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# Biogeography of Arkansas Mammals with Notes on Species of Questionable Status

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## Abstract

Seventy-one native or re-introduced species of mammals were analyzed with respect to their geographical distributions and relationships to the four broad physiographical regions of Arkansas. Mammalian diversity in the Ozark Mountains, Ouachita Mountains/Arkansas River Valley, Gulf Coastal Plain, and Mississippi Alluvial Plain/Crowley's Ridge was not area dependent. The majority of mammalian species (44) occurs statewide with the greatest diversity in the interior highland regions. The Ozark Mountains contain the most species endemic to an area. Thirteen species which are of questionable status in Arkansas are discussed. The presence of the plains pocket gopher (*Geomys bursarius*), a second species of pocket gopher in Arkansas, is noted. New distributional maps for the desert shrew (*Notiosorex crawfordi*) and small-footed bat (*Myotis leibii*) are presented.

## Introduction

The state of Arkansas, located on the western edge of the deciduous forest biome, is an ecologically diverse area. The more than 83,600 ha located within the political boundaries of the state can be divided roughly into two broad regions. The interior highlands are located west and north of a line extending diagonally across the state from southwest to northeast. The lands to the east and south of this line are collectively called the coastal plain. The Arkansas River and associated valleys and flood plains divide the state north and south and extend from Fort Smith, Sebastian County southeast to Desha County where the river empties into the Mississippi River (Foti 1974; Shepherd, 1984).

Foti (1974) detailed five physiographic regions (Fig. 1). The interior highlands consist of the Ozark and Ouachita Mountain ranges. The Ozarks were first formed as a dome-shaped uplift that was eroded and further uplifted. The current plateaus (Springfield, Salem, and Boston Mountains) have been eroded by numerous streams. The entire area is characterized by horizontal bedrock strata that have drainage patterns radiating in all directions. The Ouachita Mountains consist of a series of narrow eastwest ridges separated by narrow valleys with regular drainage patterns. The Ouachitas exhibit extreme folds and faults with minor uplifting. This region is further subdivided into the Arkansas River Valley, Fourche Mountains, Central Ouachita Mountains, and Athens Piedmont Plateau. The escarpment separating the interi-

or highlands from the coastal regions is rather abrupt and often has precipitous slopes.

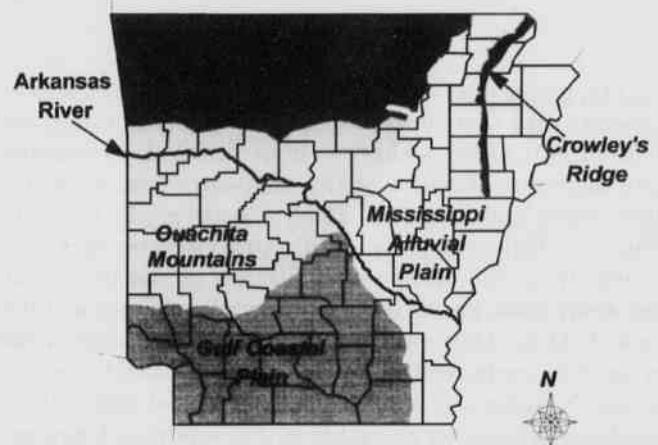


Fig. 1. Major physiographic regions of Arkansas. Modified from Foti (1974).

The lowlands or coastal regions consist of the West Gulf Coastal Plain, Mississippi Alluvial Plain, and Crowley's Ridge. The West Gulf Coastal Plain is bounded on the northwest by the Ouachita Mountains. It is characteristically rolling and hilly and is eroded by south and southeastwardly flowing streams. Soils consist primarily of well-drained, deep sandy or silty clay loams with recent alluvium along the waterways. The Mississippi Alluvial

Plain is a fairly level southerly and southeasterly sloping plain covered with recent alluvium and terrace deposits. Crowley's Ridge, located on the Mississippi Alluvial Plain, runs in a general southeasterly and southerly direction. This ridge is heavily mantled with loess and varies from 0.8-19km in width and has a maximum elevation of 168 m above sea level.

Sealander and Heidt (1990) described 75 native and introduced species of mammals in Arkansas. Elrod et al. (in press) recently documented the presence of the plains pocket gopher (*Geomys bursarius*) in the state. Over the past 200 years changing land-use patterns, exploration, and over-hunting have contributed to many changes in the mammalian fauna. Several species have been extirpated (red, wolf, ocelot, bison) or nearly extirpated (beaver, otter, black bear, and white-tailed deer) and others (such as the gray bat, Indiana bat, Ozark big-eared bat, and mountain lion) are endangered. There are still other species for which little biogeographical information exists.

The purpose of this paper is to analyze the Arkansas mammalian fauna with respect to the physiographic regions. We further discuss 13 species of nonendangered mammals which we have identified as being of questionable status.

### Materials and Methods

The major data sources for this study were the species accounts and distributional maps from Sealander and Heidt (1990). Other sources of data included surrounding state accounts (Lowery, 1974; Schwartz and Schwartz, 1981; Davis and Schmidly, 1994; Choate et al., 1994), literature published since 1990, and current specimen records from the vertebrate museums as Arkansas State University (ASU) and the University of Arkansas at Little Rock (UALR). Domestic or feral species were not included in the study, reducing the analysis to 71 species. Crowley's Ridge and the Mississippi Alluvial Plain physiographic regions were combined for analysis. Crowley's Ridge is an embedded feature of the Mississippi Alluvial Plain and mammalian distributions do not grossly reflect the presence of the Ridge.

### Results and Discussion

**Biogeography.**—Table 1 lists the 71 species used in this analysis together with their physiographic and faunal affinities. The Arkansas mammalian fauna represents eight orders with Rodentia (28 species), Chiroptera (16), and Carnivora (14) combining for over 81% of species

Table 1. Distribution of the mammals of Arkansas by Faunal Element (FE) and Physiographic Region (PR). FE: W=Widespread; CH=Chihuahuan; CA=Campestrian; E=Eastern; A=Austral; B=Boreal; N=Neotropical; I=Introduced (Designations follow Armstrong et al., 1986 and Choate et al., 1994). PR: ST=Statewide; OZ=Ozark Mountains; OU=Ouachita Mountains; MAP=Mississippi Alluvial Plain/Crowley's Ridge; GCP=West Gulf Coastal Plain.

Species	FE	ST	OZ	OU	MAP	GCP
<b>ORDER DIDELPHIMORPHIA</b>						
<i>Didelphis virginiana</i>	N	•				
<b>ORDER INSECTIVORA</b>						
<i>Sorex longirostris</i>	E		•	•		
<i>Blarina carolinensis</i>	A	•				
<i>Blarina hylophaga</i>	E		•			
<i>Cryptotis parva</i>	E	•				
<i>Notiosorex crawfordi</i>	CH		•	•		•
<i>Scalopus aquaticus</i>	E	•				
<b>ORDER CHIROPTERA</b>						
<i>Myotis lucifugus</i>	W	•				
<i>Myotis austroriparius</i>	A			•	•	•
<i>Myotis grisescens</i>	A		•			
<i>Myotis septentrionalis</i>	E		•	•		
<i>Myotis sodalis</i>	E		•	?		
<i>Myotis leibii</i>	W		•	•		
<i>Lasioncyteris noctivagans</i>	W	•				
<i>Pipistrellus subflavus</i>	E	•				
<i>Eptesicus fuscus</i>	W	•				
<i>Lasiurus borealis</i>	E	•				
<i>Lasiurus seminolus</i>	A			•	•	•
<i>Lasiurus cinereus</i>	W	•				
<i>Nycticeius humeralis</i>	E	•				
<i>Coryrhinus townsendii</i>	CH		•			
<i>Coryrhinus rafinesquii</i>	A			•	•	•
<i>Tadarida brasiliensis</i>	N			•	•	•
<b>ORDER XENARTHRA</b>						
<i>Dasypus novemcinctus</i>	N	•				
<b>ORDER LAGOMORPHA</b>						
<i>Sylvilagus floridanus</i>	E	•				
<i>Sylvilagus aquaticus</i>	A	•				
<i>Lepus californicus</i>	CH		•			
<b>ORDER RODENTIA</b>						
<i>Tamias striatus</i>	E		•	•		
<i>Marmota monax</i>	B		•	•		
<i>Sciurus carolinensis</i>	E	•				
<i>Sciurus niger</i>	E	•				

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<i>Glaucomys volans</i>	E	•				
<i>Geomys breviceps</i>	CA	•				
<i>Geomys bursarius</i>	CA		•			
<i>Castor canadensis</i>	W	•				
<i>Oryzomys palustris</i>	A	•				
<i>Reithrodontomys montanus</i>	CA		•			
<i>Reithrodontomys humulis</i>	A			•	•	•
<i>Reithrodontomys megalotis</i>	CH				•	
<i>Reithrodontomys fulvescens</i>	CH	•				
<i>Peromyscus maniculatus</i>	W	•				
<i>Peromyscus leucopus</i>	W	•				
<i>Peromyscus gossypinus</i>	A		?	•	•	•
<i>Peromyscus attwateri</i>			•	•		
<i>Ochrotomys nuttalli</i>	A	•				
<i>Sigmodon hispidus</i>	N	•				
<i>Neotoma floridana</i>	A	•				
<i>Microtus ochrogaster</i>	CA		•	•	•	
<i>Microtus pinetorum</i>	E	•				
<i>Ondatra zibethicus</i>	W	•				
<i>Synaptomys cooperi</i>	E				•	
<i>Rattus rattus</i>	I	•				
<i>Rattus norvegicus</i>	I	•				
<i>Mus musculus</i>	I	•				
<i>Myocastor coypus</i>	NI			•	•	•

## ORDER CARNIVORA

<i>Canis latrans</i>	W	•				
<i>Vulpes vulpes</i>	W	•				
<i>Urocyon cinereoargenteus</i>	N	•				
<i>Ursus americanus</i>	W	•				
<i>Bassariscus astutus</i>	CH			?		•
<i>Procyon lotor</i>	W	•				
<i>Mustela frenata</i>	W	•				
<i>Mustela vison</i>	W	•				
<i>Taxidea taxus</i>	W		•	•		
<i>Spilogale putorius</i>	A	?	•	•		
<i>Mephitis mephitis</i>	W	•				
<i>Lutra canadensis</i>	W	•				
<i>Felis concolor</i>	W	•?	•	•		
<i>Felis rufus</i>	W	•				

## ORDER ARTIODACTYLA

<i>Cervus elaphus</i>	W		•			
<i>Odocoileus virginianus</i>	W					

present. There are 44 (62%) species that occur statewide; the remaining 27 species reach the limits of their geographical range within Arkansas.

The greatest diversity of species occurs in the upland, regions (69 species), while 56 species occur in the coastal

plains. Of the four regions, diversity is greatest in the Ozark Mountains (63 species) followed by the Ouachita Mountains (61), Mississippi alluvial Plain/Crowley's Ridge (54), and the Gulf Coastal Plain (53). Species diversity within the physiographic regions is not area dependent, but reflects other factors such as climate or habitat diversity (Fig. 2). All the physiographic regions, with the exception of the Ouachita Mountains, have faunal elements found only in that area (Table 2). The Ozark Mountains not only have the greatest diversity, but also the largest number of these unique species. Within the Gulf Coastal Plain, the ringtail, *Bassariscus astutus*, is listed as unique; however, Majors et al. (1996) reported the species may be more widespread in the state (see discussion below).

Sealander and Heidt (1990) discussed the geographic affinities of Arkansas mammals. They concluded that the

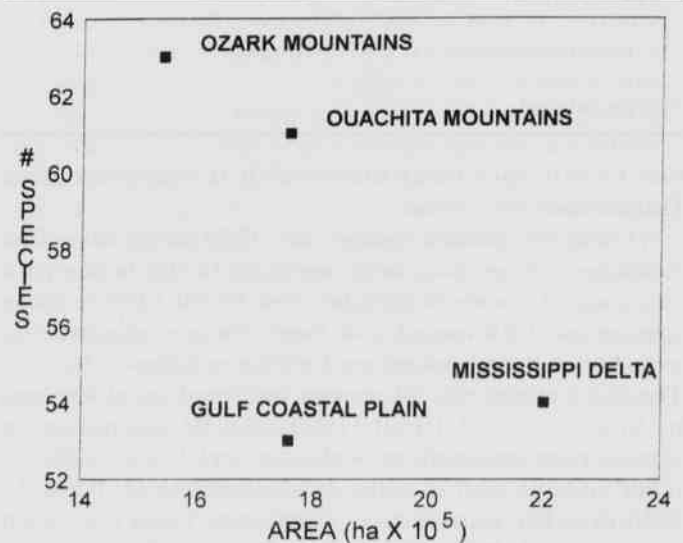


Fig. 2. Species area curve for Arkansas mammals and physiographic regions.

native mammal fauna was made up of a least four main elements with respect to late Pleistocene and recent geographic origins in North America. These faunal elements included Northern-Northwestern (N-NW), Southern-Southwestern (S-SW), Eastern-Southeastern (E-SE), and Western-Southwestern (W-SW). In addition, they listed some 14 species whose origins are somewhat obscure and, therefore, were not included in any of the other categories. We have reclassified the faunal elements of Arkansas (Table 1) to correspond with Armstrong et al. (1986) and Choate et al. (1994). Following those authors, we did not assign *Peromyscus attwateri* to a specific region as its systematic relationships are not clear. We did, however, assign *Geomys breviceps* to the Campestrian region

Table 2. Mammals unique to Arkansas Physiographic Regions

## OZARK MOUNTAINS

<i>Blarina hylophaga</i>	- Elliot's Short-tailed Shrew
<i>Myotis grisescens</i>	- Gray Myotis
<i>Corynorhinus townsendii</i>	- Ozark Big-eared Bat
<i>Lepus californicus</i>	- Black-tailed Jackrabbit
<i>Geomys bursarius</i>	- Plains Pocket Gopher
<i>Reithrodontomys montanus</i>	- Plains Harvest Mouse
<i>Cervus elaphus</i> *	- Elk

## MISSISSIPPI ALLUVIAL PLAIN/CROWLEY'S RIDGE

<i>Reithrodontomys megalotis</i>	- Western Harvest Mouse
<i>Synaptomys cooperi</i>	- Southern Bog Lemming

## GULF COASTAL PLAIN

<i>Bassariscus astutus</i>	-Ringtail
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\* Reintroduced

due to this species affinities with *G. bursarius* (Earl Zimmerman, *pers. comm.*).

Using the revised system, 22 (33%) of the classified Arkansas species have been assigned to the widespread category. As with Sealander and Heidt (1990) these species are widespread and have obscure origins. The majority of these species are carnivores followed by bats. The list includes the 14 species indicated as widespread by Sealander and Heidt (1990). An additional seven species were assigned by Sealander and Heidt (1990) to other regions, and include: *Myotis lucifugus* (N-NW), *M. leibii* (W-SW), *Lasionycteris noctivagans* (W-NW), *Castor canadensis* (N-NW), *Peromyscus leucopus* (E-SE), *Canis latrans* (W-SW), and *Taxidea taxus* (W-SW). The elk (*Cervus elaphus*) was not assigned by Sealander and Heidt (1990).

The majority of species were assigned to the Eastern (16) and Austral (12) regions that, like the Eastern-Southeastern region of Sealander and Heidt (1990), correspond primarily to forested habitats. The next highest group of species originated from southern and southwestern areas; Chihuahuan (6) and Neotropical (5). The fewest number of species are from more northern areas; Campestrian (4) and Boreal (1).

**Species of Questionable Status.**-- The following 13 species of mammals have been documented in Arkansas; however, information on their distribution and status is sparse. While in most cases Arkansas lies well within their geographical distributions (Hall, 1981), records from the state are rare. Although they are not categorized as either

endangered or threatened, we believe that these species should receive research attention.

*Sorex longirostris*--The southeastern shrew has only been documented in Arkansas only nine times (Sealander and Heidt, 1990; Huston and Nelson, 1994). This has been in spite of extensive pit trapping (Garland and Heidt, 1989) as well as the examination of thousands of owl pellets from various parts of the state by one of the authors (VRM). The current distributional map for the species (Sealander and Heidt, 1990) includes all of Arkansas except for the West Gulf Coastal Plain. All of the recorded specimens, however, have been from the interior highlands. Although *S. Longirostris* has been recorded from the bluffs along the Mississippi River in Shelby County, Tennessee no specimens have as yet been recorded from the Mississippi Alluvial Plain.

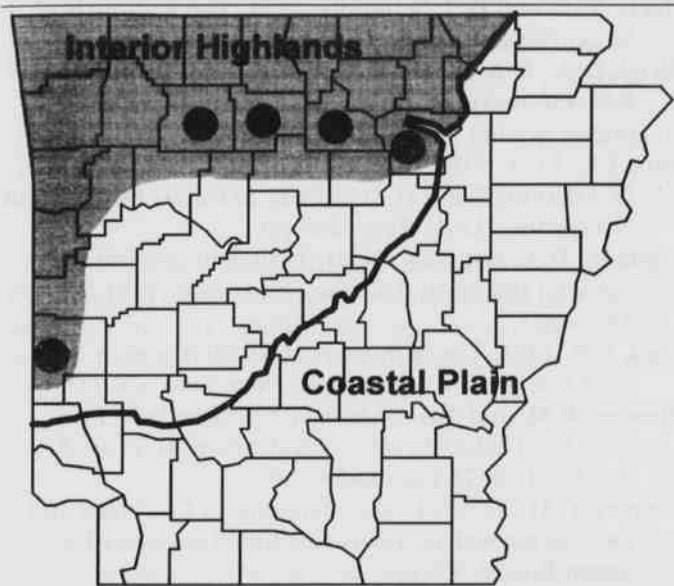
*Notiosorex crawfordi*--The desert shrew has been reported previously (Sealander and Heidt, 1990) from Washington, Crawford, and Hempstead counties. Since then, specimens have been recorded from owl pellets in Lafayette and Miller counties (ASU museum records). Figure 3a represents the current distribution in Arkansas. Although this species is peripheral in Arkansas, because of its elusiveness and size, it may be more locally abundant than previously thought.

*Myotis leibii*--There are relatively few records of the small-footed bat in Arkansas. Sealander and Heidt (1990) included only the the Ozark Mountains in their distribution map. Saugey et al. (1993) reported a specimen from



Fig. 3. a. Proposed range of the desert shrew (*Notiosorex crawfordi*) in Arkansas.

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● County Record

Fig. 3. b. Proposed range of small-footed bat (*Myotis leibii*) in Arkansas.

Mena, Polk County in the Ouachita Mountain region. Because this species has a tolerance for cold and relatively dry locations for hibernation (McDaniel et al., 1982), including under rocks and stones (Barbour and Davis, 1969), it is speculated that this species may utilize rock glaciers scattered in the western Ouachita Mountains. We have elected to redraw the distributional map of this species (Fig. 3b) to include the western portion of the Ouachita Mountains.

*Myotis austroriparius*—The southeastern bat has been reported from the Ouachita Mountain region in Garland (Davis et al., 1955) and Montgomery counties (Saughey et al., 1993), however, it is much more common in the lowland regions of the state (Steward, 1988; Sealander and Heidt, 1990). We feel that with the additional records reported by Saughey et al. (1993), this species requires additional research on its distribution and status and may be more common than previously thought.

*Lasiurus seminolus*—The seminole bat has been reported from six counties in Arkansas (Sealander and Heidt, 1990). Its distribution includes the Ouachita Mountains and West Gulf Coastal Plain. While seemingly difficult to net, further study is needed to ascertain the exact range and status of this species in Arkansas.

*Lepus californicus*—Black-tailed jackrabbits have been recorded only from Benton and Washington counties in northwest Arkansas. Historically there was a population of jackrabbits on the University of Arkansas at

Fayetteville agricultural farm outside of Fayetteville, Washington County. Jackrabbits were last seen on the farm in 1985 or 1986 (Loren Wheeler, UAF, pers. comm). From a mail survey done in 1995-96, Majors et al. (1996) reported positive responses from trappers and biologists in most of the northwest counties; all respondents indicated that the jackrabbit was rare. Arkansas definitely represents the eastern edge of the jackrabbit's range, and its presence may be spurious.

*Geomys bursarius*—A population of pocket gophers in Izard County was recently determined to be the plains pocket gopher (Elrod et al., in press). This population had previously been thought to be *G. breviceps* (Sealander and Heidt, 1990). Although locally abundant in Izard County, the status of the plains pocket gopher in Arkansas is unknown at this time and is receiving additional attention by two of the authors (DAE,GAH).

*Reithrodontomys montanus*—The plains harvest mouse has been reported from only Benton and Washington counties. Arkansas represents the extreme eastern edge of this mouse's range, which is similar to the black-tailed jackrabbit, with the Ozark plateaus marking the limit of their distribution. The status of this species is undetermined, however, it is probably very rare.

*Reithrodontomys humulis*—The eastern harvest mouse has a divided distribution in Arkansas, being found in the southwest and northeast part of the state. This species has been collected from Columbia, Greene, Hempstead, Lee, Mississippi, and Sebastian counties. While scattered, the species appears to be locally abundant and more extensive trapping efforts may reveal that it may be more widespread than thought.

*Bassariscus astutus*—All but one ringtail record (Bradley County) are sight records. Majors et al. (1996) reported trapper and biologist responses from within Sealander and Heidt's (1990) range for this species, as well as responses from Howard and Polk counties adjacent to the published range. Further, they reported sightings from in and around the Sebastian County area. One trapper from Polk County detailed a description of a ringtail being killed by a hunting dog. It is possible that the ringtail may be more widespread than previously thought, however, it is very elusive and rare.

*Mustela frenata*—Although listed as occurring statewide, there is little documentation for the long-tailed weasel (Ashley, Craighead, Crawford, Cross, Drew, Jackson, Miller, Searcy, and Woodruff counties) in Arkansas. Majors et al. (1996) reported survey results from an additional 41 counties. In all cases, respondents indicated that the long-tailed weasel was rare. It would seem that this species, although widespread, is relatively rare.

*Taxidea taxus*—Sealander and Heidt (1990) reported the badger from only Washington County. Cartwright

and Heidt (1994) reported a specimen from Franklin County and a roadkill from Stone County. Usually one or two badgers from unknown localities are sold annually by Arkansas Trappers. Majors et al. (1996) reported the sightings of badgers from trappers and biologists from most of the northwest counties of the state. Most respondents indicated that the species was rare. Majors et al. (1996) also speculated that some of the respondents might have confused a sighting of a badger with that of a woodchuck (*Marmota monax*). The badger must be considered rare in Arkansas.

*Spilogale putorius*—The eastern spotted skunk has only been documented from the upland regions of Arkansas (Independence, Izard, Lawrence, Newton, Pulaski, Randolph, Sebastian, and Washington counties), and is associated with rock outcrops. Although presumably occurring statewide, there have been few if any reliable sightings in the coastal plain areas. Spotted skunks may have occurred in those regions in the historical past, but due to intensive agriculture and general clearing of the land, they have become, at least locally, extirpated. Majors et al (1996) reported numerous sightings from throughout the state. They further speculated that some respondents may have simply responded to a "skunk", thus combining reports of the spotted skunk with those of the striped skunk (*Mephitis mephitis*). They concluded that the findings were confusing and in need of further followup. The status of this species needs to be investigated.

Arkansas has a rich and varied mammalian fauna. While we have chosen to emphasize the above species for discussion, there are other species for which biological information is lacking. We would encourage biologists and state and federal agencies to emphasize obtaining base-line data on Arkansas mammals. These data will be essential for maintaining and managing our resources in the future.

#### Literature Cited

- Armstrong, D.M., J.R. Choate, and J.K. Jones, Jr.** 1986. Distributional patterns of mammals in the plains states. Occas. Papers Mus. Texas Tech. Univ. 105: 1-27.
- Barbour, R.W. and W.H. Davis.** 1969. Bats of America. University of Kentucky Press, Lexington. 286 pp.
- Cartwright, M.E. and G.A. Heidt.** 1994. Distributional records of the badger (*Taxidea taxus*) in Arkansas. Proc. Ark. Acad. Sci. 48:248.
- Choate, J.R., J.K. Jones, Jr., and C. Jones.** 1994. Handbook of mammals of the south-central states. Louisiana State Univ. Press, Baton Rouge. 304 pp.
- Davis, W.H., W.Z. Lidicker, Jr. and J.A. Sealander.** 1955. *Myotis austroriparius* in Arkansas. J. Mamm. 36:288.
- Davis, W.E. and D. J. Schmidly.** 1994. The mammals of Texas. Texas Parks and Wildlife Press, Austin. 338 pp.
- Elrod, D.A., G.A. Heidt, D.M.A. Elrod, M. Birdsong and E.G. Zimmerman.** (in press). A second species of pocket gopher in Arkansas. Southwest. Nat.
- Foti, T.L.** 1974. Natural divisions of Arkansas. Pp. 11-38, In Arkansas Natural Area Plan, Arkansas Department of Planning, Little Rock. 248 pp.
- Garland, D.A. and G.A. Heidt.** 1989. Distribution and status of shrews in Arkansas. Proc. Ark. Acad. Sci. 43:35-38.
- Hall, E.R.** 1981. The Mammals of North America. 2nd ed. 2 Vols. John Wiley and Sons, New York, N.Y. 1181 pp.
- Huston, R.M. and T.A. Nelson.** 1994. Barn owl (*Tyto alba*) food habits in westcentral Arkansas. Proc. Ark. Acad. Sci. 48:73-74.
- Lowery, G.H., Jr.** 1974. The mammals of Louisiana and its adjacent waters. Louisiana State University Press, Baton Rouge. 565 pp.
- Majors, T.J., D.C. Brock and G.A. Heidt.** 1996. A mail survey to determine the status of black-tailed jackrabbit, ringtail, long-tailed weasel, badger, and eastern spotted skunk in Arkansas. Proc. Ark. Acad. Sci. 50:in press.
- McDaniel, V.R., M.J. Harvey, R. Tumilson and K.N. Paige.** 1982. Status of the small-footed bat, *Myotis leibii leibii*, in the southern Ozarks. Proc. Ark. Acad. Sci. 36:92-94.
- Saughey, D.A., D.R. England, L.R. Chandler-Mozisek, V.R. McDaniel, M. Rowe and B.G. Cochran.** 1993. Arkansas range extensions of the eastern small-footed bat (*Myotis leibii*) and northern long-eared bat (*Myotis septentrionalis*) and additional county records for the silver-haired bat (*Lasiorycteris noctivagans*), hoary bat (*Lasiurus cinereus*), southeastern bat (*Myotis austroriparius*), and Rafinesques big-eared bat (*Plecotus rafinesquii*). Proc. Ark. Acad. Sci. 47:102-106.
- Schwartz, C.W. and E.R. Schwartz.** 1981. The wild mammals of Missouri. University of Missouri Press and Missouri Dept. of Conservation, Columbia. 356 pp.
- Sealander, J.A. and G.A. Heidt.** 1990. Arkansas mammals: Their natural history, classification, and distribution. University of Arkansas Press, Fayetteville. 308 pp.
- Shepherd, B.** 1984. Arkansas's natural heritage. August House, Little Rock, AR. 116 pp.
- Steward, T.W.** 1988. Distributions and habitat affinities of the mammals of southwest Arkansas. M.S. thesis. Arkansas State Univ. 77 pp.