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Testimony on Control and Eradication of Giant Salvinia
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The LSU AgCenter has been involved in investigating and implementing control measures for giant salvinia since 1999.

After its discovery on Toledo Bend Reservoir in 1998, a herbicide screening site was established adjacent to the Sabine River Authority headquarters building at Pendleton Bridge. This screening site was operated for three years and it was where all herbicides registered for aquatic use, all herbicides with pending registrations for aquatic use and many herbicides that could possibly be registered were screened.

With the discovery of giant salvinia near Cameron, La., in 2000, a biological control program was initiated. It is interesting to note that the only effective eradication of giant salvinia in Louisiana was accomplished at the Cameron site by using salt water. The traditional drainage and pumping facilities were temporarily reversed, and the infested canals and associated ponds were filled with high salinity water from the nearby Calcasieu Navigation Channel. After the salvinia had died, the process was reversed, removing the salt water from the system with little, if any, negative effect on the native plant life. Remnant populations of giant salvinia not associated with the drainage system were treated with a herbicide (diquat) by a contract applicator until no live giant salvinia could be located. With the eradication of the giant salvinia from the Cameron location all further herbicide and biological control research was suspended in that area.

The Cameron site was the only infestation site where high salinity water was available in enough quantity to be efficacious. So herbicide screening trials at various locations at Toledo Bend Reservoir continued until 2004.

In 2005, an infestation was identified in the lower Bayou Des Allemands and was traced to the vicinity of the Company Canal. In 2006, large-scale biological control and herbicide trials were established on Golden Ranch near Gheens, La. A 6 acre aquaculture facility was made available by the landowner, stocked with giant salvinia and then infested with giant salvinia weevils obtained from the Corps of Engineers site near Center, Texas. The reproduction of the weevils was limited due to the possible uneven sex ratio of males to females. In early 2007, an active population of weevils was found on Toledo Bend near Negreet, La., and weevils were transported to the Golden Ranch site where they flourished. By 2009, this nursery site had produced approximately 1.2 million adult weevils that were transplanted into 18 water bodies in Louisiana and two in Texas.

In addition to the mass rearing of weevils for release, basic biology research on the weevils was also under way. Studies at the Golden Ranch site confirmed reports in the literature from Australia that under ideal growing conditions giant salvinia can approach an 80 percent daily coverage rate, or, stated another way, the giant salvinia can reach a point where it can double the area of water covered every 1.5 days (Attachment 1).

Basic studies conducted at the Golden Ranch site and in Baton Rouge discovered or confirmed several important things about the weevils:

1. The weevils cannot fly. This is important in planning a distribution system, since any movement of weevils from one place to another that is not directly connected by water is unlikely. The weevils must be moved by people to accomplish any large-scale control program.
2. In southern Louisiana it takes a minimum of two full years for the population to reach a threshold where the weevils consume the salvinia faster than the salvinia can reproduce.
3. Once the weevils reach this threshold, the number of adult weevils increases rapidly, and the amount of available salvinia in the nursery declines as rapidly.

4. In our work, this threshold is approximately 40 adult weevils per kilogram of salvinia (Attachment 2).

Most herbicide screening work was transferred to the Golden Ranch site and continued until 2010 at that location. A number of new herbicides, not available during the initial screenings, were tested at the Golden Ranch site. Of those, three recently were registered for use on giant salvinia thanks in part to our screening work.

At the request of and in cooperation with the Louisiana Department of Wildlife and Fisheries, an extensive grass carp biological control trial was conducted at the Golden Ranch site in 2009. The trial confirmed that grass carp will not eat giant salvinia even when it is the only plant material available. This was not unexpected, since grass carp usually do not consume floating plants and giant salvinia contains a metabolic inhibitor (thiamine inhibitor) that if consumed in quantity is toxic to the fish (and other animals).

A small number of weevil releases were made in 2008. In 2009, working in cooperation with Louisiana Wildlife and Fisheries personnel, approximately 50,000 pounds of weevil-infested salvinia was harvested from the Golden Ranch site and transplanted to lakes throughout northwest Louisiana. This amount of material represents approximately 1 million adult weevils. These weevils were released by Louisiana Wildlife and Fisheries personnel on Lake Bisteneau, Caddo Lake, Cross Lake, Toledo Bend, Clear Lake, Loggy Bayou and Black Lake. An additional 10,000 pounds of infested salvinia was harvested and transplanted to sites in south central Louisiana. Releases in south Louisiana were made in Lake Salvador, Bayou Des Allemands, Golden Ranch, Delta Farms, Bayou Black, Mandalay NWR, Jean Lafitte National Park and the Atchafalaya Spillway. Additional weevil releases were made in south Louisiana in 2010 and early 2011.

The weevil releases in south Louisiana made in 2008 and 2009 have been successful. Several canals adjacent to Bayou Des Allemands that were impassable in 2008 currently are free of giant salvinia. Salvinia populations on Golden Ranch have been reduced by nearly 90 percent. On parts of Delta Farms salvinia has been reduced by 80 percent. Prior to opening of the spillway for flood control in 2011, the areas in the Atchafalaya spillway with weevil releases had substantial reductions in salvinia population densities. Similar salvinia reductions have been observed at other release sites.

It must be noted that the salvinia weevil never eradicates giant salvinia. As in its native Brazil, it consumes salvinia to the point it can no longer maintain huge population numbers – allowing some salvinia and some salvinia weevils to remain somewhat in equilibrium.

The successes discussed above are very encouraging. Unfortunately, the same cannot be said for the weevil releases in northwestern Louisiana. The unusually cold winter of 2009-2010 and the winter of 2010-2011 that was nearly as cold winter decimated the weevil populations. Samples obtained shortly after Feb. 1, 2010, from Lake Bisteneau indicated no weevil survival. (Samples taken from all release sites in south Louisiana in February 2010 and February 2011 showed good to excellent weevil survival.) The cold winter temperatures also decimated the salvinia populations in other areas, as well, it is unlikely that any weevils survived the cold temperatures in northwestern Louisiana.

The weevil nursery at Golden Ranch was discontinued at the landowner's request. We currently have two nurseries established with plans to harvest weevils in 2011. We have two additional nurseries completed with plans to harvest in 2011 and three additional nurseries in the construction phase.

The results of over more than two dozen herbicide trials conducted by the LSU AgCenter since 1999 have identified a number of herbicides that are effective in controlling giant salvinia when applied according to directions. A number of the effective herbicides have obtained federal registration from the EPA and are available for use. These herbicides can be divided into two groups: foliar sprays and total water treatments. Diquat (Reward), flumioxazin (Clipper) and glyphosate (numerous trade names) are foliar treatments shown to be effective with multiple applications. Fluridone (numerous trade names) and more recently penoxulam (Galleon) are total water treatment herbicides (the giant salvinia absorbs the herbicide through root uptake) often are effective from a single application, but the contact time (time the plants are exposed to the herbicide) may be as long as 60 days. Exchange of water (rainfall, normal

current flow, etc.) with the minimum exposure time negates control. Even with these herbicides proven to be effective, chemical control of giant salvinia is problematic for several reasons:

1. All of the foliar applied herbicides require multiple applications to have a significant effect on matted giant salvinia. Multiple applications are expensive and labor intensive.
2. The total water treatment herbicides require long contact times. This works well in small confined areas (ponds with little watershed area), but it often does not work well in larger water bodies with larger watersheds and does not work at all in areas of moving water.
3. All of these herbicides are expensive (as high as \$1,600 per gallon on the upper end), and state budgets are limited.
4. With the phenomenal growth rate of giant salvinia (Attachment 1), complete control is difficult to achieve, since only a few surviving plants can repopulate an area in a brief time.

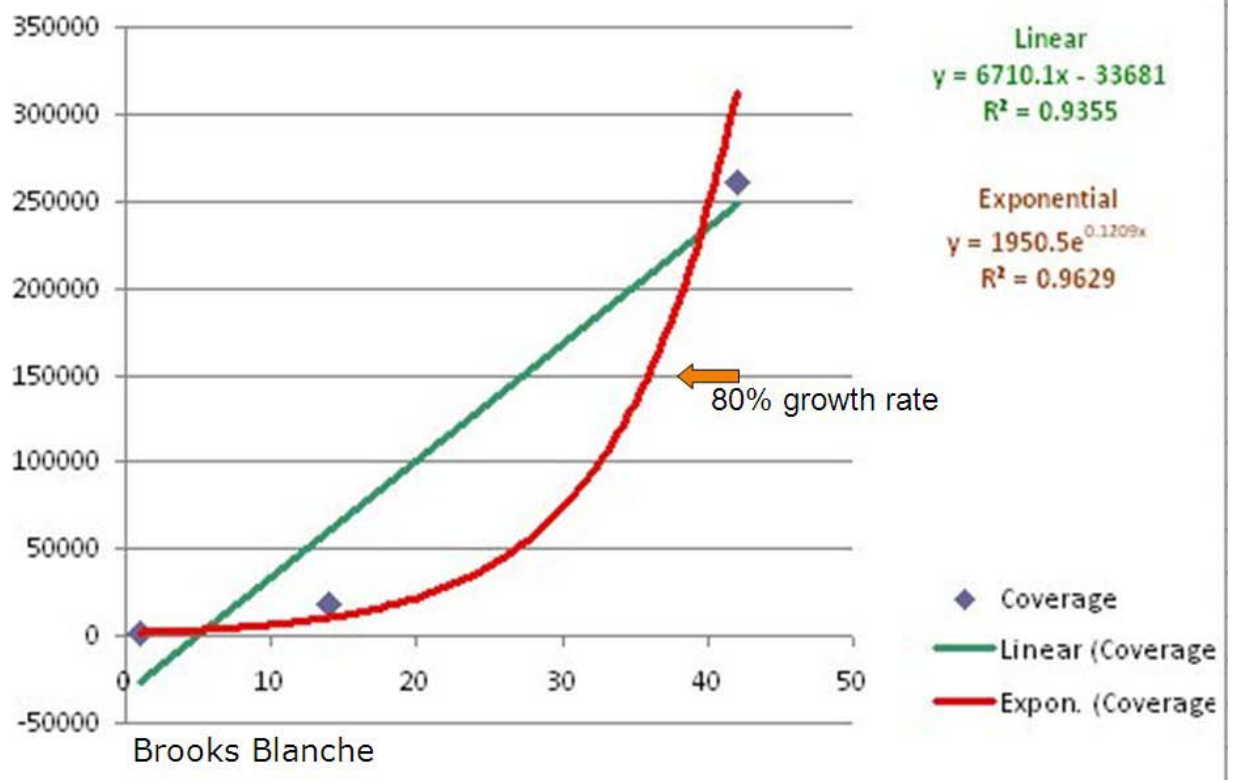
The LSU AgCenter has and continues to operate an outreach program of meetings, publications, videos and so forth to inform the public of the threat of giant salvinia and recommending that the boating public clean their boats and trailers of any aquatic vegetation before launching into uninfested waters. As part of the outreach program, the LSU AgCenter also conducts a series of educational programs in cooperation with the Louisiana Department of Agriculture and Forestry to train commercial and public sector applicators in the proper methods of applying herbicides to giant salvinia and other nuisance aquatic plants.

Future research plans include a continuation of the herbicide screening program and refining/increasing our salvinia weevil production capabilities. Of specific interest is research directed at hopefully finding a strain of the salvinia weevil that can accommodate the low winter temperatures northwestern Louisiana experienced in 2009-2010 and 2010-2011. Additional research will be predicated on finding additional research funds.

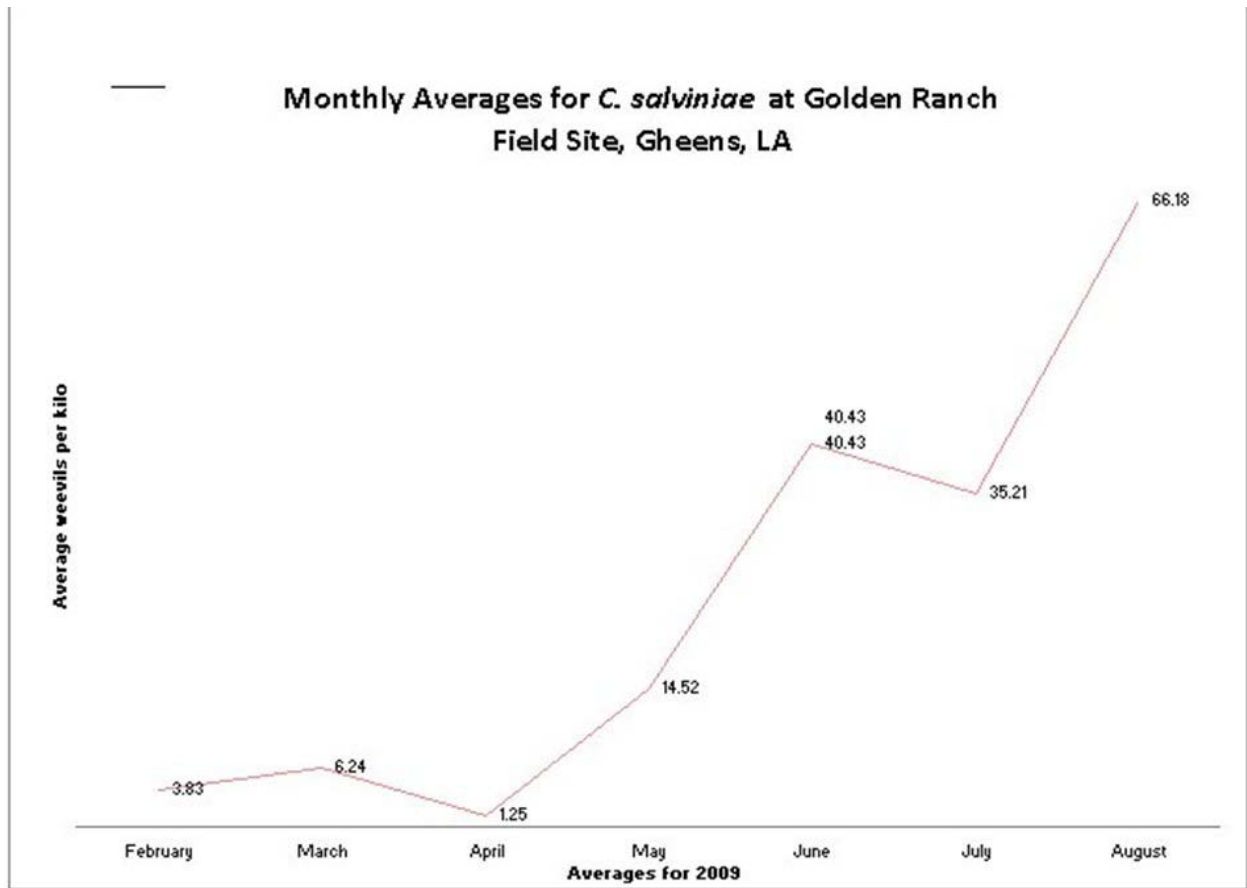
In conclusion, we believe herbicide sprays and weevil releases will reduce the levels of infestation of giant salvinia in south Louisiana to acceptable levels, but eradication is very unlikely. Applications of herbicides should be made on new and accessible locations. Salvinia weevil releases should be made in more remote areas and where herbicide applications are not cost effective. Unless a cold-tolerant strain of salvinia weevil is identified and made available for use in north Louisiana, biological control measures always will be subject to winter kill. Unless and until a cold-tolerant strain is available, salvinia control will depend on herbicide applications and help from mother nature.

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Total Coverage 3 points



Attachment 1. Giant salvinia growth curve.



Attachment 2: Salvinia weevil growth curve at Golden Ranch 2009. At the point where the weevil populations reach approximately 40 adults per kilogram of salvinia, the salvinia starts to decline, and the weevils are forced onto the fewer remaining plants.