

## THERMAL PREFERENCE OF THE EASTERN PIPISTRELLE BAT (*Pipistrellus subflavus*) DURING HIBERNATION

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### ABSTRACT

A survey of seven caves in the Great Smoky Mountains National Park and surrounding area revealed that the eastern pipistrelle bat (*Pipistrellus subflavus*) selected hibernating roosts in relatively remote areas of caves containing little or no air flow. Over 80% of the bats in these areas were hibernating in places where the ambient temperature was 8-11°C. Both highest and lowest temperature extremes were avoided by this species in most caves. These data contrast with previous reports that *P. subflavus* tends to occupy the warmest areas of caves. It does, however, support the hypothesis that this species hibernates in caves where air temperatures are stable. This strategy may aid them in maintaining a state of prolonged torpor.

### INTRODUCTION

Numerous investigators have studied temperature preferences of hibernating bats in caves (Swanson and Evans, 1936; Twente, 1955; McNab, 1974; Humphrey, 1980). The eastern pipistrelle (*Pipistrellus subflavus*) is one of the smallest bats in eastern North America. It is generally believed to hibernate deep within the warmest, innermost, regions of caves (Barbour and Davis, 1969; McNab, 1974), where they undergo exceptionally prolonged periods of continuous torpor (Davis, 1964; McNab, 1974). The purpose of this study was to examine the thermal preference of *P. subflavus* in selected Tennessee caves which occur near the center of the species' geographic range.

### MATERIALS AND METHODS

From January through March 1979, seven caves were visited and surveyed, each on a single occasion in Blount County, Tennessee (Table 1). Six of the caves were located within the Great Smoky Mountains National Park and one was located on the periphery of the park. Bats were individually counted using tally counters, and temperature readings were taken using a digital thermometer (Markson Scientific Inc., accuracy  $\pm .3^\circ\text{C}$ ). Temperature readings were taken in parts of caves that were both occupied and unoccupied by bats.

the warmer areas of cooler caves in which the upper temperature limit of the caves were within their preferred range.

The eurythermic conditions found in many Tennessee caves are not always available throughout the range of this species. Although cave bats tend to select hibernating temperatures that bear an inverse relationship to their weight (McNab, 1974), the available temperature range places constraints upon hibernating roosts chosen by a species. Yet in Minnesota, *P. subflavus* are known to hibernate at air temperatures of 6.8°C (Swanson and Evans, 1936) and in Florida at temperatures above 14°C (McNab, 1974). This raises a question regarding the hibernating strategy of the eastern pipistrelle. In general, a bat may follow one of two strategies. It can either hibernate deep within caves in areas of warmer but more stable air temperatures or in regions (usually near entrances) where the temperatures are lower but more affected by changes in winter weather (Yalden and Morris, 1975). The former strategy allows a bat to remain in torpor longer at a higher metabolic expense, while the latter strategy sacrifices continuous torpor for low metabolic rates. Given the small size of the pipistrelle, it is no surprise that their strategy is to occupy relatively stable areas of caves where they remain in prolonged torpor (Davis, 1964; McNab, 1974). It would appear that this strategy prevails despite temperature extremes at the northern and southern boundaries of this species' geographic range. Data from this study indicate that there may be an optimal temperature at which eastern pipistrelles prefer to hibernate as long as the remote, stable areas within caves can be found. McNab (1974) reported that *P. subflavus* hibernating at 10°C remain in continuous torpor for twice as long as when hibernating at temperatures from 12.5-14.5°C. Davis and Reite (1967) have shown that *P. subflavus* will begin to arouse when ambient temperature is raised from 10°C to 15°C or lowered from 5°C to 0°C. These facts suggest that temperatures much above 10°C or below 5°C are not optimal for hibernation of this species. Past observations of pipistrelles selecting the highest available temperatures may have been influenced by human

TABLE 1. Range of cave and hibernation site temperatures, and numbers (N) of *Pipistrellus subflavus* found in seven caves in eastern Tennessee. Temperatures of hibernation sites are those where 75% or more of the *P. subflavus* were found.

Cave	N	Temperature range (°C)	
		Hibernation site	Cave
GREGORY	391	8.5-10.7	8.4-12.1
SALTPETER	108	8.0- 8.5	2.0- 8.5
SCOTT GAP	65	8.3- 9.0	5.1-10.7
BLOWHOLE	1,305	8.2-10.8	5.0-14.3
TORY SHIELDS	9	10.0-10.5	2.3-10.5
HATCHER	315	8.5-10.5	8.5-13.5
BULL	300	9.3- 9.8	8.5-11.4

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## OCCURRENCE OF THE HAIRY-TAILED MOLE IN CLAIBORNE COUNTY, TENNESSEE

## SHORT NOTE

During the Spring of 1978 a hairy-tailed mole (*Parascalops breweri*) was found lying along side the gravel road connecting the communities of Tiprell and Arthur in Claiborne County, Tennessee, approximately one and one-half miles north of Arthur at an elevation of 1300 feet. The mole was a male. It weighed 33 gm, the total length was 149 mm, tail length was 22 mm and hind foot was 17 mm. It is assumed the mole was forced from its tunnel due to flooding since the find was made during a period of heavy rains. The specimen was prepared as a study skin and has been deposited in the Lincoln Memorial University collection.

In Tennessee, the hairy-tailed mole is known to occur in the extreme eastern portion of the state. Kennedy and Harvey (1980) in discussing and illustrating the distribution of this species, do not report



FIG. 1. Hairy-tailed mole (*Parascalops breweri*) from Claiborne County, Tennessee.

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