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**Augmentation Proposal for the fine-lined pocketbook *Lampsilis altilis*, in the  
Conasauga River Basin in Polk County Tennessee and Murray County, Georgia**  
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**Background:**

In 1998 the Tennessee Aquarium Research Institute (TNARI) began development of facilities and techniques for the captive propagation of imperiled mussels of the upper Coosa River basin. This project was undertaken with the support and advisement of the U.S. Fish and Wildlife Service (FWS) Asheville, NC Field Office {Contract # 1448-40181-98-G-014}. The focus of initial efforts were: the development of a facility that could mass propagate freshwater mussels, hold adult mussels long-term, and begin pilot propagation efforts with upper Coosa River basin species. Additionally, since no recent survey information existed, another goal was to complete a comprehensive survey of the upper Coosa River Basin in Georgia.

Survey efforts have concluded the species is nearly extirpated in Georgia, and the only remaining viable population is in the Conasauga River basin. This augmentation proposal seeks to stabilize the remaining populations in the Conasauga River basin. Small releases of *Lampsilis altilis* have occurred in the Conasauga Basin since 2000. However, technical improvements have made mass releases possible (> 3,000 juveniles per release). Augmentations of existing populations of *L. altilis* with newly transformed juveniles are experimental in nature and conducted in areas of suitable habitat where the species occurs in low numbers. Each release will comply with U.S. Fish and Wildlife Service Freshwater Mollusk Controlled Propagation, Augmentation, and Reintroduction Plan for the Mobile River Basin.

Species recovery through artificial propagation has been designated a viable recovery strategy by the FWS Mobile Basin Recovery Plan (USFWS 1999) and in a separate policy directive by the USFWS (2000). Specific requirements of artificial propagation are detailed in the Freshwater Mussel and Snail Controlled Propagation, Augmentation, and Reintroduction Plan for the Mobile River Basin Freshwater (USFWS 2003). Partners for this project are TNARI, The Nature Conservancy, U.S. Fish and Wildlife Service, U.S. Forest Service, and the Tennessee Wildlife Resources Agency. Mussel brood-stock for this effort was collected from 2 different Conasauga River basin tributaries: Holly and Rock creeks. Glochidia were extracted from 3 different female mussels for this culture effort. The 2003 culture efforts have produced over 18,000 juvenile *Lampsilis altilis* that are ready for release.

All propagation and recovery efforts are conducted under United States Fish and Wildlife Service Permit SA 98-12 – Amendment 3, Georgia Department of Natural Resources Permit 29-WMB-03-147, and Tennessee Wildlife Resources Agency Permit 1071.

**Augmentation strategy:**

Newly transformed juveniles will be released at 2 separate localities in the Conasauga River basin. These locations were selected on the basis of suitable habitat and initial low densities of mussels.

**I. Conasauga River, just above the USFS Cherokee District boundary, Polk County, Tennessee, (N 35° 00.190' W 84° 41.322').**

This release would be the 4<sup>th</sup> augmentation at this specific location. Previous augmentations of fine-lined pocketbook at this site were:

2002 – 297 newly transformed *Lampsilis altilis* released  
2001 – 867 newly transformed *Lampsilis altilis* released  
2000 – 234 newly transformed *Lampsilis altilis* released  
Total = 1,398

Coordination with the U.S. Forest Service for the release has been made. The U.S. Forest Service has granted permission for the release pending state (TWRA) and U.S. Fish and Wildlife approval. The contact person for the release is Jim Herring with the Cherokee District.

Broodstock for previous releases were obtained from the Conasauga River and Holly Creek.

Currently 3,800 newly transformed *Lampsilis altilis* are now ready for release at this location. This release site was selected because of its position on Forest Service Property and distance from the Jacks River basin. Recent toxicity monitoring has indicated continuing toxicity problems in the Jacks River basin, and more detailed toxicity study is ongoing. This area is strongly suspected of receiving toxic inputs from private lands high in the Jacks River basin as evidenced by the near complete disappearance of pleurocerid and viviparid gastropods from the upper section of the Conasauga River below the Jacks and Conasauga confluence.

**II. Holly Creek, near Holly Creek/Cool Springs Road (Osborne Property), Murray County, Georgia, (N 34° 38. 319' - W 84° 42. 808'). This location is approximately 2 miles downstream of the USFS boundary.**

This release would be the 2<sup>nd</sup> augmentation at this specific location. Previous augmentations of fine-lined pocketbook at this site were:

2002 - 869 newly transformed *Lampsilis altilis* released at this location.

Broodstock for the 2002 release came from Holly Creek.

The landowner contact for the release: John Osborne, P.O. Box # 444, Eton, GA 30724 – Phone: (706) 695-5601. The Osborne's have been contacted and granted permission for the 2003 *L. altilis* release.

Currently 14,000 newly transformed *Lampsilis altilis* are now ready for release at this location. The stream channel at this location offers excellent physical habitat conditions, but is an extremely oligotrophic locality with low water hardness. As a result, mussel densities at this locality are naturally low. Monitoring efforts conducted at the site have located *Villosa* spp., but no *L. altilis*. However, both pleurocerid and viviparid snails occur at this locality in good densities (no sediment toxicity issues).

**Site preparation:**

Both augmentation sites were chosen for their low abundances of fine-lined pocketbooks (*L. altilis*), and presence of other mussels (*Villosa* spp.) at these localities. A single live *L. altilis* was located in 2002 at the Conasauga River augmentation locality. This individual was a juvenile and appeared to be 2-3 years of age, and could possibly have been the result of the first augmentation effort. Mussel densities are so low at both locations detailed quadrat data from each augmentation site would not provide usable data (i.e., all zeros).

**Scheduled release date:**

The releases will be conducted pending the approval of this augmentation proposal by the project partners (USFWS, TNARI, GA-DNR, TWRA, TNC).

**Future monitoring:**

An effort to locate juvenile *Lampsilis altilis* at the Conasauga River augmentation locality will be made this year. Additional efforts to locate juvenile mussels at both localities will take place annually, after a minimum 3 years augmentation effort. Due to the slow growth of mussels, especially in low nutrient, headwater systems, it may require at least 5 years of effort to determine if recovery through augmentation is possible, at these localities. As large numbers of mussels are not expected to occupy the nutrient poor habitat, no formal quantitative monitoring program is planned. Initially, only timed searches can effectively be used to show differences in densities between sites and dates. However, if augmentation results are better than expected, a more specific quantitative site evaluation plan will be developed.

**Disease risk:**

Although unknown, it is believed any disease risk to indigenous unionids through augmentation of juvenile mussels is minimal. After transformation, juvenile mussels are kept in holding tanks separate from the adult mussels. Adult mussels are known to harbor digenean parasites (*Aspidogaster* spp.) and parasitic mites (*Unionicola* spp.) as well as gut commensal nematodes (*Dorylaimus* spp.). However the parasites must be present in order to infect mussels. Since juveniles are kept separately from adults, and no mussels occur in the supply water, the likelihood of parasitic transmission to newly produced juvenile mussel is extremely minimal.

**Genetic considerations:**

In order to avoid genetic swamping, the same individual female mussels will not be used more than twice for any propagation effort (MRB policy directive). Additionally, a sample of 20 individual juvenile mussels have been frozen and will be transferred to the North American Mollusk Genetic Database at the University of Alabama, in Tuscaloosa for storage. Therefore a program of genetic monitoring of re-introduced populations could be developed if augmentation efforts are successful.

**Augmentation locality and recovery problems:**

Augmentation efforts will not improve mussel densities that were caused by poor habitat conditions. Sediment toxicity and some hydrologic disruption hinder recovery efforts at either location. Chronic habitat problems also cause difficulties assessing augmentation efforts, since it's nearly impossible to separate a failure of recovery efforts from lingering habitat problems. As these animals are tied to long-term habitat stability, no true recovery can occur until habitat issues are adequately addressed.

Physical habitat structure at both augmentation localities is excellent and the channels appear remarkably stable with low sedimentation. However, each augmentation site has it's own specific problems. Sediment toxicity problems in the Conasauga River appear to have had detrimental impacts on all molluscan populations in the river (including snails). Because sediment organic content in these systems is low ( $\approx 1.5\%$ ), as is the water hardness (conductivity  $\approx 60 \mu\text{mhos}$ ), it is likely any toxicity compound released in the basin would be almost immediately bioavailability (i.e., little buffering capacity from the sediments or water). Serious drought conditions during the last few years have undoubtedly exacerbated toxic conditions.

A large-scale toxicity study has been initiated, and specific toxic interactions are being targeted as part of a separate study. In the middle section of the Conasauga drainage where buffers are more intact, sediment toxicity assessments have always been negative. This section of the Conasauga River (between GA Route 286 – US 76 Bridge crossings) is currently home to 5 species of federally listed mussels and remains the best mussel habitat in the upper Coosa Basin. Clearly, targeting problem areas would improve conditions throughout the basin for these animals.

Holly Creek has no toxicity problems, but does suffer moderate channel destabilization problems. Mussels occur downstream of U.S. Forest Service property where a significant portion of the watershed is devoted to cattle grazing, with small or non-existent streamside buffers. The 10-12 mile corridor between

the U.S. Forest Service Boundary and the city of Chatsworth is home to 5 federally listed mussels, 1 species of federally listed fish (*Cyprinella caerulea* – Blue Shiner), and is believed to contain the last remaining population of *Medionidus parvulus*, the Coosa moccasinshell. The site is also likely the last remaining location for *Cambarus cymatilis* (Conasauga blue burrowing crayfish). It is likely the remaining mussel, fish, and crayfish populations in Holly Creek would respond favorably to riparian zone restoration and channel stabilization efforts. However, stability issues aside, the locality represents the best available habitat in the upper Coosa Basin in Georgia. Mussel augmentation efforts at this locality should continue for an additional 4 years, to determine if the site could be a viable holding location.

Evaluation of Coosa River basin mussel propagation and recovery efforts would best be determined at a locality where questions of habitat viability are not at issue. In our opinion, given the limited availability of glochida, length of time required to show determinate results (minimum of 5 years), difficulty in planning and executing mussel recovery efforts, development time required to propagate any individual species (2 years minimum), and overall imperilment of freshwater mussels in the Mobile River Basin, mussel reintroduction agreements should be expedited with all partners for the Coosa River at Wetumpka, in Elmore County, Alabama. Pending a formal T & E reintroduction agreement, if restoration efforts at Wetumpka could proceed with rare, non-listed taxa, this would greatly assist the design of future T & E species recovery efforts when a final agreement is reached.

A similar agreement should also be pursued with the U.S. Army Corps of Engineers regarding minimum flow and temperature restoration of the Coosawattee River below Carters Dam (Murray and Gordon Cos. GA). Pending a minimum flow agreement for the lower-Coosawattee River, Coosa River Basin mussel restoration in Georgia is not viable long-term, because of remaining habitat challenges at the landscape level. Because these landscape problems are so difficult to address, and mussel restoration efforts so difficult to accomplish; temperature and flow restoration at Carter's dam remains the only option to secure viable habitat for these animals in Georgia. Flow restoration efforts have restored mollusk populations at other localities throughout the southeast (i.e., Duck River, Tennessee and Coosa River, at Wetumpka), and there is every reason to believe the same type of effort would work in the upper Coosa River Basin. Without some type of large-scale effort, recovery programs for Coosa River Basin animals should be relocated to Alabama, where the best available habitat remains, in an effort to keep these species from extinction.

**References:**

1999. U.S. Fish and Wildlife Service. Recovery Plan for Mobile River Basin Aquatic Ecosystem, 128 Pages,
2000. U.S. Fish and Wildlife Service. Policy regarding controlled propagation of species listed under the endangered species act. Federal Register 65(183) 56916-56922.
2003. U.S. Fish and Wildlife Service. Freshwater mussel and snail controlled propagation, augmentation, and reintroduction plan for the Mobile River Basin.

Subject: L. altilis site release plan  
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Hi all,

The attached document is the site release plan for our upcoming L. altilis release in Georgia and Tennessee. The Freshwater Mussel and Snail Controlled Propagation, Augmentation, And Reintroduction Plan For The Mobile River Basin, requires a specific release plan be developed and approved by the USFWS, before any release of a propagated mollusk is allowed to take place in the MRB.

Paul Hartfield and I have developed this first site release plan for Lampsilis altilis, so I am forwarding this to you for records (Paul has approved the specific plan).

I have a release authorization letter from GA-DNR (thanks Brett) but am still awaiting final release authorization from Tennessee. I also have approval for the release from the landowner and the USFS.

I will let you know the release date when finalized, but it should be sometime within the next 2 weeks.

Any comments to the plan are appreciated.

Thanks for your support!

pj

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