

***Lampsilis higginsii* and *Quadrula fragosa*
recovery project
Genoa National Fish Hatchery**



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Genoa National Fish Hatchery**

Production activities carried out at Genoa National Fish Hatchery (NFH) during 2010 for the federally endangered Higgins' Eye Pearlymussel (*Lampsilis higginsii*) represent the eleventh year of a multi-year effort to re-establish and enhance populations of this endangered mussel within the Upper Mississippi River watershed. Funding for this project was provided by the U.S. Army Corps of Engineers, and the U.S. Fish and Wildlife Service. Cooperating partners included the U.S. Fish and Wildlife Service Ecological Services Division, State of Minnesota Department of Natural Resources, State of Wisconsin Department of Natural Resources, State of Iowa Department of Natural Resources, and the State of Illinois Department of Natural Resources.

The goal of this project is to produce sufficient quantities of healthy juvenile and sub-adult *L. higginsii* for reintroduction into suitable habitats within its current and former range as identified by the Mussel Conservation Team Action Plan for 2010. Areas for reintroduction or cage propagation during 2010 included 4 sites identified by the plan. These areas included sites within the Mississippi R. watershed in Iowa, Wisconsin and Minnesota (Figure 1). Due to the lack of historical intensive propagation success with this species, the focus of production efforts during 2010 was extensive in nature, with the majority of juvenile mussels' excysting in natural environments. The following report is a synopsis of the major activities performed through the Genoa NFH during the calendar year 2010. Categories for discussion include: 1. Host fish production. 2. Infestation and incubation. 3. Host fish

cage project and free releases. 4. Winged Mapleleaf propagation. 5. Dive Support Activities. 6. Future plans.

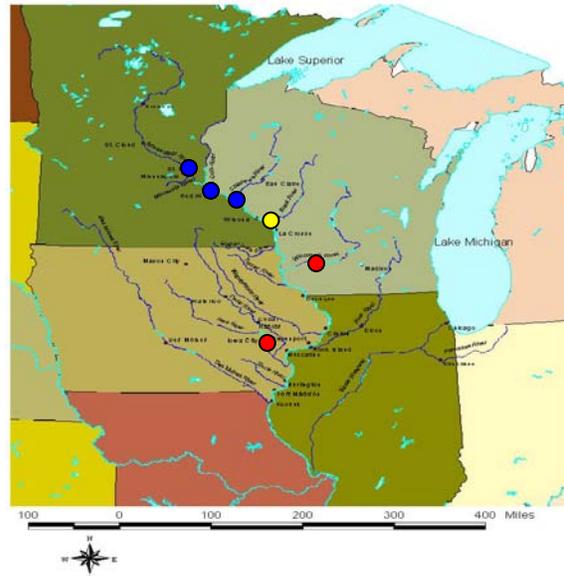


Figure 1. *L. higginsii* cage culture (yellow), free release (red) and sub-adult release sites (blue) in 2010.

Host Fish Production

The facility produced and used two known host fish species for *L. higginsii* production during 2010. Largemouth bass, *Micropterus salmoides*, smallmouth bass, *Micropterus dolomieu*, were selected based on juvenile mussel production histories for these fish on the facility. Numbers of fish inoculated and released during the spring 2010 infestation operation included 1,720 largemouth bass, 1,610 smallmouth bass for a total of 3,330 fish. This number is slightly less than the 3,779 fish released in 2009 due to the reduced number of cages and free released fish requested by the US Army Corp of Engineers.

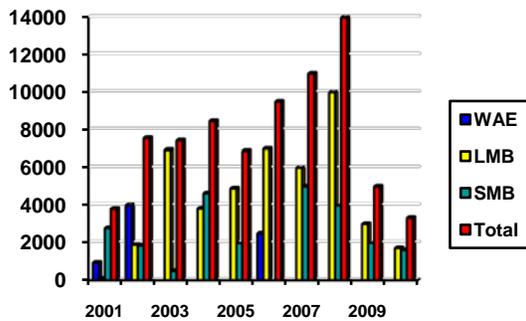


Figure 2. Annual host fish production at Genoa NFH for *L. higginsii* project.

Post attachment survival of host fish was excellent during 2010 exceeding 97.0% of infested fish surviving through distribution. This value is consistent with those of recent years. As of this writing, 4,000 host fish are being overwintered at the hatchery for potential use with Higgins eye in 2011 pending a decision by either the MCT or the USFWS to produce a 2011 year class of *L. higginsii*.

Infestation and Incubation

Mussel infestation operations during spring 2010 included 3,330 fish. Estimated numbers of spring juveniles produced was 483,490 a sharp decline from the 2009 production of 1,373,214 (Figure 3).

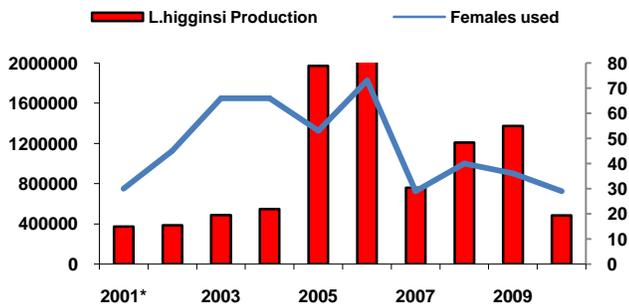


Figure 3. Juvenile production estimates for *L. higginsii* (bar) and number of females used (line) by year at Genoa NFH.

This decrease in production of juveniles

is attributed to three factors. 1) fewer females used 2) fewer fish infested and 3) smaller host fish overall due to a cooler production season in 2009.



Figure 4. Gravid female *L. higginsii* collected at Cordova, IL. for propagation work at Genoa NFH.

As in the past, transformation estimates are based on representative samples of all fish infested within the project. These fish are held in monitoring aquaria until excystment is completed and the numbers of collected juveniles applied to total fish released. Donor female *L. higginsii* mussels used during 2010 operations were collected from two populations within the upper Mississippi R. watershed (Figure 1; Table 1). Mussels were collected from Mississippi River populations at Prairie du Chien, WI., and Cordova, IL.

Table 1. Production values for spring 2010 *L. higginsii* project at Genoa NFH.

Strain	# Donor ♀'s	Est. Juv. Produced
Cordova	16	282,790
Prairie du Chien	13	200,700
Totals	29	483,490

Total numbers of mussels used for glochidia harvested at the facility was 29 in 2010 (Table 1). All mussels were

collected by hatchery divers and arrived at the culture facility in excellent condition. Over 95% of females were gravid and contained adequate numbers of glochidia to meet production goals. No underdeveloped larvae were detected in any of the females and all sampled glochidia responded to standard NaCl viability tests.

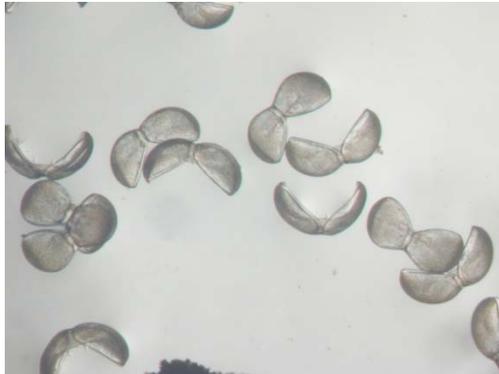


Figure 5. Harvested glochidia prior to exposure to fish hosts. Photo Genoa NFH.

Donor mussels were each marked with a Hallprint™ shellfish tag returned to collection sites after glochidia harvest. All appeared in good condition with no mortalities or moribund individuals observed. Genetic samples consisting of buccal swabs were collected from all mussels during 2010. These samples

Table 2. Cage locations, numbers and estimated juveniles produced.

Location	#Cages	#/Fish	Est. Trans.	Strain
Miss. R. La Crescent	30 closed	900 LMB	200,700	PdC
Miss. R. Onalaska	27 closed	820 LMB	100,860	Cordova
Total	57	1,720	301,560	

were preserved in 90% ethyl alcohol and are being stored at the Upper Midwest Environmental Science Center, Lacrosse, Wisconsin.

All fish infested during spring 2010 operations were held at the facility for a

minimum of two weeks post exposure to ensure encystment of attached juveniles and reduce fish losses to stress and predation. After this incubation period those fish designated for release were removed from the holding facility and transferred by hatchery personnel to pre-determined plant sites within the Mississippi River watershed. The majority of host fish were used in either free release or cage propagation efforts, allowing them to release their mussel complement within the watershed. A sample of fish were held at the facility to provide excystment values to be applied to free release and cage programs. Juvenile excystment ranged from 21 – 40 days post infestation for all strains of *L. higginsii* and hosts at Genoa NFH during spring of 2010.

Host Fish Caging Project

In 2010, the host fish caging effort involved two new propagation sites, both in Pool 8 near La Crosse, WI. The first, at an Upper Mississippi River Refuge storage site near La Crescent, MN was stocked with 30 cages holding the Prairie du Chien strain Higgins eye infested host fish. The second site, located adjacent to the Lake Onalaska spillway below Lock and Dam 7, was stocked with 27 cages holding Cordova strain Higgins eye infested host fish. In total, 57 closed bottomed mussel culture cages with representatives of two sub-populations of *L. higginsii* were used in 2010 (Table 2). No open bottom cages were used in 2010. Tentative data from the sample cages harvested in October 2010 for the 2010 cohort of *L. higginsii* produced at the La Crescent Refuge and Onalaska spillway sites indicate a nearly total loss in production for these strains in 2010

(Table 3). Heavy siltation in the cages due to seasonal flooding may have contributed to the poor culture success at the La Crescent location, while further analysis is necessary at the spillway site.

Table 3. Data from fall 2010 assessment of *L. higginsii* culture cages in Upper Mississippi and St. Croix Rivers (St. Croix cages are from the 2008 year class). Parenthetical values are total number of cages for that strain.

Strain	# cages surveyed	Total Number recovered
PdC	1(30)	0
Cordova	2(27)	0
Cordova (2009 cohort)	27(27)	187
St. Croix (2008 cohort)	16(16)	6,477
Total	28/88	6,664

Harvest of sub-adults from the 2008 cohort of St. Croix strain *L. higginsii* produced an excellent yield of 6,477 mussels that were released in Pool 2, 3 and 4 during September 2010. A total of 187 Cordova strain 2009 cohort were collected from cages at Sturgeon Lake (Upper Mississippi River, Pool 3), and were placed in a single cage for further culture and future retrieval.

Host Fish Free Release Program

The practice of releasing glochidial bearing host fish has been carried out since the early 1900's as a management tool to increase Unionid populations and has been an important strategy in the relocation efforts for Higgins' Eye. The effectiveness of historic operations carried out by management agencies in the early part of the 20th century were not readily ascertainable due to large existing native mussel populations'

endemic to receiving waters. This fact, coupled with an inability to differentiate propagated mussels from naturally produced mussels, hampered monitoring of historic restoration programs. Higgins' Eye populations in areas used in recent free releases as a restoration tool had historic populations at detectable levels, but currently show no recruitment or are absent totally from surveys. Population increases in the immediate future for this species in areas within or adjacent to release sites may be directly attributable to the current reintroduction program. Juveniles from free release host fish produced 37.6% of the total estimated juvenile mussels released for spring 2010 (Table 4). Assessments of the Wapsipinicon River in Iowa have produced sub-adults from previous free release stockings since 2005. In 2010 a search of the Wapsipinicon River yielded one live and two fresh dead *L. higginsii*.

Table 4. Free release site locations, host numbers, and estimated Cordova strain juveniles produced spring, 2010.

Release Site	Location UTM	#/Species	Est. Trans. Juveniles
Iowa River.	15T-0621987 4614786	1070 SMB	120,910
WI River Prairie du Sac	16T-0279102 4794164	540 SMB	61,020
Totals			181,930

Mucket Bucket Juvenile Culture

A new method for culturing juvenile mussels in captivity was tested at Genoa NFH in 2010. The mucket bucket is a downweller system comprised of nested buckets fitted with chambers for holding juvenile mussels. A submersible pump circulates water within the system and temperature is

maintained with a standard aquarium heater. A multi-species algae diet is provided to the mussels by bulk feeding 2-4 times daily. Juveniles resulting from enumeration counts this season were held for culture in the buckets.



Figure 6. A ‘mucket bucket’ used for culture of juvenile mussels at Genoa NFH.

The initial test consisted of 5,479 *L. higginsii*, and 171 *Q. fragosa*. Unfortunately, none of these juveniles survived through the summer. Culture results for common species were far more promising, and additional culture trials are planned for fall propagation.

Winged Mapleleaf

The Winged Mapleleaf *Quadrula fragosa* is found in Region 3 only as a remnant population in the St. Croix River and is one of the most endangered freshwater mussels in North America. Genoa NFH became the first facility ever to propagate this critically endangered species during FY 2005. The hatchery, (in cooperation with the states of Minnesota and Wisconsin, U. S. Geological Survey, National Park Service, Macalister College, LaCrosse Fish & Wildlife Conservation Office, and the Twin Cities Field Office)

continued propagation efforts for this species in late 2009 and continued in 2010. At the end of 2009 two gravid female winged mapleleaf collected from the St. Croix River were used to inoculate 270 channel catfish. Even though these fish were held under controlled conditions there were some fish health issues that resulted in only 139 catfish surviving until spring of 2010 at which time they were placed by hatchery personnel and cooperators in 4 production cages placed in the Wisconsin side of the St. Croix River across from Stillwater, MN. An estimated total of 2,502 juveniles were produced in 2010. Due to slow growth rates of this species assessments of production cages was deferred until mid 2011 to allow for adequate growth, and to ensure mussels were of large enough size to facilitate assessment. Cages placed in the St. Croix Rivers in 2009 were checked in September 2010; unfortunately no juveniles were recovered in the 4 cages.



Figure 8. Winged Mapleleaf shell, collected on the St. Croix River, photo courtesy Genoa NFH.

In September 2010, four gravid female winged mapleleaf collected from the St. Croix River were used to inoculate 362 channel catfish at Genoa NFH. These catfish will be held at the hatchery until

spring 2011 at which time they will be placed in cages, a subset of fish will be held to estimate total number of juveniles produced for the entire batch.

In addition to fish held at Genoa NFH, glochidia were provided to the USGS Upper Mississippi Ecological Science Center to infest 32 channel catfish for a study on efficiency of host fish based on host size. Approximately 600 juveniles were returned to Genoa NFH for fall culture in our bucket systems as a result of this study.

Mobile Aquatic Rearing System (MARS)

In 2009, Genoa NFH with assistance from the USACE's Blackhawk Park, set up and ran mussel culture trials in a mobile trailer that was supplied with Mississippi River water. No live juveniles were recovered during the first season of culture. Due to extenuating circumstances, predominantly staff turnover, no culture trials were conducted during 2010. To improve culture success in 2011, changes such as using fiberglass tanks verses aluminum tanks and the addition of spray bars to improve flow will be added. Sub-adult mussels will also be placed in the MARS to test the systems' ability to culture larger juveniles.



Figure 9. Inside the MARS “rover” showing small tanks on top of the two larger tanks.

Diving Support Activities

Genoa NFH staff divers participated in a wide range of diving activities in support of these two recovery programs. Staff divers carried out donor female collections, culture cage placement and retrieval. Qualitative and quantitative assessments on the Mississippi River were postponed due to high water conditions. Hatchery divers were particularly active in the collection of winged mapleleaf for propagation, an effort that involved diving three times weekly over a six week period. Hatchery divers conducted 36 dives logging 52 hours of dive time carrying out duties outlined in the Mussel Conservation Team Action Plan for 2010.

Future Plans

Genoa NFH will hold host fish for *L. higginsii* work in 2011 should the MCT or USFWS decide to continue propagation efforts. Currently the hatchery is rearing Mississippi River strain brood channel catfish to insure future year classes of catfish for winged mapleleaf propagation. We also plan to begin restoration efforts for the snuffbox, *Epioblasma triquetra*, a species recently proposed for federally endangered status.

Acknowledgements

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Appendix A: Tag numbers by strain of 29 Higgins Eye females used in spring 2010 infestation at Genoa NHF.

Prairie du Chien	Cordova
C058	C038
C059	C039
C060	C042
C061	C043
C062	C044
C063	C045
C064	C046
C065	C047
C066	C049
C067	C050
C068	C051
C069	C052
C070	C053
	C054
	C055
	C056
