

WINGED MAPLELEAF (*Quadrula fragosa*)

**PLAN FOR CONTROLLED PROPAGATION,
AUGMENTATION, AND REINTRODUCTION**

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The following reviewed this plan and provided helpful comments:

U.S. Fish and Wildlife Service

U.S. Army Corps of Engineers

National Park Service

U.S. Geological Survey

Arkansas Game and Fish Commission

Minnesota Department of Natural Resources

Wisconsin Department of Natural Resources

Macalester College

Southwest Missouri State University

University of Minnesota

Welch/Harris Inc.

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INTRODUCTION

The range of the winged mapleleaf has been reduced by more than 90 percent; the species is presently known only in the St. Croix River (Wisconsin and Minnesota) and Ouachita River and tributaries in Arkansas. At the time of listing in 1991, the species was considered to be endangered as it was eliminated from nearly all of its original range, the remaining population in the St. Croix River was vulnerable to catastrophic stochastic events, reproductive success was threatened by low population numbers, and changes in land use practices within the watershed were anticipated. Since that time, the other known population was discovered in Arkansas.

A more recent threat to native mussels on the St. Croix/Upper Mississippi River system is posed by non-indigenous zebra mussels (*Dreissena polymorpha*). Dense zebra mussel colonization on native mussels has had a severe impact on native mussel communities in the Upper Mississippi River system. Currently zebra mussels occur only in the lower reach of the St. Croix River, but zebra mussel reproduction is evident and the species is expanding its range upstream (Karns 2002). Consequently, zebra mussels are a major concern to the well-being of the winged mapleleaf.

The U.S. Fish and Wildlife Service's (Service) controlled propagation policy (Policy) (USFWS 2000) acknowledges the role of propagation for threatened and endangered species recovery and provides guidance for the establishment of propagation as a recovery strategy. This plan was developed to meet the purpose and intent of that Policy.

PURPOSE, GOAL, AND OBJECTIVES

The purposes of captive propagation, augmentation, and reintroduction are to:

- 1) reduce or alleviate risk of extinction,
- 2) restore extirpated populations, and
- 3) provide for recovery and the potential for delisting.

The goal of this augmentation and reintroduction (A/R) program is to restore viable winged mapleleaf populations to appropriate reaches of historical habitat through augmentation of existing populations or reestablishment of extirpated populations. The objectives of this plan are to:

- 1) establish basic protocols for propagating winged mapleleaf,
- 2) communicate and coordinate among partners and the affected public before relocation of wild stock or release of hatchery stock to the wild, and
- 3) facilitate population establishment within its historic range.

JUSTIFICATION FOR CONTROLLED PROPAGATION, AUGMENTATION, AND REINTRODUCTION

Historically a wide-ranging species, the last remaining reproducing population of winged mapleleaf now is restricted to a 12-mile reach of the St. Croix River. A few individuals have been found in the Ouachita River and tributaries in Arkansas, although population numbers do not appear to be at viable levels. This species' range has been reduced severely and the life cycle for this freshwater mussel precludes quick recolonization of areas from which they have been extirpated. Therefore, augmentation and reintroduction (A/R) are crucial tools to save the species from extinction.

RELATIONSHIP TO RECOVERY PLAN

Reintroduction of the species into its historical range is necessary to recover winged mapleleaf. The Winged Mapleleaf Recovery Plan (Recovery Plan) requires that five discrete and viable populations in at least three tributaries of the Mississippi River drainage basin must be established to recover the species (USFWS 1997). The Recovery Plan also states that further analyses may indicate the need for more than five populations "to maintain the species" and may resolve "the optimal geographic distribution for those populations."

The recovery plan calls for several tasks to facilitate the reintroduction and conservation of the species. The current status of selected tasks is shown below:

Task 2C1. Reproductive phenology: Determine the phenology of reproduction.

Status: The reproductive phenology of the winged mapleleaf in the St. Croix River is now well understood. For example, in 2003 the recovery team was able to recommend a specific range of dates during which to search for gravid winged mapleleaf. As a result, a sufficient number of gravid females were found and used to carry out fish host research successfully.

Task 2C2. Glochidial host: Identify the glochidial host(s).

Status: A relatively large number of gravid females were found in the fall of 2003. As a result, researchers with the Service, University of Minnesota, Macalester College, and U.S. Geological Survey (USGS) documented successful transformation of winged mapleleaf glochidia on blue catfish (*Ictalurus furcatus*) and channel catfish (*I. punctatus*). Transformation on these two species was significant enough to indicate that both species may be useful for artificially propagating the species.

Task 4: Reestablish *Q. fragosa* populations in historical range.

Task 4A. Translocation:

Task 4A1. Translocation protocol: Evaluate translocation techniques and establish a translocation protocol.

Status: No translocation protocol has been developed for winged mapleleaf. Since 2000, the Service and partner agencies have carried out extensive work on the translocation, propagation, and reintroduction of Higgins eye pearl mussel (*Lampsilis higginsii*) (Mussel Coordination Team 2003). We are proposing to adapt the techniques that have been developed and refined for Higgins eye and other mussel species nationwide for the propagation and translocation of winged mapleleaf.

Task 4A2. Suitable habitat: Identify rivers within the historical distribution of *Q. fragosa* which have suitable physical, chemical, and biological habitat for reintroduction of *Q. fragosa*. Give priority to the following factors when selecting translocation sites:

a) Rivers close to the St. Croix River with similar environmental and climatic factors to which the St. Croix River population is adapted and capable of supporting new populations that may function as a metapopulation.

b) Rivers with sufficient long-term protection (such as mussel sanctuaries, state or National parks) to qualify under the guidelines for population habitat protection in Task 5C.

c) Rivers at low risk from colonization by *Dreissena* spp.

Status: The Service's Twin Cities Field Office has recently begun to identify streams within the historical range of winged mapleleaf whose species composition, habitat, and water quality likely are conducive to supporting a reintroduced population of this species. The Service will consider the factors listed above in addition to other factors when identifying suitable reintroduction sites.

Task 4B. Mussel culture and propagation:

Task 4BI. in situ vs. ex situ: Evaluate in situ vs. ex situ approaches to recovery and develop methods consistent with the findings.

Status: As stated above, the Service and its conservation partners have developed significant expertise in mussel culture and propagation through their work with Higgins eye and other mussel species. The methods that have been used with evident success for these species have included a combination of ex situ and in situ techniques – fish are infested with glochidia in a propagation facility and glochidia are allowed to complete their transformation in the river on caged or free-swimming fish. These techniques are proposed here for winged mapleleaf.

PARTNERS

In addition to the Service's Ecological Services and Fisheries Divisions, the USGS, National Park Service, University of Minnesota, Macalester College, Southwest Missouri State University, and states of Minnesota, Wisconsin, and Arkansas have been cooperating in studies of life history, genetics, and in developing holding and propagation technology for winged mapleleaf. Additional parties will be involved as propagation work continues; a partial list of partners in mollusk conservation efforts can be found in Appendix I below.

DEFINITIONS

Augmentation

Augmentation describes the increase in numbers of a mussel species within a defined area of habitat through the transplantation of adults from other locations or through the release of hatchery-propagated individuals. Augmentation is appropriate when the population size of a listed species is minimal within an occupied area (i.e., the available habitat is deemed suitable for a higher density of individuals) and/or the population is experiencing recruitment failure. It is also appropriate where the species may be absent within apparently suitable habitat that is contiguous with and accessible to occupied habitat (i.e., expansion). As defined in this plan, augmentation includes this potential for limited expansion to nearby stream reaches, absent any dispersal barriers. Augmentation of existing populations generally will be considered when the Service and its partners have established that the conditions that led to the decline of the species have been eliminated or improved (e.g., water chemistry, flow, etc.) to the extent that populations are likely to grow and persist.

Augmentation increases the likelihood of population success for spawning, fertilization, host fish infestation, and, ultimately, recruitment within sparsely occupied habitat. It may be used to expand the range of a species within contiguous habitats accessible to existing populations, reducing the likelihood of extirpation due to localized catastrophic events. The potential for augmentation with winged mapleleaf from existing populations is limited, particularly in the Ouachita River system, which has low numbers of surviving individuals. In addition, augmentation with hatchery produced juveniles carries the potential of disease introduction and/or genetic swamping.

Controlled Propagation

Controlled propagation references the production of individuals, generally within a managed environment, for the purpose of augmenting a wild populations, or reintroduction to the wild to establish new populations. Controlled propagation includes the infestation of fish to be released at relocation sites as well as infestation in the lab and subsequent transformation of juveniles.

For the winged mapleleaf, controlled propagation serves to increase survival during a life stage that experiences poor survival in the wild. Increasing the number of glochidia that come into contact with host fish will increase the number of juveniles that transform. Subsequently placing these juveniles into suitable habitat further increases their chances of survival.

Reintroduction

Reintroduction describes the establishment of adult or juvenile winged mapleleaf into historically occupied stream reaches where the species no longer occurs and where we do not expect natural immigration from extant populations. Reintroductions may be accomplished by transplanting adults from extant populations or through the release of hatchery-propagated individuals. The reintroduction of winged mapleleaf into areas of historical habitat will be considered when the Service and its partners have established that the conditions that led to the

extirpation of the species have been eliminated or improved (e.g., water chemistry, flow, etc.) to the extent that populations are likely to grow and persist.

POPULATION AUGMENTATION OR REINTRODUCTION VIA CONTROLLED PROPAGATION

Only limited attempts at controlled propagation of winged mapleleaf have been made while conducting host fish identification trials. Therefore, although the methods proposed here for winged mapleleaf have been used rather extensively with other endangered species, we will consider propagation of winged mapleleaf as experimental until initial trials are successful. Each action carried out under this plan, including initial trials and subsequent reintroduction attempts, will require detailed planning before issuance of appropriate permits. In general, any party wishing to conduct controlled propagation of winged mapleleaf must provide a detailed plan to the Service.

Site Plan

Partners (including the Service) wishing to plan, sponsor, or conduct specific A/R actions must obtain all necessary state and federal permits and produce a Site Augmentation/Reintroduction Plan (Site Plan) before conducting any activities. Site Plans for potential A/R activities will be developed in cooperation with and distributed to the appropriate Service Field and Regional Office(s) before the propagation and A/R season. Approval of the Site Plans by the Service is necessary before conducting any A/R activities. The Service's Twin Cities (MN) Ecological Services Field Office and, outside of Minnesota, the local Ecological Services Field Office shall approve each site plan before its implementation. Appropriate National Environmental Policy Act (NEPA) and Endangered Species Act (ESA) section 7 requirements must be met prior to implementation of a site plan. Although state permits will be required, the Service Field Offices should fully coordinate their review of each Site Plan with relevant state and local agencies, other interested parties, and other federal agencies. Collection of gravid females, successful production of progeny, number of progeny produced, etc., are never certain, but Site Plans should include as much information as possible. At a minimum, they must include the following:

Justification

- provide an outline of the expertise of site coordinator and implementation team, description of facilities and proposed methodology, source of stock (fish and mussels), and disposition of progeny;
- provide justification for the work, including benefits to the species, likely impacts to source populations and to mussel communities and habitats at reintroduction sites;
- describe all necessary precautions to be taken to prohibit the potential introduction or spread of diseases and parasites into controlled environments or suitable habitat and to minimize the likelihood of killing or harming wild individuals during A/R;
- describe how activities will be conducted so as to prevent the escape or accidental introduction of individuals outside of their historical range;
- describe fish management guidelines for any fish to be used for propagation and how those

guidelines would comply with state regulations (e.g., use of disease-free fish) and allow for the conservation of native fish stocks.

- include an Alternatives Analysis (see Alternatives Analysis section) and an explanation as to why A/R is necessary at the site; and
- include geographic (spatial) and quantitative objectives for winged mapleleaf at the A/R site.

Site Selection

Sites for A/R activities will be selected based on the historical and current distribution of the species; habitat conditions; and past, present, or future threats (including probable future projects, such as bridge reconstruction or bank revetment). Additionally, the current diversity at the site and the interests of the affected states and landowners will be considered. Potential sites will be prioritized by the recovery partners using these criteria. Selected sites should be used and monitored for a period of at least 10 years or until there is evidence of success or failure. Concentrating efforts at a site will reduce monitoring costs and facilitate genetic modeling (see Genetic Considerations section). If cages are to be used for propagation, sites should be tested to ensure suitability (i.e., the location is sufficiently protected to avoid being washed out or sedimented). In the Site Plan, include:

- exact location(s) where animals are to be introduced;
- status of the winged mapleleaf at the A/R site;
- if winged mapleleaf have declined significantly or been extirpated from the site, explain likely reasons and evidence that those factors are no longer operating, as well as reasons for the lack of natural colonization of the site, and how these factors might affect the long term viability of the species at the site.;
- relationship of the A/R site to other populations of the target species;
- current habitat conditions at the A/R site;
- baseline conditions: describe the habitat conditions and existing populations of other mussel species prior to A/R;
- timing of pre-project data collection ;
- suitability of the site for cage propagation, if using cages;
- possible limiting factors at the A/R site, including invasive species (e.g., zebra mussels);
- age and disposition of animals to be released (adults or juveniles, hatchery-produced or wild); and
- source of the stock of fish and mussels (location and drainage), and justification for using this location.

Affected Parties

As stated above, the Service will consider A/R activities to be individual experiments. To protect genetic integrity, biological diversity, and to avoid conflicts, all A/R activities will be coordinated with all affected recovery partners (i.e., Service field and regional offices, other affected federal agencies, state agencies, riparian landowners, other potentially interested and affected members of the public, such as including adjacent riparian landowners, water

appropriators, recreational user groups, hydropower facilities, among others). The Site Plan should identify all partners and affected entities, including:

- cooperating and responsible partners, and
- identification of potentially interested and affected members of the public.

In addition, the Site Plan will describe how contact will be made with affected parties, who is responsible for the contact, and whether public meetings will be planned.

Budget

Provide cost and staffing estimates for implementation and identify likely sources of funding. Determine the expected roles of each involved party, including the Service and states. The budget analysis should also address, if possible, contingencies for each phase of A/R, should the needed funding not be available.

Monitoring

As A/R is experimental in nature a monitoring regime is critical to determine its success and continued feasibility. Each site at which A/R is conducted should have a plan developed for monitoring. At a minimum, the monitoring plan should consist of the following:

- Explicit monitoring goals--each cohort of juvenile mussels and associated community parameters at A/R sites will be monitored annually for 3 years, beginning the 3rd year after transformation, and again after year 10. Goals should include quantitative components and be statistically comparable across years.
- Definition of success—enumerate criteria by which success will be evaluated at the site (i.e., number of surviving individuals, age structure, evidence of reproduction, persistence through time);
- Observations--include a record of detailed notes of life history observations, fecundity, survival, mortality, water chemistry, seasonality, identity of wild individuals used for propagation, and any other conditions/observations important to successful propagation of the species;
- Reporting--monitoring reports will be prepared and distributed to all affected partners and potentially affected parties identified in the Site Plan.
- Responsibilities-- a description of the division of monitoring responsibilities among the partners

Additional Information

- a copy of all appropriate permits;
- any other pertinent information.

Reporting

Recovery partners conducting hatchery propagation studies, A/R releases, or A/R monitoring

studies will provide an annual report of activities to the Service¹ and other involved partners, including:

- a brief description of their propagation and/or A/R program, including objectives and status;
- list of cooperators, if any;
- activities conducted or obstacles to achieving monitoring, propagation, or reintroduction efforts; and
- a brief description of the status of augmented or reintroduced populations, if any.

Alternatives Analysis

The following alternatives should be considered in developing Site Plans:

Controlled Propagation

Controlled propagation requires the temporary removal of reproductively mature, gravid females from the wild for propagation of progeny in captivity. Risks include potential mortality of adults during collection and in the hatchery, mortality of larvae and young in the hatchery, mortality of infested fish, mortality of reintroduced juveniles, and uncertainty regarding environmental requirements of the species in the hatchery and at A/R sites. Controlled propagation is likely to become an important tool to save winged mapleleaf from eventual extinction due to acute and chronic threats.

Adult Translocation

Although collection and translocation of adult mussels into suitable habitat or to augment a declining population requires less intervention than controlled propagation, adult winged mapleleaf should not be translocated for reintroduction or augmentation while only one known reproducing population exists. Risks of adult translocation involve potential mortality during collection and relocation, reduction in size of parental population, and lack of knowledge of environmental requirements of the species. Species like winged mapleleaf, with only one known reproducing population of relatively limited size, should not be considered for adult translocation to augment populations or for reintroductions until such time as other reproducing populations have been established through natural or other means.

No Action

The no action alternative is likely to lead to the extinction of the winged mapleleaf in the foreseeable future due to chronic conditions or stochastic events. Based on historical evidence, this species was once widespread and is now restricted to only one reproducing population. Habitat degradation and other threats have been alleviated in some river reaches from which they have been extirpated. Therefore, doing nothing would likely result in a failure to capitalize on an opportunity to significantly reduce the risk of this species' extinction. Further, population

¹ Contact Susan Rogers, Twin Cities Field Office, USFWS, 612.725-3548 ext. 219, susan_rogers@fws.gov if necessary to clarify which Service offices should receive reports.

viability analysis indicates that an introduction of zebra mussels would cause the population to decrease rapidly towards extinction (Kjos et al. 1998), demonstrating that doing nothing is not an acceptable alternative.

MUSSEL AND FISH STOCK

Subadult or adult mussels should be relocated from locally robust populations. However, only one viable population of winged mapleleaf is thought to exist, which limits options for source stock. Nevertheless, relocations of subadults and adults and the use of adults for propagation shall only be done after an assessment of their potential effects to the source populations in the Site Plan and through section 7 of the ESA. Where feasible, removal of mussels for translocations should affect less than 5% of the donor population. Because winged mapleleaf is evidently extant in only two drainages, the Service and its partners may consider factors other than inter-population distance (e.g., similarity of habitat, climate, host fish communities, water quality) when deciding which population would be most appropriate as a source for a reintroduction site.

Both the channel and blue catfish are suitable host species for winged mapleleaf glochidial transformation. Both catfish species are not present at every winged mapleleaf location (i.e., blue catfish are not present in the St. Croix River); therefore, the catfish species sympatric with the parent winged mapleleaf population should be used for propagation.

GENETIC CONSIDERATIONS

At this time, the only population of winged mapleleaf known to be reproducing occurs in the St. Croix River in Minnesota/Wisconsin. Winged mapleleaf also occurs in Arkansas, but no evidence of reproduction has been documented. Genetic studies to date have shown little variability between individuals from the St. Croix and Ouachita Rivers (Serb and Harris 2003). However, the genetic marker examined was not appropriate to examine inter-population differences; therefore, the Service will not permit mixing of mussels or their progeny from the two different populations. Without genetic data for reintroduction sites (e.g., extirpated sites), factors other than genetics will likely be most important for selecting the most appropriate source population.

To maximize genetic diversity and avoid inbreeding, hatchery-produced juveniles from individual females should be used once per site, where feasible. Gravid mussels used to produce juveniles for stocking will be uniquely marked and returned to the point of capture. Subsequent releases should come from other appropriate subpopulations of wild mussel stock whenever possible. Mussel transplantation and augmentation are very much an experimental process. As such, all actions will be carefully documented. Further, the Service will develop a Genetics Management Plan, which will provide guidelines to conserve genetic integrity of augmented/reintroduced populations.

DISPOSITION OF EXCESS PROGENY FROM RESEARCH ACTIVITIES

Propagation efforts or host fish trials may result in excess juvenile mussels. Larger numbers of

research or hatchery-produced offspring should be considered for:

- augmentation or reintroduction releases;
- toxicity testing; or
- other experimental needs.

Small numbers of juveniles, excess individuals, or specimens rendered unfit for population augmentation or reintroduction to historical habitats that result from research activities can be properly preserved for genetic testing (e.g., ethanol, frozen), appropriately labeled, and deposited in the Mussel Tissue Repository at the U.S. Geological Survey, La Crosse, Wisconsin (Contact Dr. Teresa Newton, see Appendix I).

NOTIFICATION OF AFFECTED PARTIES

The Service will notify all recovery partners and any other affected private or public entity identified by the partners of planned A/R activities and will provide them with the Site Plan at least 30 days before relocating or releasing animals in the wild. Site Plans are subject to the final approval of the Field Supervisor in the Service's Twin Cities Ecological Services Field Office, which is the lead office for the recovery of this species, and the Field Supervisor of the Service's local Ecological Services Field Office.

CONTROLLED PROPAGATION PLAN REVIEW

This Plan is a working document that is subject to modification based on results of current and future research and recovery activities involving mussel propagation, augmentation, or reintroduction. Recovery Partners are encouraged to provide comments and suggestions to Ms. Susan Rogers, USFWS, Twin Cities ES Field Office, Bloomington, MN (see Appendix I). The Service will conduct an annual review of this Plan and will incorporate new information, protocols, etc., as they become available, into revised versions.

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APPENDIX I: RECOVERY PARTNER CONTACTS

U.S. Army Corps of Engineers- St. Paul District

U.S. Fish and Wildlife Service - Genoa National Fish Hatchery
LaCrosse Fishery Resources Office
Twin Cities Field Office
Arkansas Field Office

National Park Service- St. Croix National Scenic Riverway
Minnesota Department of Natural Resources
Wisconsin Department of Natural Resources
Arkansas Game and Fish Commission
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