

**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. 9 From: 7.01.2012 Through: 9.30.2012

**Abstract:**

The **Center for Invasive Species Eradication** (CISE) has continued operations this quarter. The focus of operations has been expanding production of weevils at the Caddo Lake NWR weevil rearing facility, the continued evaluation of cold tolerance of the salvinia weevil in a laboratory setting, expanding efforts to better understand weevil population growth and plant biomass impacts conducting chemical evaluations and assessing the impacts of chemicals and surfactants on weevil survival.

Treating giant salvinia on Caddo Lake with biocontrols remained a priority this quarter. An estimated 54,400 weevils were released this quarter bringing the yearly total up to 85,400. Weevil densities at the release site have reached the threshold where observable giant salvinia damage is occurring.

Education and outreach continues to be a focus of the project. The document entitled "A Guide to Mass Rearing the Salvinia Weevil for Biological Control of Giant Salvinia" was published this quarter and is being distributed electronically. Additionally, information on giant salvinia control continues to be distributed via Texas A&M AgriLife Extension Service programming.

**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 August 31, 2012 a total of \$456,607 has been spent on the project. Another \$130,045 is currently encumbered and will be spent this fiscal year.

#### **Task 70% 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 80% 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 has continued this quarter with the focus being on enhancing weevil rearing capacity at Caddo Lake NWR, improving on-lake evaluation methods and continuing chemical trials this year.

#### **Task 80% 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

Interagency communication continued this quarter with the focus being on coordinating both biological and chemical treatments on Caddo Lake. With weevil releases and large scale chemical applications underway, communication remains critical.

A joint effort between project staff, TPWD and USACE at Lake B.A. Steinhagen near Jasper has resulted in exceptional information on salvinia weevil population dynamics and also yielded successful giant salvinia control on approximately 150 acres.

A meeting of the Interagency Giant Salvinia Control Team is also being planned for next quarter and will further support collaborative efforts

#### **Task 80% 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/>

#### **Task 80% 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)*

On-lake chemical demonstrations were delayed this quarter due to limited access to the primary treatment site and delays in require permitting. Due to the late point in the growing season, these trials will be delayed until the spring 2013 growing season.

#### **Task 40% 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)*

The second series of small-scale chemical trials were completed this quarter at Caddo Lake NWR. Preliminary data should be available next quarter on chemical efficacy.

### **Task 80% Complete**

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

Action will resume on this task next quarter.

### **Task 25% Complete**

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

Lab based evaluations on chemical and surfactant toxicity were carried out this quarter with promising results. As compared to the control weevil population, no significant differences in mortality were observed in weevils treated with chemical and/or surfactants.

Small scale evaluations to assess the weevil's ability to move from dying plant material to living plant material following a chemical treatment were also carried out this quarter. Results indicated that weevils do have the ability to migrate to healthy plants.

A large scale demonstration of this concept is being planned for next growing season.

### **Task 70% 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)

Experiments on cold tolerance of populations of salvinia weevil from Florida, Louisiana, Texas and Australia were completed and data are being summarized. Results indicate significant difference in the ability of weevils from different regions to recover from exposure to cold temperatures.

A replicated study was initiated at Caddo Lake and Lake Steinhagen to more closely determine weevil population growth and impact on plant biomass. Also, weevil density and salvinia biomass were monitored in a large area release site on Lake Steinhagen in

cooperation with Texas Parks and Wildlife. Results from these studies indicate that weevil populations typically follow an exponential growth curve when sufficient plant matter is present. These results indicate that it is critical to have a population of weevils present in an area and able to begin reproduction earlier in the spring.

#### **Task 85% 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*

Rearing tanks were managed to support adult weevil reproduction, larval growth and subsequent emergence of first generation adults. To date, 85,400 adult weevils have been released this year and an estimated 256,000 larvae have been released.

Water quality is becoming an issue and filtration systems are being explored to remedy this situation. This will enable use of water supplied by the refuge and eliminate the need to haul lake or potable water and save significant personnel time.

#### **Task 93% 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 maintain routine contact with LAERF personnel regarding weevil rearing and release methodologies. USACE-LAERF personnel provided significant guidance in the development of the "Guide to Mass-Rearing Salvinia Weevils for Biological Control of Salvinia."

#### **Task 85% 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.*

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

Salvinia containing an estimated 54,400 adult weevils and associated larvae and eggs was collected from the three rearing tanks and released at the Bird Roost release site on Caddo Lake on July 19th and August 9th. Personnel from the Cypress Valley Navigation District and Gecko Pest Control assisted with the release. An adjacent area was established as a control site and no weevils were released at this site.

Weevil density studies conducted on Caddo and B.A. Steinhagen Lakes has revealed that building weevil populations earlier in the growing season is best. As a result, it is ideal to maintain an on-lake population and supplement it with additional reared weevils as early in the growing season as possible to increase weevil density.

Improved water quality monitoring is being implemented to improve rearing efficiency.

#### **Task 90% Complete**

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

An initial cost assessment for producing weevils as a biological control of giant salvinia has been completed and is included in “A Guide to Mass Rearing the Salvinia Weevil for Biological Control of Giant Salvinia.” Further assessment will be summarized toward the end of the project in a formal 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***

Information included in “A Guide to Mass Rearing the Salvinia Weevil for Biological Control of Giant Salvinia” briefly discusses these biological treatment recommendations. More work will be conducted on this in the coming quarters.

#### **Task 15% Complete**

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

Lab based evaluations on chemical and surfactant toxicity were carried out this quarter with promising results. As compared to the control weevil population, no significant differences in mortality were observed in weevils treated with chemical and/or surfactants.

Small scale evaluations to assess the weevil’s ability to move from dying plant material to living plant material following a chemical treatment were also carried out this quarter. Results indicated that weevils do have the ability to migrate to healthy plants.

A large scale demonstration of this concept is being planned for next growing season.

#### **Task 70% 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 action to report this quarter.

### **Task 40% 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/>.

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

### **Task 70% 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*

A student presentation on the research into the utilization of triploid grass carp to control giant salvinia will be presented as a Student Paper at the Aquatic Plant Management Society meeting in Salt Lake City, Utah in July.

Plans are also being made for project presentations at the Texas Aquatic Plant Management Society meeting next quarter.

Extension personnel continued to deliver education and outreach material to the public during the quarter.

### **Task 80% 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*

No new activity to report this quarter.

### **Task 20% 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 94% Complete**

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

An AgriLife Today news release was developed this quarter describing success of the salvinia weevil at B.A. Steinhagen Lake and describing the hopes to replicate results at Caddo Lake.

This story was picked up by additional media outlets.

We are also actively engaging the Houston Chronicle to get them to cover the success as well.

### **Task 75% 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 GPS when needed.

### **Task 50% 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.

### **Task 70% Complete**

## **Planned Activities for Next Quarter:**

- continue cold tolerance studies in the lab
- continue small scale chemical trials at the Caddo Lake NWR
- 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 coordination with CVND and TPWD on spraying

**Attachments:**

- cover of "A Guide to Mass Rearing the Salvinia Weevil for Biological Control of Giant Salvinia"
- copy of AgriLife Today news release
- before and after photos of weevil success at B.A. Steinhagen near Jasper

# **A Guide to Mass Rearing the Salvinia Weevil for Biological Control of Giant Salvinia**



# A Guide to Mass Rearing the Salvinia Weevil for Biological Control of Giant Salvinia

**Allen Knutson and Julie Nachtrieb**

**Project Coordinators**

## **Chapter Authors**

Chapter 1 Giant Salvinia, Salvinia Weevil, and Biological Control of Giant Salvinia

*Allen Knutson and Abhishek Mukherjee*

Chapter 2 Water Quality Parameters Important to Growing Giant Salvinia

*Allen Knutson*

Chapter 3 Rearing the Salvinia Weevil for Biological Control of Giant Salvinia  
at the U.S. Army Corps of Engineers Lewisville Aquatic Ecosystem Research Facility

*Julie G. Nachtrieb*

Chapter 4 Rearing the Salvinia Weevil in Outdoor Tanks at Caddo Lake, Texas

*Patrick Ireland, Allen Knutson, and Lucas Gregory*

Chapter 5 Rearing the Salvinia Weevil in the Greenhouse

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Chapter 6 Rearing the Salvinia Weevil in Ponds

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Special Publication

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## Weevils successfully destroy acres of lake-invading plants

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WOODVILLE – A weevil that feeds exclusively on giant salvinia has successfully destroyed about 150 acres of the invasive plant this summer on B.A. Steinhagen Lake near Woodville in East Texas, according to personnel involved in a statewide giant salvinia management program.

Researchers from the U.S. Army Corps of Engineers, Texas Parks and Wildlife Department, Texas A&M AgriLife Extension Service and Texas A&M AgriLife Research are working to control giant salvinia, a free-floating aquatic fern native to South America. The plant has invaded 17 Texas lakes and bodies of water in the southeastern U.S., according to Dr. Allen Knutson, AgriLife Extension entomologist in Dallas.

Knutson said the fast-growing plant forms dense mats, which interfere with water recreation, displace native vegetation and reduce oxygen content of the water, often harming fish and other aquatic life.

The Texas Parks and Wildlife Department's Aquatic Habitat Enhancement Program staff has released more than 112,000 adult weevils since 2010 from its Jasper rearing facility onto B.A. Steinhagen Lake.

Knutson, Dr. Abhishek Mukherjee and Dr. Kevin Heinz, Texas A&M University department of entomology, and Chris Moret, Texas Parks and Wildlife Department, studied the lake's weevil populations this year and in 2011.

"Late last winter, weevil numbers ranged between 20 and 30 weevils per kilogram of salvinia and are now up to 60 per kilogram, which is an excellent population," Mukherjee said. "Populations of this size cause more damage to the plant than it can overcome and are able to effectively control giant salvinia."

"Photos taken before and after weevil releases illustrate the tremendous job the weevils have



Giant salvinia in Lake Steinhagen (photo courtesy Floyd Boyett, U.S. Army Corps of Engineers)

done in controlling giant salvinia this year,” said Floyd Boyett of the U.S. Army Corps of Engineers in Woodville. “We purposefully refrained from spraying this area to see what the weevils could do this year.

“Now, there is abundant open water, and what giant salvinia remains is contained within floating mats of grass or lotus along the shore,” he said. “Weevils are in areas east and south of where they were released, indicating that the floating material must have carried the weevils a good distance and allowed them to establish.”

Knutson said a similar effort aims to recreate these successful results at Caddo Lake in northeast Texas. Research there is being conducted at a weevil-rearing facility at the U.S. Fish and Wildlife Service’s Caddo Lake National Wildlife Refuge through the Center for Invasive Species Eradication. The center is part of the Texas Water Resources Institute, AgriLife Research and AgriLife Extension and operated in collaboration with Texas Parks and Wildlife, U.S. Fish and Wildlife Service’s Caddo Lake National Wildlife Refuge and the Caddo Lake Institute.

Lucas Gregory, the water institute’s manager for the project, said giant salvinia is extremely abundant at Caddo Lake this year.

“The flood and freezes in the winters of 2010 and 2011 greatly reduced the amount of giant salvinia present in Caddo Lake, but it has come back with a vengeance this year,” he said. “Some areas of the upper lake are almost impassable due to thick mats of salvinia.”

So far in 2012, the facility has produced about 50,000 adult weevils, which were released at a research site on Caddo Lake, Knutson said.

“Efforts to establish a self-sustaining weevil population on Caddo are underway,” Knutson said. “However, the effectiveness of the salvinia weevil, a tropical insect, is limited by cold winters, especially at Caddo Lake.

“Our research has demonstrated that populations vary in their ability to survive freezing weather,” he said. “We are now searching for cold-tolerant strains that could better survive cold winters in Texas and therefore have a greater impact on salvinia infestations the following summer.”

Knutson and Mukherjee plan to acquire some weevils from Argentina later this year and evaluate their cold-hardiness in laboratory tests at Texas A&M.

“By collecting weevils in higher, and therefore colder, elevations in Argentina, we expect to find weevils more cold tolerant than those currently in the United States, which were originally collected from Brazil,” he said. “Finding more cold-tolerant weevil populations would be especially helpful when colder winters return to East Texas.”

The Caddo Lake giant salvinia project is funded by Congressional support through the U.S.

Department of Agriculture's Natural Resources Conservation Service.

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Giant Salvinia at B.A. Steinhagen in April 2012: estimated coverage of approximately 300 acres



Same area of B.A. Steinhagen in August 2012: estimated coverage of giant salvinia is about 100 to 150 acres located around the shoreline

