

**PROJECT TITLE:** Determining the Status and Distribution of *Obovaria sp. cf arkansasensis* ("Ozark Hickorynut") and *Quadrula refulgens* (Purple Pimpleback) in Arkansas

**PROJECT SUMMARY:** The purpose of this project is to survey under-sampled drainages to locate individuals and populations of the freshwater mussels *Obovaria sp. cf arkansasensis* and *Quadrula refulgens*, a necessary first step in any conservation effort. *Obovaria sp.* is known to occur in the Little Red River drainage; however, its area of occupation and population numbers are poorly known. In addition, it is unclear whether other historic *Obovaria* populations in the White River and St. Francis River drainages represent *Obovaria sp.* or *Obovaria arkansasensis*; therefore, phylogeographic analysis is required to determine the morphological and distributional boundaries for these species. *Quadrula refulgens* is known in Arkansas from a single individual collected in Bayou Macon. Neither Bayou Macon nor Boeuf River, major southward draining tributaries to the Tensas River (LA) in southeastern Arkansas, have been systematically surveyed for freshwater mussels. *Quadrula refulgens* is morphologically similar to *Q. mortoni* and *Q. pustulosa*, and phylogeographic analysis is required to determine the morphological and distributional boundaries for these species also. The objective of this study is to fill data gaps with regards to distribution and population status of *Obovaria sp. cf arkansasensis* and *Quadrula refulgens* to determine if they should be considered species of greatest conservation need (SWCN) and added to the Arkansas Wildlife Action Plan (AWAP).

**PROJECT LEADER:**

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**PROJECT BUDGET:**

<b>SWG AMOUNT REQUESTED -</b>	<b>\$62,140</b>
<b>MATCH AMOUNT (35%) -</b>	<b>\$33,803</b>
<b>TOTAL AMOUNT -</b>	<b>\$95,942</b>

**PROJECT STATEMENT:**

**Need** - Freshwater mussels represent some of the most imperiled species in North America. Locating individuals and populations is a necessary first step in any conservation effort. In order to manage freshwater mussel resources, it is imperative to know the present distributions and population status of species of greatest conservation need (SGCN).

Harris *et al.* (2010) summarized the status of Arkansas mussels and noted in southeastern Arkansas, the mussel fauna of Bayou Macon remains relatively unknown. The discovery of *Quadrula refulgens* in Bayou Macon, a highly-modified-for-agricultural-drainage Delta stream, suggests that this habitat may offer refuge to other rare Gulf Coast drainage fauna. *Quadrula refulgens* is closely related to *Q. mortoni* and *Q. pustulosa*, their distributional limits are poorly

understood and defined in the lower Mississippi Valley, and they are difficult to differentiate morphologically (Serb *et al.* 2003, Harris *et al.* 2010).

The Inoue *et al.* (2013) mtDNA phylogeny revealed five reciprocally monophyletic clades and high levels of evolutionary divergence among clades within the *Obovaria arkansasensis* complex including one unique clade in the White River drainage AR (*Obovaria sp. cf arkansasensis*). White River drainage specimens analyzed in Inoue *et al.* (2013) were exclusively from the Archey Fork Little Red River; however, populations referred to as *Obovaria arkansasensis* have historically occurred in other White River drainage rivers (Cache, Black, Strawberry, and White rivers) and the St. Francis River drainage. Assessment of *Obovaria sp. cf arkansasensis* distribution and population status requires determination of whether *Obovaria sp.* is endemic to the Little Red River system or more widespread within the White and St. Francis river drainages.

**Purpose and Objectives** - The purpose of this project is to fill data gaps for 2 freshwater mussel species that are potentially SGCN. Objectives are to determine the distributions and assess population status for *Obovaria sp. cf arkansasensis* and *Quadrula refulgens* in Arkansas.

**Location** - The proposed project is located within the Mississippi Alluvial Plain, Ozark Highlands, and South Central Plains ecoregions. Proposed survey limits / sample sites for each species are as follows:

***Obovaria sp. cf arkansasensis***

Archey Fork Little Red River. From Rocky Hill Road (35.70359; -92.45932) downstream to the U.S. Hwy 65 crossing at Clinton, ca. 27.3 stream kilometers (kms)(17.0 river miles).

Black River. From Pocahtontas, a distance of ca. 8.0 rkm (5.0 rmi) upstream and downstream. From Black Rock, ca. 8.0 rkm (5.0 rmi) upstream and downstream.

St. Francis River. From Parkin downstream to the vicinity of Wittsburg, a distance of ca. 24.4 rkm (15.2 rmi).

White River. From Newport upstream to Oil Trough, ca. 37.3 rkm (23.2 rmi).

***Quadrula refulgens***

Bayou Macon. From AR Hwy 1 crossing downstream to AR - LA state line, a distance of ca. 137.7 stream kms (~87.0 stream miles), all within Chicot and Desha counties.

Boeuf River. From AR Hwy 278 downstream to U.S. Hwy 52, a distance of 43.2 rkm (26.9 rmi), all within Chicot County

Bayou Bartholomew. Three sites that correspond to the lower, middle and upper reaches in AR. Lower site, downstream of AR Hwy 173 to the AR - LA state line. Middle site, downstream of AR Hwy 35 to Drew County Road 59. Upper site, downstream of AR Hwy 293 to Lincoln County Road 30. Sample sites will be located in Ashley, Drew, and Lincoln counties.

Ouachita River. Two sites, one downstream of Felsenthal Lock and Dam to the AR - LA state line and the other between the confluence of Moro Creek and U.S. Hwy 63, all in Union County.

**Approach - *Obovaria sp. cf arkansasensis***

An initial survey through the Archey Fork Little Red River survey area to define locations presenting suitable mussel habitat with evidence of mussel assemblages (live or dead shell visible) will be conducted by wading (water <0.5 meter deep), snorkeling (water >0.5 meter deep), diving (water >1.5 meter deep) or a combination thereof. The qualitative timed-search approach with limited excavation may be the best for detecting mussel presence or demonstrating a reasonable probability of mussel absence (EPA 2013); therefore, our initial

survey method will be qualitative timed searches. For *Obovaria sp. cf arkansasensis* specimens and any federally listed threatened or endangered species length, height, and width dimensions will be measured to the nearest 0.1 mm with calipers, and the sex determined when possible. All mussels encountered will be identified to species, recorded on site specific data sheets that include GPS site coordinates, and the mussels replaced in the substrate. Following the initial survey, mussel assemblages containing *Obovaria sp.* will be quantitatively assessed to provide population estimates using the appropriate sampling protocol (Strayer and Smith 2003, Smith 2006). Specimens obtained during quantitative sampling will be handled and data recorded as previously discussed for qualitative timed searches.

For the Black, White, and St. Francis rivers target areas, timed searches will be conducted using dive techniques to locate *Obovaria arkansasensis* complex individuals. All mussels encountered will be processed as detailed previously for the Archey Fork Little Red River survey. *Obovaria* specimens encountered will be measured to the nearest 0.1 mm with calipers, the sex determined, and all specimens photographed. A subset, not to exceed 5 specimens per site, will be sacrificed by fixing and preserving in 95% ethanol for phylogenetic analyses following the methods employed by Inoue et al. (2013).

#### **Approach - *Quadrula refulgens***

Due to the small size of headwaters reaches of Bayou Macon and Boeuf River, a variety of access methods will be necessary. Stream segments will be navigated by boat, canoe, kayak or pedestrian means and sites presenting suitable mussel habitat with evidence of mussel assemblages (live or dead shell visible) will be surveyed and mussel specimens processed as previously described for Archey Fork Little Red River. For specimens of *Quadrula mortoni*, *Q. pustulosa*, and *Q. refulgens* and any federally listed threatened or endangered species length, height, and width dimensions will be measured to the nearest 0.1 mm with calipers, and the sex determined when possible. Voucher specimens will be collected for all non-listed species, live animals will be fixed and preserved in absolute ethanol, and subsequently deposited in the Mollusk Collection, Museum of Zoology, Arkansas State University.

Following an initial pass through targeted reaches of Bayou Macon and Boeuf River to define locations and estimate size (area) of mussel assemblages, a maximum of 5 assemblages from each drainage will be quantitatively assessed (Strayer and Smith 2003, Smith 2006). Specimens obtained during quantitative sampling will be handled and data recorded as previously discussed for qualitative timed searches. A subset of the *Quadrula mortoni/pustulosa/refulgens* complex, not to exceed 100 specimens from each drainage, will be sacrificed by fixing and preserving in 95% ethanol for phylogeographic analyses following the methods employed by Serb et al. (2003).

Freshwater mussels have been recently inventoried in Bayou Bartholomew (Brooks et al. 2008) and the Ouachita River (Posey 1997); however, no effort was made to differentiate *Q. refulgens* from *Q. pustulosa* during these surveys, and *Q. mortoni* was not considered a possibility for these drainages (Harris et al. 2010). Three mussel assemblages from sample sites in Bayou Bartholomew and two mussel assemblages from Ouachita River sample sites will be quantitatively sampled to provide population estimates (Strayer and Smith 2003, Smith 2006). A subset of the *Quadrula mortoni/pustulosa/refulgens* complex, not to exceed 25 specimens from each sample site will be sacrificed by fixing and preserving in 95% ethanol for phylogenetic analyses following the methods employed by Serb et al. (2003).

**Expected Results and Benefits:**

The taxonomic status of *Obovaria arkansasensis* complex populations in the White and St. Francis River drainage systems will be determined, and the ranges of both *Obovaria arkansasensis* and *Obovaria sp. cf arkansasensis* will be defined. Both semi-quantitative and quantitative data will be obtained to elucidate the relative abundance of these taxa. The presence of *Quadrula refulgens* will be confirmed (or refuted) in Bayou Macon, Boeuf River, Bayou Bartholomew, and Ouachita River, and both semi-quantitative and quantitative data will be obtained to determine its relative abundance. The proposed project will provide data to bridge distribution and population status data gaps and determine SGCN status for both species.

**BUDGET BREAKDOWN (35% Match)****Proposed start date: June 30, 2016****Completion date: October 30, 2018**

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**Principal Investigator: Brook L. Fluker**

<b>Cost Category</b>	<b>Federal</b>	<b>Non-Federal</b>	<b>Total</b>
<b>1. Salaries and wages</b>	\$23,144	\$10,450	\$33,594
<b>2. Fringe benefits</b>	\$2,359	\$3,605	\$5,964
<b>3. Supplies</b>	\$7,400		\$7,400
<b>4. Equipment</b>	\$2,000		\$2,000
<b>5. Travel</b>	\$21,588		\$21,588
<b>6. Total direct costs</b>	\$56,491	\$14,055	\$70,546
<b>7. Indirect costs on Federal Request</b>	\$5,649		\$5,649
<b>8. Indirect costs on Non-Federal Match</b>		\$5,060	\$5,060
<b>9. Waived Indirect Costs</b>		\$14,688	\$14,688
<b>10. Total estimated costs</b>	\$62,140	\$33,803	\$95,943

## QUALIFICATIONS:

Brook L. Fluker: Received Ph.D. in Biology from the University of Alabama in 2011 with an emphasis in phylogenetics, population genetics, and conservation of freshwater fishes. Has 11 years of experience sampling, handling, and collecting tissues from freshwater fishes in North America, including experience assisting with surveys of freshwater mussels and snails and seasonal abundance surveys for several federally protected fishes. This work has resulted in six publications, 10 technical reports, and 30+ presentations at professional conferences and meetings.

John L. Harris: Received Ph.D. in Zoology from University of Tennessee in 1986 with emphasis in taxonomy and systematics of aquatic fauna concentrating on fish and mussels. Has 30+ years experience in performing mussel surveys and impact analyses resulting in numerous peer-reviewed publications and/or agency reports. Has co-directed or been a committee member for 15 graduate students researching distribution and/or life history aspects of freshwater mussels in Arkansas.

## References

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- Smith, D. R. 2006. Survey design for detecting rare freshwater mussels. J. N. Am. Benthol. Soc. 25(3):701–711.
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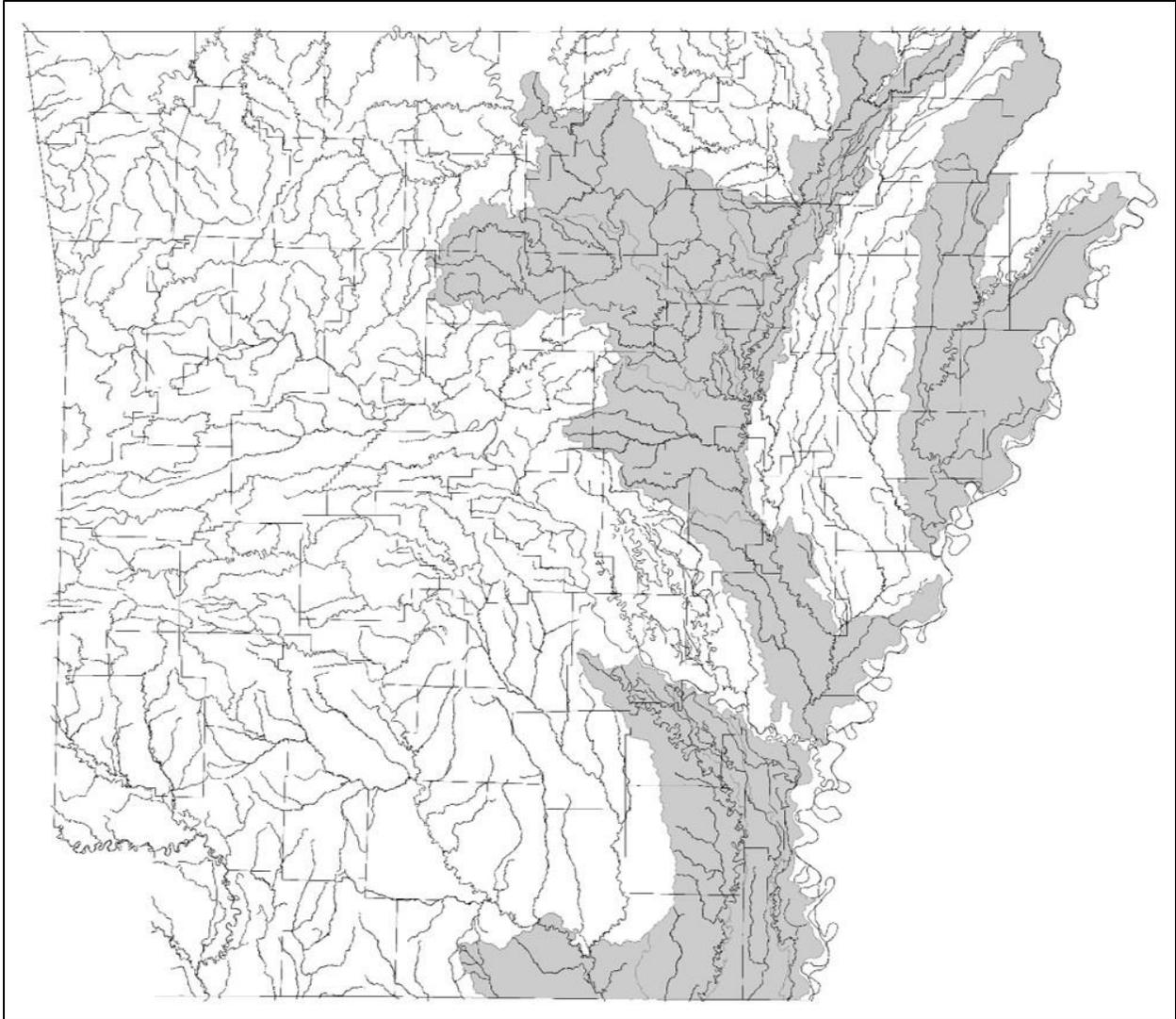


Figure 1. Proposed project is located in the shaded drainage basins in northeast Arkansas (*Obovaria sp. cf arkansasensis*) and southeast Arkansas (*Quadrula refulgens*).