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ABANDONED MINE FAUNA OF THE OUACHITA MOUNTAINS, ARKANSAS: VERTEBRATE TAXA

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ABSTRACT

Numerous visits, over the past four years, of 27 abandoned mines in the Ouachita Mountains of Arkansas revealed that the mines are serving as hibernacula, breeding sites, and permanent or temporary habitats for numerous vertebrates. The following species were observed either directly or by sign: Class Amphibia, Order Urodela — *Eurycea multiplicata*, *Desmognathus brimleyorum*, *Plethodon caddoensis*, *P. glutinosus*. Order Anura — *Gastrophyrne carolinensis*, *Rana palustris*, *R. catesbeiana*. Class Reptilia, Order Squamata, Suborder Serpentes — *Thamnophis proximus*, *Diadophis punctatus*, *Elaphe obsoleta*, *Nerodia erythrogaster*, *Agkistrodon contortrix*. Class Aves, Order Passeriformes — *Sayornis phoebe*. Order Strigiformes — *Otus asio*. Class Mammalia, Order Marsupialia — *Didelphis virginiana*. Order Chiroptera — *Lasiurus borealis*, *L. seminolis*, *Myotis lucifugus*, *M. keenii*, *M. austroriparius*, *Eptesicus fuscus*, *Lasionycteris noctivagans*, *Pipistrellus subflavus*. Order Rodentia — *Neotoma floridana*, *Peromyscus attwateri*. Order Carnivora — *Procyon lotor*, *Ursus americanus*.

INTRODUCTION

Physiographically, Arkansas can be broadly divided into the Interior Highlands (Ozark and Ouachita Mountains) and Gulf Coastal Plain. The boundary between the mountain ranges is not always well delineated, however, the Arkansas River Valley is generally considered to separate the two. The Ozark Mountains consist primarily of dolomite while the Ouachita Mountains include shale, sandstone, and novaculite. Consequently, the Ozark Mountains contain a great many natural caves which are absent in the Ouachita Mountains; however, because of mining activities there are a large number of abandoned mines located in the Ouachita Mountains (Foti, 1974).

Caves and mines play an important role in the ecology of a great many species, serving as permanent or temporary habitats. Studies of cavernicolous fauna in Arkansas have centered around the caves of the Ozark Mountains (Bishop, 1944; Hubricht, 1950; Sealander and Young, 1955; Smith, 1960, 1964, 1968; Brandon, 1962; McDaniel and Smith, 1976; and McDaniel and Gardner, 1977) with only incidental mention of vertebrate fauna in one mine in the Ouachita Mountains (see McDaniel and Gardner [1977] for a summary). This study was undertaken to investigate as many abandoned mines as possible, in the Ouachita Mountains, in an effort to document the occurrence and use of the mines by vertebrate taxa.

METHODS AND MATERIALS

During the past four years, 27 abandoned mines in Garland (8 mines), Montgomery (3 mines), Polk (12 mines), and Pike (4 mines) counties, Arkansas (Fig. 1, Table 1) were located and visited a minimum of eight times (at least once each season). In several cases, where unusual species occurred or breeding populations were found, mines were visited several times each year. Collections were minimal and voucher specimens are located in the Vertebrate Collections at UALR and Arkansas State University.

Following McDaniel and Smith (1976), we have included the probable ecological position of the species in the mine environment, all Arkansas mine records assembled by writers to date, and a comment concerning the status, collection, or life history of the species. Following Barr (1963) and McDaniel and Smith (1976) the terms "troglobite" (obligate cavernicoles), "troglophile" (commonly found in caves), "trogloxenes" (may be common in caves but must leave to complete their life history, e.g. bats), and "accidental" (unable to survive long in the cave environment) have been employed in the species accounts.

RESULTS

No fish or troglobitic vertebrate fauna were found in any of the mines examined. McDaniel and Gardner (1977) reported three species of fish, including two troglobites (*Amblyopsis rosae* and *Typhlichthys subterraneus*) and one troglobitic salamander (*Typhlotriton spelaeus*) in Ozark caves.

ANNOTATED LIST OF VERTEBRATE FAUNA IN ABANDONED MINES

CLASS AMPHIBIA

Order Urodela

Family Plethodontidae

Plethodon glutinosus glutinosus (Green). Troglophile. Although primarily epigeal, this salamander has been commonly reported in caves (McDaniel and Gardner, 1977; Barnett, 1970). In this study, numerous slimy salamanders were found in Milk, Slimy, Vawter, Twin Upper, and Twin Lower mines. Breeding populations were found in Slimy and Vawter mines; and brooding behavior has been observed and studied by one of the authors (DAS).

Plethodon caddoensis Pope and Pope. Troglophile. The Caddo Mountain salamander is primarily epigeal; however, large aggregations in Twin and Sugarstick mines were previously reported by the authors (Saugey et al., 1985). Another small population was found in Camp Wilder Mine and individuals are occasionally found in Pipistrelle and Big Ear mines. Egg clusters, for the past two consecutive years, have been found in one mine. This species is endemic to the Novaculite Uplift of the Ouachita Mountains and is listed as endangered in Arkansas (Reagan, 1974) and a status review is currently being conducted by the Jackson, Mississippi, Endangered Species Field Station.

Desmognathus brimleyorum (Stejneger). Troglophile. The Ouachita dusky salamander is primarily epigeal; however, the salamander has been numerous in the mines where it has been found (Recreation, Stinger, Twin Creeks, and Pipistrelle mines). Egg clutches have been observed (deposited on the underside of rocks) in one mine and larvae in two mines. In those mines with larvae, the pools contained abundant leaf litter and isopods. One of the authors (DAS) observed *Desmognathus* larvae feeding on the isopods.

Eurycea multiplicata (Cope). Troglophile. This species is primarily aquatic being found under stones, logs, and other debris in streams and springs, both in the open and in caves (Bishop, 1943). In Arkansas, Strecker (1908) reported the many-ribbed salamander in

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Table 1. Abandoned mines of Arkansas Ouachita Mountains. Letters refer to keyed mines in Figure 1.

A. Conquistador	O. Golden One
B. Milk	P. Golden Two
C. Slimy (Spillway)	Q. Elf
D. Sleeping Child	R. Twin Upper
E. Shallow	S. Twin Lower
F. Vawter	T. Pipistrelle
G. Recreation	U. Big Ear
H. Walnut	V. Camp Wilder
I. Silver	W. Candy
J. Gardner	X. Langley Hillside Upper
K. Stinger	Y. Langley Hillside Lower
L. Heath	Z. Mercury One
M. Silverworld	Z ₁ Mercury Two
N. Twin Creeks	

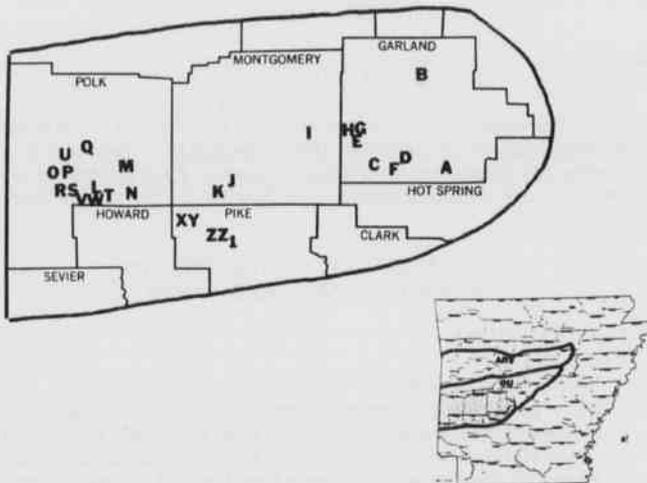


Figure 1. Map illustrating abandoned mines in the Ouachita Mountains, Arkansas. See Table 1 for the names of mines corresponding to the letters. Inset map shows relative position of study area (stippled portion) to Ouachita Mountains (OU) and Arkansas River Valley (ARV).

association with the Ouachita dusky salamander. Larvae and adults were found in Golden One and Recreation mines. Larvae in Recreation Mine were in the same pools as those of *D. brimleyorum*. The mines with larvae contained shallow streams with a gravel substrate.

Order Anura

Family Microhylidae

Gastrophryne carolinensis (Holbrook). Accidental. This species was found at the entrance to Slimy Mine.

Family Ranidae

Rana palustris Le Conte. Troglaxene or Troglophile. This was the most common frog found in the mines (Stinger, Silverworld, Twin Creeks, Golden One, Golden Two, Big Ear, and Camp Wilder mines). McDaniel and Gardner (1977) also reported this species to be quite common in Ozark caves. As in the Ozarks, these animals often were found past the twilight zone. During the winter months 8-10 individuals were found hibernating in Big Ear and Silverworld mines.

Rana catesbeiana Shaw. Troglaxene or Accidental. Several individuals were found hibernating in the total dark zone of Big Ear Mine. Bullfrogs have been previously reported to utilize caves, including

those of the Ozarks (Barr, 1953; Grove, 1974; McDaniel and Gardner, 1977).

Class Reptilia

Order Squamata

Suborder Serpentes

Family Colubridae

Thamnophis proximus (Say). Accidental. One specimen was found near the entrance to Twin Upper Mine.

Diadophis punctatus stictogenys Cope. Accidental. One specimen was found about 10 meters from the entrance to Slimy Mine. A specimen of this species was also reported from an Ozark Cave (McDaniel and Gardner, 1977).

Elaphe obsoleta obsoleta (Say). Troglaxene. One specimen was found, in the summer, coiled in roots at the ceiling near the entrance of Silver Mine. Mines would provide refugia and ready food sources (e.g., bats) for this species (Wright and Wright, 1957) and these snakes are probably more common around entrances to the mines than recorded. A black rat snake was reported in a cave in the Ozarks (McDaniel and Gardner, 1977).

Nerodia erythrogaster flavigaster Conant. Troglaxene. This species was found near the entrances of Pipistrelle and Candy mines. Permanent water in the mines may offer an alternative temporary habitat as epigeal water becomes scarce during the summer months.

Family Viperidae

Agkistrodon contortrix contortrix (Linnaeus). Troglaxene. One specimen was found near the entrance to Candy Mine.

Class Aves

Order Passeriformes

Family Hirundinidae

Sayornis phoebe (Latham). Troglaxene. Several eastern phoebe nests were found within the entrances to Gardner, Big Ear, and Candy mines.

Order Strigiformes

Family Strigidae

Otus asio (Linnaeus). Accidental. Two eastern screech owl pellets were found, during the summer, at the entrance to Candy Mine. The owl may have utilized the mine for water or a midday resting area.

Class Mammalia

Order Marsupialia

Family Didelphidae

Didelphis virginiana Kerr. Troglaxene. Opossum tracks were found several times in Slimy mine. One of the authors (DAS) has noted that when opossum tracks were present, egg clutches of *Plethodon glutinosus* were missing from their deposition site.

Order Chiroptera

Family Vespertilionidae

Eptesicus fuscus (Palisot de Beauvois). Troglaxene. Big brown bats were typically found in the cooler entrances of Conquistador, Walnut, Golden Two, and Mercury One mines. While quite common in the Ouachita area, individuals of this species were usually solitary in the mines.

Lasiurus borealis (Muller). Accidental. Swarming behavior was observed at the entrances to Recreation, Walnut, and Golden Mines. Red bats were reported by McDaniel and Gardner (1977) in two Ozark caves and Saugey et al. (1978) found the remains of 140 red bats in another Ozark cave. The red bat normally inhabits trees.

Lasiurus seminolis (Rhoads). Accidental. A single specimen was netted outside the entrance to Golden Mine. This record represented a range extension for the species and has been previously reported (Heath et al., 1983). The seminole bat's habits are similar to those of the red bat.

Myotis austroriparius (Rhoads). Troglaxene. This species has been observed on two separate occasions in Mercury One Mine which is located on a peninsula in Lake Greeson, Pike County. The entrance shaft projects some 20 meters into the mountain before it expands forming a chamber some 7 meters in diameter and 7 meters in height. The height of the entrance shaft is approximately 2 meters. During a winter visit (January, 1984) 150 individuals (both red and gray color phases) were observed hibernating in the mine

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and in an early spring visit two years later (March, 1986) only 15 individuals were present. The presence of this species in Pike County represents a new county record. Mississippi myotis were previously reported from a mine located 17 km NW of Hot Springs, Garland County (Davis et al., 1955; Sealander and Young, 1955); however, it is believed that this mine has since been flooded by Lake Ouachita.

Myotis keenii (Merriam). Trogloxene. Although in fairly small numbers, this species has been found in 12 mines (Slimy, Shallow, Recreation, Walnut, Stinger, Heath, Golden One, Twin Upper, Pipistrelle, Big Ear, Candy, and Langley Hillside Upper). The largest hibernating aggregation consisted of 12 bats. The largest number during the remainder of the year was 57 females in Spring, 1985, in Big Ear Mine. Three of these bats were sacrificed and found to be pregnant; however, mines are not used as maternity colonies. When roosting, these bats are typically found solitarily in crevices near the entrances. *M. keenii* were recorded from the previously mentioned mine 17 km NW of Hot Springs, Garland County (Davis et al., 1955; Sealander and Young, 1955).

Myotis lucifugus (LeConte). Trogloxene. A single male was observed in Walnut Mine. This species was reported from the previously mentioned mine 17 km NW of Hot Springs, Garland County. McDaniel and Gardner (1977) reported that the little brown bat occurred in small numbers in Ozark caves.

Lasiorycteris noctivagans (LeConte). Trogloxene. A single specimen was observed hibernating in the breezeway of Mercury One Mine on Lake Greeson, Pike County. The ambient temperature was 2°C. The specimen represents a new county record for this species. Typically a tree bat, this species has been documented from mines and caves (Barbour and Davis, 1969). In addition, Saugey et al. (1978) found one skull in an Ozark cave.

Pipistrellis subflavus (F. Cuvier). Trogloxene. The eastern pipistrelle is extremely widespread and abundant. It has been observed in every mine at all times of the year. Over a three year period, winter visits to Pipistrelle Mine have revealed 600-800 hibernating individuals in this 70 meter straight-shaft mine.

Order Rodentia
Family Cricetidae

Neotoma floridana (Ord). Trogloxene. Eastern woodrat nests were found around the entrances to Twin Upper, Twin Lower, and Candy mines.

Peromyscus attwateri Trogloxene. Brush mouse scat and a nest were found about 15 meters inside the entrance to Slimy Mine and a live mouse, with its nest, was observed in Twin Upper Mine.

Order Carnivora
Family Procyonidae

Procyon lotor (Linnaeus). Trogloxene. Raccoon tracks were found in the mud of Stinger Mine. Raccoons may use mines as refugia or feeding sites.

Family Ursidae

Ursus americanus Pallas. Trogloxene. Black bear were not actually observed by the authors, however, they have been observed utilizing several mines (L. Ateshire, Mena, Polk County, AR. pers. comm.).

DISCUSSION

Abandoned mines represent important ecological features of the Ouachita Mountains, in that at least 27 vertebrate taxa are utilizing the mines for some purpose. It is to be expected that several other species may also utilize the mines on a temporary basis, either as refugia or feeding sites. These results lend additional emphasis to the statement by Maser et al. (1979) that, "Unique habitats occupy a very small percent of the total forest land base, yet they are disproportionately important as wildlife habitats."

McDaniel and Gardner (1977) reported the occurrence of 53 vertebrate taxa utilizing Ozark caves; several of which were accidentals which we might also expect to find. Caves provide a more extensive cavernicolous habitat than do mines (most of the mines were straight or 'L' shaped

shafts extending 30-150 meters). However, the deep constant temperature zone of the mines was rather stable averaging between 8-11°C, with a short variable temperature zone. In addition, many of the mines, through seepage, contained permanent pools or streams. All of the pools within the mines contained varying amounts of leaf litter. These characteristics may have contributed to 18 vertebrate taxa common to both Ozark caves (34% total taxa) and Ouachita abandoned mines (67% total taxa).

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