

1996

Distribution and Natural History Aspects of the Arkansas Endemic Crayfish, *Cambarus causeyi* Reimer

Henry W. Robison
Southern Arkansas University

Gene Leeds
U.S. Forest Service

Follow this and additional works at: <https://scholarworks.uark.edu/jaas>



Part of the [Terrestrial and Aquatic Ecology Commons](#)

Recommended Citation

Robison, Henry W. and Leeds, Gene (1996) "Distribution and Natural History Aspects of the Arkansas Endemic Crayfish, *Cambarus causeyi* Reimer," *Journal of the Arkansas Academy of Science*: Vol. 50, Article 21.

Available at: <https://scholarworks.uark.edu/jaas/vol50/iss1/21>

This article is available for use under the Creative Commons license: Attribution-NoDerivatives 4.0 International (CC BY-ND 4.0). Users are able to read, download, copy, print, distribute, search, link to the full texts of these articles, or use them for any other lawful purpose, without asking prior permission from the publisher or the author.

This Article is brought to you for free and open access by ScholarWorks@UARK. It has been accepted for inclusion in Journal of the Arkansas Academy of Science by an authorized editor of ScholarWorks@UARK. For more information, please contact scholar@uark.edu, uarepos@uark.edu.

Distribution and Natural History Aspects of the Arkansas Endemic Crayfish, *Cambarus causeyi* Reimer

Henry W. Robison

Department of Biological Sciences
Southern Arkansas University
Magnolia, AR 71753-5000

Gene Leeds

U.S.D.A. Forest Service
Pleasant Hill Ranger District, P.O. Box 190
Clarksville, AR 72830

Abstract

Recent collections of the Arkansas endemic crayfish, *Cambarus causeyi* Reimer, have yielded important information concerning its distribution and habitat within the state. New locations and county records are enumerated, habitat preferences discussed, and status of this heretofore rare crayfish species is clarified.

Introduction

Cambarus causeyi Reimer is a state endemic (Robison and Bouchard, 1980; Robison and Smith, 1982; Robison and Allen, 1995), occurring only in the upper elevations of the Boston Mountains subdivision of the Ozark Mountain physiographic province in Arkansas. Previous to this study, collections by Robison and the late Dr. Horton H. Hobbs (Smithsonian Institution) had yielded only six localities of *C. causeyi* in two counties (Pope and Stone) in Arkansas since its discovery by Dr. Hobbs in 1941 and its original description by Reimer (1966). This paucity of known locations had rendered *C. causeyi* one of our rarest state animals.

The present study was initiated in 1992 to delimit the precise distribution, abundance, status and habitat of *C. causeyi* and further, to gather life history information about this enigmatic state inhabitant.

Methods and Materials

Cambarus causeyi is considered a primary burrower of the Boston Mountains and is never found in open water; thus, attempts to collect with traditional seining of streams is ineffective. Digging of burrows with shovel and trowel, though sometimes onerous, has proven quite successful in previous field work and was utilized in this study. Specimens were preserved in 70% isopropyl alcohol and placed in the Smithsonian Institution Crayfish Collection or retained in a voucher collection in the Pleasant Hill Ranger District Office, Clarksville, AR after identification and careful study of individual variation.

Generally, to correctly identify a species of a particular crayfish, first form males (males in reproductive condition) must be collected for comparison of reproductive structures. Female and juvenile male specimens many

times do not yield positive identifications. However, because *Cambarus causeyi* is so morphologically distinctive, juveniles and female specimens can be positively identified rather easily.

Field work was conducted from April, 1992 to February, 1995. Much of the collecting took place during the early and late spring when moisture levels were optimal.

All of the former known collection localities of *Cambarus causeyi* were re-visited in 1992-94 in an attempt to determine if populations still existed. Collection efforts were primarily centered in the Boston Mountains in and around Johnson, Newton, Pope, Stone and Madison counties.

In addition, museum records of the Smithsonian Institution were examined for additional specimens of *C. causeyi*. All previous literature dealing with *C. causeyi* was consulted, and distributional information was utilized.

Results and Discussion

Habitat Description.--*Cambarus causeyi* is a primary burrowing crayfish, i.e. it spends most of its life inhabiting burrows, rarely venturing out except occasionally during the reproductive period. Hobbs (1989) commented that its habitat was streams and complex burrows.

This study has shown that *C. causeyi* is an inhabitant of complex burrows in upland environs. Burrows are typically shallow, but one of us (GL) collected two individuals from the same burrow, a male located 76.2 cm deep and a female 180.3 cm deep. Occasionally, when there is a lack of soil in the area inhabited, *C. causeyi* actually removes small pieces of slate and deposits these pieces at the mouth of its small burrow openings. *Cambarus causeyi* also lives beneath rocks in wet soil where it tunnels, especially in intermittent mountain seepage areas. In some

cases to extract specimens, a large rock or boulder had to be moved and the area beneath often was so wet that a finger was all that was needed to follow the tunnel to extract the specimens.

One female specimen was collected on 25 April 1992 in Madison County from a rather unusual habitat type. Although there were several burrows with numerous pieces of slate at their mouths, no specimens could be extracted. Instead, a small (7.6-25.4 cm), shallow (5.1-12.7 cm) rivulet running along the side of the road from various seepage areas coming out of the side of the mountain was dip-netted. A single, extremely reddish female specimen was captured in the deepest part of the small rivulet, as she tried to escape the net. The discovery of a female outside of the burrow may indicate that *C. causeyi* may occasionally leave the burrow to forage in an adjacent small waterway, given the rocky nature of the habitat and possible lack of available foods in the rocky burrow. In one instance earlier in 1980, the senior author (HWR) collected a single individual from small gravel and watercress (*Nasturtium officinale*) in a spring in Stone County by hand.

There appears to be a good correlation in this study between *C. causeyi* and burrows containing isopods and amphipods. Whether *C. causeyi* is utilizing the same food resources or feeding on the isopods and amphipods or both is not clear. *C. causeyi* was never found in burrows without isopods and/or amphipods during this study.

Cambarus Life History Cycle.--Like other crayfishes, *Cambarus causeyi* exists in two morphological forms during the year. Form I males are males in reproductive condition in which one of the terminal elements of the gonopods (first pleopods) is corneous. Form II males are essentially non-reproductive males. During the mating season, form I males seek out receptive females for mating.

Table I presents data from 42 of the 47 collections of *C. causeyi* taken during our study. A total of 13 form I males, 25 form II males, and 30 females were used to assess sex and reproductive condition (Table 1). Form I males were found in seven months including May, October, and December when no form II males were collected. Non-breeding males (form II) predominate in March, but are equal or greater in February, April, June, July, August, September, and November.

While these data on mating period are difficult to interpret, mating probably occurs in *C. causeyi* between December and February (Table I), as four form I males were found during that period, and by March, six of the seven males collected were in form II. However, form I males were found until May and even in July (Table 1).

After oviposition by the female, eggs are attached to her abdomen, and she is said to be "in berry" or ovigerous. A single ovigerous female was found on 9 July 1996

in a shallow burrow. This specimen represents the first ovigerous *C. causeyi* specimen ever found. Eggs are carried a number of weeks until they hatch. No females carrying young or juveniles were captured during this study.

Richard Baker (pers. comm.) kept a single female *C. causeyi* in an aquarium for over a year, and it did not molt to his knowledge. It finally molted on 23 November 1996.

Distribution and Abundance.--*Cambarus causeyi* is an Arkansas endemic crayfish (Robison and Allen, 1995) and the only member of the genus other than the two troglitic cave forms (*Cambarus zophonastes* and *C. aculabrum*) to have its distribution centered entirely within Arkansas (Fig. 1). It was described originally by Reimer (1966) from three collections, the first of which was collected in July, 1941, taken in Pope County by Dr. Hobbs. In his checklist of American crayfish Hobbs (1989) noted the distribution of *C. causeyi* as "known only from the Arkansas River basin in Pope County, Arkansas." Reimer (1966) described this species from a spring and natural pond 6.4 km west of Sandgap, Pope Co., AR on St. Hwy. 124. Some clarification is necessary as Sandgap's name is now Pelsor and the highway is actually St. Hwy. 123, not 124.

Cambarus causeyi has been previously considered extremely rare in Arkansas and has only been collected six times from 1941-1986 from four localities in Pope County and once in Stone County previous to this study. Correspondence with Dr. Hobbs revealed that only nine specimens of *C. causeyi* had ever been collected prior to our study, all of which were deposited in the Smithsonian Institution Crayfish Collection. This paucity of historic specimens had led investigators to consider *C. causeyi* as one of the rarest crayfishes in the state prior to this study.

During this study 87 individuals were captured in 47 collections from 40 different localities, and five new counties were added to the known distributional range of *Cambarus causeyi*, namely Madison, Johnson, Franklin, Newton, and Searcy counties. *Cambarus causeyi* was most abundant in Johnson County where 67 specimens were captured followed by Pope County with eight specimens, Newton County with six, Madison and Franklin counties with two each, and Searcy and Stone counties each producing one specimen. Specimens of *C. causeyi* were collected in every month except January (Table 1). The greatest number of individuals taken during the study was in April (22 specimens) (see data below).

The following are the known distributional localities of the crayfish, *Cambarus causeyi*, by county, locality, date of collection (if known - day, month, year), number of specimens collected, and museum number, if available.

FRANKLIN CO. : 4 mi. E. of Cass (Sec. 22, T12N, R26W). no date available. 1 spec.; 4.5 mi. E. of Cass (Sec. 27, T13N, R26W). no date. 1 spec. **JOHNSON CO.:** Spring 15 mi. N. of Clarksville, AR. 25/05/93. 3 spec.; N.

Table 1. Frequency of Occurrence of Form I males, Form II Males, Females, Females Carrying Eggs (Ovigerous), Females Carrying Young, and Juveniles in 42 Arkansas Collections of *Cambarus causeyi*.

Month	No. Coll.	Number of Collections with					
		Form I Males	Form II Males	Females	Ovigerous Females	Females with Young	Juveniles
January	0	0	0	0	0	0	0
February	4	2	2	1	0	0	0
March	8	1	6	9	0	0	0
April	8	3	5	5	0	0	0
May	3	3	0	2	0	0	0
June	3	0	2	3	0	0	0
July	6	1	4	4	1	0	0
August	3	0	3	2	0	0	0
September	3	0	2	2	0	0	0
October	1	1	0	0	0	0	0
November	2	0	1	1	0	0	0
December	1	2	0	1	0	0	0
TOTALS	42	13	25	30	1	0	0

of Clarksville. 12/04/94. 2 spec.; Abner Hollow Spring (Sec. 18, T13N, R25W). 30/04/92. 1 spec.; Same location. 11/05/92. 1 spec.; Same location. 27/07/92. 1 spec.; McKay Bog (Sec. 25, T11N, R23W). 25/05/93. 2 spec.; Foot Print Spring (Sec. 25, T11N, R23W). 27/07/92. 3 spec.; East Foot Print Bog (Sec. 25, T11N, R23W). 01/07/92. 1 spec.; North of Arbaugh R-stream (Sec. 9, T12N, R24W). 01/07/92. 1 spec.; Middle Ridge Spring (Sec. 29, T12N, R24W). 31/08/92. 3 spec.; Same location. 24/06/93. 5 spec.; Same location. 16/09/92. 3 spec.; Locked gate L.G. Stream (Sec. 33, T12N, R24W). 17/09/92. 1 spec.; Clara Hill Stream (Sec. 3, T12N, R24W). 08/03/92. 1 spec.; Phillips Farm Stream (Sec. 32, T12N, R25W). 03/08/92. 3 spec.; Same location. 23/03/93. 2 spec.; Same location. 23/09/92. 1 spec.; Same location. 24/08/92. 1 spec.; Dry Hollow Spring (Sec. 23, T12N, R24W). 03/02/93. 3 spec.; Morgan Hollow Spring (Sec. 18, T12N, R23W). 04/02/93. 1 spec.; Long Creek Spring (Sec. 35, T11N, R23W). 23/02/93. 1 spec.; Mt. Pleasant Spring (Sec. 15, T12N, R23W). 24/03/93. 2 spec.; Same location. 25/03/93. 1 spec.; FSR 1405 stream below rd. c. (Sec. 11, T12W, R23W). 23/03/93. 1 spec.; FSR 1405, spring (Sec. 14, T12W, R23W). 08/04/93. 7 spec.; FSR 1417, spring (Sec. 14, T12W, R24W). 14/07/93. 1 spec.; Turkey Hill Spring (Sec. 35, T12N, T24W). 14/07/93. 1 spec.; Clifty Spring (Sec. 15, T12N, R23W). 24/03/93. 1 spec.; Dip Vat Spring (Sec. 23, T12N, R25W). 01/03/94. 3 spec.; Young Point Spring (Sec. 20, T11N, R23W). 24/02/95. 5 spec.; Oak Spring (Sec. 36, T12N, R25W). 01/06/95. 2 spec.;

Hargis (Sec. 25, T12N, R25W). 14/11/95. 2 spec.; White Road Spring (Sec. 21, T11N, T22W). 10/07/96. 1 female in berry. **MADISON CO.:** Roadside seepage on St. Hwy. 16, 3.1 mi. S. of jct. of St. Hwys. 16 and 23 and 0.4 mi. W. of Dutton. 25/04/92. 1 spec.; Freewill (Sec. 10, T11N, R23W). 18/04/95. 1 spec. **NEWTON CO.:** spring, 16 mi. E. Fallsville (Sec. 24, T13N, R24W). 23/09/92. 1 spec. Same location. 08/04/93. 4 spec.; Mossville (Sec. 2, T14N, R23W). 23/04/96. 1 spec. **POPE CO.:** TYPE LOCALITY. A spring and natural pond, 4 mi. W. of Sandgap (=Pelsor), AR on St. Hwy. 124 (=123). 1963. *Holotype:* Form one male (USNM 116678); Allotypic female (USNM 116679); mountain spring, 20.5 mi. S. of Newton Co. line on St. Hwy. 7. 30/07/41. 1 male form II (USNM 144339); Stream on St. Hwy. 164, 1.8 mi. NW of jct. of St. Hwy. 7 and 164. 16/04/73. 1 male form II (USNM 144603); Roadside seepage area and small stream, 9.4 mi. S. of Newton Co. line on St. Hwy. 7. 16/04/73. 1 male form I, 1 female (USNM 144601); Roadside seepage, 21.8 mi. S. of Newton Co. line on St. Hwy. 7. 16/03/86. 1 female (USNM 219057); Seepage area and small creek, 21.8 mi. S. of Newton Co. line on St. Hwy. 7. 16/04/73. 1 female (USNM 144602). **SEARCY CO.:** ca. 3 mi. S. of Witt Springs (Sec. 36, T13N, R18W). 20/03/94. 1 spec. **STONE CO.:** Spring at Meadowcreek, near Fox, AR. 05/03/80. 1 spec.

Conservation Status.--The conservation status of *Cambarus causeyi* has been in doubt. The Arkansas Nature Heritage Commission listed *C. causeyi* as S1 indicating an extremely rare condition, typically with five or fewer esti-

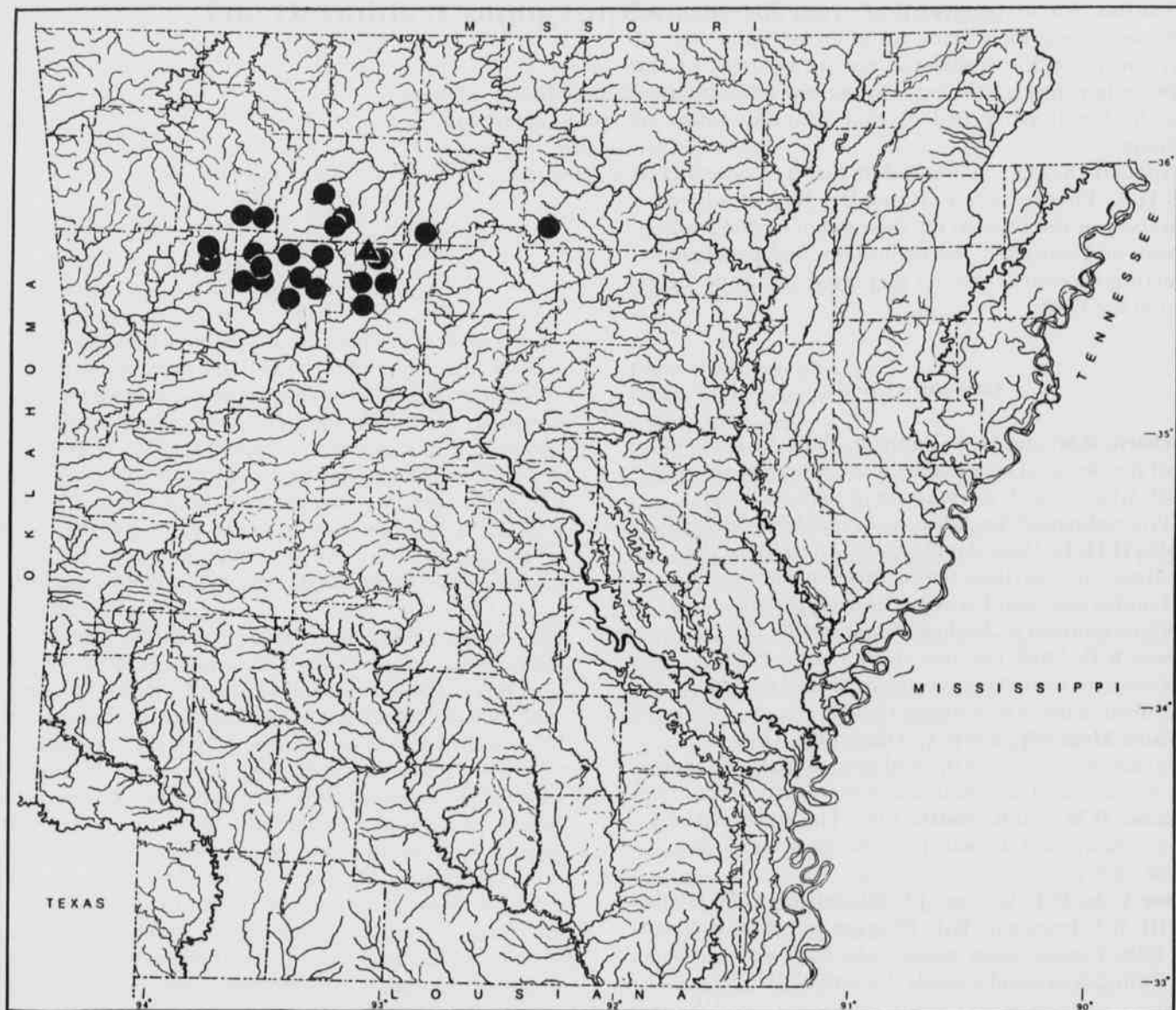


Fig. 1. Distribution of *Cambarus causeyi* in Arkansas. Triangle represents type locality; circles represent locations where collected.

mated occurrences in the state based on previous collections of Robison and Hobbs. Because of the specimens collected during this study, it is our belief that this species should be given a status of "special concern." This should be monitored in the future to ascertain populations levels, but we believe it is not currently threatened or endangered. Taylor et al. (1996) used our data which are published herein to denote *C. causeyi* as "special concern" in their recent comprehensive list of the conservation status of crayfishes of the United States and Canada.

ACKNOWLEDGEMENTS.—We are particularly grateful to

the U.S.D.A. Forest Service, Pleasant Hill Ranger District, for the logistical support given us during this study. Initial partial funding of the project in 1993-1994 to HWR was through a small travel grant from the Arkansas Natural Heritage Commission Non-Game Species program. The support of Mr. Harold Grimmert and William Shepherd of the ANHC is sincerely appreciated. Additional travel support in 1994-95 to HWR was provided by the Southern Arkansas University Research Committee.

Sincere appreciation and gratitude is expressed to my

mentor, the late Dr. Horton H. Hobbs, Jr., Smithsonian Institution, for his verification of the specimens of *Cambarus causeyi*, for sharing his immense knowledge of crayfishes, and his continued encouragement of the senior author through the years to become more involved with the fascinating and diverse crayfish fauna of Arkansas.

Special thanks are extended to Mr. Louie Leeds (U.S.D.A. Forest Service) and Dr. Jack Bridgeman (University of the Ozarks) for their aid in locating collecting sites and especially the enthusiasm and penchant for collecting *Cambarus causeyi* displayed by Louie Leeds when in the field.

Literature Cited

- Bouchard, R.W. and H.W. Robison.** 1980. An inventory of the decapod crustaceans (crayfishes and shrimps) of Arkansas with a discussion of their habitats. *Proceedings of the Arkansas Acad. of Sci.* 34:22-30.
- Hobbs, H.H. Jr.** 1989. An illustrated checklist of the American crayfishes (Decapoda: Astacidae, Cambaridae, and Parastacidae). Smithsonian Contributions to Zoology, Number 480. 236 pp.
- Reimer, R.D.** 1966. Two new species of the genus *Cambarus* from Arkansas (Decapoda, Astacidae). *Tulane Studies in Zoology* 13:9-15.
- Robison, Henry W. and R.T. Allen.** 1995. Only in Arkansas, a study of the endemic animals and plants of Arkansas. Univ. Arkansas Press. Fayetteville. 118 p.
- Robison, H.W. and K. Smith.** 1982. The endemic flora and fauna of Arkansas. *Proc. Arkansas Acad. Sci.* 36:52-57.
- Taylor, C.A., M.L. Warren, J.F. Fitzpatrick, H.H. Hobbs, III, R.F. Jezerinac, W.L. Pflieger and H.W. Robison.** 1996. Conservation status of the crayfishes of the United States and Canada. *Fisheries* 21:25-38.