational programs and transfer of information*

Coordination and communication amongst project personnel continued this quarter with the focus being on enhancing weevil rearing at Caddo Lake NWR, expanding research on cold tolerance of weevils and their genetic adaptations, applying chemical and biological controls simultaneously and securing additional funding to continue needed research efforts. Discussions on the need to secure long term funding for the center's operation also increased this quarter.

Task 90% Complete

Subtask 2.2: *Work with groups currently engaged in controlling Giant Salvinia and other invasive species to foster collaboration and information transfer on the state of the science in controlling Giant Salvinia. These groups include those participating in the Interagency Giant Salvinia Control Team, including the Caddo Lake Institute, Cypress Valley Navigation District, East Texas Baptist University, Northeast Texas Municipal Water District, Northwestern State University, Louisiana Dept. of Fish and Wildlife, Louisiana State University, Texas AgriLife Research, Texas AgriLife Extension Service, Texas Parks and Wildlife Dept., USDA Agricultural*

Research Service, Animal & Plant Health Inspection Service, Natural Resource Conservation Service, US Army Corps of Engineers, Engineer Research & Development Center and Lewisville Aquatic Ecosystem Research Facility, and US Fish and Wildlife Service

The CISE team continues to coordinate with entities engaged in giant salvinia control at Caddo Lake as well as other entities nationally. Discussions on how to expand biocontrol production efforts at Caddo and other lakes have increased.

Task 90% Complete

Subtask 2.3: *Work with project personnel to meet reporting requirements and to produce effective project publications*

The document titled "A Guide to Mass Rearing the Salvinia Weevil for Biological Control of Giant Salvinia" was completed published online. The document can be downloaded at: http://cise.tamu.edu/caddo/

A manuscript entitled "Biological control of giant salvinia (S*alvinia molesta*) in a temperate region: cold tolerance and low temperature oviposition of *Cyrtobagous salviniae"* was co-authored by Abhishek Mukherjee, Allen Knutson, Daniel Hahn and Kevin M. Heinz and was submitted to the *Journal Biological Control* and is in review.

Task 90% Complete

Task 3. Chemical Treatment and Evaluation: Texas AgriLife Research and Extension

Subtask 3.1: *Researchers and Extension Specialists will work with others to establish chemical treatment research and demonstration sites to the extent possible at Caddo Lake for Giant Salvinia control. (Killing Giant Salvinia at Caddo Lake is the primary focus; as such, demonstrations at private or isolated locations may be required for research demonstrations of chemical treatment combinations)*

Foliar applications of ten different herbicide combinations were made to a giant salvinia-infested canal that feeds into Caddo Lake. 30 days post treatment, Aquamaster (glyphosate 54%) applied in combination with Reward (diquat) at a rate of 3 qt. & 1 qt./ac. or Clipper (flumioxazin) at a rate of 71 oz.& 6 oz/ac., were the only treatments that provided in excess of 90% control. Glyphosate 41% alone at 4 qt./acre provided 90% control. Clipper plus Aquathol K (6 oz. & 1 pt./A) provided 85% control.

Evaluations will continue, and additional studies are planned employing integrated methods using herbicides and weevils for control.

Task 80% Complete

Subtask 3.2: *Test and evaluate chemical treatment practice alternatives for controlling Giant Salvinia at Caddo Lake using a variety of chemicals, surfactants, and combinations at various concentrations and timings (This may include contracting with local or private chemical applicators to chemically treat Caddo Lake)*

Foliar applications of ten different herbicide combinations were made to a giant salvinia-infested canal that feeds into Caddo Lake. 30 days post treatment, Aquamaster (glyphosate 54%) applied in combination with Reward (diquat) at a rate of 3 qt. & 1 qt./ac. or Clipper (flumioxazin) at a rate of 71 oz.& 6 oz/ac., were the only treatments that provided in excess of 90% control. Glyphosate 41% SL alone at 4 qt./acre provided 90% control. Clipper plus Aquathol K (6 oz. & 1 pt./A) provided 85% control.

Task 90% Complete

Subtask 3.3: *Evaluate the efficacy and cost effectiveness information of each treatment scenario*

Cost comparisons are being calculated to determine the cost effectiveness of the highest performing chemical treatment options.

Task 60% Complete

Subtask 3.4: *Work with personnel in Task 4 to evaluate the efficacy of utilizing chemical treatments in concert with biological control*

Plans have been completed for employing integrated methods using herbicides and weevils for control. Top performing chemical combinations from the above listed trials will be used here. This test will be conducted early next quarter.

Task 80% Complete

Task 4. Biological Treatment and Evaluation: Texas AgriLife Research and Extension

Subtask 4.1: *Collaborate with other agencies and groups to setup new studies and cooperate in ongoing research and Extension educational programs dealing with biological strategies for controlling Giant Salvinia at Caddo Lake; practices which can be utilized for public and private lands statewide (If needed, research and demonstration sites away from Caddo Lake will be utilized as quickly killing Giant Salvinia at Caddo Lake is the priority)*

A research study was initiated on Caddo Lake to provide data on weevil population increase and impact on salvinia using one meter square frames.

A Research Collaboration has been set up with the Foundation for the Study of Invasive Species in Argentina. Through this effort, Argentinian colleagues will collect salvinia weevils along a north-south gradient in Argentina with a goal of collecting weevils from colder climes. Once collected, these weevils will be shipped to the Texas A&M Department of Entomology quarantine facility where their cold tolerance and low temperature reproduction ability will be evaluated. These weevils cannot and will not be released in Texas per USDA-APHIS guidelines.

Task 90% Complete

Subtask 4.2: *Work with TPWD and local Caddo Lake agencies, organizations and individuals to enhance weevil rearing capabilities for use at Caddo Lake*

An estimated 42,000 adult salvinia weevils have been released thus far at the release site on Caddo Lake. Follow up monitoring throughout the summer indicates that weevil numbers rapidly increase throughout the growing season eventually reaching level where giant salvinia control is obvious. In this release site, giant salvinia biomass had been reduced by approximately 80% by September.

Discussions with CLI have also been initiated on ways to more closely involve the general public in expanding salvinia weevil production and application to infested waters. Public support for biological control has greatly increased this year as the giant salvinia infestation has grown to its highest levels yet.

Task 95% Complete

Subtask 4.3: *Coordinate with USACE's Lewisville Aquatic Ecosystem Research Facility to collaborate in ongoing efforts, transfer knowledge and expand their operations*

AgriLife Extension personnel continue to maintain routine contact with LAERF personnel regarding weevil rearing and release methodologies.

Task 91% Complete

Subtask 4.4: *Evaluate improved methods of rearing weevils, harvesting weevils, delivering weevils to infested areas in Caddo Lake and various timing options of weevil applications in Caddo Lake to determine the most effective biological treatment scenarios to employ to the extent possible; as indicated earlier, killing Giant Salvinia at Caddo Lake may result in the need for research demonstration sites in the vicinity of Caddo Lake.*

A research study was initiated on Caddo Lake to provide data on weevil population increase and impact on salvinia using one meter square frames.

The document titled "A Guide to Mass Rearing the Salvinia Weevil for Biological Control of Giant Salvinia" remains available online at http://cise.tamu.edu/caddo/ and in the Texas AgriLife Extension Service Bookstore online at https://agrilifebookstore.org/.

Task 96% Complete

Subtask 4.5: *Assess practice efficacy and cost effectiveness of utilizing weevils in the control of Giant Salvinia*

No new activity to report.

Task 40% Complete

Subtask 4.6: *Use information gleaned from demonstration sites to develop biological treatment recommendations and guidelines for use of weevils to treat Giant Salvinia in infested areas*

Treatment recommendations for biocontrol are beginning to be developed based off of information gleaned thus far.

Task 50% Complete

Subtask 4.7: *Work with personnel in Task 3 to evaluate the efficacy of utilizing chemical treatments in concert with biological control*

Plans have been finalized to evaluate the weevil's ability to move from dying plant material to living plant material following a chemical treatment. Small scale treatments indicated that this was possible and a large scale demonstration of this concept will be carried out utilizing top performing chemical combinations discussed in Task 3.2 and 3.3. This evaluation should be carried out early next quarter.

Task 80% Complete

Task 5. Other Treatment: All involved agencies

Subtask 5.1: *Work with federal, state and local agencies as well as local entities and individuals to evaluate the feasibility, efficacy and cost effectiveness of utilizing other treatment options (hydrological, mechanical, others) for controlling Giant Salvinia*

No additional evaluations are expected to occur. This task is considered complete; however, should feasible options surface, they will be evaluated.

Task 100% Complete

Subtask 5.2: *Convert feasible options into treatment practice descriptions to include in recommended treatment strategies and guidelines*

No new activity to report this quarter.

Task 30% Complete

Subtask 5.3: *Develop treatment prescriptions suitable for inclusion in NRCS FOTGs, Extension printed materials and other guides for treating Giant Salvinia; these will take the form of job sheets, fact sheets, supplements to conservation practice standards and technical brochures.*

The document titled "A Guide to Mass Rearing the Salvinia Weevil for Biological Control of Giant Salvinia" was completed this quarter and published online at http://cise.tamu.edu/caddo/ and in the Texas A&M AgriLife Extension Service bookstore online at https://agrilifebookstore.org/

Tri-fold "The Pond Destroyers: Common and Giant Salvinia" continues to be distributed at Extension meetings.

While not a treatment prescription, the development of the manuscript titled "Biological control of giant salvinia (S*alvinia molesta*) in a temperate region: cold tolerance and low temperature oviposition of *Cyrtobagous salviniae"* will provide critical information to scientist actively engaged in the advancement of biological control application and effectiveness globally.

Task 83% Complete

Task 6. Education and Outreach: Texas AgriLife Extension Service and Texas Water Resources Institute

Subtask 6.1: *Extension and TWRI will work with TPWD and other agencies to enhance existing outreach and education efforts through the use of news releases, TV spots, demonstrations, and other communications focused on prevention of spread and control methods for Giant Salvinia*

Several presentations have been made recently to local groups in the vicinity of Caddo Lake that focus on the giant salvinia issue at hand and treatment options available.

Newspaper articles, Facebook posts and blog posts continue to be published highlighting the giant salvinia problem at Caddo Lake, CISE efforts and other partner efforts. Progress made by the weevils has also been documented through online outlets and a newspaper article is also in the works.

Task 93% Complete

Subtask 6.2: *Identify and secure partnerships with local, state, regional and national organizations (ex: B.A.S.S., fishing and hunting guides, cities, water sports manufacturers, Ranger Boats, Evinrude, Mercury, others) to expand the dissemination of educational materials on Giant Salvinia*

Local support is growing significantly as a result of the larger than normal giant salvinia infestation this summer. CLI has been instrumental in garnering this support.

Task 30% Complete

Subtask 6.3: *Develop and host CISE website for invasive species eradication information and as an outlet for information dissemination*

Website development is complete and provides links to numerous information outlets. Content is continually being added to the site. In addition, a Facebook page and online blog are updated as new information is ready to be presented. All pages are advertised to the public when the opportunity is available.

CISE Web address: http://cise.tamu.edu/
Project Web address: http://cise.tamu.edu/caddo
Project blog: http:/caddosalvinia.blogspot.com/
Facebook page: link can be found on the above blog.

Task 96% Complete

Subtask 6.4: *Facilitate education and outreach efforts and support media relations*

Several presentations have been made recently to local groups in the vicinity of Caddo Lake that focus on the giant salvinia issue at hand and treatment options available. These included:

Task 88% Complete

Task 7. GIS Support: Texas AgriLife Research

Subtask 7.1: *Texas AgriLife Research will provide GIS support for all aspects of the project and develop maps illustrating project activities and demonstration locations*

CISE project personnel continue to document treatment and research activities using GIS when needed.

Task 75% Complete

Task 8. Include Treatment Scenarios in Agency Guidelines: All Agencies

Subtask 8.1: *Using information gleaned from this project, develop detailed strategies and practices for control of Giant Salvinia for inclusion in agency guidelines such as NRCS FOTGs, Extension bulletins and factsheets, TPWD outreach information and other agency materials for utilization in both private and public water bodies*

The "Guide to Mass-Rearing Salvinia Weevils for Biological Control of Salvinia" was completed this quarter. This document provides a complete current state of knowledge for raising salvinia weevils under different scenarios. This document will be published as an AgriLife Extension Electronic Special Publication.

Task 60% Complete

Subtask 8.2: *Work closely with NRCS and other agencies to disseminate the control practices for Giant Salvinia as appropriate*

"The Pond Destroyers: Common and Giant Salvinia" continues to be distributed at Extension meetings.

Copies of "Aquatic Vegetation Identification Cards," Texas A&M AgriLife Extension Service publication B-6095 available online at the Texas A&M AgriLife Bookstore are being distributed to expand general knowledge on the ID and treatment of giant salvinia and other aquatic plants present in Texas. (see attached)

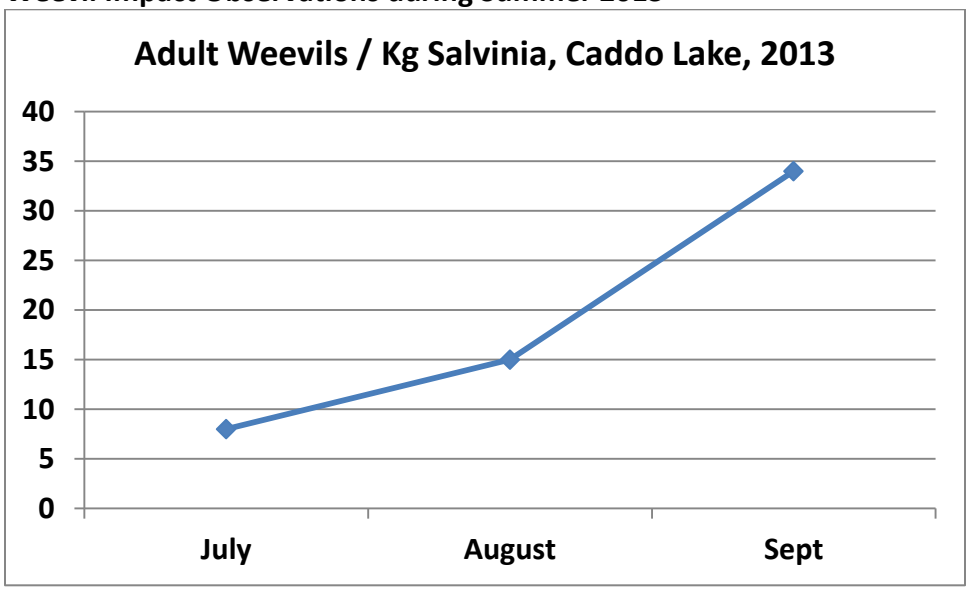
Task 75% Complete

Planned Activities for Next Quarter:

- distribute the "Guide to Mass-Rearing Salvinia Weevils for Biological Control of Salvinia" via online avenues
- continue to monitor weevil release sites and release additional weevils as they are available
- continue monitoring weevil population dynamics and distribution
- obtain weevils from South America and initiated cold tolerance and reproduction temperature threshold evaluations
- continue on lake chemical trials when weather and giant salvinia conditions permit

- continue trials to determine effectiveness of using biological and chemical treatment simultaneously

Weevil Impact Observations during Summer 2013



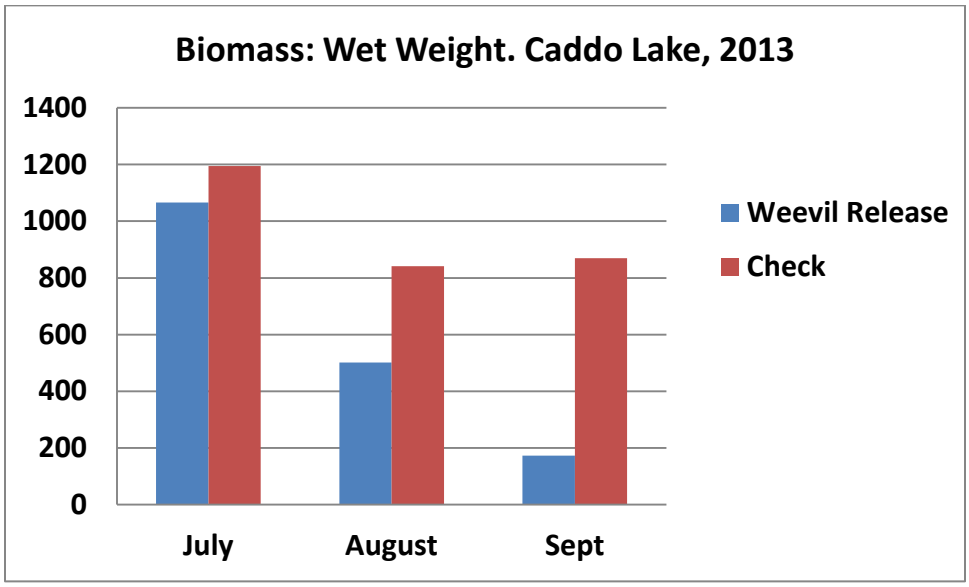


Photo of Weevil Release Site

Discussion regarding each of these photos has been recently posted on the CISE blog at: http://caddosalvinia.blogspot.com/ The “open water” and brown salvinia are a sign of biological action at each of these sites.

2013 Weevil Release Site

2012 Weevil Release Site