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SYNOPSIS OF BATS OF NEBRASKA

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The first published report of bats from Nebraska was by Thomas Say and Edwin James (James, 1823), who as naturalists accompanied Major Stephen H. Long's expedition to the Rocky Mountains in 1819-1820 and who recorded the occurrence of three species at the "Engineer Cantonment," located on the Missouri River in what now is Washington County. In contrast, Jones (1964), in the most recent treatment of the entire chiropteran fauna of the state, recorded 12 species, representing two families of the suborder Microchiroptera, based upon a survey of the relevant literature and examination of 465 specimens.

Field studies conducted in Nebraska during the past 15 years have resulted in the accumulation of considerable new data on bats, which help to clarify the distribution of many species in the state and also have led to several contributions to the published literature (see Kunz, 1965; Farney and Jones, 1975; Jones and Choate, 1978). N. J. Czaplewski summarized all information available through 1975 in a master's thesis submitted to Kearney State College.

The present treatment is a synopsis of current knowledge of bats in Nebraska. Thirteen species, based on examination of 888 specimens, are treated in the accounts that follow. One species is reported for the first time from the state. Fortunately, relatively recent publications are available on Chiroptera for the states bordering Nebraska and we have taken these into account in preparation of this paper. The reader is referred especially to

Armstrong (1972) on Colorado, Bowles (1975) on Iowa, Jones and Genoways (1967*b*) and Turner (1974) on South Dakota, Jones *et al.* (1967) on Kansas, and Long (1965) on Wyoming. Other pertinent literature is cited at the appropriate place in text.

Distribution maps are provided for each species on record from Nebraska. For those that are thought to reach distributional limits in the state, the probable area of occurrence is shaded. Solid symbols represent specimens examined, whereas open symbols represent records from the published literature; circles indicate precise localities and triangles indicate those known only to county. Some localities of record are not plotted on distributional maps because undue crowding of symbols would have resulted; such localities are in italic type in lists of specimens examined and other records. For the same reason, symbols occasionally are slightly offset on maps. All external and cranial measurements in text and the key are in millimeters.

We are grateful to many persons for allowing one or more of the authors to study specimens in their care. Museums from which material was examined are as follows (abbreviations used in text in parentheses): American Museum of Natural History (AMNH); Chadron State College (CSC); Field Museum of Natural History (FMNH); Hastings Museum (HM); Vertebrate Museum, Kearney State College (KSC); Museum of Natural History, The University of Kansas (KU); Museum of the High Plains, Ft. Hays State University (MHP); The Museum, Michigan State University (MSU); Museum of Vertebrate Zoology, University of California (MVZ); Nebraska Game, Forestation and Parks Commission (NGFPC); Union College (UC); Museum of Zoology, University of Michigan (UMMZ); Department of Zoology, University of Nebraska (UNDZ); University of Nebraska State Museum (UNSM); National Museum of Natural History (USNM); Conners Museum, Washington State University (WSU).

ACCOUNTS OF SPECIES

Family VESPERTILIONIDAE

Myotis keenii septentrionalis (Trouessart, 1897)

Keen's Myotis

Distribution in Nebraska.—Eastern part of state, westward along Niobrara River at least to Brown and Keya Paha counties, and westward in Republican River drainage at least to Webster County (see Fig. 1).

This species first was reported from Nebraska by Webb and Jones (1952) on the basis of specimens taken from man-made

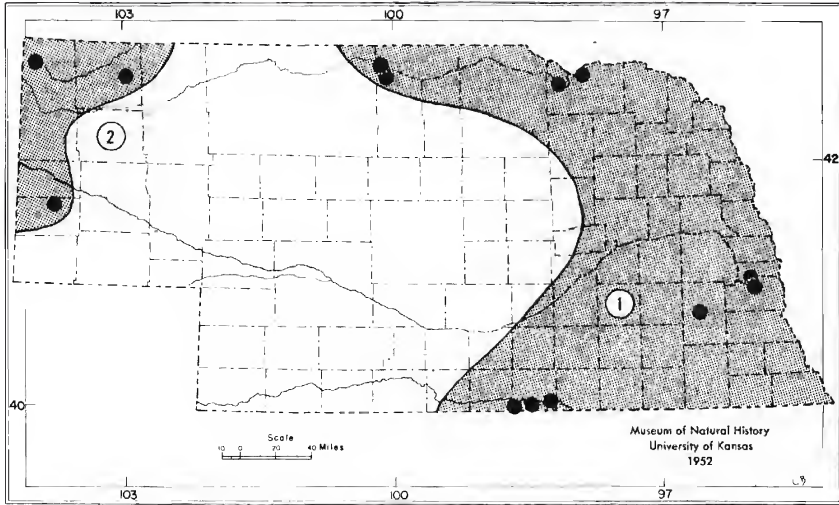


FIG. 1.—Distribution in Nebraska of 1) *Myotis keenii septentrionalis* and 2) *Myotis thysanodes pahasapensis*. See text for explanation of symbols.

limestone quarries, which *M. keenii* inhabits the year around, on either side of the Platte River in Cass and Sarpy counties. Subsequently, it has been taken at several other localities in the eastern half of the state and has been collected at one place or another in association with all other species of bats reported from eastern Nebraska. At the known western limits of its distribution, *M. keenii* has been obtained in bat traps set along or near waterways in deciduous riparian woodlands. A female from Webster County was found roosting in a barn along with a small group of *Eptesicus fuscus*.

In addition to known records listed here, it should be mentioned that a bat reported as "*Myotis subulatus*" from Crystal Lake, Dakota County (Stephens, 1945), may have been a Keen's myotis (see Davis, 1969, and Jones, 1976). It is also of note that *M. keenii* is the most common of three species inhabiting an abandoned mine in Marshall County, Kansas, but a few miles south of the Nebraska (Gage County) border (Jones *et al.*, 1967), and it is a common inhabitant of the Black Hills, where an apparently isolated population occurs (Turner, 1974).

Four females taken on 25-26 May 1975 near Guide Rock, Webster County, were pregnant with a single fetus each, measuring 15-17 in crown-rump length.

Specimens examined (112).—BROWN COUNTY: Fairfield Creek, 19 mi. N Johnstown, 2300 ft., 1 (KSC). CASS COUNTY: 1-1½ mi. NE Louisville, 5 (4 KU, 1 UNSM). KEWA PAHA COUNTY: 1 mi. S, 18 mi. E Valentine, 2300 ft., 1 (KSC). KNOX COUNTY:

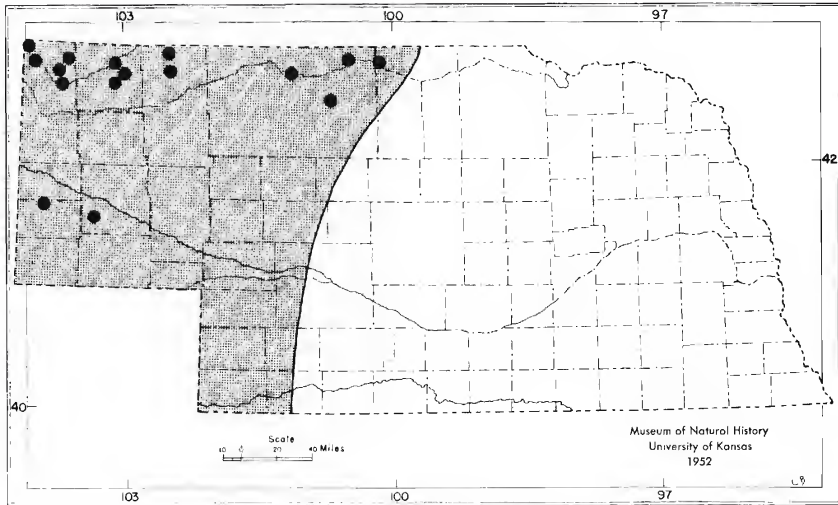


FIG. 2.—Distribution in Nebraska of *Myotis leibii ciliolabrum*. See text for explanation of symbols.

4 mi. E Niobrara, 10 (KSC); 5 mi. S, 1 mi. W Verdel, 2 (KSC). LANCASTER COUNTY: Lincoln, 11 (1 NGFPC, 10 UC). SARPY COUNTY: "cave" near Gretna Fish Hatchery, 8 (UNSM); ½-1 mi. W Meadow, 64 (16 KU, 2 KSC, 3 MSU, 2 MVZ, 2 NGFPC, 1 UNZ, 36 UNSM, 2 W. G. Frum collection). WEBSTER COUNTY: 3 mi. S Red Cloud, 1 (KSC); ¼ mi. S, 2¾ mi. W Guide Rock, 3 (KSC); Advent Creek, 1 mi. S, 1½ mi. W Guide Rock, 2 (KSC); Willow Creek, ¾ mi. S, 2 ⅜ mi. W Guide Rock, 3 (KSC); 6 mi. S, 3 mi. E Riverton, 1 (KSC).

Myotis leibii ciliolabrum (Merriam, 1886)

Small-footed Myotis

Distribution in Nebraska.—Western part of state (see Fig. 2).

The small-footed myotis is the smallest of Nebraska bats, with the exception of *Pipistrellus subflavus*. It is a saxicolous species in that its distribution is limited primarily to areas of rocky cliffs, outcroppings, and dissected badlands, especially in the Panhandle area. There are no records of *M. leibii* from south of the Platte River in southwestern Nebraska and its status there is uncertain. The species is, however, known from northwestern Kansas.

Most specimens available from Nebraska were shot as they foraged in clearings of deciduous or coniferous trees, or over water, or were captured in bat traps or mist nets set over water or in flyways adjacent to woody vegetation. Swenk (1908), however, took two individuals from under a loose strip of pine bark, and Quay (1948) reported bats found in "pockets" behind loose sheets of rock in the badlands of northern Sioux County.

Stephens (1945) recorded *M. leibii* (as *M. subulatus*) from Dakota County, far to the east of the otherwise known distribution in the northern part of the state, but this report may relate to some other species (see account of *M. keenii*) and is not admitted here. The certain easternmost record in Nebraska is from along the Niobrara River in western Keya Paha County.

Except for an individual taken in a building on the Chadron State College campus in February 1970, all records are from the warm months of the year (May through September). A female from Sioux County carried a single fetus on 12 July 1944 (Quay, 1948). Lactating females were taken in 1975 on 14, 15, and 18 July in Sioux County and on 8 August in Banner County.

Specimens examined (57).—BANNER COUNTY: 10 mi. S, 2½ mi. E Gering, 21 (KSC); 9 mi. N, 5 mi. E Harrisburg, 1 (KU). CHERRY COUNTY: Valentine, 1 (UNSM); 8½ mi. S, ½ mi. W Nenzel, 2750 ft., 1 (KSC); Hackberry Lake, Valentine National Wildlife Refuge, 1 (KU). DAWES COUNTY: Chadron, 2 (1 CSC, 1 UNSM); NE ¼ sec. 14, T. 32 N, R. 48 W, 3 (CSC); 6 mi. S Chadron, 2 (1 UNZ, 1 UNSM); Little Bordeaux Creek, 7¼ mi. S, 3½ mi. E Chadron, 1 (CSC); 10 mi. S Chadron, 1 (KU). KEYA PAHA COUNTY: 1 mi. S, 18 mi. E Valentine, 2300 ft., 4 (KSC). MORRILL COUNTY: Roundhouse Rock, 1¼ mi. N, 3½ mi. E Redington, 1 (KSC). SHERIDAN COUNTY: 15 mi. N Rushville, 2 (KU); Rushville, 1 (KU). SIOUX COUNTY: center of W ½ Antelope Township, 1 (UMMZ); SE ¼ Sugarloaf Township, 1 (UMMZ); Warbonnet Canyon, 1 (UNSM); NE ¼ sec. 20, T. 33 N, R. 53 W, 1 (CSC); Monroe Canyon, 5-5½ mi. N, 2½ mi. W Harrison, 4500 ft., 9 (3 KU, 6 KSC); 1 mi. N, 10 mi. W Crawford, 1 (UNSM); Glen, 1 (UNSM).

Myotis lucifugus

Little Brown Myotis

Distribution in Nebraska.—Eastern part of state (*Myotis lucifugus lucifugus*) and northwestern part of state (*Myotis lucifugus carissima*)—see Fig. 3.

The two subspecies of *M. lucifugus* that occur in Nebraska (*carissima* in the northwest and *lucifugus* in the east) evidently do not meet in the state, although intergradation should be looked for along the Niobrara River. *M. l. carissima*, which is not an uncommon inhabitant of the Pine Ridge in Dawes and Sioux counties, is notably paler in color and slightly larger than *M. l. lucifugus*, which is known from scattered localities in the eastern third of Nebraska. It should be noted that Smith (1958) recorded this species from Thomas County, in the Sand Hills and far from other known localities of occurrence. Because he preserved no specimens and this record of occurrence seems unlikely, we have not admitted it here.

Hibernacula have not been found on the Pine Ridge, but both sexes are known to hibernate in limestone quarries on either side

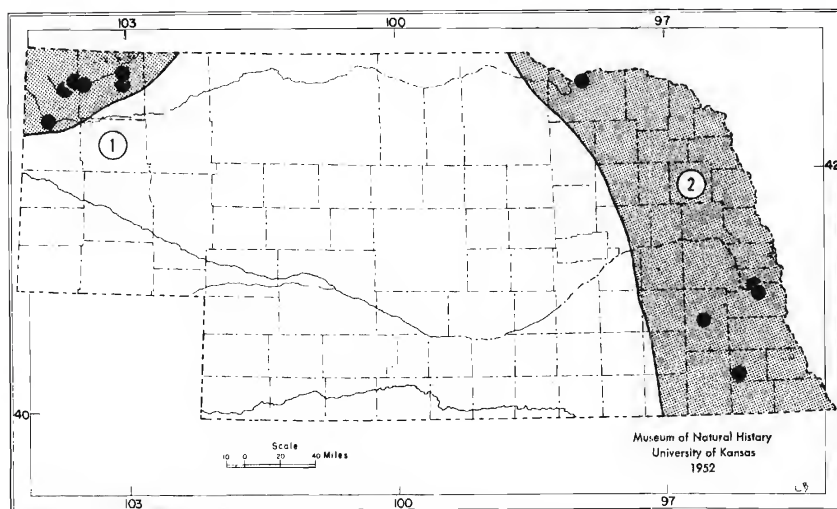


FIG. 3.—Distribution in Nebraska of *Myotis lucifugus*: 1) *M. l. carissima*, 2) *M. l. lucifugus*.

of the Platte River in Cass and Sarpy counties, as they are in an abandoned mine just south of the Nebraska border in Marshall County, Kansas (Jones *et al.*, 1967), and in the Black Hills region (Martin and Hawks, 1972). Both adult males and females have been taken in Dawes and Sioux counties in warm months, and both were banded by T. H. Kunz in the summer of 1969 in Johnson County. The sexes seem to occupy different diurnal roosts in summer, however. It is of note that a hibernating individual banded near Blue Rapids, Kansas, on 28 March 1965 was recaptured near Sterling, Johnson County, on 24 August 1968.

A pregnant female was netted and banded by Kunz in Johnson County on 24 June 1969; he also took a number of lactating females and juveniles of both sexes on the same date and captured young-of-the-year of both sexes there in late July. Additional reproductive data are limited to the collection of immature individuals on the Pine Ridge, which indicates the presence of maternity colonies.

Myotis lucifugus carissima Thomas, 1904

Specimens examined (31).—DAWES COUNTY: Chadron, 1 (UNSM); 6 mi. S Chadron, 1 (UNSM); 3 mi. W Crawford, 18 (UNSM). SIOUX COUNTY: 5½ mi. W Crawford, 7 (UNSM); 3 mi. S Glen, 2 (UNSM); Agate, 2 (1 KU, 1 UMMZ).

Myotis lucifugus lucifugus (Le Conte, 1831)

Specimens examined (31).—CASS COUNTY: 1 mi. N, 2 mi. W Louisville, 1 (UNSM). JOHNSON COUNTY: 8 mi. S Sterling, 1 (KU). KNOX COUNTY: 4 mi. E Nio-

brara, 1 (KSC). LANCASTER COUNTY: Lincoln, 1 (UC). SARPY COUNTY: 5 mi. SE Gretna Fish Hatchery, 1 (UNDZ); "cave" near Gretna Fish Hatchery, 3 (UNSM); 5 mi. NW Louisville, 1 (UC); ½-1 mi. W Meadow, 22 (7 KU, 14 UNSM, 1 UNDZ).

Myotis thysanodes pahasapensis Jones and Genoways, 1967

Fringe-tailed Myotis

Distribution in Nebraska.—Known in western part of state from Banner, Dawes, and Sioux counties (see Fig. 1).

The fringe-tailed myotis first was reported from Nebraska by Farney and Jones (1975) based on a male taken on 7 August 1972 in Banner County. However, a bat previously reported as *Myotis evotis* (see Swenk, 1908, and Jones, 1964) from Sioux County has, upon reexamination, proved to be *M. thysanodes* (Jones and Choate, 1978). In addition, J. D. Druecker netted four females in Dawes County in 1970, three in June and one in August. These were taken in riparian deciduous growth along Little Bordeaux Creek below pine-clad buttes. *Myotis leibii*, *M. volans*, *Eptesicus fuscus*, and *Lasiurus cinereus* were taken along with the specimens from Dawes County. All of the same species, save *M. volans*, were taken in a bat trap with the male from Banner County, which was captured in a spring-fed ravine in the Wildcat Hills. The specimen originally reported as *M. evotis* from Sioux County was caught over a pond in an insect net by Merrit Cary on 22 July 1901.

It is of interest that a bat caught in a trap set 1 mi. S and 18 mi. E Valentine, in Keya Paha County, by a field party from Kearney State College (including Czaplewski and Farney) on 18 August 1972 was identified as *M. thysanodes*. Unfortunately, this specimen escaped and the record is, therefore, not admitted here. Nevertheless, the possibility that fringe-tailed myotis may occur eastward in Nebraska some distance along the Niobrara River is of considerable interest.

The subspecies *M. t. pahasapensis* was described originally by Jones and Genoways (1967a) and was thought at that time to be limited to the Black Hills, where it since has been found to be a common inhabitant (Turner, 1974). In addition to the Nebraska records here listed, the subspecies, which likely is isolated from others of the species, also now is known from the South Dakota Badlands (Jones and Choate, 1978).

No reproductive data are available from Nebraska. Turner (1974) reported pregnant and lactating females from western South Dakota in June, and in late July and August, respectively.

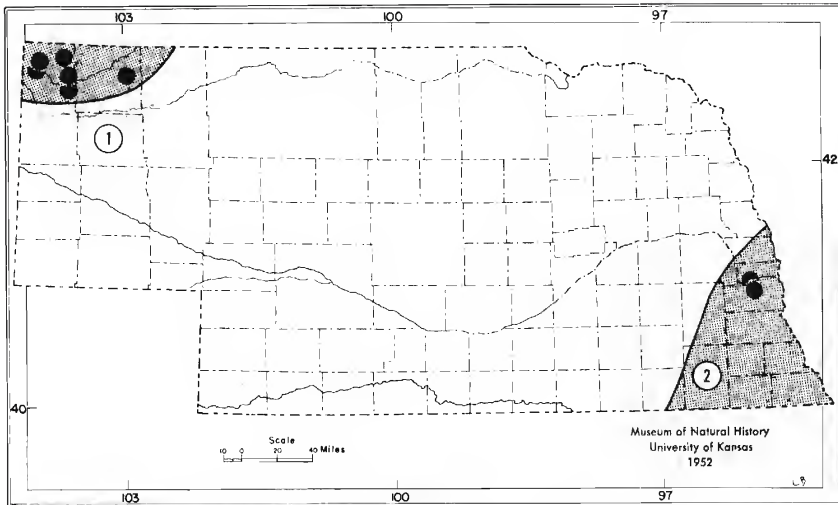


FIG. 4.—Distribution in Nebraska of 1) *Myotis volans interior* and 2) *Pipistrellus subflavus subflavus*. See text for explanation of symbols.

Specimens examined (6).—BANNER COUNTY: 10 mi. S, 2½ mi. E Gering, 4500 ft., 1 (KSC). DAWES COUNTY: NE ¼ sec. 14, T. 32 N, R. 48 W, 1 (CSC); Little Bordeaux Creek, 8½ mi. S, 3½ mi. E Chadron, 3 (CSC). SIOUX COUNTY: Warbonnet Canyon, 1 (UNSM).

Myotis volans interior Miller, 1914

Long-legged Myotis

Distribution in Nebraska.—Known only from Pine Ridge and adjacent areas in northwestern part of state (see Fig. 4).

This species first was reported from Nebraska by Quay (1948), and since has been found to be a common inhabitant of the Pine Ridge and adjacent areas in Dawes and Sioux counties. It is to be looked for also along the Niobrara river to the east of the Pine Ridge and it is possible that *M. volans* will be found on the pine-capped Bighorn and Wildcat ridges south of the Platte River in the extreme western part of the Panhandle.

Quay (1948) found "about 180" individuals in a fissure in the badlands north of Harrison on 22 June 1944, but preserved only two. He did note that "of the several dozen of these bats examined closely, all were females. Four that were dissected contained a single fetus each." More recently, lactating females were taken in Sioux County on 16 and 19 July 1975 and a volant young-of-the-year on 9 August 1972. Of 19 adult females captured in Sioux County on 15 August 1975, nine were pregnant (one aborting a

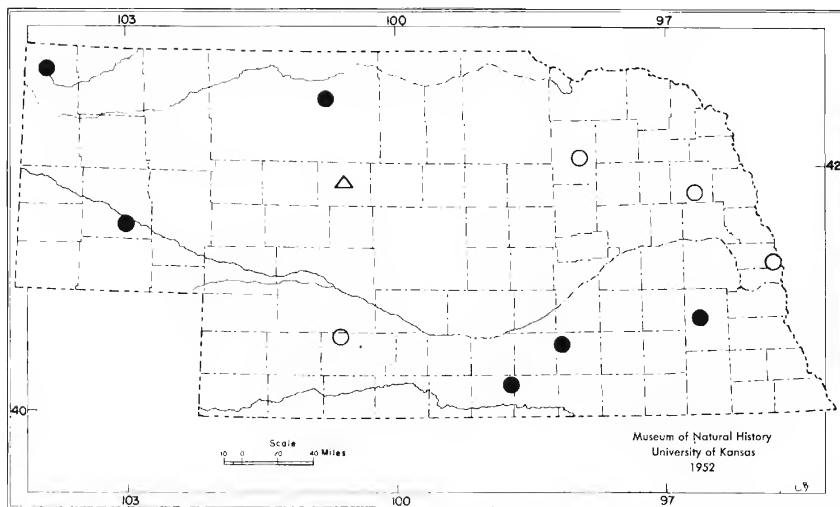


FIG. 5.—Distribution in Nebraska of *Lasionycter noctivagans*. See text for explanation of symbols.

fetus at the time of capture), and four were lactating. Such seasonally late reproduction has been reported previously for *M. volans*.

Specimens examined (34).—DAWES COUNTY: Little Bordeaux Creek, 7 $\frac{1}{2}$ mi. S, 3 $\frac{1}{2}$ mi. E Chadron, 1 (CSC). SIOUX COUNTY: 1 mi. S, 4 mi. W Orella, 1 (UNSM); 8 mi. N Harrison, 2 (UMMZ); Monroe Canyon, 5 mi. N, 2 $\frac{1}{2}$ mi. W Harrison 4500 ft., 28 (25 KSC, 3 KU); 1 mi. N, 10 mi. W Crawford, 1 (UNDZ); 3 mi. S Glen, 1 (UNSM).

Lasionycter noctivagans (Le Conte, 1831)

Silver-haired Bat

Distribution in Nebraska.—Any part of state in migration; resident status uncertain (see Fig. 5).

Silver-haired bats may occur in Nebraska only during migrations—northward in spring and southward in late summer and early autumn—although the possibility should not be overlooked that they are summer residents in some areas, particularly along the Niobrara River and on the Pine Ridge. Also, recent recordings of hibernating *L. noctivagans* in several midwestern states are of note. Known resident summer populations nearest Nebraska are in eastern and central Iowa (Bowles, 1975), and on the Black Hills (Turner, 1974). Both males and females occur in summer in the latter region, but evidently only females reside in Iowa at that time. Swenk (1908) reported this species in Nebraska

as "fairly common during migrations, probably not breeding within our limits."

We have examined seven specimens from the state for which locality and date of capture are known. Two of these possibly represent residents—a female taken in mid-June 1956 in Cherry County and a male obtained on 19 June 1966 in Sioux County. The others, almost certainly southward migrants, were collected on the following dates: 28 August 1910 (Lancaster County), 8 September 1918 (Clay County), 11 September 1975 (Lancaster County), last week of September 1976 (Morrill County), and 2 October 1945 (Franklin County). One of the migrants was "caught in a brick pile," whereas another was found in a pile of boards in a barn.

Specimens examined (8).—CHERRY COUNTY: Snake River, NW of Valentine National Wildlife Refuge, 1 (NGFPC). CLAY COUNTY: Inland, 1 (HM). FRANKLIN COUNTY: Campbell, 1 (HM). LANCASTER COUNTY: Lincoln, 2 (1 AMNH, 1 UNSM). MORRILL COUNTY: sec. 15, T. 18 N, R. 49 W, 1 (CSC). SIOUX COUNTY: Sowbelly Canyon, 3 mi. N, 2 mi. E Harrison, 1 (UNSM). County unknown: "Nebraska," 1 (UNSM).

Additional records.—ANTELOPE COUNTY: Neligh (Jones, 1964:89). CLAY COUNTY: Harvard (Jones, 1964:89). CUMING COUNTY: West Point (Swenk, 1908:103). DOUGLAS COUNTY: Omaha (Swenk, 1908:103). FRONTIER COUNTY: Curtis (Jones, 1964:89). THOMAS COUNTY: no specific locality (Smith, 1958:59). County unknown: Platte River (Miller, 1897:87).

Pipistrellus subflavus subflavus (F. Cuvier, 1832)

Eastern Pipistrelle

Distribution in Nebraska.—Known only from Cass and Sarpy counties; probably occurring elsewhere in southeastern part of state (see Fig. 4).

This bat is known in Nebraska only from limestone quarries on either side of Platte River in Cass and Sarpy counties, which it inhabits along with *Myotis keenii*, *M. lucifugus*, and *Eptesicus fuscus*, and where it is common in hibernation but relatively rare in summer. Probably this species will be found elsewhere in southeastern Nebraska, although the dearth of available hibernacula there may severely limit its distribution. The species occurs throughout eastern Kansas (Jones *et al.*, 1967) in suitable habitat, including an abandoned mine but a few miles south of the Nebraska (Gage County) border, and over much of central and eastern Iowa (Bowles, 1975). The Nebraska records are along the western margin of distribution of *P. subflavus*. No reproductive data are available from the state.

Specimens examined (52).—CASS COUNTY: 1-1½ mi. NE Louisville, 8 (3 FMNH, 1 KU, 4 UNSM); 1½ mi. W. Louisville, 4 (UC). SARPY COUNTY: 5 mi. SE Gretna

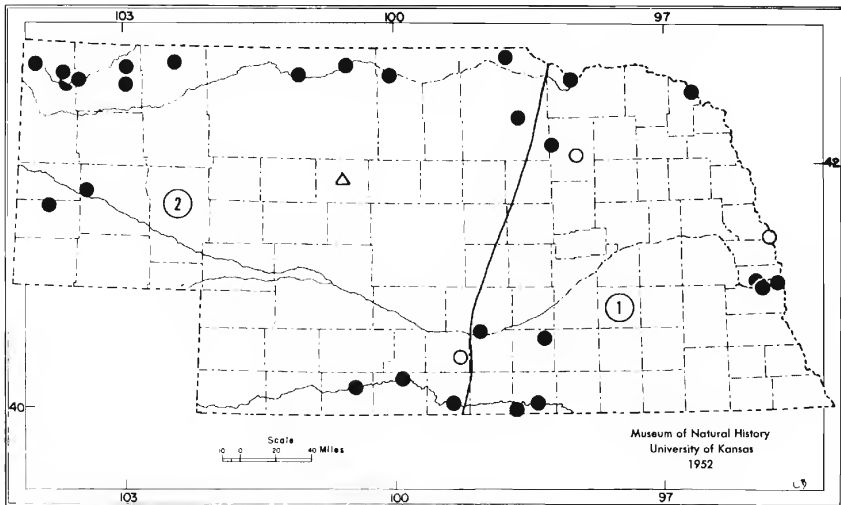


FIG. 6.—Distribution in Nebraska of *Eptesicus fuscus*: 1) *E. f. fuscus*, 2) *E. f. pallidus*. See text for explanation of symbols.

Fish Hatchery, 3 (UC); *5 mi. NW Louisville*, 2 (UC); $\frac{1}{2}$ -1 mi. W *Meadow*, 35 (3 KSC, 16 KU, 2 MVZ, 1 UNZ, 7 UNSM, 1 NGFPC, 3 P. H. Krutzsch collection, 2 W. G. Frum collection).

Eptesicus fuscus

Big Brown Bat

Distribution in Nebraska.—State-wide (see Fig. 6).

The big brown bat is the most widely distributed chiropteran species in the state and perhaps the most common. It is known to inhabit a variety of man-made structures, such as barns or abandoned buildings, attics of homes and churches, and room-and-pillar quarries. Some roosts are occupied only in summer, but others are used the year around because they also serve as hibernacula. Pregnant females normally form maternity colonies separate from groups of adult males and nonpregnant females in late spring and summer, but the sexes hibernate together in the same refugium in the cold months.

E. fuscus undoubtedly utilizes many types of natural retreats, but the only two instances of such habitation reported from Nebraska are from rock fissures and from woodpecker nest cavities in a hollow tree. The species has been taken in roosts in company with, or collected at the same place as, all but three of the other species of bats known from Nebraska (and is recorded from at least one county from which each of the remaining three has

been reported). At the latitude of Nebraska, the big brown bat generally emerges from winter torpor in April or early May and enters hibernation again in October. Individuals may arouse occasionally from hibernation in winter, especially in circumstances where subfreezing temperatures necessitate seeking a more protective roost.

The number of young produced by females is geographically variable in temperate North America. Those from the eastern United States have two as a rule, whereas those from the intermountain west and Pacific coastal areas generally give birth to a single offspring. Nebraska is in the zone of transition and it is not surprising, therefore, that both single and twin fetuses or young have been reported from females from the state as follows: four of five pregnant females taken in Cherry County on 18-23 June 1936 carried two fetuses, whereas the fifth carried one, as did a female obtained there on 14 July 1975 (crown-rump length 26); of nine pregnant females collected in Sioux County in the first four days of July 1957, one carried two fetuses and the remainder only one. Lactating females have been captured in July, August, and as late as the first week of September (two large young in Sheridan County). The earliest volant young-of-the-year of which we have record were taken in Banner County on 20 July 1959.

Two subspecies, *E. f. fuscus* in the east and *E. f. pallidus* in the west, occur in Nebraska. Specimens from the eastern third of the state are clearly referable to *fuscus*, whereas those from the Panhandle are typical of *pallidus*. Bats from the central part of the state are intergrades between the two and are assigned to one or another on the basis of average characteristics. *E. f. fuscus* differs from *E. f. pallidus* in being darker in color, especially dorsally, and slightly larger in size. Adult females of both subspecies average about five per cent larger than males.

Eptesicus fuscus fuscus (Palisot de Beauvois, 1796)

Specimens examined (167).—ADAMS COUNTY: Hastings, 4 (2 HM, 2 KU); *no specific locality*, 1 (HM). ANTELOPE COUNTY: 1 mi. S, 4 mi. E Ewing, 1 (KSC). BUFFALO COUNTY: ½ mi. N, 1 mi. E Kearney, 1 (KSC); Kearney, 39 (KSC). CASS COUNTY: 1½ mi. NE Louisville, 4 (2 FMNH, 2 KU); Plattsmouth, 1 (UNSM). DIXON COUNTY: Ponca State Park, 2 (UC). KNOX COUNTY: 1 mi. W Niobrara, 1 (KU). SARPY COUNTY: ½-1 mi. W Meadow, 40 (3 KSC, 12 KU, 1 NGFPC, 24 UNSM). WEBSTER COUNTY: 4½ mi. E Red Cloud, 64 (60 KU, 4 UNSM); 6 mi. S, 3 mi. E Riverton, 9 (KSC).

Additional records.—ANTELOPE COUNTY: Neligh (Jones, 1964:92). KNOX COUNTY: Niobrara (Jones, 1954:482). WASHINGTON COUNTY: Engineer Cantonment [=approximately 2 mi. E Ft. Calhoun], the type locality of *Vespertilio arquatus* Say (in James, 1823:167). WEBSTER COUNTY: Red Cloud (Jones, 1964:92).

Eptesicus fuscus pallidus Young, 1908

Specimens examined (190).—BANNER COUNTY: 9 mi. N, 5 mi. E Harrisburg, 15 (KU); 10 mi. S, 2½ mi. E Gering, 4500 ft., 12 (KSC). BOYD COUNTY: 4 mi. N, 2½ mi. W Spencer, 12 (KU). CHERRY COUNTY: Valentine, 4 (1 UNSM, 3 UNDZ); *Minnechaduzza Creek, Valentine City Park*, 2 (KSC); *Ft. Niobrara National Wildlife Refuge, 4 mi. E Valentine*, 37 (20 KU, 2 MVZ, 13 NGFPC, 2 UNSM); 8 mi. S, ½ mi. W Nenzel, 2800 ft., 7 (KSC). DAWES COUNTY: Chadron, 2 (1 KU, 1 UNSM); *NE ¼ sec. 14, T. 32 N, R. 48 W*, 2 (CSC); *Little Bordeaux Creek, 7¾ mi. S, 3½ mi. E Chadron*, 2 (CSC); 10 mi. S Chadron, 1 (UMMZ). FURNAS COUNTY: Arapahoe, 1 (KSC). HARLAN COUNTY: Alma, 3 (UNSM). HOLT COUNTY: ½ mi. S O'Neill, 1 (KSC). KEYA PAHA COUNTY: 1 mi. S, 18 mi. E Valentine, 2300 ft., 3 (KSC); 2½ mi. S Norden, 2 (KSC). MORRILL COUNTY: Bayard, 1 (KU). RED WILLOW COUNTY: Indianola, 14 (KSC). SHERIDAN COUNTY: 15 mi. N Rushville, 2 (KU). SIOUX COUNTY: Warbonnet Canyon, 6 (UNSM); *NE ¼ sec. 20, T. 33 N, R. 53 W*, 1 (CSC); *Monroe Canyon, 5-5½ mi. N, 2½ mi. W Harrison, 4500 ft.*, 20 (9 KSC, 8 KU, 3 NGFPC); *Monroe Canyon, 4 mi. N, 2 mi. W Harrison*, 3 (UNSM); ½ mi. N, 11 mi. W Crawford, 3 (UNSM); 5½ mi. W Crawford, 19 (8 KU, 11 UNSM); 1 mi. S, 4 mi. W Crawford, 4 (UNSM); 3½ mi. N, 1 mi. E Glen, 1 (UNSM); *Glen*, 1 (UNSM); 1 mi. S, 4 mi. E Glen, 1 (UNSM); 3 mi. S Glen, 6 (UNSM).

Additional records.—PHELPS COUNTY: Funk (Jones, 1964:93). THOMAS COUNTY: no specific locality (Smith, 1958:59).

Lasiurus borealis borealis (Müller, 1776)

Red Bat

Distribution in Nebraska.—Probably state-wide in suitable habitats in warm months (see Fig. 7); migrates southward in winter.

The red bat is a common inhabitant of eastern Nebraska in the warm months of the year. It is a solitary, tree-roosting species, finding daytime retreats in deciduous trees such as box elder and various kinds of elms, and it frequents a wide variety of wooded habitats—from farm lots and small urban communities to extensive deciduous riparian timberlands. The species is rare in the western part of the state because of the paucity of habitable environments but is known from the Pine Ridge in Sioux County and from along the Platte River in Garden County. Probably it will be found elsewhere in the Panhandle along the few major waterways and in at least the larger cities and towns.

L. borealis is, at the latitude of Nebraska, a migratory bat and individuals move southward to unknown wintering grounds beginning in late summer, and return northward again in spring. The earliest known seasonal date of capture of a red bat in Nebraska is of a female taken on 26 April and the latest that of a male captured on 19 September.

Breeding occurs sometime prior to northward migration and females, therefore, are gravid upon arrival in spring. Parturition

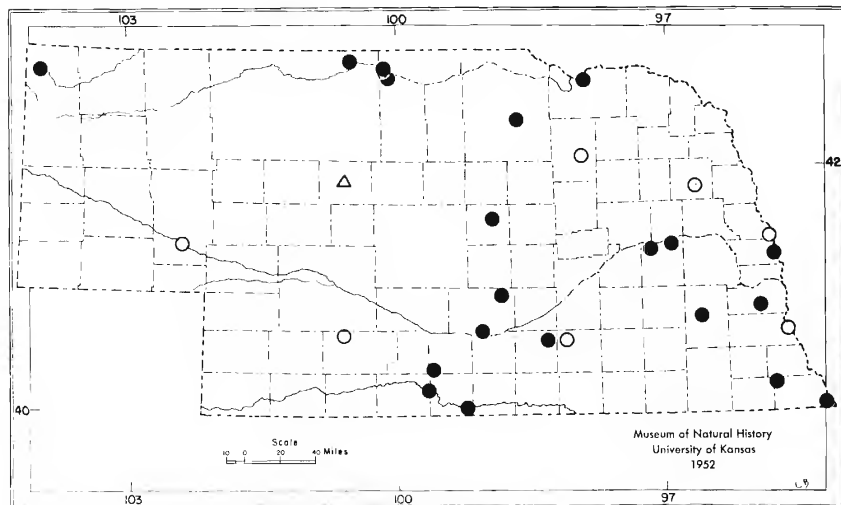


FIG. 7.—Distribution in Nebraska of *Lasiurus borealis borealis*. See text for explanation of symbols.

takes place in late May and June. The recorded number of young for this species ranges from one to five, but the known range in the Plains states is two to four, with four the mode. The following reproductive data are available for Nebraska-taken females (county names in parentheses); four fetuses (20 in crown-rump length) on 31 May (Butler); four young on 14 June (Buffalo); lactating on 21 June (Phelps); three young on 24 June (Adams); four young on 25 June (Buffalo); four young on 29 June (Buffalo); four young on 5 July (Lancaster); lactating on 15 July (Sioux); four young on 24 July (Buffalo). Females with nursing young occasionally are dislodged from trees by strong winds, heavy rain or hail, or for other reasons, and are unable to escape from the ground owing to the weight of their offspring; this accounts for the relatively large number of females accompanied by young in museum collections.

Jones *et al.* (1967) concluded that adult males were uncommon in Kansas in spring and early summer, during the time females were rearing young, and the same seems to be true in Nebraska. What happens to adult males at this time is unknown, but they begin to appear in numbers in late summer, prior to southward migration. Geographic segregation of the sexes is not so marked as in *L. cinereus* but is worthy of additional study.

Specimens examined (82).—ADAMS COUNTY: Hastings, 5 (HM). BROWN COUNTY: Fairfield Creek, 19 mi. N Johnstown, 2300 ft., 1 (KSC). BUFFALO COUNTY: Ravenna, 5 (KSC); Kearney, 14 (KSC). BUTLER COUNTY: 2 mi. N, 2 mi. W Bell-

wood, 1 (UNSM); 4 mi. N Octavia, 1 (KU). CASS COUNTY: Weeping Water, 1 (UNSM). CHERRY COUNTY: Minnechaduz Creek, Valentine City Park, 1 (KSC). DOUGLAS COUNTY: Omaha, 3 (1 UNSM, 2 R. Velich collection). FURNAS COUNTY: 1 mi. S Oxford, 1 (MHP). HARLAN COUNTY: 1¼ mi. S, 1 mi. W Republican City, 1 (KSC). HOLT COUNTY: ½ mi. S O'Neill, 3 (KSC). KEYA PAHA COUNTY: 1 mi. S, 18 mi. E Valentine, 2300 ft., 2 (KSC). KNOX COUNTY: 4 mi. E Niobrara, 4 (KSC). LANCASTER COUNTY: Lincoln, 26 (2 ANMH, 1 FMNH, 2 KU, 6 UC, 11 UNSM, 4 UNDZ). PHELPS COUNTY: Spring Creek, ½ mi. S, 6 mi. W Atlanta, 1 (KSC). RICHARDSON COUNTY: 5 mi. N, 2 mi. W Humboldt, 2 (KU); Rulo, 1 (WSC); 3 mi. SE Rulo, 1 (NGFPC). SIOUX COUNTY: Monroe Canyon, 5 mi. N, 2½ mi. W Harrison, 4500 ft., 5 (KSC). VALLEY COUNTY: Ord, 3 (KU).

Additional records.—ANTELOPE COUNTY: Neligh (Jones, 1964:95). CLAY COUNTY: Inland (Jones, 1964:95). CUMING COUNTY: West Point (Swenk, 1908:139). FRONTIER COUNTY: Curtis (Jones, 1964:95). GARDEN COUNTY: Oshkosh (Jones, 1964:95). OTOE COUNTY: Nebraska City (Swenk, 1908:139). PHELPS COUNTY: *no specific locality* (Jones, 1964:95). RICHARDSON COUNTY: *Humboldt* (Swenk, 1908:139). THOMAS COUNTY: *no specific locality* (Smith, 1958:59). WASHINGTON COUNTY: Engineer Cantonment [=approximately 2 mi. E Ft. Calhoun] (James, 1823:369). County unknown: "*Nebraska*" (H. Allen, 1894:153).

Lasiurus cinereus cinereus (Palisot de Beauvois, 1796)

Hoary Bat

Distribution in Nebraska.—State-wide in suitable habitats in warm months (see Fig. 8); migrates southward in winter.

Lasiurus cinereus is the largest of Nebraska's bats and, save for *Eptesicus fuscus*, the most widely distributed. Like the red bat, it is migratory and seeks daytime retreat in deciduous trees and other woody vegetation, where individuals roost singly or in family groups consisting of a female with young while the latter still are nursing. May is the earliest month of record from Nebraska (although a female was taken on 26 March 1953 just south of the border of the state in Cheyenne County, Kansas) and October is the latest, records in both months based on single specimens; all other hoary bats known from Nebraska have been collected in the months of June, July, and August.

As reported by Findley and Jones (1964), adult females of this species generally reside in areas of lower altitude and latitude in the Plains states than do adult males, and this appears to be true in Nebraska. Adults of both sexes do occupy the Pine Ridge and Wildcat Hills, however, and possibly males will be found as summer residents elsewhere in the state. Much remains to be learned about the migratory habits of *L. cinereus* in central North America.

Most hoary bats collected in Nebraska have been taken in bat traps or mist nets set in or near deciduous vegetation or over

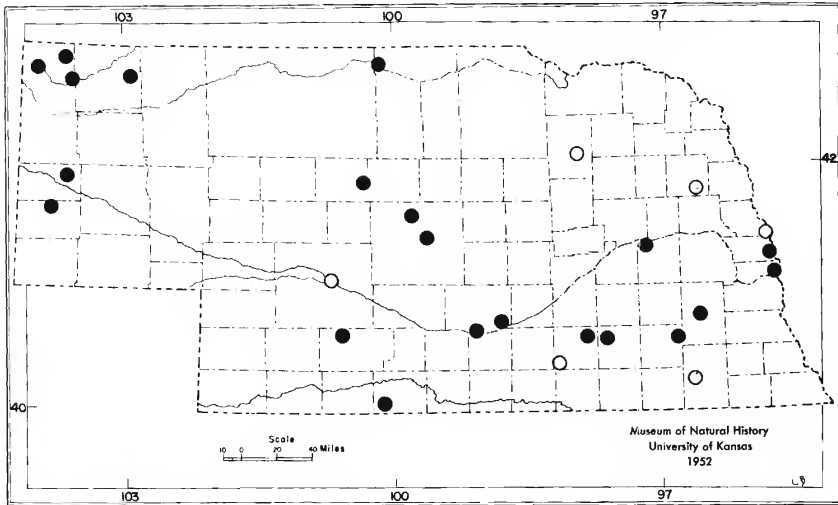


FIG. 8.—Distribution in Nebraska of *Lasiurus cinereus cinereus*. See text for explanation of symbols.

water, shot as they foraged at dusk, or found (females with nursing young) on the ground after having been dislodged from a daytime roost. A specimen from Thomas County was found impaled on a barbed-wire fence.

Females normally bear twins. One with two fetuses was taken in Sarpy County on 6 June; another with two was obtained, in Douglas County on 16 June. Females accompanied by two young are on record from 6 June (Lancaster County), 17 June (locality unknown), 19 June (Douglas County), and 6 July (Buffalo County). Lactating individuals have been collected on 16 and 30 July in Sioux County. Volant young-of-the-year have been taken as early as the last week of June in the southern part of the state.

Specimens examined (96).—ADAMS COUNTY: Hastings, 2 (HM). BANNER COUNTY: 10 mi. S, 2½ mi. E Gering, 4500 ft., 13 (KSC). BUFFALO COUNTY: Gibbon, 1 (KSC); Kearney, 4 (KSC). BUTLER COUNTY: 2 mi. N, 2 mi. W Bellwood, 1 (KU). CLAY COUNTY: Inland, 2 (HM). CUSTER COUNTY: Victoria Springs, 1 (UMMZ); Broken Bow, 2 (UMMZ). DAWES COUNTY: Little Bordeaux Creek, 7¾ mi. S, 3½ mi. E Chadron, 8 (CSC). DOUGLAS COUNTY: Omaha, 4 (R. Velich collection). FRONTIER COUNTY: Curtis, 1 (AMNH). FURNAS COUNTY: Wilsonville, 1 (HM). KEYA PAHA COUNTY: 1 mi. S, 18 mi. E Valentine, 2300 ft., 1 (KSC). LANCASTER COUNTY: 4 mi. W Lincoln, 1 (UNSM); Lincoln, 8 (1 UC, 5 UNSM, 2 UDNZ). SALINE COUNTY: Crete, 1 (UC). SARPY COUNTY: Bellevue, 1 (R. Velich collection). SCOTTS BLUFF COUNTY: Lake Minatare, 8 mi. N Minatare, 4050 ft., 1 (KSC). SIOUX COUNTY: 1 mi. S, 4 mi. W Orella, 1 (UNSM); Monroe Canyon, 5 mi. N, 2½ mi. W Harrison, 4500 ft., 33 (28 KSC, 5 KU); 1 mi. N, 10 mi. W Crawford, 3 (UNSM); 5½ mi. W Crawford 1 (UNSM). THOMAS COUNTY: 1 mi. W Halsey, 1 (KU); Halsey, 1 (AMNH); 1

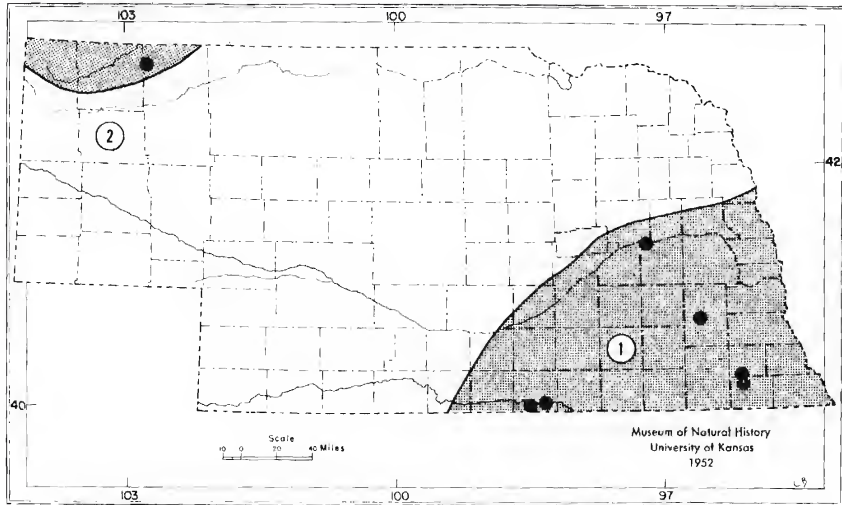


FIG. 9.—Distribution in Nebraska of 1) *Nycticeius humeralis humeralis* and 2) *Plecotus townsendii pallescens*. See text for explanation of symbols.

mi. S, 1 mi. W Halsey, 1 (KSC). County unknown: Loup Fork, 1 (USNM); "Nebraska" 1 (USNM).

Additional records.—ADAMS COUNTY: Logan Township (Jones, 1964:97). ANTELOPE COUNTY: Neligh (Jones, 1964:97). CUMING COUNTY: West Point (Swenk, 1908:139). GAGE COUNTY: Beatrice (Swenk, 1908:139). LINCOLN COUNTY: North Platte (Jones, 1964:97). WASHINGTON COUNTY: Engineer Cantonment [=approximately 2 mi. E Ft. Calhoun], the type locality of *Vespertilio pruinosus* Say (in James, 1823:167).

Nycticeius humeralis humeralis (Rafinesque, 1818)

Evening Bat

Distribution in Nebraska.—Southeastern part of state, north at least to Butler County and west in Republican River drainage at least to Webster County (see Fig. 9).

The evening bat reaches the northwestern limit of its known distribution in Nebraska. It was first reported with certainty from the state by Jones and Vaughan (1959) on the basis of four specimens shot over a sand pit lake adjacent to the Platte River in Butler County. Subsequently, the species has been taken in four additional counties in the southeastern part of Nebraska and evidently is widely distributed in summer in the vicinity of deciduous stands bordering waterways there. *N. humeralis* no doubt hibernates in the state although all records currently available are from between 1 June and 21 September.

Watkins (1970) found a number of maternity colonies of this bat in rural buildings in northwestern Missouri and adjacent Iowa, and such colonies likely will be found in southeastern Nebraska. Two females, each carrying two fetuses, were taken in Butler County on 1 June 1957. A volant subadult male was taken on 30 June 1975 in Webster County. Kunz (1965) captured flying young-of-the-year in mid-July in Lancaster County and in late July in Pawnee County and took a lactating female on 24 July 1964 in Johnson County. No adult males have been taken in Nebraska to date.

H. Allen (1864, 1894) listed a specimen from "Nebraska" that was collected by J. G. Cooper in 1857. According to Jones (1964), this specimen probably originated from some place in the Blue River drainage.

Specimens examined (15).—BUTLER COUNTY: 2 mi. N, 2 mi. W Bellwood, 4 (2 KU, 2 UNSM). JOHNSON COUNTY: Turkey Creek, 6 mi. S, ½ mi. E Vesta, 1 (UNSM). LANCASTER COUNTY: Salt Creek, 6 mi. S, ¼ mi. E Lincoln, 5 (UNSM). PAWNEE COUNTY: 1 mi. N, 4½ mi. E Lewiston, 3 (2 UNSM, 1 UNZ). WEBSTER COUNTY: 1 mi. N, 2¼ mi. W Guide Rock, 1 (KSC); 3 mi. S Red Cloud, 1 (KSC).

Plecotus townsendii pallescens (Miller, 1897)

Townsend's Big-eared Bat

Distribution in Nebraska.—Presently known only from Sheridan County (see Fig. 9).

Although known for many years from the Badlands, Black Hills, and adjacent areas of South Dakota, *P. townsendii* has not been reported previously from Nebraska. On 5 October 1972, a single male was taken at a ranch home situated on a grassy flat just below the pine-clad bluffs and buttes of the Pine Ridge in northwestern Sheridan County. It was found hanging on a screened door.

Townsend's big-eared bat is primarily a cavernicolous species and suitable permanent roosting sites, especially hibernacula, are few in northwestern Nebraska. Nonetheless, the species should be looked for elsewhere on the Pine Ridge in Dawes and Sioux counties and possibly occurs in the area of the Wildcat and Big-horn ridges in Banner and Scottsbluff counties to the south.

Specimen examined (1).—SHERIDAN COUNTY: 14 mi. N, 2 mi. W Hay Springs, 1 (CSC).

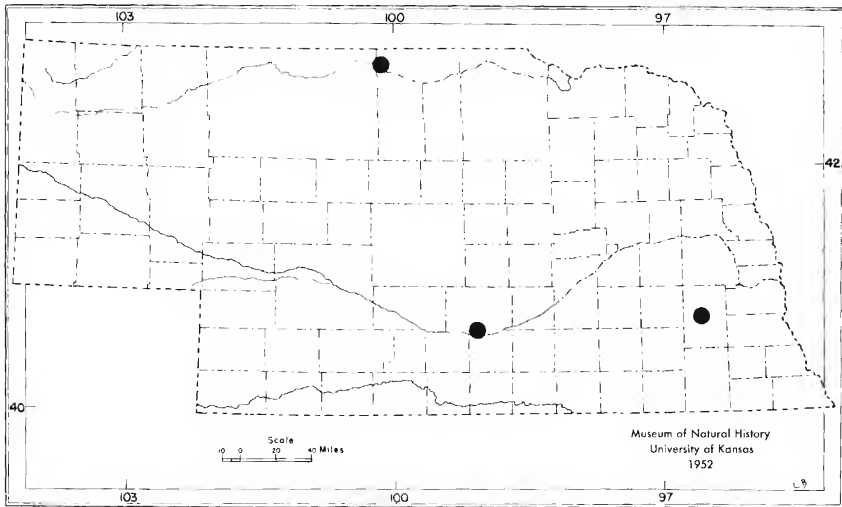


FIG. 10.—Distribution in Nebraska of *Tadarida brasiliensis mexicana*. See text for explanation of symbols.

Family MOLOSSIDAE

Tadarida brasiliensis mexicana (Saussure, 1860)

Brazilian Free-tailed Bat

Distribution in Nebraska.—Known only from Buffalo, Keya Paha, and Lancaster counties (see Fig. 10).

The status in Nebraska of this migratory free-tailed bat is poorly understood. Only six specimens have been reported from the state—three from Lancaster County, two from Buffalo County, and one from Keya Paha County. All those from Lancaster County were taken in Lincoln (Jones, 1964) as follows: a male with unworn teeth on 15 August 1913; a pregnant female on 27 June 1931, which gave birth to a single young the day following capture; and a male with unworn teeth on 27 August 1956. The two bats from Kearney, both relatively young, were a dead female and a mummified male found on 18 September and 4 October 1973, respectively (Farney and Jones, 1975). They were taken from a building inhabited by *Eptesicus fuscus*. The specimen from Keya Paha County, a male with unworn teeth, was captured in a bat trap set adjacent to trees in the floodplain of the Niobrara River on 17 August 1972 (Farney and Jones, 1975). This bat, which represents one of the northernmost localities of record in North America, was caught along with individuals of *Myotis*

keenii, *M. leibii*, *Eptesicus fuscus*, *Lasirus borealis*, and *L. cinereus*.

Free-tailed bats reported from Nebraska evidently are young-of-the-year that wandered northward in late summer after leaving congregations to the south of the state. We surmise that the June-taken pregnant female represents a bat that may have "overshot" its intended destination in spring migration. The distributional pattern of this species to the north of known maternity colonies in northern Oklahoma and adjacent Kansas was documented by Jones *et al.* (1967); Nebraska records further elucidate this pattern.

Specimens examined (6).—BUFFALO COUNTY: Kearney, 2 (KSC). KEWA PAHA COUNTY: 1 mi. S, 18 mi. E Valentine, 2300 ft., 1 (KSC). LANCASTER COUNTY: Lincoln, 3 (1 AMNH, 2 UNSM).

KEY TO BATS OF NEBRASKA

The following key, adapted in part from Jones (1964) and Jones *et al.* (1967), stresses external and easily observable dental characteristics so that it will be of maximum use in identification of bats in the flesh. Nevertheless, some species of the genus *Myotis* are difficult to distinguish even in the laboratory and interested persons are encouraged to preserve specimens for positive identification and subsequent scientific study. Whole bats may be preserved most easily by immersing them in formalin (U.S.P. 40 per cent, available at most drug counters) diluted nine parts to one with water. To prevent decay of viscera, the abdomen should be injected with the same preservative by means of a syringe; alternatively a slit approximately three-quarters of an inch in length should be made in the abdomen to allow preservative to enter the visceral cavity. After prepared and immersed in preservative for 24 hours, specimens may be sealed in a plastic bag after being wrapped in a piece of cotton, paper toweling, or absorbent cloth that is soaked with preservative. Dried specimens such as skulls, skeletons, or mummified individuals also are of value. Material may be shipped in a sturdy container to any one of the authors (addresses follow section on cited literature) or to the nearest major museum for identification and permanent storage.

Although much remains to be learned about the distribution of bats in Nebraska, it nonetheless will be helpful for users of this key to consult maps in the foregoing text to establish probable occurrence of a species in any given area. Where cranial measurements or post-canine dental formulae are used to identify specimens, it is important to be aware that it may be necessary to have

a thoroughly cleaned skull in hand in order to appreciate the differential characters.

1. Tail extending conspicuously beyond posterior border of uropatagium (tail membrane); anterior border of ear with six to eight horny excrescences; lower incisors bifid (Molossidae) *Tadarida brasiliensis*
Tail not extending conspicuously (5 mm. at most), if at all, beyond posterior border of uropatagium; anterior border of ear relatively smooth; lower incisors trifid (Vespertilionidae) 2
2. Single pair of upper incisors; total number of teeth 30-32 3
Two pairs of upper incisors; total number of teeth 32-38 5
3. Upper surface of uropatagium essentially naked; one pair of upper premolars (total of 30 teeth)..... *Nycticeius humeralis*
Upper surface of uropatagium thickly furred throughout; two pairs of upper premolars (total of 32 teeth) 4
4. Dorsal pelage hoary (dark brownish tipped with grayish white); forearm more than 45; greatest length of skull more than 17.5 *Lasiurus cinereus*
Dorsal pelage reddish orange to yellowish brown; forearm less than 45; greatest length of skull less than 14.5..... *Lasiurus borealis*
5. Dorsal pelage blackish frosted with white or, if not, ear tremendously enlarged (28 or more in length from notch); premolars 2/3 (total of 36 teeth) 6
Dorsal pelage not blackish frosted with white (brown, reddish brown, or yellowish brown); ear not noticeably enlarged (22 or less in length from notch); premolars 1/2, 2/2, or 3/3 (total of 32, 34, or 38 teeth) 7
6. Upper surface of uropatagium furred proximally from a third to half of its length; dorsal pelage blackish frosted with white; ear from notch less than 15 *Lasionycteris noctivagans*
Upper surface of uropatagium only thinly furred at base; dorsal pelage pale brownish; ear from notch 28 or more..... *Plecotus townsendii*
7. Dorsal pelage pale reddish brown; upper surface of uropatagium furred proximally for about half its length; two pairs of upper premolars (total of 34 teeth) *Pipistrellus subflavus*
Dorsal pelage brownish or yellowish brown; upper surface of uropatagium only thinly furred at base; one pair or three pairs of upper premolars (total of 32 or 38 teeth) 8
8. Total length more than 110; greatest length of skull more than 18; premolars 1/2 (total of 32 teeth) *Eptesicus fuscus*
Total length less than 110; greatest length of skull less than 18; premolars 3/3 (total of 38 teeth)..... 9
9. Dorsal pelage pale yellowish brown, contrasting noticeably with blackish ears and membranes; forearm usually less than 33; hind foot usually less than 8 from heel; mastoid breadth and interorbital breadth usually no more than 7.5 and 3.5, respectively *Myotis leibii*
Dorsal pelage brownish, not contrasting noticeably with color of ears and membranes; forearm more than 33; hind foot more than 8 from heel; mastoid breadth and interorbital breadth usually greater than 7.5 and 3.5, respectively 10

10. Ear when laid forward extending noticeably beyond tip of nose, length from notch 16 or more; length of maxillary tooththrow more than 5.5; length of mandibular tooththrow more than 6.9.....11
 Ear when laid forward extending barely, if at all, beyond tip of nose, length from notch 16 or less; length of maxillary tooththrow 5.5 or less; length of mandibular tooththrow 6.9 or less12
11. Posterior border of uropatagium with conspicuous fringe of hairs; ears long, 18-21 from notch; greatest length of skull more than 16
 *Myotis thysanodes*
 Posterior border of uropatagium not conspicuously fringed with hairs; ears moderate in length, 16-18 from notch; greatest length of skull less than 16*Myotis keenii*
12. Braincase rising abruptly from rostrum; ears shorter, usually 11-14 from notch; calcar keeled *Myotis volans*
 Braincase rising gradually from rostrum; ears longer, usually 14-16 from notch; calcar not keeled.....*Myotis lucifugus*

ZOOGEOGRAPHIC COMMENTS

Because they are volant, because several species occurring in Nebraska are migratory, and because vast areas on the Great Plains are unsuitable for habitation by bats, it is sometimes difficult to categorize them as precisely as terrestrial mammals with respect to zoogeographic affinities. Nevertheless, such relationships are reasonably apparent for most of the 13 species known from the state. Five kinds, *Myotis leibii*, *M. lucifugus*, *Eptesicus fuscus*, *Lasionycteris noctivagans*, and *Lasiurus cinereus* have broad distributions in at least temperate North America (some occur also outside that region) and are best regarded as widespread species, with no particular faunal affinities insofar as Nebraska is concerned. Of these five, *M. leibii* has the most restricted overall distribution, occurring mostly to the west and southwest of the state and obviously reaching it from that direction. As noted earlier, most or all records of *L. noctivagans* are of migrant individuals.

Distributional data for Nebraska clearly indicate that four species (*Myotis keenii*, *Pipistrellus subflavus*, *Lasiurus borealis*, and *Nycticeius humeralis*) reached the state from the east, having affinities with the eastern deciduous forest, although *M. keenii* has a disjunct subspecies in the Pacific Northwest, and *L. borealis* is widely distributed in temperate and tropical areas of the Americas. *Myotis volans* is a boreomontane species that invaded Nebraska from the west, as evidently did *M. thysanodes* and *Plecotus townsendii*. The latter two probably are better recognized as species with southwestern affinities rather than as boreomontane,

however. *Tadarida brasiliensis*, known only from three localities in Nebraska, is a species that has invaded temperate North America from the tropics.

SPECIES OF POSSIBLE OCCURRENCE IN NEBRASKA

Three species of bats have been reported in proximity to the borders of Nebraska and may occur within the state. The long-eared myotis (*Myotis evotis*), a bat occurring throughout much of the montane western United States, is known from northwestern South Dakota, but appears to be geographically and ecologically separated from *Myotis thysanodes*, which inhabits the Black Hills (Jones and Choate, 1978). This bat possibly will be found on the Pine Ridge, although it should be noted that *M. thysanodes* is recorded from there.

Another vespertilionid, *Myotis sodalis*, likely occurs in deciduous woodlands in the extreme southeastern part of the state. It presently is known from as near Nebraska as Nodaway County in northwestern Missouri, where pregnant females were taken in mature, virgin woodland (Easterla and Watkins, 1969).

Tadarida macrotis, a large free-tailed species, has been recorded from several states adjacent to Nebraska—two specimens from Iowa (Bowles, 1975), three from Colorado (Armstrong, 1972), and three from Kansas (Hays et al., 1978)—and is to be looked for as a wanderer in any part of the state.

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