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Distribution, Natural History Aspects, and Status of the Arkansas Endemic Crayfish, *Fallicambarus harpi* Hobbs and Robison, 1985

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Abstract

Recent fieldwork in westcentral Arkansas has revealed the Arkansas endemic crayfish, *Fallicambarus harpi* Hobbs and Robison, to be more abundant than formerly believed. New localities and county records are provided in addition to information on the habitat preferences, sex ratio, color variation, reproductive biology, and conservation status of this burrowing crayfish.

Introduction

The crayfish genus *Fallicambarus* is believed to have originated in southwestern Arkansas on the West Gulf Coastal Plain (Bouchard and Robison, 1980). Currently there are 16 known species of *Fallicambarus* in North America, eight of which are known from Arkansas. Six of these eight species, *Fallicambarus harpi*, *F. strawni*, *F. caesius*, *F. jeanae*, *F. gilpini* and *F. petilicarpus*, are endemic to Arkansas (Robison and Allen, 1995). Unfortunately, we know little about the precise distributional limits, biology, or status of any of these state endemics as most were described from one or only a few sites. One of those endemic species was described by Hobbs and Robison (1985) as *F. harpi* from a single location in Pike County, Arkansas.

Hobbs (1969) originally proposed the taxon *Fallicambarus* to receive an assemblage of eight species of crayfishes that had been formerly assigned to *Cambarus*. Later, Hobbs (1973) revised the genus *Fallicambarus* and divided this assemblage of 11 species into two subgroups or subgenera, placing six species in the nominate subgenus *Fallicambarus* and five in the subgenus *Creaserinus*. Presently, there are 16 species in the genus *Fallicambarus*, seven of them in the subgenus *Fallicambarus* and nine in the subgenus *Creaserinus*.

General Habitat Description.--Members of the genus *Fallicambarus* are seldom found in permanent bodies of water, and as adults, only after rains or during floods do they frequent temporary pools or runoff (Hobbs and Robison, 1989). Instead, these primary burrowers inhabit burrows where for most of the year the water table does not drop more than a meter or so beneath the surface. Such areas may be easily recognized by the presence of hydrophilic sedges. Most often in our area, *Fallicambarus* burrows are found to occur in low-lying areas that are permanently maintained as grass/forb through mowing or cattle grazing, such as highway roadsides, yards, cemeteries, pastures, and

even baseball fields. Burrows of the members of the genus *Fallicambarus* are occasionally topped with slender chimneys, although more often they are marked by irregular mounds of earthen pellets of a size proportional to that of the crayfish occupant. Rarely, large colonies of these crayfishes occur where an entire field is studded with the small chimneys signifying their presence.

Distribution in Arkansas.--The range of the genus *Fallicambarus* is a discontinuous one in which the larger segment extends from Ontario southward to Aransas County, Texas, and eastward to the Apalachicola River basin of southwestern Georgia. In Arkansas, members of this genus are confined to the Gulf Coastal Plain and foothills of the Ozark and Ouachita Mountains along the Fall Line (area of soft sediments meeting an area of hard rock sediments). Members do not penetrate westward in the Arkansas Valley as far west as Morrilton, Arkansas.

***Fallicambarus* Life History Cycle.**--*Fallicambarus* crayfish males exist in two morphological forms during the year. Form I males exhibit reproductive condition in which one or more of the terminal elements of the gonopods (first pleopods) are corneous. Form II males are essentially non-reproductive. During the mating season, form I males actively seek out receptive females for mating. Most matings of the members of the genus *Fallicambarus* occur between January and May. After oviposition by the female, eggs are attached to her abdomen and she is said to be "in berry" or ovigerous. Eggs are carried a number of weeks until they hatch.

Taxonomic Status.--*Fallicambarus harpi* was described by Hobbs and Robison (1985) from Pike County, Arkansas. Its closest relatives taxonomically appear to be *F. strawni* and *F. jeanae* (Hobbs and Robison, 1985), and *F. devastator* (Hobbs and Whiteman, 1987). *Fallicambarus harpi* differs from these in possessing a free (never adnate) cephalic process on the first pleopod of the form I male (Hobbs and Robison, 1985).

The objective of this study was to conduct a current

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status survey of *F. harpi* Hobbs and Robison. Specific objectives of the study were to determine the relative abundance and precise distributional limits of the range of *F. harpi*; to gather data on life history aspects of *F. harpi* including information on habitat, description of burrows, reproductive period, and any other biological data available; to gather data on ecological requirements of *F. harpi*; and to assess the current status (as to rarity) of *F. harpi* based on distributional and biological data gathered.

Methods and Materials

Field work was conducted from September, 1999 through the spring and early summer of June, 2000. Much of the collecting took place during March, April, May and early June, 2000 when wet conditions were optimal. *Fallicambarus harpi* is a primary burrower, i.e. it occupies burrows all year long in one place and rarely leaves them. To collect specimens, it is normally necessary to dig them out. Although digging of burrows can be quite laborious, it generally remains the most reliable method known to collect burrowing crayfishes. However, we found the best method of collecting specimens during this study proved to be picking up individuals (usually Form I males) that were walking around outside their burrows on humid or rainy evenings, as reported by Bouchard and Robison (1980). They mentioned that collecting on humid evenings or after a rain storm is by far the easiest method of collecting burrowing crayfishes. In the present study, 185 individuals, or 86 percent of these collected, were taken at night by hand as they walked about on humid evenings or after heavy rainfall. Success, however, is solely dependent on the unpredictable behavior of the crayfish (Bouchard and Robison, 1980). On some evenings which were not demonstrably different from the successful ones, crayfishes did not venture out remaining instead in their burrow entrances.

Other methods supplemented digging of burrows, and hand picking at night, including baited strings and crayfish traps. However, both excavation and hand collecting proved to be the superior methods of collecting specimens.

Specimens were preserved in 60% isopropyl alcohol and placed in the Southern Arkansas University Invertebrate Collection and the National Museum of Natural History, Smithsonian Institution crayfish collection after identification to species and careful study of individual variation among species.

As *F. harpi* was only known from the type locality in Pike County when this study was initiated, the type locality became the focal point of the new investigation. Since the original discovery of *F. harpi*, periodic visits to the type locality over the past 18 years by HWR had demonstrated that the species still occurred there. Collection efforts were centered in the Ouachita Mountains in a broad circle

including Pike County. Twelve other counties in that circle were surveyed and a total of 63 collections was made to determine if any additional populations could be found.

In addition to field collections in 1999-2000, museum collections housed at the National Museum of Natural History, Smithsonian Institution and Southern Arkansas University were examined for specimens of *F. harpi*. All previous literature dealing with the various *Fallicambarus* species in Arkansas was also reviewed.

Results and Discussion

Habitat.--No information on the burrows of *F. harpi* was available prior to this study. The first burrows were seen on 3 March 2000 at the type locality. Inspection of the type locality in September 1999 monthly until February 2000 revealed no burrowing activity. Interestingly, burrowing activity of *F. harpi* began almost two weeks earlier at the type locality than at the other localities in Glenwood where it occurred. The height of burrowing activity occurs in April, as literally hundreds of burrows were found at the type locality and scores of others were distributed throughout the Glenwood area and various locations east along U. S. Highway 70 to Hot Springs in Garland County.

Dissection of 35 burrows provided data on the type burrows inhabited by *F. harpi*. Depth ranged from 45-85 cm with a mean of 66 cm. Height of the chimneys ranged from 0 to 20 cm with a mean of 11.8 cm. The burrows were all complex, generally in sandy-clay soil situated in wet grassy areas often with abundant sedges nearby. In five cases, rocky soils with clay were present with no grass. Often in these upland areas, many of the burrows were located in pastures where a suitable substrate is present and pasture grasses are kept low by grazing animals.

In other areas where pastures are unavailable, roadside ditches are the preferred habitat. Such ditches often hold water during the spring and early summer months and some soil is present in the substrate, allowing for burrowing.

Distributional Range.--Searches for *F. harpi* in the 13 counties around and including Pike County revealed the presence of 12 new populations of this crayfish that previously was known only from the type locality in the northeast corner of Pike County. The 12 new populations were found in three new counties (Montgomery, Hot Spring and Garland); and several new populations in Pike County were discovered (Fig. 1).

The new populations are as follows:

Pike County: (1) Private yard along U.S. Highway 70 Business route in Glenwood city limits (Sec. 2, T5S, R24W); (2) Private yard, approximately one-fourth mile north of U. S. Highway 70 Business route in Glenwood city limits (Sec. 2, T5S, R24W); (3) Front lawn of Glenwood Nursing Home



Fig. 1. Map 1 legend above.

approximately one-half mile north of U.S. Highway 70 Business route in Glenwood city limits (Sec. 2, T5S, R24W); (4) Roadside ditch of Ford Automotive Dealer along U. S. Highway 70 (Sec. 1, T5S, R24W); and (5) Lawn of Caddo Ranger District Office in Glenwood City limits (Sec. 2, T5S, R24W). **Montgomery County:** (1) Roadside ditch along St. Hwy. 240 at Hopper, AR. (Sec. 33, T14S, R25W); (2) Pasture along U.S. Hwy. 70 at Roadside Park (Sec. 32, T4S, R23W); (3) Roadside ditch at Welsh along U.S. Hwy. 70 (Sec. 28, T4S, R23W). **Hot Spring County:** (1) Roadside ditch at Cross Roads, 12.7 miles west of the junction of U. S. Hwy. 70 and Co. Rd. 322 on U. S. Hwy. 70 (Sec. 19, T4S, R22W); (2) Roadside ditch 1 mile east of Bonnerdale (Sec. 16, T4S, R22W). **Garland County:** (1) Roadside ditch at Hempwallace, 9.4 miles east of the county line (Sec. 25, T3S, R24W); (2) Roadside ditch one mile east of Percy (Sec. 32, T3S, R21W).

In summary, the known distributional range for *F. harpi* is 12 localities in four counties: Pike, Montgomery, Hot Spring and Garland (Fig. 1). New populations were discovered in Montgomery, Hot Spring, and Garland counties, as well as several new sites in Pike County. This species ranges from the Hopper community in Montgomery County south to Glenwood in Pike County and extends east to the western edge of Hot Springs in Garland County. At each of these locations, *F. harpi* was found to be a highly localized and locally abundant crayfish.

Biological Aspects.—Form I males were collected first on 16 March 2000 (Table 1) from the type locality. No Form I males were taken at the other localities in Glenwood as burrows had barely begun to be built in early March. Form I males were collected in March, April, May, and into June

(Table 1). A total of 182 males was collected of which 163 were Form I males, and 17 were Form II males while 2 were juveniles. Thirty-four females were taken in the study, 24 adults, and 10 juveniles (Table 1). No ovigerous females or females carrying young were found despite intensive searches. Six tiny juvenile specimens (14 mm) were discovered in a burrow on 6 June 2000.

During the study, five additional species of crayfishes were collected while searching for *F. harpi*. The crayfish species captured included *F. jeanae*, *F. strawni*, *F. fodiens*, *Procambarus liberorum*, and *P. acutus*.

Sex Ratio.—The highly skewed sex ratio in *F. harpi* observed in Table 1 is certainly an artifact of collection methods. A total of 180 adult males (163 Form I males and 17 Form II males) versus a mere 24 adult females was collected. It is obvious that the reason so many Form I males were caught in the spring was the high success seen in hand collecting during the night hours after rainfall or on humid nights. This is the time period when Form I males typically leave their burrows in search of females (Bouchard and Robison, 1980; Hobbs and Robison, 1989). Females were not crawling around outside their burrows as much on such evenings, and males were inadvertently selected for during those periods.

Color Variation.—Color variation is well known in members of the genus *Fallicambarus* (Hobbs and Robison, 1989). It is apparent in *F. fodiens*, which has three color forms and often at the same location (Hobbs and Robison, 1989). *Fallicambarus jeanae* has two distinctive color morphs, one of which was formerly described by Hobbs (1973) as a distinct new species, only to later be synonymized with *F. jeanae* by Hobbs (1989). *Fallicambarus* also displays much color variation among the various populations and within the same population. Colors and patterns range from a carapace that is unspotted to one with few spots to one that is heavily spotted. Indeed, all these variations were found in specimens taken from the type locality on the same night (11 March 2000). Generally, the unspotted form is the most common and widespread of the color variants. The purpose of such color variability in burrowing crayfishes is puzzling.

Status.—Taylor et al. (1996) provided the most current conservation estimate for crayfishes. They found 19.2% percent of the crayfish fauna in the United States and Canada to be endangered, while 13.3% was threatened, and 14.8% was considered as special concern. While 52.0% or 176 species of the 338 native crayfishes were considered "stable," 48.0% or 162 species were in need of some conservation status or consideration.

Taylor et al. (1996) listed *F. harpi* as "endangered" based on the best information available at the time. This survey indicates that *F. harpi* is much more common than previously believed; indeed it is locally abundant at some localities, where literally hundreds of burrows were

Table 1. Frequency of occurrence of form I males, form II males, females, and juveniles in collections of *Fallicambarus harpi*.

Month	Number of Collections	Number of Individuals				Total
		Form I Males	Form II Males	Females	Juveniles	
January	0	0	0	0	0	0
February	6	0	0	0	0	0
March	13	63	4	3	3	73
April	27	97	5	12	2	116
May	14	3	7	4	1	15
June	3	0	1	5	6	12
July	0	0	0	0	0	0
August	0	0	0	0	0	0
September	0	0	0	0	0	0
October	0	0	0	0	0	0
November	0	0	0	0	0	0
December	0	0	0	0	0	0
Totals	63	163	17	24	12	216

discovered. On the basis of this new information, it is our recommendation to remove *F. harpi* from its "endangered" status and move it to a status of "special concern" due to its restricted range and endemism. Periodic monitoring surveys of the populations are critical to provide for informed decisions concerning conservation of this species.

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