Federal

Region 3 Section-6 Grant Proposal
Final 6-7-06

Title: Biology, Propagation, and Reintroduction of Northern Riffleshell (*Epioblasma torulosa rangiana)* and Clubshell (*Pleurobema clava)*

Principal Investigator: Thomas Watters, PhD, Department of Evolution, Ecology and Organismal Biology, Ohio State University, Museum of Biological Diversity, 1325 Kinnear Road, Columbus, Ohio 43212 (614-292-6170 (v), 614-292-7774 (f))

Duration of Project: Three years

1 - Need: This project is being undertaken to bolster existing populations and establish additional populations of two endangered mussel species -- the Clubshell and Northern Riffleshell. These species have declined greatly over the past century and currently occur in 5 % of their historic range. Remaining populations are highly fragmented (USFWS 1993).

The clubshell was once found throughout most of the Ohio River system and in watersheds within the states of Indiana, Kentucky, Michigan, Pennsylvania, and West Virginia. It is considered extant in 13 streams: West Branch (MI, OH), Fish Creek (IN, OH), Tippecanoe River (IN), Green River (KY), Little Darby Creek (OH), Elk River (WV), Allegheny River (PA), Hackers Creek (WV), Pymatuning Creek (OH), French Creek (PA), Conneaut Outlet (PA), Conneauttee Creek (PA), and LeBoeuf Creek (PA) (USFWS 1994).

The Northern Riffleshell historically had a similar range as the clubshell, but it ranged further north into the Detroit and St. Clair Rivers, as well as tributaries of Lake Erie and Lake St. Clair. It currently occurs in seven U.S. streams: Green River (KY), French Creek (PA), LeBoeuf Creek (PA), Alleghany River (PA), Detroit River (MI), and Big Darby Creek (OH) (USFWS 1994). Populations numbers are such that finding gravid females is only likely in French Creek (T. Watters, pers. comm. 2003).

One recovery plan addressing both of these species was published in 1994 (USFWS 1994). This recovery plan, and the National Strategy for the Conservation of Native Freshwater Mussels (National Native Mussel Conservation Committee 1998), calls for research into these species' basic biology, propagation, and reintroduction into their historic range.

2 -Objective: The overall goal for this project is to set the course for achieving reclassification to threatened and assist in the recovery of these two species. The reclassification criterion is to establish viable populations of each species in 10 drainages; these populations should include both peripheral and central populations to maintain whatever fraction of original genetic variability remains. Expert-identified priority-one recovery activities for both the clubshell and northern riffleshell include research on propagation and supplemental stocking and reintroduction, as per the recovery plan. The proposed project will propagate both species in an existing research facility for population augmentation and reintroduction. The numbers to be propagated, augmentation and reintroduction sites, and type of populations will be determined in conjunction with state and federal agencies, as per the Recovery Plan Task 3.3.

The recovery plan for these species calls for the reintroduction of the species to suitable areas (Recovery Task 4), including the release of metamorphosed juveniles (4.23) and infested fishes (4.24). The specific objectives of this project are to: (1) Establish a reproductively viable population of clubshell in Little Darby Creek (OH), Fish Creek/St. Joseph River (OH) and the Vermilion River (IL) through propagation and release of infested fishes into suitable habitats, and; (2) Establish a reproductively viable population of northern riffleshell in Big Darby Creek (OH), Fish Creek/St. Joseph River (OH), and the Vermilion River (IL) through propagation and release of infested fishes into suitable habitats. When the objectives of this project are achieved, a portion of the reclassification criteria will be fulfilled with approximately five viable clubshell

populations and five viable northern riffleshell populations across each species respective ranges.

3-Expected Results or Benefits: This proposed project will bolster existing populations and reestablish the species in historic sections of their range, resulting in the potential to reclassify these species to threatened status. Thus, the expected results are directly related to the expert-identified activities of supplemental stocking and reintroduction. Quantifying numbers of juvenile mussels that will be introduced back into the wild is difficult. Numbers will depend on a multitude of factors including degree of host infestation, juvenile mussel transformation, and number and quality of augmentation and reintroduction sites selected. Additional benefits generated from this project would include improved and maintained habitat quality and an increased knowledge of unionid abundance and diversity in the respective drainages proposed for augmentation and reintroduction.

4-Approach: A reintroduction plan (attached) has already been developed by The Ohio State University (G. Thomas Watters and Kody F. Kuehnl) for the augmentation (OH, IL) and reintroduction (IL) of clubshell and northern riffleshell. The reintroduction plan includes the following: (1) species population trends and biology; (2) present and future threats to conservation; (3) a list of potential sites for augmentation and reintroduction in each of the cooperating states (Ohio and Illinois); (5) a plan for preserving the genetic variation at augmentation and reintroduction sites; and (6) monitoring the survival and growth of juveniles at these sites on the long-term. Cooperating states will continue to provide leadership in determining additional potential augmentation and reintroduction sites, including conducting any necessary mussel surveys, water quality analyses, habitat assessment and management, analyses of other threats, and other necessary field tasks.

This proposal seeks funding for a dedicated staff person to propagate the mussels at the Freshwater Mussel Conservation Facility (FMCF) and assist in collecting and planting of host fishes and gravid female mussels. The project will be overseen by Dr. Tom Watters (Project Leader/614-292-6170/watters.1@osu.edu) and all activities of augmentation and reintroduction of clubshell and northern riffleshell will be supervised by Dr. Watters. In addition, the proposal requests funding for the states of Ohio and Illinois for their work in identifying sites for populations' augmentation and reintroduction, water quality testing, habitat management and other associated tasks. In addition funds have been allocated to purchase equipment in the form of two modular aquatic habitat units for the purpose of identifying additional hosts and propagating juveniles of both clubshell and northern riffleshell. This project is not part of an existing section 6-funded program.

During the first year of the project any remaining documentation will be completed (e.g. obtaining appropriate permits for surveying, collecting tissue samples of the target species, etc). In addition, the FMCF will be propagating juvenile mussels using the surrogate species listed in the reintroduction plan to further strengthen propagation protocols and develop the necessary technology and knowledge to facilitate the propagation of clubshell and northern riffleshell. The FMCF will be determining the proper conditions for the rearing of juvenile mussels, acquiring host fish, and preparing the facility for clubshell and northern riffleshell importation. Genetic characterization of the existing populations of clubshell will be determined by Leetown Science Center (USGS) using micro satellite markers previously identified for clubshell. Following genetic analysis, source sites will be selected as identified in the reintroduction plan. Northern riffleshell will be collected from the Allegheny River (PA), brought to the FMCF, and spawned in the late summer and fall. Additionally, if gravid clubshell females are located during efforts to

collect mantle clips and test for water and habitat quality in Ohio, they will be collected and brought to the FMCF. A year-end completion report will be prepared by Tom Watters and Kody F. Kuehnl (Lead OSU Researcher), reviewed by the John Navarro (ODNR Division of Wildlife – 614-265-6346) and submitted to USFWS Federal Assistance.

During year two of the project, the Illinois Department of Natural Resources (ILDNR) will identify suitable habitats in Illinois and will stringently sample these sites for specific localities for augmentation and reintroduction of clubshell and northern riffleshell. Mussel richness and diversity will be determined at these sites to ensure healthy populations of other unionids exist. In spring and early summer, gravid female clubshell will be collected and brought to the FCMF; depending on the number of gravid females collected, males and non-gravid females may also be collected in order to ensure sufficient numbers of infected fish, juveniles, and sub-adults for release. Larvae from both species will be collected and used to infect host fish. Three methods will be used for population augmentation and reintroduction in the Fish Creek/St. Joseph River and Darby watersheds in Ohio and the Vermilion watershed in Illinois: release of infested fishes, release of newly metamorphosed juveniles, and release of juveniles reared in captivity. It is believed that reared juveniles have the greatest potential to survive once released, but are most difficult to grow to that stage. Conversely, release of infested fishes and newly metamorphosed juveniles is relatively easy, but these techniques probably will have the greatest mortality in the wild. For this reason, we advocate a balance of the three approaches. Methods to monitor success will also be employed, such as genetic markers and cages. Test cages will be made and used to monitor levels of vandalism and sedimentation in-stream. Northern riffleshell will be spawned in the fall. All propagation activities will be performed by FMCF staff. Additional juveniles may be available for use by states other than

Ohio and Illinois in years two and three. A year-end completion report will be prepared by G. Thomas Watters and Kody F. Kuehnl, reviewed by the ODNR and submitted to USFWS.

During year three of the project, controlled propagation of clubshell and northern riffleshell will continue. Infested fishes and juveniles produced over the winter will be released into the augmentation and reintroduction sites in Ohio and Illinois. In spring and early summer, additional gravid female clubshell will be collected and brought to the FCMF; depending on the number of gravid females collected, males and non-gravid females may also be collected in order to ensure sufficient numbers of infected fish, juveniles, and sub-adults for release. Larvae from both species will be collected and used to infect host fish collected by ODNR and ILDNR. The three release mechanisms previously described will be used to augment populations of both species in the Fish Creek/St. Joseph River and Darby watershed in Ohio for a second time (if necessary) and to reintroduce both species to the Vermilion River in Illinois. Methods to monitor success will also be employed, such as genetic markers and in-stream cages. Success of the first year's augmentation efforts will be measured. Additional juveniles may be available for use by states other than Ohio and Illinois in years two and three. A project-end completion report will be prepared by G. Thomas Watters and Kody F. Kuehnl, reviewed by the ODNR and submitted to USFWS.

Evaluating the success of the three methods proposed in this project in terms of survival and growth of the larvae and juveniles presents challenges. Because mussels live for several years buried in the substrate and are exceptionally small as juveniles (<250 μm), it is unlikely that juveniles released to the stream via infested fishes or as recently metamorphosed juveniles could be recovered within the three year period of the study. Thus, in order to help measure the success of this proposed project, infested fishes will be kept in cages within the stream until the

glochidia metamorphose. In addition, juveniles propagated at the FMCF may also be caged at each site and monitored during years two and three of the project. The cages will be examined during the three year period to determine if the mussels are present, alive, and growing. We advocate several cages to minimize the potential of cage loss. Neither species of mussel will reach sexual maturity during the three year period. We propose caging a subset of the released mussels at both reintroduction and augmentation sites. At augmentation sites in particular it will be necessary to employ cages to determine if juveniles are the result of propagation or natural recruitment.

5-Location: Propagation activities outlined here will be conducted at the Columbus Zoo & Aquarium Freshwater Mussel Conservation Facility, located at Shawnee Hills, Ohio. Collection of host fishes and gravid mussels will occur within the drainages selected for augmentation or reintroduction. In the event gravid female mussels of the target species cannot be obtained from the augmentation/reintroduction sites, the closest genetically related individuals will be used as broodstock for augmentation and reintroduction (previously identified by USGS Leetown Science Center).

Release of infested fishes and juvenile mussels will occur in the Battelle-Darby MetroPark, Franklin County, OH and Fish Creek, Williams County, OH for northern riffleshell. Release of infested fishes and juvenile mussels will occur in Madison County, OH and Fish Creek, Williams County, OH for clubshell. The sites for release of both target species in the Vermilion watershed will be determined in year two of the project by the ILDNR using the criteria outlined in the reintroduction plan.

6-Estimated Cost: During the **first year** of the project, the state of Ohio is budgeted **$54,032** (Federal Share) to rear juveniles of surrogate species, and determine augmentation and reintroduction sites, including conducting any necessary mussel surveys, water quality analyses, habitat assessment and management, analyses of other threats, and other necessary field tasks. The Ohio State University will be receiving a grant agreement from the state of Ohio to conduct much of this work. Under this agreement, equipment, including two modular aquatic habitat units will be purchased as previously identified in the approach section of this document. In year one, the Illinois Department of Natural Resources (DNR) conduct site-related activities, described above for Ohio.

During the **second and third years**, the state of Ohio is budgeted **$44,197** (Federal Share) and **$44,162** (Federal Share) to: 1) propagate the Clubshell and Northern Riffleshell for population augmentation and reintroduction using the three methods, 2) collect host fishes and gravid female mussels, and 3) plant infected fishes and juvenile mussels. In years two and three, Illinois will assist with collecting host fishes and gravid female mussels and planting infected fishes and juvenile mussels in Illinois. In addition, any remaining site analyses or habitat management will be conducted during these years.

A 10% state match has been included in this budget because it is a multi-state proposal. Dr. Thomas Watters is providing direction and oversight for this proposed project; a portion of his salary and benefits will be used as match for Ohio because they are paid for by the Ohio Division of Wildlife (DOW).