

Habitat Requirements, Occupancy Estimation and Status of Primary Burrowing Crayfishes in Southwestern Arkansas

Project Summary: Primary burrowing crayfishes are one of the most understudied groups of aquatic taxa in the United States. This factor, when coupled with the very narrow endemic ranges of many of these species, makes proper management and monitoring an unattainable goal. Using newly developed field sampling techniques and a combination of both species distribution and occupancy modeling, we propose to determine habitat requirements of two rare Arkansas crayfishes (*Fallicambarus harpi* and *Procambarus reimeri*) and estimate total range of both species in the state. Information generated will assist resource managers in determining best management practices and population statuses for both species. Field and modeling techniques developed for this project will be applicable to other primary burrowing crayfishes in the genera *Fallicambarus* and *Procambarus* found in Arkansas. The proposed research project will form the core of one University of Illinois M.S. student’s thesis.

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Project Partners: Dr. Michael Dreslik, Illinois Natural History Survey, Prairie Research Institute – University of Illinois, 1816 S. Oak, Champaign, IL 61820, dreslik@illinois.edu; Mr. Brian Wagner, Arkansas Game and Fish Commission, 915 East Sevier St., Benton, AR 72015, bkwagner@agfc.state.ar.us; Mr. Josh Seagraves, Arkansas Highway and Transportation Department, 10324 Interstate 30, Little Rock, AR 72209, josh.seagraves@arkansashighways.com.

Project Budget:

	50% match scenario	35% match scenario
SWG Grant Funds Requested:	\$90,568	\$93,473
Match Provided:	\$87,736	\$60,831
Total Project:	\$178,304	\$154,304

Project Statement

Need: Because of their secretive life-history, difficulty in collecting them, and lack of attention, basic biological information on the habitat requirements, diet, and reproductive behavior of primary burrowing crayfishes is solely lacking. Approximately 85% of the 75 primary burrowing crayfishes found in the United States have severely restricted ranges, most being known from one or two counties or single sites. These two factors are responsible for the fact that 22% of the species listed as endangered or threatened in a recent conservation review (Taylor et al. 2007) were primary burrowers.

Arkansas is home to 17 species of primary burrowing crayfishes, eight in the genus *Fallicambarus*, 6 in genus *Procambarus*, 2 in *Cambarus*, and one in *Bouchardina*. Of these, seven (*B. robinsoni*, *F. gilpini*, *F. harpi*, *F. pelticarpus*, *F. strawni*, *P. reimeri*, and *P. regalis*) have been identified under the Arkansas Wildlife Action Plan (AR WAP) as funding priorities. In all cases, the need for distributional and habitat information was highlighted. Since their descriptions, little to no work has been done to determine distribution and life-history requirements for these species. In addition, these seven species were included in a recent petition filed by the Center For Biological Diversity for listed under the federal Endangered Species Act. Our proposed project described below would provide data to sufficiently address the action items listed in the AR Wildlife Action Plan.

Purpose and Objective(s): Using a combination of field sampling, scoring of habitat at known and randomly selected locations, and modeling we will address all of the action items listed in the AR WAP for two of the rarest crayfish species on the list, the Ouachita Burrowing Crayfish (*Fallicambarus harpi*) and the Irons Fork Burrowing Crayfish (*Procambarus reimeri*).

Our objectives are as follows: 1) estimate current distribution of both *F. harpi* and *P. reimeri*; 2) estimate population sizes of both species; 3) determine habitat requirements for both species; 4) determine the impact of certain roadway maintenance activities on both species; 5) determine if field and computer methods utilized for this study can be applicable to other closely related primary burrowing crayfishes listed in AR WAP.

Location: Fieldwork will be conducted in the upper Ouachita and Caddo River drainages of southwestern Arkansas, mainly Pike, Polk, and Montgomery counties. In addition to known historical locations for both species, other locations with what appears to be suitable habitat will be sampled. Those additional sampling locations may be adjacent counties such as Scott and Howard.



Figure 1A) current known range of *Fallicambarus harpi*, denoted by triangle and dots circled in red (from Robison and Crump 2004); B) current known range of *Procambarus reimeri*, denoted by small black dots circled in red (from Hobbs and Robison 1988).

Approach: We will visit all known historical locations for both *F. harpi* and *P. reimeri* (Fig. 1) and 10 additional sites with suitable habitat randomly selected within a 20 km² buffer centered on the historical center of each species' range (20 total additional sites). At each location we will mark all burrows when present and attempt to capture the crayfish in each burrow using a newly developed method employing baited fishing hooks. This method has been shown to have a much higher capture rate than other burrow sampling techniques and does not destroy the burrows. At all sites, habitat variables such as, but not limited to, dominate vegetation types, % canopy cover, and depth to water table will be recorded at burrows and in habitats without burrows immediately adjacent. The densities of active burrows per unit of area will also be recorded. All sites will be visited and sampled three times over the course of one year.

Using presence/absence and habitat data collected during the field visits, we will develop habitat models for both species, incorporating detection probabilities and occupancy modeling following the methods of Peterman et al. (2013). We will test several models to determine best predictors and test the preferred model with newly selected field sites during the second spring of the project. The results of the second round of field sampling will then be integrated to refine the selected, final model. Finally, we will use the selected model to predict the total range for both *F. harpi* and *P. reimeri* in Arkansas, determine habitat requirements for both, and estimate the impact of altered roadside habitats.

This project will represent the core research component of one University of Illinois (UIUC) M.S. student's thesis.

Expected Results and Deliverables:

1. Update and model the distribution of two of Arkansas' rarest crayfishes
2. Highlight regions of suitable habitat for both species for future field surveys
3. Determine habitat requirements of two of Arkansas' rarest crayfishes
4. Determine the population status of two of Arkansas' rarest crayfishes
5. Examine the impacts of various road maintenance activities on primary burrowing crayfishes

6. Refine field and modeling techniques for primary burrowing crayfishes for use with other such species found in Arkansas and upland ecoregions of the United States

Budget:

Budget Item	50% match scenario		35% match scenario	
	Request	Match	Request	Match
2 yr. assistantship (UIUC)	\$45,576		\$45,576	
Tuition (UIUC)	\$26,660		\$26,660	
Staff Time (AGFC)		\$8,200		\$8,200
Staff Time (AHTD)		\$8,856		\$8,856
Staff Time (INHS/UIUC)		\$39,500		\$15,500
Supplies/contractual ser.	\$4,000		\$4,000	
Hourly labor (INHS/UIUC)	\$1,602		\$1,602	
Travel (AGFC)		\$1,800		\$1,800
Travel (AHTD)		\$1,144		\$1,144
Travel (INHS/UIUC)	\$6,920		\$6,920	
F&A	\$5,810		\$8,715	
Unrecovered F&A		\$28,236		\$25,331
Totals:	\$90,568	\$87,736	\$93,473	\$60,831
Project Cost:	\$178,304		\$154,304	

Literature Cited

Hobbs, H. H. Jr. and H. W. Robison. 1988. The crayfish subgenus *Girardiella* (Decapoda: Cambaridae) in Arkansas, with the descriptions of two new species and a key to the group in then genus *Procambarus*. Proceedings of the Biological Society of Washington 101(2):391-413.

Robison, H. W. and B. Crump. 2004. Distribution, natural history aspects, and status of the Arkansas endemic crayfish, *Fallicambarus harpi* Hobbs and Robison, 1985.

Peterman, W. E., J. A. Crawford, and A. R. Kuhns. 2013. Using species distribution and occupancy modeling to guide survey efforts and assess species status. Journal for Nature Conservation, <http://dx.doi.org/10.1016/j.jnc.2012.11.005>.

Taylor, C. A., G. A. Schuster, J. E. Cooper, R. J. DiStefano, A. G. Eversole, P. Hamr, H. H. Hobbs III, H. W. Robison, C. E. Skelton, and R. F. Thoma. 2007. A reassessment of the conservation status of crayfishes of the United States and Canada: the effects of 10+ years of increased awareness. Fisheries 32(8): 372-389.

Qualifications:

Dr. Chris Taylor is a Senior Research Biologist and Curator of Crustaceans at the Illinois Natural History Survey and an Adjunct Assistant Professor in the Department of Natural Resources and Environmental Sciences at the University of Illinois. He received his B.S. and M.S. from Southern Illinois University at Carbondale and his Ph.D. from the University of Illinois. Chris has been conducting research on the conservation and ecology of eastern North American crayfishes for the past 19 years. He has published over 30 peer-reviewed papers and two books on crayfishes and is co-chair of the American Fisheries Society's Endangered Species Committee's Crayfish Subcommittee.

Dr. Michael J. Dreslik received his doctoral degree from the University of Illinois Urbana/Champaign in 2005. Since, he works as an ecologist with the Illinois Natural History Survey. Dr. Dreslik has conducted numerous studies that have focused on surveying and documenting threatened and endangered species. He has used modeling techniques to determine factors such as occupancy and detectability rates, population sizes, macro and micro-habitat suitability, and even viability analyses.

Mr. Brian Wagner is the Nongame Aquatics Biologist with the Arkansas Game and Fish Commission. He has a Master's Degree in Fisheries from Virginia Tech, and has been involved in aquatic conservation and research with the Commission for 24 years. For the past 15 years, he has been the Commission's Nongame Aquatics Biologist. Brian coordinates the Commission's Nongame Aquatics Program and has specific oversight of nongame fish and crayfish efforts. He is a Certified Fisheries Scientist and has authored or co-authored peer-reviewed publications on sport fish, nongame fish, crayfish, reptiles, and amphibians. Brian leads the State Wildlife Grants Crayfish Taxa Team, and is also active on the Fish, Cave, and Invertebrate Taxa Teams.

Mr. Josh Seagraves is an Environmental Scientist with the Arkansas Highway and Transportation Department. He has a Master of Science Degree in Biology from Arkansas State University, where he conducted research on the life history traits of several federally listed freshwater mussel species. Josh has 12 years of experience in the field of environmental biology, working for various private, state and federal agencies. Josh currently coordinates the Department's endangered species consultations with the US Fish and Wildlife Service and conducts stream and wetland impact assessments to insure compliance with the National Environmental Policy Act and the Clean Water Act.