

OFFICE OF RESOURCE CONSERVATION
State of Illinois
Grant

PROJECT NUMBER: T-54 D-1

PROJECT TITLE: Developing a Propagation Technique for Native Illinois River CWCP Mussels

PURPOSE: The Nature Conservancy (TNC), with the Illinois Department of Natural Resources (IDNR), will experiment with captive rearing of the butterfly mussel, a species of special concern in the state as listed in the Wildlife Action Plan, within a restored (but not reconnected) backwater of the Illinois River at TNC's Spunky Bottoms Preserve (Illinois Wildlife Action Plan, X Appendices-Appendix I, p. 295). TNC will adapt propagation techniques developed for Higgins Eye mussel recovery on the Mississippi River to determine the best possible methods for propagating these mussels, and whether the techniques can be used to reestablish viable mussel populations in the Illinois River.

NEED: A greater proportion of freshwater mussels are considered "Species in Greatest Need of Conservation" (29 of 61; 48%) than any other taxonomic group; an additional 19 species are extinct or extirpated (Illinois Wildlife Action Plan, III. B, pp 31-33). Approximately 49 species of freshwater mussels have been documented from the Illinois River (IR), but fewer than half are still present. The butterfly mussel, ***Ellipsaria lineolata***, formerly relatively abundant and widely distributed in the IR, has been extirpated from the river since the early 1900's. The species is of special concern in the state and is listed in the Illinois Wildlife Action Plan (Illinois Wildlife Action Plan, X Appendices-Appendix I, p. 295). The reported fish hosts (freshwater drum, green sunfish and sauger) for the butterfly, necessary for completion of the unionid life cycle, are present in the IR and are abundant in many sections of the river. This mussel's elimination from the IR has been attributed to siltation and poor water quality. Recent studies indicate that some species of freshwater mussels have begun to recover as conditions in the IR improve; however, those mussels still have source populations located in the IR or its tributaries which can provide the individuals needed for recolonization.

Historic general distribution ranges for *E. lineolata* include the Mississippi River drainage from western Pennsylvania west to Minnesota, south to eastern Iowa, Kansas, and Oklahoma (Parmalee and Bogan, 1998). The mussel, once present in the Illinois River in significant numbers has in recent history been all but eliminated. Surveys of the IR dating back to 1870 showed *E. lineolata* from 1870 through 1912 and subsequent surveys in 1969 showed it as absent from the system. The most recent survey recorded only one individual at mile marker 48.4 in the Alton pool (Whitney, et al, 1997). Status of the mussel indicates it is a species of special concern in Tennessee and also in Illinois (Parmalee and Bogan, 1998). It is currently listed as a threatened species in Iowa and endangered in both Ohio and Wisconsin (Cummings and Mayer, 1992). Interviews with resource professionals and literature review indicate no viable populations of *Ellipsaria lineolata* remaining within the Illinois River or its tributaries. To reintroduce this species, or other extirpated species, to the IR requires a means of reestablishing a source population. The source population should be a regional ecotype adapted to the water and climate of the area and also be of sufficient size to provide adequate numbers of individuals to establish a reproductively viable population in the river. With adequate water quality and the necessary fish host for completion of the mussel's life cycle, mussels which have been extirpated could be reestablished, restoring some of the mussel diversity formerly characteristic of the IR. This project directly meets the following objective for the butterfly mussel: "Experimental propagation, modeled after *Lampsilis higginsii* (Higgins Eye) efforts in the Mississippi, should be refined with other species

in other systems...and evaluated as an effective conservation action.” (Illinois Wildlife Action Plan, F: Research, Monitoring and Evaluation; p.101)

OBJECTIVES: The objectives of the proposed research are to:

- 1) **Investigate the suitability of Spunky Bottoms for butterfly mussel propagation by reviewing water quality and food availability data which has already been collected on site.** An alternate site proposed would be The Conservancy’s Emiquon Preserve. Since this grant proposal development, Emiquon has undergone extensive restoration activities and water has returned to the site. Suitable sites with dependable water levels have been identified and could be used if water levels diminish or water quality parameters fall outside parameters at Spunky Bottoms. Timeframe: May - June 2008. Estimated % of budget: 5
2. **Collect approximately 20-40 gravid female mussels from pool 19 of the Mississippi River.** Transfer mussels to Genoa national Fish Hatchery for host infestation procedure. Timeframe: July 2008. Estimated % of budget: 10.
3. **Propagate mussels with host fish from the Genoa, WI fish hatchery using two water quality treatments, aerated and unaerated, in 10 cages each at the TNC’s Illinois River backwater restoration site at Spunky Bottoms near Meredosia, IL** TNC’s Emiquon Preserve near Havana, IL may serve as a suitable alternate location for the project if needed. Timeframe: August 2008- June 2010. Estimated % of budget: 40
4. **Monitor and compare treatments of propagated mussels at project site (Spunky or Emiquon alternate).** Timeframe: August 2008-June 2010. Estimated % of budget: 30.
5. **Determine sites along the Alton reach of the Illinois River for mussel reintroduction using historic bed distribution.** Timeframe: April-May 2010. Estimated % of budget: 3.
6. **Reintroduce propagated mussels at determined sites along the Illinois River.** Timeframe: June 2010. Estimated % of budget: 2.
7. **Complete analysis of monitoring data to determine differences between propagation techniques.** Timeframe: June 1-October 1, 2010. Estimated % of budget: 5.
8. **Produce final recommendations and project report.** Timeframe: Due December 31, 2010. Estimated % of budget: 5.

EXPECTED RESULTS OR BENEFITS: The proposed propagation techniques have been successfully used on the Higgins Eye mussel and the proposed project will test the success of applying the techniques to another species of mussel as required in the IWAP (p. 101). Currently conservation professionals within the Upper Mississippi River basin have experienced some success using similar propagation techniques within main stem river and connected floodplain areas. However, certain realities of these systems such as flooding, current, sedimentation, and exotic species have been limiting factors to widespread success. If the techniques developed through this project prove successful, the process could be a model for other mussel species

propagation work in controlled backwater environments and will help restore mussel diversity to the Illinois River. Baseline information on growth and development of the butterfly mussel will be collected which can later be compared to historical data as well as provide a metric for future projects with this or other mussel species. The final deliverable will be a research paper on the techniques and results of this project that will be submitted for publication. Presentations on the methods and results of this research study will also be presented at scientific conferences.

This project will move Illinois closer to the statewide objective for mussels: maintain populations at all currently occupied locations and reestablish at 50% or more historic locations where suitable habitat persists or can be restored (Illinois Wildlife Action Plan, C; p.40). The Streams Campaign identified one of the priority actions as restoring populations of imperiled and extirpated aquatic animals, including reintroducing native species when decimating factors have been eliminated and natural recovery is unlikely (Illinois Wildlife Action Plan, Streams Campaign Action 4b; p. 63 and Illinois Wildlife Action Plan, F: Research, Monitoring and Evaluation; p.101).

APPROACH:

Objective 1: Investigate the suitability of the site for butterfly mussel propagation by reviewing water quality and food availability data which has already been collected on site. Project collaborators will review water quality data, water levels, and algal community composition collected by TNC staff and Western Illinois University staff in previous monitoring activities. The previously gathered data is not reflected in the overall project budget. TNC's Emiquon Preserve may act as an alternate project site if Spunky Bottoms is deemed unsuitable because of low water levels or other variables such as dissolved oxygen and food availability. Emiquon may be suitable to use as a backup site also in the event of a catastrophic flood overtopping of the Spunky Bottoms river levee system. This type of event would be highly unlikely given the fact that the current levee system is substantial and no flood overtopping has occurred at Spunky Bottoms since the levees were installed in the 1930's.

Objective 2: Collect approximately 20-40 gravid female mussels from pool 19 of the Mississippi River. Transfer mussels to Genoa national Fish Hatchery for host infestation procedure.

Female butterfly mussels will be collected from Pool 19 of the Mississippi River. There is a large population of these mussels at this location and the location is geographically similar, with approximately the same latitude and climate, to the proposed IR propagation and release sites. The shell of *E. lineolata* is noticeably dimorphic with the females generally being smaller in relation to males as well as being more swollen and inflated posteriorly (Parmalee and Bogan, 1998). From expert reports a substantial number of butterfly mussels can be found in shallow, off-channel sections of Pool 19 and they are easily located by "puddling". This method involves searching by tactile means in 3 to 4 feet of water. Secondary means of collection will be by brail bar towed behind a boat. Project staff, IDNR collaborators, and students from the Western Illinois University Kibbe Field Station will be assisting in the collection. Mussels will be collected between June and August when the butterfly is typically gravid. Adult gravid females will be transported to the fish hatchery at Genoa, WI with hatchery tank equipment from IDNR Fisheries. As part of the Higgins Eye recovery plan, personnel at this site have successfully completed the parasitic glochidial phase of the mussel life cycle.

Project staff will assist IDNR staff at the Havana Fisheries Field Station in the construction of twenty floating cage systems. Plans and a prototype have been acquired from the Genoa Fish hatchery and will be used in construction of the cages.

Objective 3. Propagate mussels with host fish from the Genoa, WI fish hatchery using two water quality treatments, aerated and unaerated, in 10 cages each at the TNC's Illinois River backwater restoration site at Spunky Bottoms near Meredosia, IL. . Known hosts for *E. lineolata* are green sunfish, freshwater drum, and sauger (Fuller, 1978). All these are locally abundant and also can be obtained from the hatchery certified VHS free. These fish will be infested at the Genoa hatchery and then transported to TNC's Illinois River backwater restoration site at Spunky Bottoms near Meredosia, IL (or the Emiquon alternative). The infested fish will be placed in cages held in the backwater lake adjacent to the IR. This provides a controlled environment where disturbance can be minimized and water quality conditions can be monitored. Ten cages will be placed in each of two treatments, aerated and unaerated. Cages will be secured by means of aircraft cable and up to six concrete anchors per cage. The aeration system will be secured similarly and buoyed by a PVC float. The areas chosen for the cage arrays is naturally isolated and secluded from strong winds by berms made from ditch spoil piled up from years of ditch maintenance.

After parasitic infestation and glochidial transformation is complete, which typically takes up to three weeks, host fish will be removed by project staff and released at the project site. The selected host species are already present at Spunky Bottoms and the proposed alternative site.

Objective 4. Monitor and compare treatments of propagated mussels at project site (Spunky or Emiquon alternate). One numbered cage will be selected by random number generation for each treatment and juvenile mussel survival will be monitored at the beginning and end of the growing season in May and October. Growth rates will be determined based on shell length using calipers. Mussels will also be weighed in grams using small field suitable scales. Relative weights (Wr) will be calculated and recorded for comparison to known wild population Wr from literature. Survivorship and growth rates will be compared between treatments. Growth rates of the propagated mussels will also be compared to rates established from the parent population. This will be completed during the two propagation years of the project.

Water quality parameters such as dissolved oxygen, total dissolved solids, temperature, pH, and turbidity will be measured and recorded using two Yellow Springs Instrumentation long term deployment eco-sonde systems. These systems will be cleaned and data downloaded to a lap top computer once every other month for the duration of the project. Project staff will compile the water quality data into table form for analysis and storage.

Objective 5. Determine sites along the Alton reach of the Illinois River for mussel reintroduction using historic bed distribution. During the final propagation season T. Hobson along with D. Corgiat and D. Sallee will consult historic mussel bed distribution records and confer with other resource professionals such as the Illinois Natural History Survey's Long Term Monitoring Program staff to determine a suitable site for the propagated individuals to be reintroduced.

Objective 6. Reintroduce propagated mussels at determined sites along the Illinois River. Once shell length has reached approximately 30 mm (about 2 years growth) individuals will be uniquely marked and placed at determined sites within the Alton Reach of the Illinois River for subsequent monitoring during the next season in July. Placement of the mussels will be accomplished through direct over board distribution. All

future monitoring will be conducted by TNC and IDNR staff outside the scope of this project. The site will be uniquely identified using hand held GPS in the field and recorded for return.

Objective 7. Complete analysis of monitoring data to determine differences between propagation techniques. Project collaborators will determine propagation success through analysis of data gathered throughout the project life. Success and or failure of the technique will be measured based on the number of individuals produced and their growth rates to determine differences between propagation techniques. Lessons learned through the project may ultimately benefit not only butterfly mussel on the Illinois River but other species of concern as well. Currently propagation success seen on the Mississippi River with Higgins eye mussel and select others has not been able to be duplicated on the Illinois basically because of the lack of trials and investigation.

Objective 8. Produce final recommendations and project report. T. Hobson along with assistance from project collaborators will compile data into paper and poster form for scientific presentation and review. The importance of this project is in determining the best approach to captive propagation in an isolated Illinois River backwater environment. If successful this approach can be duplicated at one of three similar sites along the Illinois. Proper presentation and review is key to understanding the process and disseminating information to conservation professionals throughout the region. Authors, contributors, and editors will include T. Hobson, D. Sallee, S. McClure, D. Perry, Doug Blodgett, D. Corgiat, and Jim Herkert. Paper presentations will be made at Freshwater Mollusk Conservation Society and Upper Mississippi River Conservation Committee meetings.

Emergency contingency plans: The river levee system was constructed at Spunky Bottoms in the 1930's and has never been over topped during a flood event. If this unlikely scenario presents itself the cages can be salvaged and the mussels, host fish, and cages can be transferred via hatchery truck to the Emiquon Preserve less than one hour away. River levels within one foot of the levee top and forecast rise will trigger the emergency transfer.

LOCATION: The Nature Conservancy's Spunky Bottoms Preserve is located in Sections 5-8, T2S, R1W and Sections 12-14, T2S, R2W, in Brown County, Illinois and is in Congressional Districts 18 & 20. The Preserve lies between a high bluff locally known as Spunky Ridge and the Illinois River, and is across from the U.S. Fish & Wildlife Service's Meredosia National Wildlife Refuge.

An alternate location, The Nature Conservancy's Emiquon Preserve is located in Sections 3,4,5,8,9,16,17, and 20, T4N-R4E, in Fulton County along the Illinois River.

PROJECT SCHEDULE:

2008

May T. Hobson & D. Perry spend 4 days @ Havana Field Station constructing 20 cages.

June T. Hobson, D. Perry & S. McClure to spend 2 days setting up the 20 cages at Spunky Bottoms Preserve.

June T. Hobson, M. Lemke & D. Perry spend 1 day to install water monitoring equipment.

July-August T. Hobson, D. Perry, S. McClure & M. Lemke of TNC and D. Sallee & D. Corgiat of IDNR spend 2 days collecting gravid female butterfly mussels on Pool 19 of the Mississippi River and transport to the Genoa hatchery. They will be assisted by volunteers from Western Illinois University (WIU)'s Kibbe Station and Rick Anderson of WIU.

August/September IDNR Hatchery truck picks up infested fish at Genoa fish hatchery and delivers to project site. T. Hobson, D. Perry, & S. McClure spend 1 day to place fish in cages at Spunky Bottoms Preserve.

October T. Hobson & D. Perry spend 1 day to release the host fish into project site waters.

November S. McClure & M. Lemke spend 1 day to download data, clean & calibrate monitoring equipment.

2009

January S. McClure spends 1 day to download data, clean & calibrate monitoring equipment.

March S. McClure spends 1 day to download data, clean & calibrate monitoring equipment.

May S. McClure spends 1 day to download data, clean & calibrate monitoring equipment.
T. Hobson & D. Perry spend 1 day to record and assess total mussel population count, size, and weight measurements for a randomly selected cage.

July S. McClure spends 1 day to download data, clean & calibrate monitoring equipment.

October S. McClure spends 1 day to download data, clean & calibrate monitoring equipment.
T. Hobson & D. Perry spend 1 day to record and assess total mussel population count, size, and weight measurements for a randomly selected cage.

2010

January S. McClure spends 1 day to download data, clean & calibrate monitoring equipment.

March S. McClure spends 1 day to download data, clean & calibrate monitoring equipment.
T. Hobson reviews literature and expert analysis of best locations for mussel re-introductions. Grant project team meets to review project and select sites for mussel reintroduction.

May S. McClure spends 1 day to download data, clean & calibrate monitoring equipment.
T. Hobson & E. Fatka spend 1 day to record and assess total mussel population count, size, and weight measurements for each cage.

June D. Corgiat of IDNR and T. Hobson, D. Perry & M. Lemke of TNC spend 2 days to mark and release mussels on selected historic bed sites on the Alton Reach of the Illinois River, located near the Spunky Bottoms Preserve.

June – December T. Hobson, D. Sallee, S. McClure, D. Perry, Doug Blodgett, D. Corgiat, and Jim Herkert will compile data and write final reports.

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IDNR staff Dan Sallee and Dean Corgiat are co-investigators on the project reviewing data for the project site and contributing professional experience. Sallee and Corgiat will also be involved in picking gravid female mussels on the pool 19 of the Mississippi. Sallee will accompany an IDNR hatchery truck in transporting host fish to the project site from Genoa Hatchery. Sallee and Corgiat will provide periodic review and oversight to the project as well as contributing to the final report paper.

Jim Mick and/or Havana field office staff will build cages. Mick will provide some project oversight and review.

LITERATURE CITED:

Illinois Department of Natural Resources. 2005. Illinois Comprehensive Wildlife Conservation Plan-Strategy (Illinois Wildlife Action Plan). Illinois Department of Natural Resources. 353 p.

Parmalee, Paul W., Bogan, Arthur E. The Freshwater Mussels of Tennessee. 1998. The University of Tennessee Press, Knoxville. 73-74 pp.

Whitney, Scott D., Blodgett, K. Douglas, Sparks, Richard E. 1997. A Comprehensive Mussel Survey of the Illinois River. A Special Draft Bulletin of the Illinois Natural History Survey. Illinois Natural History Survey, Champaign, IL. 3p. and C-13p.

Cummings, Kevin S., Mayer, Christine A. 1992. Freshwater Mussels of the Midwest. Illinois Natural History Survey, Champaign, IL. 106 p.