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Draft White Paper

Development of Translocation Protocols for Conservation and Restoration of Freshwater Mussels in the Ohio River Drainage

For

Ohio River Valley Ecosystem Team

By

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I. PROJECT PURPOSE

The primary purpose of this paper is to provide a justification and rationale to translocate adult freshwater mussels in the Ohio River drainage to achieve recovery of imperiled mussel species.

II. OBJECTIVES

- Reintroduce imperiled mussel populations in historical streams of occurrence through the translocation of adult individuals.
- Augment imperiled mussel populations with translocated adult individuals.
- Promote and effect the recovery of federally listed mussel species through these reintroduction and augmentation activities.
- Preclude the need to list other imperiled mussel species.
- Facilitate 1) buy-in from concerned partners, 2) coordination among agencies, and 3) acquisition of permits for activities covered by this document.

III. INTRODUCTION

State and federal recovery plans for endangered species identify propagation of juveniles and translocation of adults as strategies to achieve recovery; thus, both cultured juveniles and adults are being used to augment or reintroduce populations into streams targeted for species recovery. For example, from 1997-2006, federal and state facilities released more than 7 million juveniles of more than a dozen endangered species, into streams throughout the Southeast and Midwest. Survival of laboratory-reared juveniles 1-3 years of age in the wild already has been documented from these releases. Recent translocations of hundreds of adult mussels of various common species into the French Broad River, TN, also have proven successful; i.e., their survival has been high, with reproduction and recruitment documented at release sites [J. Layzer, U.S. Geological Survey (USGS), unpub. data 2002-2004]. Recent relocations of adult mussels in the St. Croix River, MN and WI, have also proven successful (Cope et al. 2003).

Populations of some imperiled mussel species in the Ohio River drainage currently are large (>10,000), and likely could support the collection and translocation of some adults to other streams. However, several key questions must first be answered prior to translocation of adults from the parent population. First, how large is the parent population? An estimate of population size is critical in determining the number of adults that can reasonably be removed, or harvested from the donor population without causing it to decline. Second, how many individuals should be released at a site to ensure that the translocated population constitutes a minimum viable population (MVP)? Determining an appropriate number of individuals to translocate to a site is critical to the future viability of the newly established population (Sarrazin and Legendre 2000; Delgado et al. 2004). Various demographic parameters should be considered such as the age structure and sex ratio of individuals to achieve viability. Should adults, juveniles, or a combination of cohorts be released? These questions are yet unanswered for freshwater mussel species; therefore, conducting research and pilot studies to fill in such data gaps is important for

the continued development of science-based conservation programs for freshwater mussels in U.S. streams.

IV. BACKROUND & JUSTIFICATION

Several streams in the Ohio River drainage now contain large and viable populations of imperiled freshwater mussels. For example, the Green, Licking, and Salt rivers, KY, contain healthy populations of the endangered fanshell pearlymussel (*Cyprogenia stegaria*). The Allegheny River, PA, contains large populations (>1 million individuals each) of two federally endangered species, the northern riffleshell (*Epioblasma torulosa rangiana*) and clubshell (*Pleurobema clava*). This same river and its tributary French Creek contain large populations of the rayed bean (*Villosa fabalis*), a federal candidate species. Historically, stream habitat and water quality in these streams was degraded from various anthropogenic impacts. However, in recent decades many of these impacts have been identified and ameliorated. Recent surveys in these streams have documented reaches of recovery for many species of mussels and fish. Hence, these streams and others in the drainage now contain excellent habitat and water quality for mussels, and environmental conditions appear suitable for release of propagated juveniles and adults. Populations should be reintroduced in some streams within the historical ranges of these species. Species with small and unviable populations should now be augmented in certain instances with released juveniles and adults to increase their population sizes and facilitate their restoration and long-term viability. Establishment of reintroduced and augmented viable populations throughout the Ohio River drainage meets with objectives outlined in state and federal recovery plans to restore the above mentioned species.

V. PROJECT DESCRIPTION

Translocation of Adult Mussels

It is likely that hundreds of adults/year of *Cyprogenia stegaria*, *Epioblasma torulosa rangiana*, *Pleurobema clava*, and *Villosa fabalis* could be translocated from their respective parent populations to streams targeted for population restoration. We believe this can be done with little to no effect on population size and viability of the parent population. However, development of scientifically defensible translocation protocols will depend on estimation and monitoring of various population dynamic parameters, such as population size, population growth rate, cohort structure, and recruitment rates. These data are critical to the development and implementation of scientifically defensible removal rates for adult mussels. Data on mussel population dynamics will need to be incorporated into a model to estimate and guide how many individuals can be removed to prevent over-collection and decline of the source population.

Modeling and determination of annual removal rates of adult mussels should be based on conservative estimates of the primary population parameters, and on a policy of

harvesting mussels at or above a "no-effect-threshold." The no-effect-threshold is that number which can be safely removed from a population without significantly affecting the modeled population trajectory over a specified time period. Such analyses are typically conducted using population modeling computer programs. Based on typical population growth rates for freshwater mussels, the number of individuals harvested annually at a no-effect-threshold would likely represent <1% of local population size. However, assuming a source population can sustain some level of harvest other factors should then be considered pertaining to the receiving population. Major factors to consider include habitat quality, water quality, localized and upstream threats, and genetic compatibility.

We anticipate that hundreds to thousands of individuals would need to be translocated to a restoration site over a 3-5 year period to create a founding population of sufficient size to constitute a demographically and genetically viable population. Based on published criteria, the effective population size (N_e) of many species is approximately 10% of the census size (Beissinger and McCullough 2002). For example, if an effective population size is chosen to preserve 90% of a population's genetic diversity over a 100-year time frame, then a target census size needs to be established to achieve the stated population restoration goals. Hence, it is critical that sufficient individuals are translocated to establish a viable population, and that future monitoring to demonstrate success is facilitated. Recent translocation projects have demonstrated that success is contingent upon a high number of mussels being relocated (e.g., typically 100s to 1000s) to a target site having similarity of ecological conditions (e.g., habitat, fish hosts) to the originating environment (Cope et al. 2003). Furthermore, such translocation strategies help ensure that the recipient population contains enough individuals with sufficient genetic variation that are capable of adapting to a range of environmental conditions in the receiving stream.

Population Monitoring and Analyses

Source populations must be monitored to ensure that demes selected for removal of adults for translocation are not declining as a result of removal activities. It is critical that a population monitoring program be incorporated into management plans for species targeted for translocation. Population monitoring must occur at both the source population and the receiving population to ensure that translocations are indeed successful. Basic population parameters such as population size, population growth rate (λ), cohort structure, survival, and recruitment should be continually estimated and monitored. Data needed to estimate the above parameters can be obtained by employing a combination of methods, such as quadrat sampling and mark-recapture of tagged adults and released juveniles (Villella et al. 2004).

VI. COORDINATION AND POLICY ISSUES

Translocating mussels, which are generally considered state resources, will require coordination with and approval from the state game and fish agency (or agencies

when interstate translocations are undertaken). Appropriate field offices of the U.S. Fish and Wildlife Service (Service) will also need to be contacted for all translocation activities and consulted with under Section 7 of the Endangered Species Act when federally listed species are involved. Translocation activities between Service regions will require coordination with managers in regional offices. In all cases involving the translocation of mussels, appropriate permits will need to be obtained from state sources for all species involved and from the Service for federally listed species. Having agency buy-in for the recovery activities outlined in this document should facilitate coordination among agencies and acquisition of permits for translocation projects.

VII. FUTURE DIRECTIONS

Translocation of adult mussels can provide biologists with an additional tool to help achieve recovery of imperiled mussel species. However, an important first step will be to characterize population dynamics of the source populations. The data from such field studies can then be used for population modeling to make projections and recommendations about appropriate removal rates at source populations, and the target population sizes to be established at restoration sites. These efforts will require a coordinated effort among project partners and the development of species specific translocation management plans.

VIII. LITERATURE CITED

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