

OCCASIONAL PAPERS

THE MUSEUM

TEXAS TECH UNIVERSITY

NUMBER 15

30 AUGUST 1973

NOTES ON THE DISTRIBUTION AND NATURAL HISTORY OF BATS IN SOUTHEASTERN MONTANA

J. KNOX JONES, JR., RICHARD P. LAMPE, CURTIS A. SPENRATH, AND
THOMAS H. KUNZ

The southeastern part of Montana has received little attention insofar as its native mammalian fauna is concerned. In the summer of 1970, members of a Field Course in Vertebrate Zoology from The University of Kansas collected mammals in Montana, principally in the Long Pine Hills, Medicine Rocks, and adjacent areas of Carter County. In the course of these field studies, 205 bats representing seven species, all of the family Vespertilionidae, were obtained. Most were taken in mist nets or were shot at dusk as they foraged or came to water; a bat trap also was used but was of limited effectiveness because suitable trapping sites were lacking.

This paper details distributional and ecological data gathered for the seven bat species collected in Carter County, and supplements information available for elsewhere in Montana (see especially Hoffmann *et al.*, 1969) and for adjacent parts of North Dakota (Genoways and Jones, 1972), South Dakota (Jones and Genoways, 1967; Andersen and Jones, 1971), and Wyoming (Long, 1965). A general description of the areas in which bats were collected will be published elsewhere (Lampe, 1971), but several habitats are figured here (see Figs. 1-3).

We express appreciation to our field companions from the Museum of Natural History, The University of Kansas, and to Dr. George W. Byers of the Department of Entomology of that institution for his diligent work in identification of stomach contents. We are grateful also to Mr. Timothy S. Burns and his colleagues of the U.S. Forest



FIG. 1.—View of eastern edge of Long Pine Hills showing prairie and pine-clad slopes. Impoundments in such areas were used by all species recorded in this study as a source of water.

Service for their hospitality and help, and to Drs. Eleanor K. Jones (ticks), John M. Kinsella (fleas), Richard B. Loomis (chiggers), B. V. Peterson (batflies), and Nixon Wilson (mites) for identification of ectoparasites. All specimens listed in the following accounts are housed in the collection of the Museum of Natural History at Kansas. Measurements and weights are of adults unless otherwise noted. All localities associated with specimens are in Carter County, Montana, but many are designated from Camp Crook, South Dakota, a hamlet just east of the Long Pine Hills.

***Myotis evotis evotis* (H. Allen, 1864)**

Long-eared *Myotis*

Specimens examined (19).—11½ mi. N, 3 mi. E Ekalaka, 2; 7 mi. N, 10 mi. W Camp Crook, 3800 ft., 8; 6½ mi. N, 5½ mi. W Camp Crook, 3400 ft., 1; 5 mi. N, 8 mi. W Camp Crook, 3700 ft., 2; 5 mi. N, 6 mi. W Camp Crook, 3500 ft., 5; 2 mi. N, 4½ mi. W Camp Crook, 3700 ft., 1.

This bat is relatively common in wooded and rocky areas of the Long Pine Hills and Ekalaka Hills as well as in the vicinity of Medicine Rocks. Two adult males were obtained from a daytime roost in a fissure in a small cliff, 5 mi. N and 8 mi. W Camp Crook. The re-

mainder of our specimens were shot or netted over man-made reservoirs that were proximal to pine-clad hills or ridges.

Two females, taken on 1 and 3 July, each carried a single embryo that measured 15 and 25 mm., respectively, in crown-rump length. A male taken on 30 June and four obtained in the period 1 to 9 July had testes that averaged 4.5 (3-6) mm. in length and the testes of seven taken in the last half of July averaged 4.2 (3-5). Two males, obtained on 30 June and 1 July, were still in old pelage, but 10 males taken later in July were molting as were two reproductively inactive females taken on 16 and 17 July. Twelve adult males weighed an average of 6.8 (5.7-7.6) grams, whereas two nonpregnant females both weighed 7.4.

Stomach contents of three *M. evotis* were as follows: one contained a cicadellid, a chironomid, a small moth (Lepidoptera), and a scarab beetle; another contained a small moth and a dragon fly (*Agrion* sp.); the third contained a small moth, a scarab beetle, and a large, black, bristly muscoid fly, probably family Calliphoridae (Diptera).

***Myotis leibii ciliolabrum* (Merriam, 1886)**
Small-footed Myotis

Specimens examined (6).—7 mi. N, 10 mi. W Camp Crook, 3800 ft., 2; 6½ mi. N, 5½ mi. W Camp Crook, 3400 ft., 2; 5 mi. N, 6 mi. W Camp Crook, 3500 ft., 1; 2 mi. N, 4½ mi. W Camp Crook, 3700 ft., 1.

Six adult females were obtained in late June and July in the Long Pine Hills. One, which carried an embryo measuring 19 mm. in crown-rump length on 29 June, was taken in a bat trap placed across a canopy-covered pathway paralleling a small, spring-fed stream. The remaining five females (nonpregnant) were shot as they foraged over man-made reservoirs. At one such place, 6½ mi. N and 5½ mi. W Camp Crook, two individuals were shot over a small, steep-banked reservoir that was located in a ravine below a larger pond. *Myotis evotis*, *M. lucifugus*, *M. volans*, *Eptesicus fuscus*, and *Lasiurus cinereus* were obtained over the larger pond, but *lucifugus* was the only other species taken with *leibii* over the smaller impoundment. Four nonpregnant females averaged 5.1 (4.6-5.7) grams in weight.

One small-footed myotis was parasitized by chiggers, *Leptotrombidium myotis*. The stomach of one individual contained a chironomid and a small coleopteran (probably family Carabidae). Contents of another stomach included remains of a small moth, a tipulid, one or two cicadellids, a small caddisfly (Trichoptera), and two kinds of small beetles (scarabs and carabids). According to George W. Byers,



FIG. 2.—Typical rock formation at Medicine Rocks State Park.

who identified stomach contents for us, *M. leibii* masticates its food to a finer degree than do other species of bats here reported.

***Myotis lucifugus carissima* Thomas, 1904**
Little Brown Myotis

Specimens examined (12).—7 mi. N, 10 mi. W Camp Crook, 3800 ft., 3; 6½ mi. N, 5½ mi. W Camp Crook, 3400 ft., 9.

We netted three specimens of this species over beaver ponds in the Long Pine Hills and shot the remaining individuals as they foraged over reservoirs located below grassy slopes near forest edge. Our single female (nonparous) was shot on 20 July; five adult males were obtained at this same place on that date and three others had been taken there previously. Six males collected from 13 to 17 July had testes that averaged 4.5 (2-7) mm. in length, whereas testes of five males obtained on 20 July averaged 5.6 (5-7). Two males obtained on 14 July were molting as was one taken the following day. Eleven adult males weighed an average of 7.5 (5.5-8.7) grams; the one adult female weighed 9.0.

Among the *M. lucifugus* examined for ectoparasites, we took mites, *Spinturnix americanus*, from one individual. Of two stomachs analyzed for food contents, one contained remains of a chironomid

and a tipulid, whereas the other had several chironomids and cicadellids, and fragments of an unidentifiable coleopteran.

***Myotis volans interior* Miller, 1914**

Long-legged *Myotis*

Specimens examined (32).—1½ mi. N, 3 mi. E Ekalaka, 8; 7 mi. N, 10 mi. W Camp Crook, 3800 ft., 15; 6½ mi. N, 5½ mi. W Camp Crook, 3400 ft., 3; 5 mi. N, 6 mi. W Camp Crook, 3500 ft., 2; 4 mi. N, 8 mi. W Camp Crook, 3650 ft., 2; 2 mi. N, 4½ mi. W Camp Crook, 3700 ft., 2.

This bat is the commonest species of *Myotis* in Carter County, occurring in the Long Pine Hills and Ekalaka Hills as well as in the sparsely wooded areas at Medicine Rocks. Approximately half our specimens were netted over beaver ponds on Slick Creek Spring, 7 mi. N and 10 mi. W Camp Crook; most of the remaining individuals were shot as they foraged over water or among nearby trees. On 9 July, several females were found in a daytime roost under bark of a Ponderosa pine.

Each of two females taken on 9 July carried an embryo (20 and 23 mm. in crown-rump length). Three females obtained on 17 July were lactating and one taken on 24 July had recently completed lactation. Testes of males taken on 13, 15, 16, 17 (two), and 24 July measured 4, 3, 5, 1, 3, and 7 mm. in length, respectively. An adult male taken on 30 June had testes measuring 3 mm. in length and was our earliest record of an individual in molt. Five males, six reproductively inactive females, and one lactating female were molting in the period 9 to 16 July.

Weights of six adult males averaged 7.6 (5.7-9.5) grams, whereas 20 nonpregnant July-taken females averaged 8.2 (6.5-10.0). Individuals of the long-legged myotis were parasitized by mites (*Spinturnix* sp.), batflies (*Bascilia forcipata*), and fleas (probably *Myodopsylla gentilis*).

Three stomachs of *M. volans* contained remains of Lepidoptera (probably noctuids) from which the heads and most of the wings and legs evidently had been removed prior to ingestion. Of five additional stomachs examined, one yielded parts of a cicadellid, a chironomid, and a small coleopteran, another contained remnants of two species of Scarabaeidae, a chironomid, a large fly (probably a calliphorid), and a sawfly (Tenthredinidae, Hymenoptera), a third revealed an unidentified dipteran, a scarab and parts of two other small coleopterans of different families, some small moths, several small caddisflies (Trichoptera), and a cicadellid, a fourth had chironomid frag-



FIG. 3.—Beaver pond on Slick Creek, 7 mi. N and 10 mi. W Camp Crook. All seven species herein reported were netted over this and adjacent ponds.

ments, and the last contained a cicadellid, a small lepidopteran, and an unidentified coleopteran.

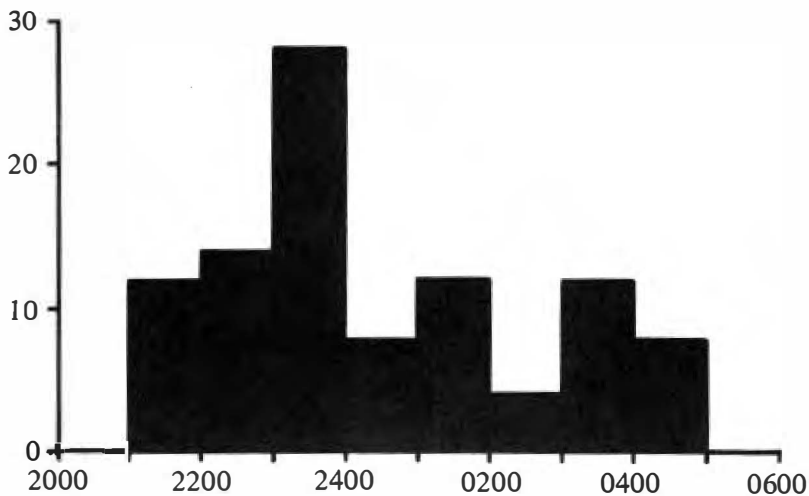


FIG. 4.—Temporal foraging pattern of 25 *Lasionycteris noctivagans* at Slick Creek on nights of 16-17 and 19-20 July. Per cent of total number captured at left; hours of capture below.

***Lasionycteris noctivagans* (Le Conte, 1831)**
Silver-haired Bat

Specimens examined (41).—7 mi. N, 10 mi. W Camp Crook, 3800 ft., 38; 5 mi. N, 6 mi. W Camp Crook, 3500 ft., 3.

The silver-haired bat is a common summer resident in the Long Pine Hills. Most of our specimens were taken in mist nets placed over beaver ponds at Slick Creek Spring. The ponds were constructed at short intervals in a ravine bordered by steep, pine-clad slopes. Duckweed covered much of the surface of the ponds and branches cached by beavers frequently were exposed (see Fig. 3).

Five volant young were netted on the night of 16-17 July and another on 20 July; one was shot on 24 July as it foraged over West Plum Creek Reservoir. Of 20 adult females taken on the night of 16-17 July, 10 were lactating. Testes of 16 adult males obtained in the period 14 to 24 July averaged 6.6 (5-8) mm., whereas those of five volant young taken in the same period averaged 4.0 (2-5) mm. Twelve adult males obtained in the last half of July were molting and a lactating female was molting on 17 July. Thirteen adult males averaged 10.2 (8.5-12.0) grams in weight, whereas the same number of nonpregnant adult females averaged 11.2 (9.8-12.5).

Temporal foraging activity was recorded on the nights of 16-17 and 19-20 July, in which periods 25 individuals were taken. Data

combined for both nights are presented in Fig. 4. An initial major period of activity is indicated between 2300 and 2400 hours with evidence of reduced activity periods later. In the only published study where temporal activity of *Lasionycteris* has been well documented (Kunz, 1973), a bimodal pattern was noted.

It is of interest that of the two methods used in this study to collect silver-haired bats, netting and shooting, the former yielded by far the larger sample, because of the large number of individuals taken well after dark at Slick Creek Spring. Adults of both sexes were taken in approximately equal numbers in July in the Long Pine Hills.

Little is known concerning the food habits of this species (see Whitaker, 1972). We examined six *Lasionycteris* stomachs, one of which contained only internal parts of an unidentifiable insect. Contents of the remaining five stomachs can be summarized as follows: each contained remains of one or more small moths; four yielded parts of hemipterans of the family Corixidae; three revealed cicadellids; one contained fragments of two species of Carabidae and another small beetle not identifiable to family, another had a small unidentified coleopteran, and a third contained a carabid; one contained a dipteran (probably a muscoid fly) and two others held one or more representatives of the dipteran family Anthomyiidae; and one revealed remains of a trichopteran.

Two specimens were parasitized by a chigger, *Leptotrombidium myotis*.

***Eptesicus fuscus pallidus* Young, 1908** Big Brown Bat

Specimens examined (71).—7 mi. N, 10 mi. W Camp Crook, 3800 ft., 27; 6½ mi. N, 5½ mi. W Camp Crook, 3400 ft., 16; 5 mi. N, 6 mi. W Camp Crook, 3500 ft., 22; 5 mi. N, 5½ mi. W Camp Crook, 3500 ft., 1; 2 mi. N, 4½ mi. W Camp Crook, 3700 ft., 4; 8 mi. S, 3 mi. W Camp Crook, 1.

This species probably is the commonest bat in southeastern Montana. Only one of our specimens was obtained other than in the Long Pine Hills, an individual shot as it foraged over the floodplain of the Little Missouri River, 8 mi. S. and 3 mi. W Camp Crook.

The earliest flying young of the year, a male that was just beginning postjuvenile molt, was obtained on 17 July. Another was shot on 18 July and three young bats, two of which were molting, were obtained on 22 July. Many adults were in the process of annual molt in July.

Two females, taken on 29 and 30 June, each carried a single embryo that measured 30 and 26 mm., respectively. Nine females obtained during the first half of July were lactating as were 12, four of

TABLE 1.—*Analysis of food remains from 29 stomachs of Eptesicus fuscus.*

Food item	Stomachs in which found	
	Number	Per cent
Coleoptera		
Scarabaeidae	23 ^{1,2}	79
Carabidae	8	28
Curculionidae	7	24
Hydrophilidae	3 ³	10
Cerambycidae	1 ⁴	3
Dytiscidae	1	3
Dermestidae	1	3
Unidentified	7 ⁵	24
Diptera		
Chironomidae	9	31
Tipulidae	7 ⁶	24
Anthomyiidae	2 ⁴	7
Calliphoridae	1	3
Unidentified	4 ⁷	14
Hemiptera		
Corixidae	9 ⁸	31
Nabidae	5 ⁹	17
Miridae	2	7
Lepidoptera		
Unidentified	8 ¹⁰	28
Homoptera		
Cicadellidae	6	21
Hymenoptera		
Formicidae	1	3
Neuroptera		
Chrysopidae	1	3
Odonata		
Coenagrionidae	1	3
Trichoptera		
Limnephilidae	1 ¹¹	3

¹Five stomachs contained two species.

²Identified to genus *Phyllophaga* in five stomachs.

³Identified to genus *Tropisternus* in one instance.

⁴One stomach contained two species.

⁵In one case, gut or crop of "large wood-eating beetle."

⁶Identified to species *Erioptera cana* in two stomachs.

⁷In one instance, identified to suborder Brachycera; in other, remains were of a muscoid fly (probably Calliphoridae); in a third, probably an anthomyid.

⁸Identified to genus *Sigara* in one instance.

⁹Identified to genus *Nabis* in one instance.

¹⁰All small moths; more than one kind per stomach in several instances.

¹¹Questionable identification to family.

which also were molting, taken during the last half of the month. Testes of six adult males collected during the first half of July averaged 8.8 (6-11) mm., whereas those of 13 adults obtained during the second half of July averaged 7.5 (4-11).

Weights of 16 summer-taken males averaged 15.6 (11.7-20.2) grams; those of 39 nonpregnant females from the same period averaged 18.8 (13.7-23.0). The heaviest young of the year recorded was a female taken on 22 July that weighed 15.9 grams.

Stomachs of 29 big brown bats taken in late June and in July were analyzed for food content. Results are given in Table 1. Coleopterans comprised the most abundant group found in stomachs, followed by Diptera, Hemiptera, Lepidoptera, and Homoptera in that order. Hymenoptera, Neuroptera, Odonata, and Trichoptera each were represented only in one stomach. Our findings differ somewhat from those reported for this species by Ross (1967:223-224) from the southwestern United States and Mexico, and by Whitaker (1972) from Indiana. Among coleopteran families, scarab beetles far outnumbered other groups, remains being recovered from 23 of the 29 stomachs examined. Of note is the fact that head parts, wing covers, and legs of scarabs were absent in stomachs, identifiable remains consisting almost entirely of parts of the thorax and abdomen. This suggests that beetles were "trimmed" of hard parts prior to ingestion by the bats.

We found *Eptesicus fuscus* parasitized by mites, *Spinturnix bakeri* and *Steatonyssus* sp., a chigger, *Leptotrombidium myotis*, a flea, *Myodopsylloides palposus*, and a tick, *Ornithodoros kelleyi*.

***Lasiurus cinereus cinereus* (Palisot de Beauvois, 1796)**

Hoary Bat

Specimens examined (24).—7 mi. N, 10 mi. W Camp Crook, 3800 ft., 10; 6½ mi. N, 5½ mi. W Camp Crook, 3400 ft., 13; 5 mi. N, 6 mi. W Camp Crook, 3500 ft., 1.

The hoary bat, a seasonal migrant, is common in the Long Pine Hills. We netted 10 individuals (two adults and eight young) over the beaver ponds along Slick Creek Spring and shot 14 others as they foraged over small reservoirs. Eight volant young were obtained on the night of 16-17 July and another on 20 July. Fresh pelage of young bats differs most conspicuously from that of adults in being less yellowish (grizzled) in appearance.

Two adult males were taken in the course of our study, one on 16 July and the other two days later. Both were shot as they foraged over a reservoir located in a ravine adjacent to a pine-clad slope, 6½ mi. N and 5½ mi. W Camp Crook. This provides the second geographic

area of record for adults of both sexes on the Northern Great Plains, Jones and Genoways (1967), Turner and Jones (1968), and Turner and Davis (1970) having earlier reported the occurrence of males and females together in the Black Hills.

Lactating females were taken in mid-July and several showed signs of annual molt. Testes of an adult male taken on 16 July measured 7 mm. in length. The two adult males mentioned above weighed 16.5 and 26.0 grams, respectively. Twelve adult females, many lactating but none pregnant, taken in July weighed an average of 28.2 (22.3-38.2) grams.

Of seven stomachs of adult hoary bats from which the contents were analyzed, all contained remains of scarab beetles, whereas two revealed unidentifiable coleopterans and one a representative of the family Dytiscidae. Other orders represented among the contents were as follows: Lepidoptera (noctuids in two and unidentifiable parts in two others); Hemiptera (Corixidae in four and Miridae in one); Homoptera (cicidellids in five); Neuroptera (Myrmeleontidae in three and Hemerobiidae in one); Diptera (Anthomyiidae in one, Calliphoridae and Tipulidae together in one, a chironomid and a muscoid fly in one, and unidentifiable fragments of two families of Acalypttratae in another). Of the seven stomachs examined, three contained remnants of five orders of insects, two contained four, and the remaining two had remains of three orders. Our limited sample differs markedly from the list of foods for this species published by Ross (1967:228), who reported *L. cinereus* to have a "strong dietary preference for microlepidoptera."

No ectoparasites were found on individuals of hoary bats examined in the field.

LITERATURE CITED

- ANDERSEN, K. W., AND J. K. JONES, JR. 1971. Mammals of northwestern South Dakota. Univ. Kansas Publ., Mus. Nat. Hist., 19:361-393.
- GENOWAYS, H. H., AND J. K. JONES, JR. 1972. Mammals from southwestern North Dakota. Occas. Papers Mus., Texas Tech Univ., 6:1-36.
- HOFFMANN, R. S., D. L. PATTIE, AND J. F. BELL. 1969. The distribution of some mammals in Montana. II. Bats. J. Mamm., 50:737-741.
- JONES, J. K., JR., AND H. H. GENOWAYS. 1967. Annotated checklist of bats from South Dakota. Trans. Kansas Acad. Sci., 70:184-196.
- KUNZ, T. H. 1973. Resource utilization: temporal and spatial components of bat activity in central Iowa. J. Mamm., 54:14-32.
- LAMPE, R. P. 1971. The mammals of southeastern Montana. Unpublished M. A. thesis, The University of Kansas, Lawrence, 68 pp.
- LONG, C. A. 1965. The mammals of Wyoming. Univ. Kansas Publ., Mus. Nat. Hist., 14:493-758.

- ROSS, A. 1967. Ecological aspects of the food habits of insectivorous bats. *Proc. Western Found. Vert. Zool.*, 1:205-264.
- TURNER, R. W., AND J. K. JONES, JR. 1968. Additional notes on bats from western South Dakota. *Southwestern Nat.*, 13:444-447.
- TURNER, R. W., AND W. H. DAVIS. 1970. Bats from the Black Hills of South Dakota. *Trans. Kansas Acad. Sci.*, 72:360-364.
- WHITAKER, J. O., JR. 1972. Food habits of bats from Indiana. *Canadian J. Zool.*, 50:877-883.

PUBLICATIONS OF THE MUSEUM
TEXAS TECH UNIVERSITY

Two publications of The Museum of Texas Tech University are issued under the auspices of the Dean of The Graduate School and Director of Academic Publications, and in cooperation with the International Center for Arid and Semi-Arid Land Studies. Shorter research papers are published as Occasional Papers, whereas longer contributions appear as Special Publications. Both are numbered separately and published on an irregular basis.

Institutional libraries interested in exchanging publications may obtain the Occasional Papers and Special Publications by addressing the Exchange Librarian, Texas Tech University, Lubbock, Texas 79409. Individuals may purchase separate numbers of the Occasional Papers for 50 cents each through the Exchange Librarian. Remittance must be enclosed with request.