

U.S. Fish & Wildlife Service

Region 3 Fisheries Fisheries Data Series

FDS 2006-004

Lampsilis higginsii recovery project Genoa National Fish Hatchery 2006



Department of the Interior
U.S. Fish and Wildlife Service
Great Lakes-Big Rivers Region

Roger R. Gordon Jr.
Tony R. Brady

12/08/2006



A photograph showing a person's hand holding several Lampsilis higginsii clams. The clams are dark brown with prominent yellow and greenish-yellow stripes. They are being held over a large pile of similar clams. In the lower-left corner, a white mesh net is visible, partially filled with clams. The background is a dark, textured surface, possibly a tray or a large container.

***Lampsilis higginsii* recovery project
Genoa National Fish Hatchery
2006**

**Roger Gordon and Tony Brady
December 8, 2006
Genoa National Fish Hatchery**

Production activities carried out at Genoa National Fish Hatchery (NFH) during 2006 for the federally endangered Higgins' Eye Pearlymussel (*Lampsilis higginsii*) represent the seventh year of a multi-year effort to re-establish and enhance populations of this rare 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 2006. Areas for reintroduction or cage propagation during 2006 included 6 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 2006 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 2006. Categories for discussion include: 1. Host fish production. 2. Infestation and incubation. 3. Host fish cage project and free releases. 4. Future program.

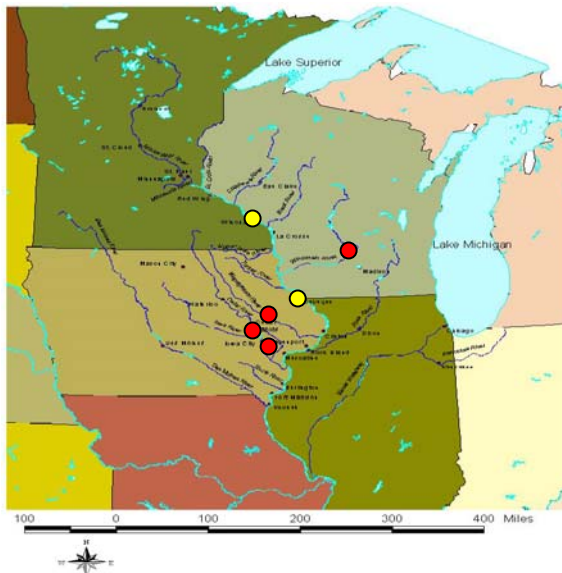


Figure 1. *L. higginsii* cage culture (yellow) and free release (red) sites in 2006

Host Fish Production

The facility produced and used two known host fish species for *L. higginsii* production during 2006. Largemouth bass (*Micropterus salmoides*) and walleye (*Sander vitreus*) were selected based on juvenile mussel production histories for these fish on the facility. The selection of walleye as a host during 2006 was due to the unavailability of smallmouth bass (*Micropterus dolomieu*). Numbers of fish inoculated and released during the spring 2006 infestation operation included 6,000 largemouth bass and 1,175 walleye for a total of 7,175 fish. This number is above the 6,884 fish released in 2005 and reflective of adequate supplies of donor female mussels.

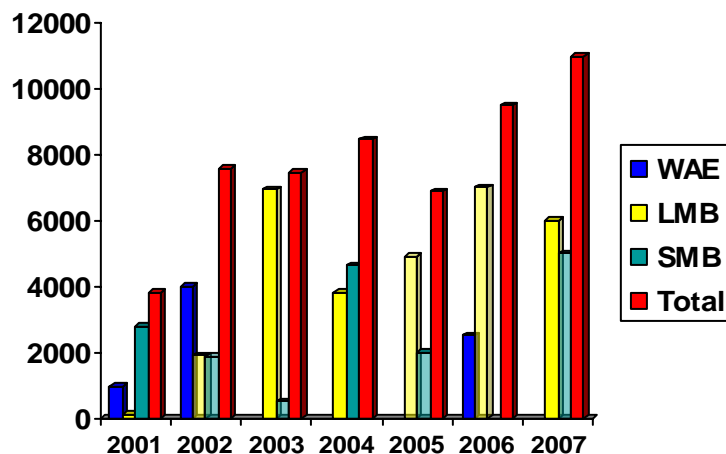


Figure 2. Annual host fish production at Genoa NFH for *L. higginsii* project

Post attachment survival of host fish was good during 2006 with 87.4% of infested fish surviving through distribution. This value is lower than in 2005 when final survival rates were over 91%. Overall survival of largemouth bass during 2006 was excellent with over 95% of infested fish being stocked. Walleye survival numbers were markedly lower with only 61.4% of infested animals surviving until stocking. As in the past, walleyes proved much less tolerant of handling stresses associated with the project and were highly susceptible to the stress mediated disease columnaris (*Flexibacter columnaris*). Despite setbacks, the annual production of host fish for *L. higginsii* restoration has continued to grow over the life of the project. The program will continue to annually produce ~10,000 hosts through FY 2007 when further evaluation will dictate future needs.

Infestation and Incubation

Mussel infestation operations during spring 2006 infested 7,715 fish. Estimated numbers of spring juveniles produced also increased for the sixth consecutive year with 2,239,554 juveniles' transformed (Figure 3).

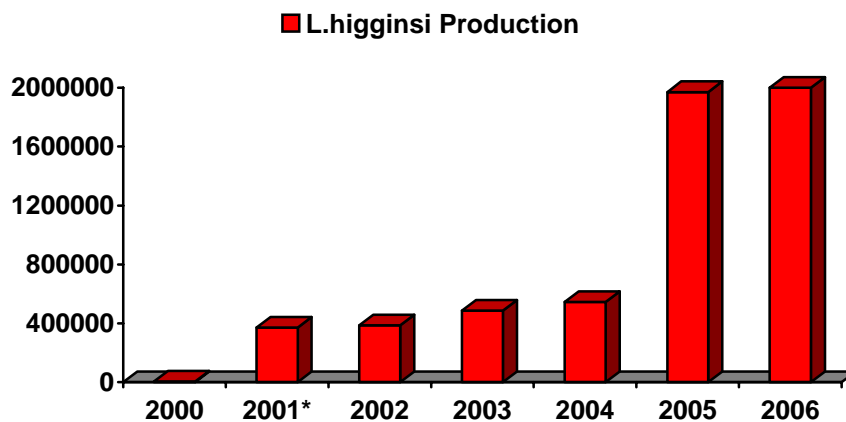


Figure 3. Juvenile production estimates for *L. higginsii* from Genoa culture facility.



Figure 4. Gravid female *L. higginsii* collected at Cordova, IL. for spring 2006 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 2006 operations were collected from four populations within the upper Mississippi R. watershed (Figure 4). Mussels were collected from the St. Croix River (Hudson Narrows), and Mississippi River populations at Cassville, WI., Prairie du Chien, WI., and Cordova, IL. High water conditions on the Mississippi River during scheduled collections for infestation events prevented station and cooperator divers from gathering sufficient numbers of gravid females from the Cassville WI. (RM 606.5) brood aggregation site. In order to meet requested numbers of fish infested with Cassville “strain” *L. higginsii* glochidia the MCT authorized the collection of additional gravid female mussels from Prairie du Chien, WI. (RM 635.8). This second site, located in the upper east channel of the Mississippi R., is within 30 river miles of the Cassville site. The sites are separated by Lock and Dam #10 located at Guttenburg, IA.,(RM 615). Total numbers of mussels harvested at the facility was 73 in 2006, an increase from 53 individuals used in 2005 (Table 1). All mussels were collected by hatchery or MN DNR divers and arrived at the culture facility in excellent condition. Over 92% of females were gravid and contained adequate numbers of glochidia to meet production goals. No intermediate larvae were detected in any of the females and all sampled glochidia responded to standard NaCl viability tests.

Table 1. Production values for spring 2006 *L. higginsii* project at Genoa NFH. Cassville/ Prairie du Chien category represents mixed stocking of these two strains at Central City, IA. site on the Wapsipinicon R.

Strain	# Donor ♀'s	# Fish / Species	Mussels/ Fish	Est. Juv. Produced
St. Croix	19	600 / LMB	332.1	199,260
Cordova (cages)	8	1200 / LMB	298.7	358,440
Cordova (free release)	5	630 / LMB	190.7	120,141
Prairie du Chien (cages)	16	1440 / LMB	391.1	563,184
Cassville/ Prairie du Chien	8 / 9	1175 / WAE	467.5	549,312
Prairie du Chien (free release)	8	2130 / LMB	210.9	449,217
Totals	73			2,239,554

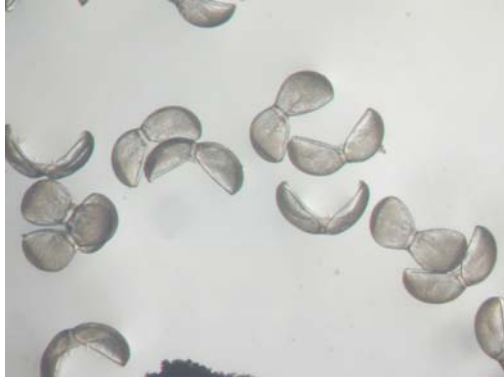


Figure 5. Harvested glochidia prior to exposure to fish hosts. Photo Genoa NFH.

Donor mussels were returned to collection sites after glochidia harvest and appeared in good condition with no mortalities or morbid individuals observed. Genetic samples consisting of mantle sections were collected from all mussels during 2006. These samples were preserved in 90% ethyl alcohol and are being stored at the Upper Midwest Environmental Science Center, Lacrosse, Wisconsin. All fish infested during spring 2006

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 surviving host fish were used in either free release or cage propagation efforts, allowing them to release their mussel compliment within the watershed. The remaining fish were held at the facility to monitor rate of transformation and provide excystment values to be applied to free release and cage programs.

Juvenile excystment ranged from 37 – 57 days post infestation for all strains of *L. higginsii* and hosts at the Genoa facility during spring of 2006 (Figure 6). Due to extended length of infestation events, excystment rates for all strains showed multiple discernable peaks for transformation.

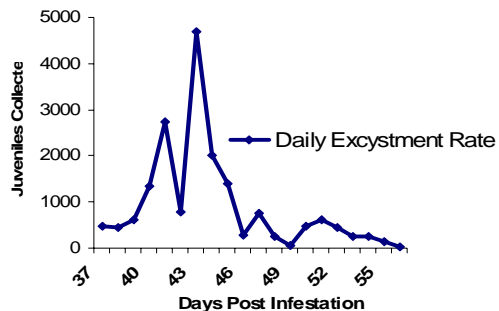


Figure 6. Juvenile *L. higginsii* collected from monitoring aquaria at Genoa NFH mussel propagation facility.

Host Fish Caging Project

In an effort to capitalize on the successes that were noted at the Lake Pepin cage site near Frontenac MN. from 2003 - 2005, plans called for the continued concentration of efforts in cage production to this site during 2006. With the exception of the floating cage site at Dubuque, IA., all cage propagation was carried out at the Frontenac site. In total, 98 closed bottomed mussel culture cages with representatives of three sub-populations of *L. higginsii* were placed at the Frontenac site during 2006 (Table 2). Results from solid bottom cages were positive across propagation sites during 2006, with live mussels counted in all cages surveyed (Table 3).

Tentative data from the sample cages harvested in September 2006 for the 2006 year class of *L. higginsii* produced at the Frontenac and Dubuque sites indicate lower production values than in 2005. All cages at the Dubuque, IA. site were harvested and the mussels individually counted prior to transfer to a overwintering site at the Frontenac, MN. cage location. As seen in table 3 the production average per cage for Dubuque was just over 108 mussels/cage. This is substantially lower than the 575 mussels/cage collected during 2005. It should also be noted that during 2005 the Cordova strain of *L. higginsii* was propagated at the Dubuque site, while during 2006 the MCT directed that the Cassville strain should be used. Due to the shortage of Cassville mussels during infestation events at the hatchery, Prairie du Chien *L. higginsii* donor females were used to infest the largemouth bass hosts for the floating cage site. Production at the Frontenac, MN. cage site also appeared to be lower than 2005 with slightly over 107 mussels/cage in 2006 as opposed to 145 mussels/cage harvested in 2005.

Table 2. Cage locations, numbers and estimated transformers produced

Location	#Cages	#/Fish	Est. Trans.	Strain
Miss. R. Frontenac	20 closed	600 LMB	199,260	St. Croix
Miss. R. Frontenac	39 closed	1200 LMB	469,320	Cassville
Miss. R. Frontenac	39 closed	1200 LMB	358,440	Cordova
Miss. R. Dubuque Floating	8 floating	240 LMB	93,864	Cassville
Total	106	3,240	1,120,884	

Table 3. Data from fall 2006 assessment of *L. higginsii* culture cages in Upper Mississippi R. Parenthetical values are total number of cages for that strain.

Strain	# cages surveyed	Ave. number recovered per cage
St. Croix	2(20)	38
Cassville	2(39)	225
Cordova	2(39)	25
Cassville/Dubuque	8(8)	109
Total	14(106)	106



Figure 7. Floating cages attached to exhibit boat at the National Mississippi River Museum and Aquarium



Figure 8. Placing floating cage containing host fish for Higgins Eye at Dubuque, IA propagation site (USFWS photo)

Unlike 2005, when *L. cardium* sub-adults were detected in Cordova strain mussels produced at the Dubuque and Frontenac sites, no interspecies contamination in caged mussels was evident.

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 restoration programs. Higgins' Eye populations in areas used for free release fish as a restoration tool had historic populations at detectable levels, but more recently show no reproduction 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 attributable to the current reintroduction program. Free release of glochidial bearing fish produced one-half of the total estimated juvenile mussels released for spring 2006 (Table 4).

Table 4. Free release site locations, host numbers, and estimated transformed juveniles produced spring, 2006

Release Site	Location UTM	# /Species	Est. Trans. Juveniles + Strain
WI. R. Prairie du Sac	16T-0279102 4794164	1050 LMB	221,445 (Prairie)
Wapsi. R. IA. Anamosa	15T-0641600 4662087	1080 LMB	227,772 (Prairie)
Wapsi. R. IA. Central City	15T-0621823 4673111	1175 WAE	549,312 (Cassville)
Iowa City IA.	15T-0621987 4614786	630 LMB	120,141 (Cordova)
Totals		3,935	1,118,670

Diving Support Activities

Genoa NFH staff divers participated in a wide range of diving activities in support of project goals. Staff divers carried out donor female collections, culture cage placement and retrieval, as well as assisted in qualitative and quantitative assessments on the Mississippi River and its tributaries. Hatchery divers also assisted state cooperators in *L. higginsii* sub-adult stocking operations and adult assessment and cleaning/aggregation activities. Hatchery divers conducted 31 dives and logged over 41 hours of dive time carrying out duties outlined in the Mussel Conservation Team Action Plan for 2006.



Figure 9. Hatchery divers assist Iowa Department of Natural Resource personnel with mussel assessment survey on the Wapsipionicon R. in central Iowa

Future Plans

Station plans call for continued support of *L. higginsii* restoration efforts through 2007. In line with established methods and management goals more than 98% of infested fish will continue to be used in cage culture and free release strategies for grow out of juvenile mussels. After the continued success realized in the floating cage culture trials during 2006, the hatchery will make efforts to fine tune and possibly expand this method to maximize returns for 2007.

The hatchery will begin testing surrogate species of lampsiline mussels in marking trials in early FY 2007 to test the efficacy of calcine as a long term marking method on *L. higginsii*. This technique, if proven feasible, will save significant time and money to the relocation effort and allow the mass marking of mussels produced.

Acknowledgements

Special thanks to all personnel associated with the successful propagation season of 2006. Special thanks to Illinois DNR biologist Dan Sallee, Iowa DNR biologists Scott Gritters and Kevin Hansen, Wisconsin DNR biologist Dave Heath, U.S. Army Corp of Engineers biologists Dennis Anderson and Dan Kelner and Minnesota DNR biologists Mike Davis and Bernard Seitman for the exceptional cooperation and assistance given to Genoa personnel throughout the past field season.



Figure 9. Dan Kelner, U.S. Army Corp or Engineers, St. Paul District, displaying advanced stage sub-adult Higgins' Eye mussels.

Resources

- Anderson, D. 2006. Mussel Coordination Team Action Plan for 2006. U.S. Army Corps of Engineers, St. Paul District, St. Paul, MN. 10pp.
- Davis, M. 2005. Clam Chronicles. Minnesota Department of Natural Resources, Lake City, Minnesota. 35 pp
- Gordon, R. 2001. Operational Procedures and Techniques for the Artificial Infestation of *Lampsilis higginsii*. U.S. Fish and Wildlife Service, Genoa National Fish Hatchery, Genoa, Wisconsin. 9 pp.
- Gordon, R. and T. Brady. 2005. *Lampsilis higginsii* recovery project. U.S. Fish and Wildlife Service, Genoa National Fish Hatchery, Genoa, Wisconsin. 9pp.
- Heath, D.J. 2004. Report on 2004 Placement of Cages Containing *Lampsilis higginsii* in the Wisconsin River near Orion. Wisconsin Department of Natural Resources, LaCrosse, Wisconsin. 4pp.

Disclaimer Notices

The Fisheries Data Series was established in 2003 to provide public access to unpublished study results. These reports are intended to document short-term field studies that are limited in or lacking statistical interpretation. Reports in this series receive limited internal review prior to release and may be finalized in more formal literature in the future. Consequently, these reports should not be cited without approval of the author or the Project Leader.

Equal opportunity to participate in and benefit from programs and activities of the U.S. Fish and Wildlife Service is available to all individuals regardless of race, religion, color, or physical or mental disability. For more information please contact:

U.S. Department of the Interior
Office for Equal Opportunity
1849 C. Street, N.W.
Washington, D.C. 20240

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people.

Appendix A: Tag numbers by strain of 73 Higgins Eye females
used in spring infestation at Genoa NHF.

St. Croix	Cassville	Prairie du Chien	Cordova
O603	C763	C770/C771	C261
O604	C764	C772/C773	C465
O605	C765	C774/C775	C486
O606	C766	C776/C777	C655
O607	C767	C778/C779	X625
O608	C768	C780/C781	X629
O609	C769	C782/C783	X630
O610	A402	C784/C785	X635
O611		C786/C787	A752
O612		C788/C789	X641
O613		C790/C791	C389
O614		C792/C793	X652
O615		C794/C753	X661
O622		C754	
O617		C756	
O618		C758	
O619		C760	
O620		C761	
O621		C757	
		C759	