Use of an Underground Winter Roost by a Male Evening Bat (Nycticeius humeralis)

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Abstract - We report use of an underground roost by an adult male evening bat (Nycticeius humeralis) during winter in southwestern Missouri. The bat was fitted with a radio-transmitter and followed to tree roosts for 28 days before it was found in a hole covered by leaf litter at the base of a live white oak tree (Quercus alba). The bat remained in the underground roost for 3 days that coincided with extremely cold ambient temperatures before moving back to a tree roost.

Bats roost in a wide variety of habitats including caves, tree cavities, under loose bark, in foliage, under leaf litter, and in manmade structures; however, roosting in burrows or other underground cavities other than caves and mines has been reported in few species worldwide. The lesser short-tailed bat (Mystacina tuberculata Gray) of New Zealand is known to burrow and use burrows (Daniel 1979), and the leaf-nosed bats (Hipposideros sp.) and slit-nosed bats (Nycteris sp.) have been found in abandoned burrows (L. W. Robbins, pers. observ.). To our knowledge, there is only one record of a forest-dwelling bat in the eastern United States found roosting underground (Lasionycteris noctivagans Le Conte; Brack and Carter 1985), but here we report such behavior by an adult male evening bat (Nycticeius humeralis Rafinesque).

Evening bats are known to roost in tree cavities and under loose bark in natural situations (Whitaker and Guerard 2003). They are also commonly found roosting in large numbers in manmade structures (Watkins 1970, Watkins and Shump 1981, Wilkinson 1992). N. humeralis is thought to be a migratory species (Humphrey and Cope 1968), but it appears the population in southwestern Missouri remains in the area throughout the year (Boyles et al. 2003).

We captured five adult male evening bats in a mist net (9 m x 6 m; Avinet, Dryden, NY) on 2 January 2004 on the Drury/Mincy Conservation Area in Taney County, MO. We fitted two of those bats with 0.52-g radio-transmitters (LB-2N, Holohil, Carp, Ontario, Canada) and tracked both bats to their day-roosts everyday until 5 February 2004.

On 30 January 2004, we tracked one bat to a hole in the ground, possibly an abandoned rodent burrow, underneath a live white oak (Quercus alba L.). Before moving to the underground roost, the bat moved on average every four days, switching between cavities in four trees. On 30 January, the

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temperature dropped to -15 °C during predawn hours, and when the bat was first located at 0800 hrs, the ambient temperature was -9.9 °C. We placed a temperature sensitive data logger (iButton, Maxim Semiconductor, Dallas, TX) in the hole and another directly outside from 1200 hrs on 30 January until the bat left the roost. The temperature inside the hole was 2.6 °C when first located and remained above 0 °C the entire time the bat was in the roost even with ambient temperatures commonly below freezing (Fig. 1). The underground roost was approximately 3 cm in diameter and 15 cm deep. It was located at the base of the tree between two above ground roots and descended at a 30° angle under the tree. Approximately 15 cm of leaf litter covered the entrance to the hole. When we removed the leaf litter, the bat was awake and making considerable noise. It appeared the bat had backed into the hole because the antenna wire on the transmitter was bent over the head of the bat and was sticking out of the opening of the hole. We tracked the bat to a cavity roost in a tree ca. 10 m away at 0900 hrs on 2 February 2004, but the bat likely moved from the underground roost the previous evening. After the bat left the roost, we excavated the hole to verify that there was not an entrance to the hole from inside the tree.

During autumn, winter, and spring (15 September–15 April), we tracked 11 evening bats to 29 roost trees (n = 161 days), and only one bat roosted underground during that period. We suggest that this roost selection was a behavioral response to the very cold ambient temperatures the bat experi-

![Figure 1. Comparison of ambient temperature and temperature in an underground roost used by a male evening bat (Nycticeius humeralis) from 1200 hrs on 30 January 2004 to 2359 hrs on 1 February 2004 in southwestern Missouri.](image-url)
enced from 29 January–1 February. It is not clear why the other bat carrying a transmitter during the same period did not move to an underground roost, but it was roosting in a very large post oak (Quercus stellata Wangenh) that likely provided it with good protection from low ambient temperatures. Other tree roosting bat species may use underground roosts, but with the paucity of winter data, it is impossible to predict which species might utilize this behavior.

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Literature Cited


The Venomous Reptiles of the Western Hemisphere. Jonathan A. Campbell and William W. Lamar. 2004. Two volumes. Cornell University Press, Ithaca, NY. 870 pp. $149.95, hardcover. ISBN 0801441412. This large-format, two volume set updates and expands The Venomous Reptiles of Latin America originally published in 1989 and covers North America, Central America, the Caribbean Islands, and South America. Volume I includes an introduction and regional accounts by country describing vegetation, topography, climate, and edaphic factors. Keys for each country are provided, some bilingual. Also included are taxonomic accounts of two species of lizards (gila monster and beaded lizard) as well as coralsnakes and sea snakes. Volume II covers the rattlesnakes and includes additional chapters on mimicry and evolution. A chapter on venom poisoning and its medical impact by North American reptiles is followed by one on snakebites of Central and South American species. Color plates of 1500 individual species are fully referenced, supplementing line drawings of many species and easy to read distribution maps. A glossary is provided and the volumes are extensively referenced. C.R.

Chance in Biology: Using Probability to Explore Nature. Mark Denny and Steven Gaines. 2000. Princeton University Press, Princeton, NJ. 291 pp. $29.95, softcover. ISBN 0691094942. Written to supplement basic biostatistics texts, this book introduces probability theory to the study of biology. The text is geared for biologists who have had an introductory calculus course but don’t remember the details. Topics are presented in increasing order of mathematical difficulty. The mechanics of molecular diffusion are used to predict maximum size of plankton and the time before an allele becomes fixed or lost in a population. Three dimensional examples explain why arteries are elastic, how horses hold their heads up, and how scallops swim. Statistical extremes are explored by predicting the size of waves on a rocky shore, the absolute longest people can live, and the likelihood of the next 400 hitter in baseball. The last chapter explains how thermal and quantum noise affects our ability to see and hear. Practice problems are given at the end of two chapters with detailed answers. Symbols, author, and subject indices are provided. C.R.

Historical Atlas of Central America. Carolyn Hall and Héctor Pérez Brignoli. 2003. University of Oklahoma Press, Norman, OK. 336 pp. $99.95, hardcover. ISBN 0806130377. This large-format book explores the history and culture of the seven states of Central America. The first section describes the natural environment and historical organization of the territory. Changing demographic patterns and culture are covered in the second section. Economics, politics, and society are described from colonial times to the present in the final three sections. Chapters describe topics such as the power of the church; pirates; development of banana, coffee and beef production; and urbanization. The text is liberally illustrated with over 400 color maps and 140 additional illustrations. Glossary, notes on illustrations, extensive list of sources, and index included. C.R.