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# THE BATS OF HOT SPRINGS NATIONAL PARK, ARKANSAS

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## ABSTRACT

A survey was conducted from June 1982 through January 1987 to determine the occurrence of bat species in Hot Springs National Park, Garland County, Arkansas; an area of approximately 2025 hectares. A total of 309 bats in the families Molossidae and Vespertilionidae were captured. Species represented included: *Eptesicus fuscus*, *Lasiurus borealis*, *Lasiurus cinereus*, *Nycticeius humeralis*, *Pipistrellus subflavus*, and *Tadarida brasiliensis cynocephala*.

## INTRODUCTION

From June, 1982 through January, 1987 we conducted a survey of bat species occurring in Hot Springs National Park (Garland County), an area of approximately 2025 hectares. Located in the Ouachita Mountains of west-central Arkansas, the park is somewhat unusual in that it partially surrounds and partially lies within the city of Hot Springs. This arrangement provided considerable diversity of potential bat habitat, ranging from occupied to unoccupied man-made structures, relatively undisturbed north slope hardwoods (*Quercus/Carya* spp.), south slope shortleaf pine (*Pinus echinata*), and mixed hardwood-pine forest types.

Two perennial streams, Bull Bayou and Gulpha Creek, and a number of ponds, both within and adjacent to the park boundary, provided riparian habitat and foraging sites. Additional habitat was provided by two abandoned mine drifts. One drift occurred within the park boundary near DeSoto Park, a city property. The other drift was located near the city waterworks facilities, north of Hot Springs. These drifts offered the only subterranean, "cave-like" habitat in the immediate area.

Published information concerning the bat fauna known to occur within the park is scarce. Gregg (1937) reported the occurrence of two specimens of the hoary bat (*Lasiurus cinereus*). Sealander and Polechla (1981) reported specimens of the red bat (*Lasiurus borealis*), evening bat (*Nycticeius humeralis*), the eastern pipistrelle (*Pipistrellus subflavus*) and a "flying" sight record for the little brown bat (*Myotis lucifugus*) and a sight record for the big brown bat (*Eptesicus fuscus*).

Additional information concerning the occurrence and distribution of bats in the Ouachita Mountains in and adjacent to the park, Hot Springs, and Ouachita National Forest have been reported by Davis *et al.* (1955), Heath *et al.* (1983, 1986), McDaniel *et al.* (1986), Saugey *et al.* (1983), Sealander (1956, 1979), and Sealander and Young (1955).

The purpose of this study was to determine and provide natural history data concerning the bat fauna common to Hot Springs National Park. Furthermore, since the study area is located within the Ouachita Mountains and contains habitat typically found in that physiographic province, the data contained herein should provide important additions to the understanding of chiropteran biology in the Ouachita Mountains.

## MATERIALS AND METHODS

Collection was primarily by mist netting as described by Tuttle (1976). A total of 30 net nights (a net night is one mist net opened into the capture position for the evening's activities) were generated on 18 different dates, with one to three net nights per date. Nets of different lengths (5.5, 12.8, and 18.3 meters) were erected and opened into the capture position prior to dusk and checked at five minute intervals until midnight (occasionally until 0100 hours). Actual netting periods varied from three to six hours depending upon time of year. Netting primarily occurred over shallow pools in Gulpha Creek in the Gulpha Gorge Campground. Each bat was removed from the net and species, sex, age, reproductive condition, time of capture, and ambient temperature were recorded. In addition, two abandoned mine drifts

were visited on several occasions during winter months to determine their use as hibernacula. In accordance with National Park Service policy, all individuals were released at the conclusion of the evening's netting activities.

Assignment of bats into age classes was determined by closure of phalangeal epiphyses. Bats were designated as juveniles on the basis of small overall size, as well as visual observation of incomplete ossification of the epiphyses.

Reproductive condition of males was determined by the position of the epididymides. Scrotal males were characterized by complete descent of the epididymides into pigmented sheaths dorsolateral to the tail and by the presence of enlarged testes. Females bats were diagnosed as pregnant by examination of an obviously enlarged abdomen and lactation was determined on the basis of teat examination.

## RESULTS AND DISCUSSION

A total of 309 bats representing two families, five genera, and six species were captured during the study. Two abandoned mine drifts were examined and found to be utilized intermittently by two species.

### Family Vespertilionidae

#### *Nycticeius humeralis* (Rafinesque)

Baker and Ward (1967) considered the evening bat to have been the second most common bat in southeastern Arkansas while Gardner and McDaniel (1978) found this species to be relatively uncommon, but present in small numbers during much of the year in northeastern Arkansas. Heath *et al.* (1983) reported twelve new county records, including Garland County, and McDaniel *et al.* (1986) reported on the occurrence and distribution of the species in southwestern Arkansas. During this study, 136 evening bats (74 males and 62 females) representing 44% of all bats captured were netted.

Two pregnant females weighing 12g each were netted on 23 May 1983. The following week (1 June) three pregnant females were netted and ranged in weight from 10.5 to 12.3g. A juvenile male, weighing 6g, was netted on 30 June 1982 and on 1 July, two additional juvenile males, weighing 5g and 6g, were netted along with a postlactating female. On 13 July, four postlactating females were captured. By 26 August, juveniles of both sexes averaged 8g with adults 2-3g heavier.

The average weight of adult males ranged between 8-9g from spring until late August when they began to rapidly gain weight. By late fall, the average adult male weighed 12.3g, an increase of 34%. Adult non-pregnant females gained an average of 29% of their body weight from 9g in spring and summer to a late fall weight of 12.7g. Adult and juvenile males were observed to be scrotal in mid-August with juveniles exhibiting testes as large as the adults. Similar observations were made by Baker and Ward (1967).

An interesting behavior was observed for this species on 11 October 1986, when bats were frequently captured in small groups of three or four individuals. The first group captured was composed of two females and two scrotal males. They struck the net simultaneously in a space

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approximately 0.5 meters in diameter; indicating they had been flying very close to one another. Approximately twenty minutes later a second similarly composed group was captured. Fifteen minutes later two small groups composed of two and three scrotal males were captured when they simultaneously struck the net at opposite ends. The significance of this behavior was probably associated with late summer/early fall swarming activities.

Although common throughout the study, *Nycticeius* were netted in greatest numbers from the last week in August until the second week of October. Baker and Ward (1967) netted this bat in December and indicated the species was most likely a winter resident of southeastern Arkansas. Sealander (1960) reported the occurrence of this bat near Fayetteville (Washington County) in mid-February. The capture of an adult male on 30 January 1987 probably indicates this species, at least in limited numbers, is a winter resident of west-central Arkansas.

The sex ratio for all evening bats netted during this study was 54:46, very similar to the 59:41 ratio reported for southeastern Arkansas by Baker and Ward (1967). The relative abundance of this species was probably due to the large number of older homes and buildings in and adjacent to the park. According to Watkins and Shump (1981), most specimens of *Nycticeius* have been found in buildings.

*Lasiurus borealis* (Muller).

Ninety-one red bats were captured with males (N = 59) encountered nearly twice as often as females (N = 32). LaVal and LaVal (1979) made similar observations regarding red bats in Missouri. Females were better represented in samples taken in May, June, and July, but were absent or occurred less frequently in samples during late summer and fall.

Pregnant females were captured on 16 May 1984 (13.3g), 23 May 1983 (2 weighed 14g each) and 1 June 1983. Lactating females were captured on 30 June and 18 July, 1982 and on 8 July 1983. Two postlactating females were captured on 1 July 1982 and one was captured on 8 July 1983. Volant juveniles were first observed on 30 June 1982 when a very small female weighing 5g was captured. Late October weights for females averaged 12g.

Males were captured on every occasion and were most abundant from mid-July through September. Two males were netted and several other red bats sighted on 30 January 1987 after a brief winter warming period. Males averaged 11.3g in late October.

As reported by Baker and Ward (1976), red bats often landed on and hovered near a pillow case used to retain captured red bats, apparently attracted by calls made from those inside. The only observed mortality involving any bat during the study occurred when a red phase screech owl (*Otus asio*) was captured as it attacked and killed a male red bat that had been netted only seconds before. The owl was released and later flew back down the creek and again became entangled in the net. Predation of bats by this and other species of owls has been well documented and reviewed by Barclay *et al.* (1982).

*Eptesicus fuscus* (Palisot de Beauvois).

The big brown bat was the third most common species. Sixty-six individuals, 33 males and 33 females were captured. Two pregnant females weighing 21.5g and 23.5g were captured on 23 May 1983, and one pregnant female was captured a week later on 1 June. Lactating females weighing 17g and 20g were netted on 26 June 1982; one of which exhibited worn canines, indicating considerable age. Four days later on 30 June, another lactating female weighing 19g was netted. The first postlactating female was captured one day later on 1 July. The first volant juvenile captured was a 13g female netted on 26 June 1982. Numerous maternity colonies of this species have been located throughout Hot Springs and Garland County. Heath *et al.* (1986) reported the occurrence of this bat from the abandoned mine drift near DeSoto Park.

Body weight of adult males and females was very similar in late October when the average was 22.5g. Interestingly, juveniles, although nearly as large as adults, weighed considerably less at 15.5 to 17.3g and gave the appearance of having very little body fat. One adult female was captured on 30 January 1987 over a shallow pool in Gulpha Creek.

*Pipistrellus subflavus* (F. Cuvier).

Six eastern pipistrelles were captured during the study. Two lactating females, weighing 4g and 6g, were netted on 30 June 1982, indicating the occurrence of a maternity site nearby. The first volant juvenile was captured two weeks later on 13 July when a 4g male was netted at the same locality. Two early August captures in 1982 and 1983 yielded an average body weight of 5g. Examination of the abandoned mine drift near DeSoto Park revealed limited use during most of the year, with more use in winter.

*Lasiurus cinereus* (Palisot de Beauvois).

The hoary bat was first reported from the park by Gregg (1937) when a large female was found frozen on the exterior door facing of the utilities building on 12 February 1936. The second specimen was recorded on 20 April of the same year when a live animal was captured by a city employee at the Hot Springs pumping plant, approximately 2 miles northwest of the city. Three hoary bats were netted during this study. A large, pregnant female was captured on 1 June 1983; on 26 August, a scrotal male weighing 20g and a large female weighing 26g were netted.

## Family Molossidae

*Tadarida brasiliensis cynocephala* (Le Conte).

Sealander and Price (1964) first reported this species in Arkansas from three widely spaced counties. Sealander and Polechla (1981) did not record free-tailed bats during a small-mammal investigation in the park, but predicted occurrence based on its known Arkansas distribution. Saugey *et al.* (1983) reported the first known maternity colonies for the species in the state (which included Garland County), expanded the known Arkansas range of the animal, and firmly established this bat as a resident species.

Captures of the free-tailed bats within the park occurred on June 30, 1 July, 26 August, and 23 September of 1982. A total of seven bats (6 males/1 female) were captured with never more than two captured on any evening. Interestingly, the largest known maternity colony of this species ever found in Arkansas (estimated at several thousand individuals) was located approximately 1 air mile away (Saugey *et al.*, 1988). The lack of captures of this species within the park may be attributable to their foraging tactics as described by Krutzsch (1955). He found their foraging routes at various heights, commonly from 5m to treetop level and on occasion, as high as 34m — far above the 2m level of single mist nets. Barbour and Davis (1969) reported *Tadarida brasiliensis mexicana* often traveled great distances, up to 65 kilometers each night, to feed along a river. While the foraging area of the large maternity colony was unknown, one might suspect these bats to have utilized one of the several large reservoirs or the Ouachita River and adjacent forested hills for watering and feeding purposes.

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