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## REPRODUCTIVE ACTIVITY AND DISTRIBUTION OF BATS IN NEBRASKA

Russell A. Benedict<sup>1,2</sup>

**ABSTRACT.**—New geographic, reproductive, and seasonal records are presented for 11 of 13 bats inhabiting Nebraska. New geographic records are presented for 10 species, most notably *Myotis lucifugus* (120 miles west of nearest known record), *M. septentrionalis* (42 miles west of nearest record), *Nycticeius humeralis* (72 miles west of nearest record), and *Pipistrellus subflavus* (258 miles northwest of nearest record). New reproductive localities are recorded for 9 species, particularly the 1st records of breeding by *Pipistrellus subflavus* in Nebraska (Cherry and Dixon Counties) and the 2nd record of breeding by *Lasionycteris noctivagans* in Nebraska (Lancaster County). New records of timing of lactation and appearance of flying-young are reported for 7 species, and new records of seasonal activity are reported for 3 species. Lastly, captures of adult males of *Lasiurus borealis* and *L. cinereus* in summer are reported from sites across the state; summer populations of these species previously were thought to consist entirely or primarily of adult females and young in some regions. Records presented here are the result of geographic range expansion of several species and of fieldwork conducted in previously unsampled areas.

*Key words:* bats, Nebraska, geographic distributions, reproduction, seasonal activity.

Geographic ranges of bats inhabiting Nebraska are poorly known. For instance, *Lasionycteris noctivagans* is thought to occur across the entire state. However, in the most recent paper summarizing distributions of bats in Nebraska (Czaplewski et al. 1979), only 15 records of this species were reported from 11 of the state's 93 counties. Furthermore, Czaplewski et al. (1979) reported only 3 new specimens of *L. noctivagans* collected since the publishing of *Distribution and Taxonomy of Nebraska Mammals* by J.K. Jones in 1964.

Likewise, our understanding of reproductive activities of bats inhabiting Nebraska is extremely limited. For example, *Myotis ciliolabrum* occurs across the western third of the state, but only 1 reproductive female was described by Jones (1964), and fewer than 12 reproductive females from 2 counties were reported by Czaplewski et al. (1979). Herein, I report new geographic, reproductive, and seasonal records for 11 of 13 species of bats known from Nebraska.

### METHODS

From 1990 to 2002 bats were caught at sites across the state during survey work or other

research projects. Bats were caught in mist nets set across streams, ponds, roads, trails, or mine entrances (in 4 instances). Most bats were released at the point of capture once nets were closed for the night; however, at least 1 voucher specimen was collected for most records presented herein. Additionally, several records reported here are of bats sighted or collected in buildings. Specimens collected during this study were deposited in the University of Nebraska State Museum (UNSM). As of the writing of this paper, some specimens have yet to be deposited in this museum; these specimens are designated with the author's field number beginning with the acronym RAB. Females were classified as lactating only if milk could be expressed from the mammary glands and as post-lactating if the mammary glands were enlarged and surrounded by bare skin but did not contain milk. Flying-young-of-the-year (FYOY) were recognized by the presence of cartilaginous strips in joints between phalanges of the wings. Dates of capture of flying-young and lactating females are compared with those known for the state. The latest date of capture of flying-young is of marginal value because this simply represents the latest date at which FYOY can be distinguished from

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adults. Seasonal records are presented in cases where individuals were caught later in the year than previously known in Nebraska. However, few nettings were conducted during months when new seasonal records could have been caught. Following are numbers of nights netted during this study, by month: April, 2; May, 6; June, 7; July, 38; August, 20; September, 10; and October, 2.

I present new records by county, listed from west to east, then north to south. Within each county, records are arranged by date. Specimens are considered new records only if they represent new captures for a given county. When detailing reproductive records, I describe pregnant females first, then lactating females, and finally flying-young. For nomenclature, I follow taxonomy used by Wilson and Ruff (1999) and van Zyll de Jong (1979, 1984).

#### RESULTS

From 1990 to 2002, I conducted 87 nights of netting and caught 1154 bats of 11 species (Table 1). Results are detailed in species accounts below. Only those bats representing new geographic, reproductive, or seasonal records are described in detail.

##### *Myotis ciliolabrum* (western small-footed myotis)

*Myotis ciliolabrum* occurs across western Nebraska reaching east to the Cherry/Brown County line along the northern tier of counties (Fig. 1). No new geographic records are presented here.

REPRODUCTIVE RECORDS.—Reproductive activity has been described for this species only from Sioux and Banner Counties (Fig. 1), 2 of the westernmost counties in the state (Jones 1964, Czaplewski et al. 1979). New reproductive records are presented from Cherry and Sheridan Counties (Fig. 1), extending the known reproductive distribution of *M. ciliolabrum* into north central Nebraska. The farthest east reproductive record presented here is approximately 160 miles east of the nearest known reproductive locality (Czaplewski et al. 1979).

Sheridan County (6 lactating females, 6 FYOY): 1 lactating female released 14 July 1998 (Beaver Creek, 7.3 miles N, 1.4 miles W Hay Springs), 3 lactating females released 29 July 2001 (Patton Creek, 17.1 miles N, 2.75 miles W Rushville), and 2 lactating females released 30 July 2001 (Patton Creek, 17.2 miles N, 3.2 miles W Rushville). One FYOY male collected 11 August 1998 (RAB 4315, Beaver Creek, 7.8 miles N, 1.7 miles W Hay Springs), 1 FYOY female released 3 August 2000 (Larrabee Creek, 13.4 miles N, 2 miles W Rushville), 3 FYOY males released 5 August 2000 (Patton Creek, 17.2 miles N, 3.2 miles W Rushville), and 1 FYOY female released 29 July 2001 (Patton Creek, 17.1 miles N, 2.75 miles W Rushville).

Cherry County (3 lactating females, 4 FYOY): 1 lactating *M. ciliolabrum* collected 28 July 2000 (RAB 4954, Minnechadua Creek, 1.35 miles N, 0.9 miles E Valentine), 1 lactating female released 27 July 2001 (floodplain of Niobrara River, 8.2 miles N, 0.3 miles E Merriam), and 1 lactating female released 31 July

TABLE 1. Number of bats caught during 87 nights of netting in Nebraska from 1990 to 2002. Also included are number of nights each species was caught, number of nights netted in its geographic range, and percentage of nights each species was caught in its geographic range.

Species	Number of bats caught	Nights caught/ nights in range	Percent nights caught
<i>Eptesicus fuscus</i>	519	54/87	62.1
<i>Nycticeius humeralis</i>	151	26/50	52.0
<i>Lasiurus borealis</i>	145	38/87	43.7
<i>Myotis septentrionalis</i>	137	39/71	54.9
<i>Lasiurus cinereus</i>	95	30/87	34.5
<i>Myotis lucifugus</i>	42	12/71	16.9
<i>Myotis ciliolabrum</i>	28	14/29	48.3
<i>Lasionycteris noctivagans</i>	11	7/87	8.0
<i>Pipistrellus subflavus</i>	18	6/53	11.3
<i>Myotis thysanodes</i>	6	3/17	17.6
<i>Myotis volans</i>	2	2/17	11.2
TOTAL	1154		

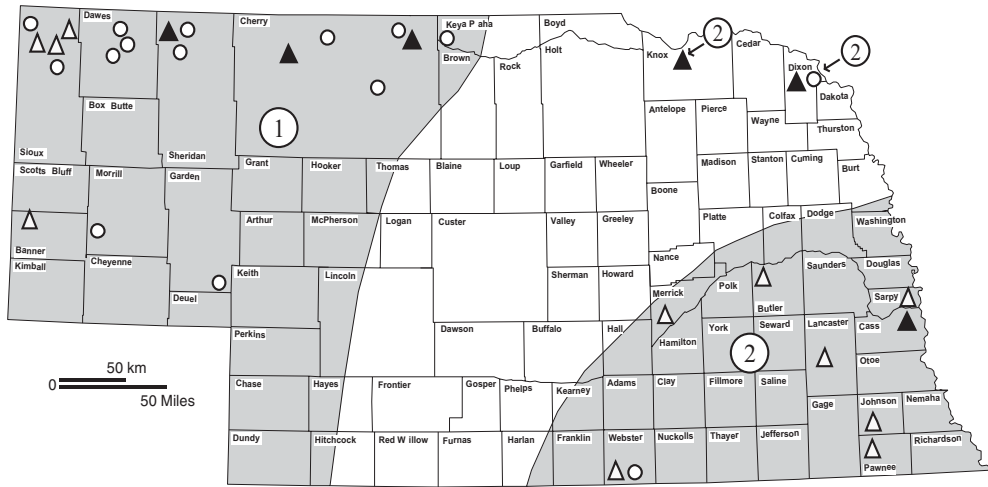


Fig. 1. Geographic distribution and new records of *Myotis ciliolabrum* (1) and *Nycticeius humeralis* (2). Shaded areas indicate geographic distribution proposed by Czaplewski et al. (1979). Open symbols are previously published records; closed symbols are new records presented in this paper. Circles are geographic records; triangles are reproductive records (triangles also indicate new geographic records in some cases; see text).

2001 (floodplain of Niobrara River, 6.2 miles S, 4.1 miles W Cody). One FYOY female collected 28 July 2000 (RAB 4956, Minnechaduz Creek, 1.35 miles N, 0.9 miles E Valentine), 2 FYOY females released 31 July 2000 (Minnechaduz Creek, 1 mile N Valentine), and 1 FYOY male released 27 July 2001 (floodplain of Niobrara River, 8.2 miles N, 0.3 miles E Merriman).

**TIMING OF REPRODUCTIVE ACTIVITY.**—During this study lactating *M. ciliolabrum* were captured 14–31 July; a total of 10 lactating females were caught during 7 nights of netting (this includes a female captured in Sioux County that was not reported above because reproductive activity is known from this county). These dates are within those previously reported for this species in Nebraska (14 July–8 August) by Czaplewski et al. (1979). Likewise, flying-young-of-the-year were captured 27 July–11 August during this study; 10 FYOY were captured during 7 nights of netting. There are no previous records of flying-young in Nebraska, but Jones et al. (1983) reported FYOY as early as 26 July in the Black Hills of South Dakota.

**SEASONAL ACTIVITY.**—*Myotis ciliolabrum* was captured during this study 14 July–13 August; 28 individuals were caught during 14 nights of netting (not all are reported above). These dates are within those previously reported for this species from Nebraska (2 May–5 Sep-

tember; Jones 1964). However, netting was not conducted within the geographic range of *M. ciliolabrum* during months that could have produced new dates of activity.

#### *Myotis lucifugus* (little brown bat)

*Myotis lucifugus* is thought to occupy 2 geographically separated areas of Nebraska. The eastern population apparently inhabits the eastern quarter of the state, but specimens are unknown from much of northeastern Nebraska (Fig. 2). The western population occupies the Pine Ridge and Niobrara River valley in extreme northwestern Nebraska.

**GEOGRAPHIC RECORDS.**—New geographic records are presented from Sheridan, Cherry, and Dixon Counties (Fig. 2). On 5 of 6 nights when these specimens were caught, *Myotis septentrionalis* also was captured, allowing side-by-side comparison of these similar species. From *M. septentrionalis*, *M. lucifugus* was distinguished by its longer forearm, greater weight, and smaller ear with a differently shaped tragus (Jones et al. 1983). The Dixon County specimen supports assertions of Jones (1964) and Czaplewski et al. (1979) that *M. lucifugus* occurs in northeastern Nebraska. Likewise, the Sheridan County specimens support the predicted occurrence of *M. lucifugus* in the eastern Pine Ridge.

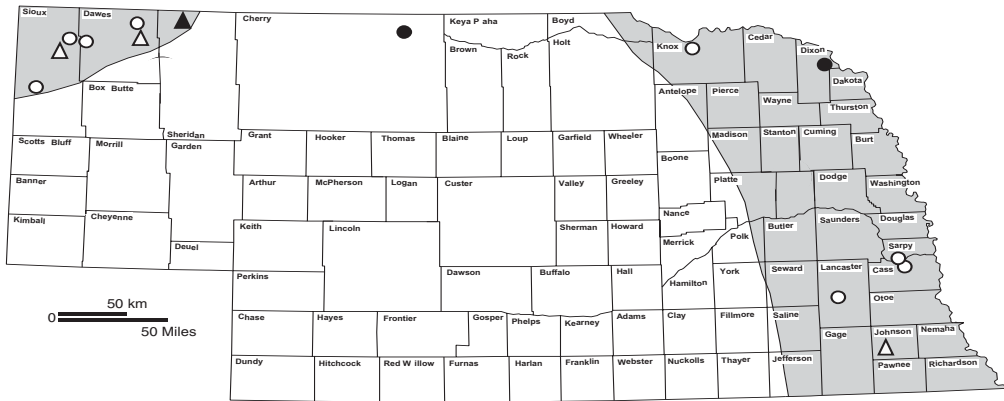


Fig. 2. Geographic distribution and new records of *Myotis lucifugus*. Shaded areas indicate geographic distribution proposed by Czaplewski et al. (1979). Open symbols are previously published records; closed symbols are new records presented in this paper. Circles are geographic records; triangles are reproductive records (triangles also indicate new geographic records in some cases; see text).

The new specimen of *M. lucifugus* from Cherry County is difficult to interpret. The nearest reported records of this species (Fig. 2) were 130 miles east (Czaplewski et al. 1979) and 120 miles west (Jones 1964) of the specimen reported here. Therefore, this new specimen may indicate a large range expansion for this species or may mark the presence of an isolated population—either a relictual population or a recent colonization. Other relictual populations occur in this part of the Niobrara River valley, most notably *Neotoma floridana baileyi* (Jones 1964). If this specimen indicates a large range extension, it could represent westward expansion of the eastern population or eastward expansion of the western population. The geography of northern Nebraska makes it more likely that the new record is derived from the eastern population. Woodlands are now nearly contiguous along the Missouri River on Nebraska's eastern border and connect to the valley of the Niobrara River, which may allow eastern *M. lucifugus* to extend west. On the other hand, for western *M. lucifugus* to expand from the Pine Ridge to the Niobrara River valley, they would have to cross roughly 50 or 60 miles of nearly treeless habitat.

The subspecific identity of this new specimen of *M. lucifugus* should provide insight into its origin. According to Jones (1964), 2 subspecies inhabit Nebraska, namely the paler and slightly larger *M. l. carissima* in the west

and *M. l. lucifugus* in the east. I examined specimens of both subspecies and found no noticeable differences in coloration. Furthermore, although *M. l. carissima* does have a larger cranium on average, substantial overlap exists between the 2 subspecies in cranial and external dimensions. Measurements of the new specimen lie in the range of overlap between the 2 subspecies, making it impossible to assign the new specimen to subspecies.

Sheridan County (4): 1 adult male collected 10 August 1998 (RAB 4308, Larrabee Creek, 14.2 miles N, 2.5 miles W Rushville), 1 adult female released 13 August 1998 (Patton Creek, 17.1 miles N, 2.75 miles W Rushville), 1 adult male collected 4 August 2000 (RAB 4978, Larrabee Creek, 14.1 miles N, 2.5 miles W Rushville), and 1 FYOY female collected 5 August 2000 (RAB 4982, Patton Creek, 17.2 miles N, 3.2 miles W Rushville).

Cherry County (1): 1 adult female collected 1 August 2000 (RAB 4964, Minnechaduzza Creek, 1 mile N Valentine).

Dixon County (1): 1 adult male collected 20 July 2001 (RAB 5081, Ponca State Park, 2.5 miles N, 0.6 miles W Ponca).

REPRODUCTIVE RECORDS.—Reproduction has been recorded in *Myotis lucifugus* in Sioux and Dawes Counties in the northwest (Jones 1964) and Johnson County in the southeast (Czaplewski et al. 1979). One new reproductive locality is presented here. The FYOY female reported above from Sheridan County (RAB

4982) represents the first evidence of reproduction by *M. lucifugus* in this county. Reproduction has been documented in adjacent Dawes County (Jones 1964).

**TIMING OF REPRODUCTIVE ACTIVITY.**—During this study 12 lactating *M. lucifugus* were captured during the nights of 15 and 16 July 1998 in Sioux County (records not presented above because breeding has been recorded from Sioux County). The only other reported date of capture of lactating *M. lucifugus* in Nebraska is 24 June (Czaplewski et al. 1979). Additionally, flying-young were captured 15 July–5 August during this study; 3 FYOY were captured during 3 nights of netting (this includes 2 bats captured in Sioux County that were not reported above because reproductive activity is known from this county). The only other date reported for flying-young *M. lucifugus* in Nebraska is “late July” (Czaplewski et al. 1979:6).

**SEASONAL RECORDS.**—During this study little brown bats were captured 1 July–5 September; 41 *M. lucifugus* were caught during 12 nights of netting (not all are reported above). This species is a year-round resident in eastern Nebraska (Jones 1964) and the Black Hills of South Dakota (Jones et al. 1983).

*Myotis septentrionalis*  
(northern long-eared myotis)

*Myotis septentrionalis* is thought to occupy most of the eastern half of Nebraska (Fig. 3), but much of this proposed distribution is unsupported by records. Additionally, an apparently isolated population recently has been reported from the northwestern corner of the state (Benedict et al. 2000).

**GEOGRAPHIC RECORDS.**—New geographic records are reported here from Dixon County and northwest Cherry County (Fig. 3). The Dixon County specimen supports claims of Jones (1964) and Czaplewski et al. (1979) that *M. septentrionalis* occurs in northeastern Nebraska. The Cherry County specimens indicate this species extends at least 42 miles farther west along the Niobrara River than reported by Benedict et al. (2000). Given the lack of suitable habitat in surrounding areas, *M. septentrionalis* likely occurs in Cherry County only in the valleys of the Niobrara River and its tributaries.

Cherry County (11): 1 adult female, 2 adult males, and 1 lactating female collected 1 August 2000 (RAB 4967, 4969–4971, Anderson Bridge

Wildlife Management Area, 9.9 miles S, 9.1 miles E Nenzel); and 1 adult female collected, 1 adult female, 1 adult male, 3 lactating females, and 1 FYOY female released 31 July 2001 (RAB 5087, floodplain of Niobrara River, 6.2 miles S, 4.1 miles W Cody).

Dixon County (3): 1 adult male collected 19 July 2001 (RAB 5078, Ponca State Park, 2.9 miles N, 0.3 miles W Ponca), and 2 adult males released 20 July 2001 (Ponca State Park, 2.5 miles N, 0.6 miles W Ponca).

**REPRODUCTIVE RECORDS.**—The only reported reproductive localities for *M. septentrionalis* in the state are in Cass County (Jones 1964), Cherry County (Benedict et al. 2000), Sarpy County (Jones 1964, Geluso et al. 2004), and Webster County (Czaplewski et al. 1979; Fig. 3). Reproductive records are presented here from Sheridan, Cherry, Knox, and Lancaster Counties. These records significantly expand the known reproductive distribution of *M. septentrionalis* in Nebraska (Fig. 3). The Sheridan County records, a flying-young and a post-lactating female, provide the 1st evidence of reproduction in the Pine Ridge; the previous 7 *M. septentrionalis* captured in this region were adult males (Benedict et al. 2000).

Sheridan County (1 post-lactating female, 1 FYOY): 1 post-lactating female collected 4 August 2000 (RAB 4979, Larrabee Creek, 14.1 miles N, 2.5 miles W Rushville), and 1 FYOY female collected 5 August 2000 (RAB 4989, Patton Creek, 17.2 miles N, 3.2 miles W Rushville).

Cherry County (4 lactating females, 1 FYOY): The lactating females and flying-young recorded above, including RAB 4970, represent the 1st records of reproduction of *M. septentrionalis* in western Cherry County.

Knox County (4 lactating females, 7 FYOY): 1 lactating female released 21 July 2001 (creek, 6.5 miles N, 5.4 miles W Verdigre), and 3 lactating females released 22 July 2001 (Schindler Creek, 5.7 miles N, 3.5 miles W Verdigre). One FYOY male released and 1 FYOY female collected 21 July 2001 (RAB 5082, unknown creek, 6.5 miles N, 5.4 miles W Verdigre), and 3 FYOY females and 2 FYOY males released 22 July 2001 (Schindler Creek, 5.7 miles N, 3.5 miles W Verdigre).

Lancaster County (3 lactating females, 1 FYOY): 1 lactating female collected 12 July 1995 (RAB 3258, Salt Creek, 5.2 miles S, 0.25 miles W Lincoln), 1 lactating female released

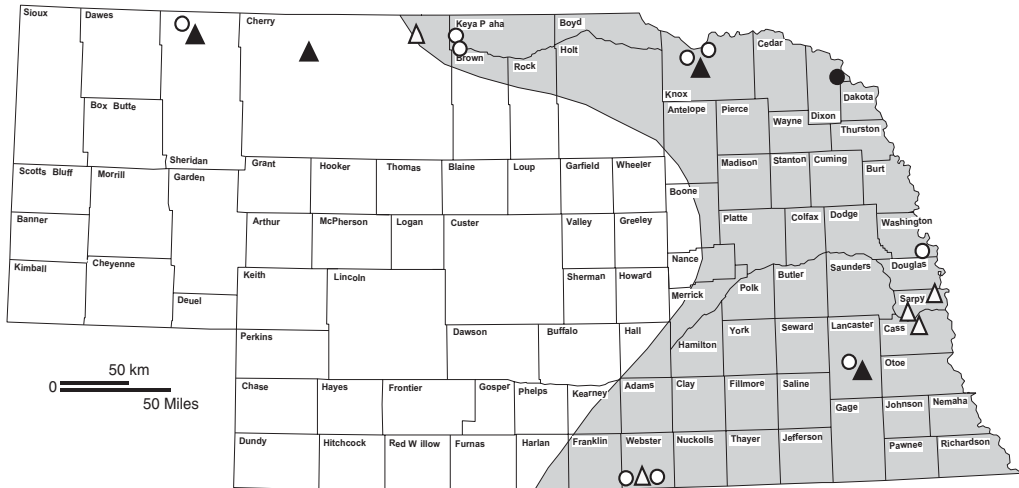


Fig. 3. Geographic distribution and new records of *Myotis septentrionalis*. Shaded areas indicate geographic distribution proposed by Czaplewski et al. (1979). Open symbols are previously published records; closed symbols are new records presented in this paper. Circles are geographic records; triangles are reproductive records.

19 July 1995 (Salt Creek, 4.25 miles S, 0.25 miles W Lincoln), and 1 lactating female released 13 July 1996 (Salt Creek, 5.2 miles S, 0.25 miles W Lincoln). One FYOY male collected 12 July 1995 (RAB 3260, 5.2 miles S, 0.25 miles W Lincoln).

**TIMING OF REPRODUCTIVE ACTIVITY.**—During this study 23 lactating female *Myotis septentrionalis* were caught between 12 July and 1 August during 12 nights of netting (this includes 12 lactating females captured in eastern Cherry County that were not reported above because reproductive activity is known from this region). This study extends the known range of dates of lactation for this species; previously known dates of lactating females for the state are 31 May–20 July (Geluso et al. 2004). Additionally, flying-young were captured 12 July–5 August; a total of 36 flying-young were caught during 11 nights of netting (this includes 26 FYOY captured in eastern Cherry County that were not reported above because reproductive activity is known from this area). These dates are within the previously known range of dates for flying-young *M. septentrionalis* in Nebraska (3 July–5 September; Geluso et al. 2004).

**SEASONAL RECORDS.**—*Myotis septentrionalis* was captured during this study on 38 nights of netting between 11 April and 16 October; 137 *M. septentrionalis* were caught

but not all are recorded above. These dates are within the known range of activity for this species in Nebraska (21 March–16 October; Geluso et al. 2004).

#### *Myotis thysanodes* (fringed myotis)

The fringed myotis has been recorded in Sioux, Dawes, and Banner Counties in northwestern Nebraska (Fig. 4; Czaplewski et al. 1979). No reproductive data are available from Nebraska and no reproductive records are presented here.

**GEOGRAPHIC RECORDS.**—New specimens of *M. thysanodes* are presented from northern Sheridan County, supporting assertions of Jones (1964) and Czaplewski et al. (1979) that this species occurs in the eastern Pine Ridge. These bats were captured roughly 28 miles northeast of the nearest reported specimens (Czaplewski et al. 1979).

Sheridan County (6): 4 adult males collected 17 July 1998 (RAB 4294, 4296, 4302–4303; Larrabee Creek, 13.4 miles N, 2 miles W Rushville), and 1 adult male released 13 August 1998 and 29 July 2001 (both from Patton Creek, 17.1 miles N, 2.75 miles W Rushville).

**SEASONAL RECORDS.**—During this study *M. thysanodes* was captured 17 July–13 August; 6 bats were captured during 3 nights of netting. The previously known dates of activity from

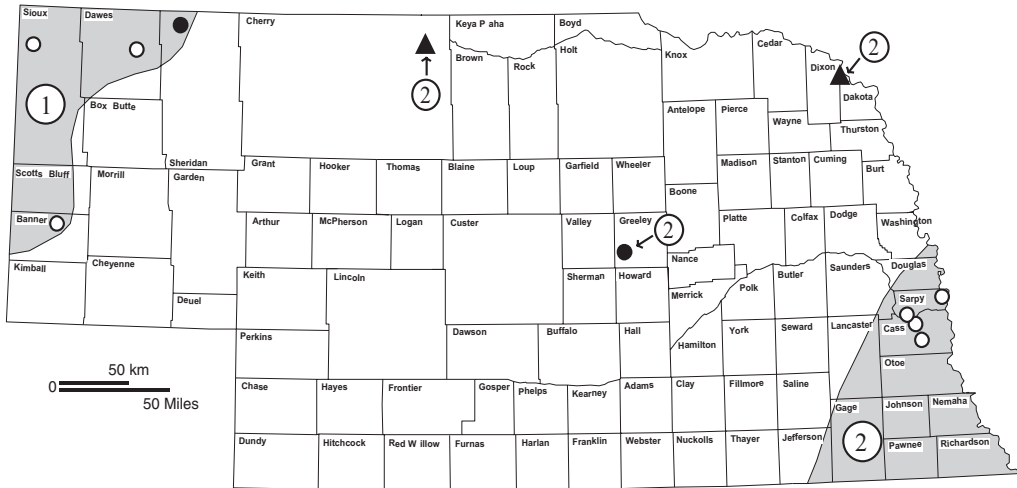


Fig. 4. Geographic distribution and new records of *Myotis thysanodes* (1) and *Pipistrellus subflavus* (2). Shaded areas indicate geographic distribution proposed by Czaplewski et al. (1979). Open symbols are previously published records; closed symbols are new records presented in this paper. Circles are geographic records; triangles are reproductive records (triangles also indicate new geographic records in some cases; see text).

Nebraska are “June” to 7 August (Czaplewski et al. 1979:7); this species occupies the nearby Black Hills of South Dakota year-round (Jones et al. 1983).

#### *Myotis volans* (long-legged myotis)

*Myotis volans* is known only from Sioux and Dawes Counties in the Pine Ridge of northwestern Nebraska (Fig. 5; Jones 1964, Czaplewski et al. 1979). No reproductive records are presented here, but this species is known to breed in the state (Czaplewski et al. 1979).

**GEOGRAPHIC RECORDS.**—A new specimen is presented from northern Sheridan County, confirming predictions of Jones (1964) and Czaplewski et al. (1979) that this species occupies the eastern Pine Ridge. This specimen was captured roughly 27 miles northeast of the nearest previously known records (Czaplewski et al. 1979).

Sheridan County (1): 1 adult male collected 5 August 2000 (RAB 4983, Patton Creek, 17.2 miles N, 3.2 miles W Rushville).

**SEASONAL RECORDS.**—During this study *M. volans* was captured 16 July and 5 August; 2 individuals were captured during these 2 nights of netting (this includes 1 bat caught in Sioux County that is not reported above because this species is known from Sioux County). These

dates are within the known range of activity of this species in the state (22 June–15 August; Czaplewski et al. 1979).

#### *Pipistrellus subflavus* (eastern pipistrelle)

*Pipistrellus subflavus* is known from 4 localities in extreme eastern Nebraska but may occur elsewhere in the southeastern corner of the state (Fig. 4; Jones 1964, Geluso et al. 2004).

**GEOGRAPHIC RECORDS.**—Three new geographic records are presented here from Dixon, Greeley, and Cherry Counties (Fig. 4). The bats from Dixon and Greeley Counties were captured 108 miles north and 136 miles west, respectively, of the nearest known specimens (Jones 1964, Geluso et al. 2004). The Cherry County specimens are 258 miles northwest of the nearest known specimens (Jones 1964), making them the farthest northwest records of *P. subflavus* in North America. These new specimens are difficult to interpret in light of what is known of this species in the state. The eastern pipistrelle is captured so infrequently in eastern Nebraska that its geographic range and breeding status are difficult to determine (Geluso et al. 2004). When combined with previously known specimens, the new records presented here could indicate this species is



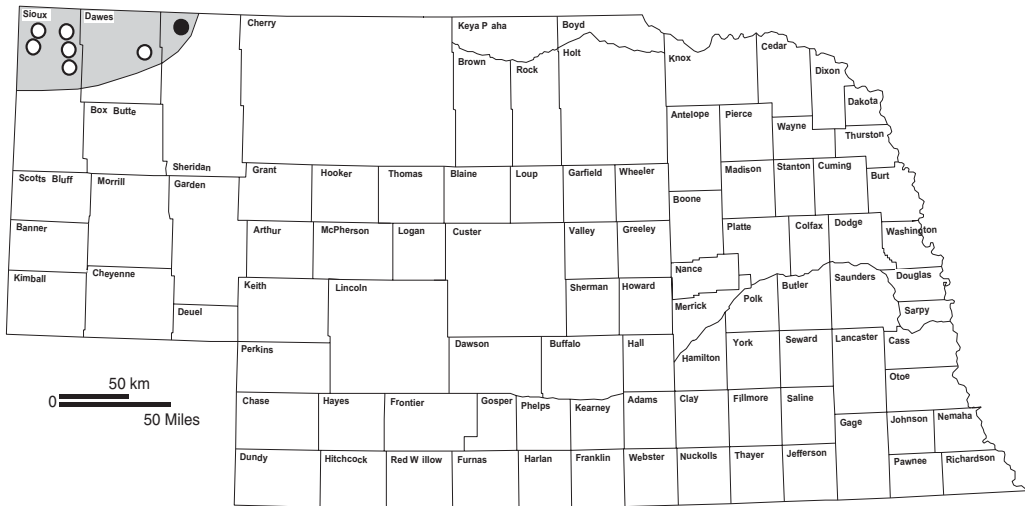


Fig. 5. Geographic distribution and new records of *Myotis volans*. Shaded areas indicate geographic distribution proposed by Czaplewski et al. (1979). Open symbols are previously published records; closed symbols are new records presented in this paper. Circles are geographic records; triangles are reproductive records.

continuously distributed along rivers in the eastern half of the state. A more likely explanation, however, is that these specimens are derived from isolated populations of this species located near rocky outcrops or mines that serve as hibernacula. The *P. subflavus* from Greeley County were caught in a mine, and the Dixon and Cherry County specimens were captured within short distances of rocky cliffs or outcrops. These isolated populations could have been present in the past but overlooked by researchers or could represent recent colonization of these areas. Considering the Greeley County specimens were caught in a mine and few rocky outcrops are present in this area, this population almost certainly represents a recent colonization. *Pipistrellus subflavus* also appears to be expanding westward in Kansas due to the construction of mines and other structures (Sparks and Choate 1995).

Cherry County (2): 1 lactating female and 1 adult male collected 28 July 2000 (RAB 4955 and 4960, Minnechaduzza Creek, 1.35 miles N, 0.9 miles E Valentine).

Greeley County (10): 1 adult male collected, and 3 adult males and 6 adult females released 31 August 2002 (RAB 5108, Happy Jack Chalk Mine, 1.2 miles S, 1 mile W Scotia).

Dixon County (1): 1 lactating female collected 19 July 2001 (RAB 5076, Ponca State Park, 2.9 miles N, 0.3 miles W Ponca).

REPRODUCTIVE RECORDS.—Prior to this study no evidence of reproduction by *Pipistrellus subflavus* had been reported in Nebraska. The 2 lactating females reported above, RAB 4955 from Cherry County and RAB 5076 from Dixon County, represent the 1st records of breeding by this species in the state.

TIMING OF REPRODUCTIVE ACTIVITY.—During this study a total of 2 lactating female *P. subflavus* were captured on 19 and 28 July. There are no previous records of lactating females from Nebraska. No flying-young *P. subflavus* have been captured in Nebraska, but a bat reported by Geluso et al. (2004) may have been a FYOY based on lack of tooth wear.

SEASONAL RECORDS.—During this study *P. subflavus* was captured 1 July–5 September; 18 bats were caught during 6 nights of netting (this includes 6 individuals captured in Cass County that were not reported above because records are known from that county). These dates extend the known range of seasonal activity of this species in Nebraska; previously known dates of activity for *P. subflavus* spanned 19 May–2 September (Geluso et al. 2004).

#### *Lasionycteris noctivagans* (silver-haired bat)

*Lasionycteris noctivagans* has been captured at localities across Nebraska (Fig. 6). Jones

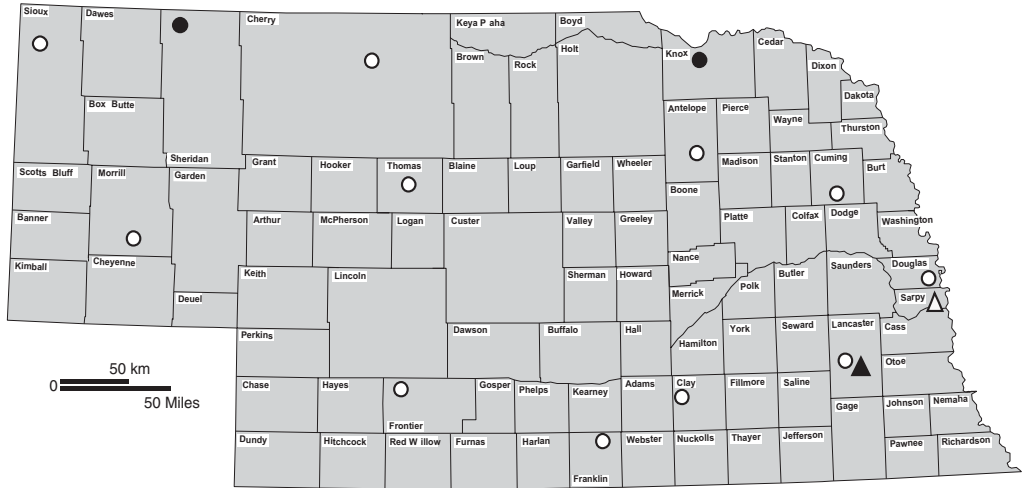


Fig. 6. New records of *Lasionycteris noctivagans*. Species occurs statewide. Open symbols are previously published records; closed symbols are new records presented in this paper. Circles are geographic records; triangles are reproductive records.

(1964) and Czaplewski et al. (1979) suggested this species may be present in the state only as a migrant.

**GEOGRAPHIC RECORDS.**—New specimens of the silver-haired bat are presented here from Sheridan and Knox Counties, further supporting the predicted statewide distribution of this species (Fig. 6).

Sheridan County (2): 1 adult male collected and 1 adult female released 5 August 2000 (RAB 4984, Patton Creek, 17.2 miles N, 3.2 miles W Rushville).

Knox County (1): 1 adult female released 22 July 2001 (Schindler Creek, 5.7 miles N, 3.5 miles W Verdigre).

**REPRODUCTIVE RECORDS.**—The 1st records of reproduction by *L. noctivagans* in Nebraska were presented by Geluso et al. (2004) from eastern Sarpy County (Fig. 6). New reproductive records are presented here from Lancaster County. Breeding by *L. noctivagans* is now confirmed in Sarpy (Geluso et al. 2004) and Lancaster Counties in Nebraska, dispelling the idea that this species is strictly a migrant in Nebraska. Whether this species breeds in central and western Nebraska is unknown at the present time.

Lancaster County (2 lactating females, 2 FYOY): 2 lactating females released 13 July 1996 (Salt Creek, 5.2 miles S, 0.25 miles W Lincoln). One FYOY male collected 17 July

1995 (UNSM 20,765, Salt Creek, 4.35 miles S, 0.3 miles W Lincoln), and 1 flying-young male collected 13 July 1996 (UNSM 26,055, Salt Creek, 5.2 miles S, 0.25 miles W Lincoln).

**TIMING OF REPRODUCTIVE ACTIVITY.**—In a single night of netting during this study, 2 lactating female *L. noctivagans* were caught on 13 July. This extends the known range of dates of lactation in this species in Nebraska; previously known dates were 16 June–6 July (Geluso et al. 2004). Additionally, 2 flying-young were caught during 2 nights of netting, 13 and 17 July. This is the first reported capture of FYOY silver-haired bats in Nebraska.

**SEASONAL RECORDS.**—One new seasonal record for *L. noctivagans* is presented here. A female was captured by hand in a barn 26 November 1997 (UNSM 25,283, Cuming County, 6 miles W Bancroft). The bat, which was roosting on a stack of hay bales, did not have visible cartilage in the phalangeal joints of the wings but had little tooth wear, suggesting it was a flying-young. Including this specimen, silver-haired bats were caught 5 May–26 November during this study; 11 bats were caught during 8 nights of netting (not all described above), and 1 bat was captured by hand. This extends the known dates of activity for this species in Nebraska from previously known dates that spanned 21 April–2 October (Jones 1964, Geluso et al. 2004).

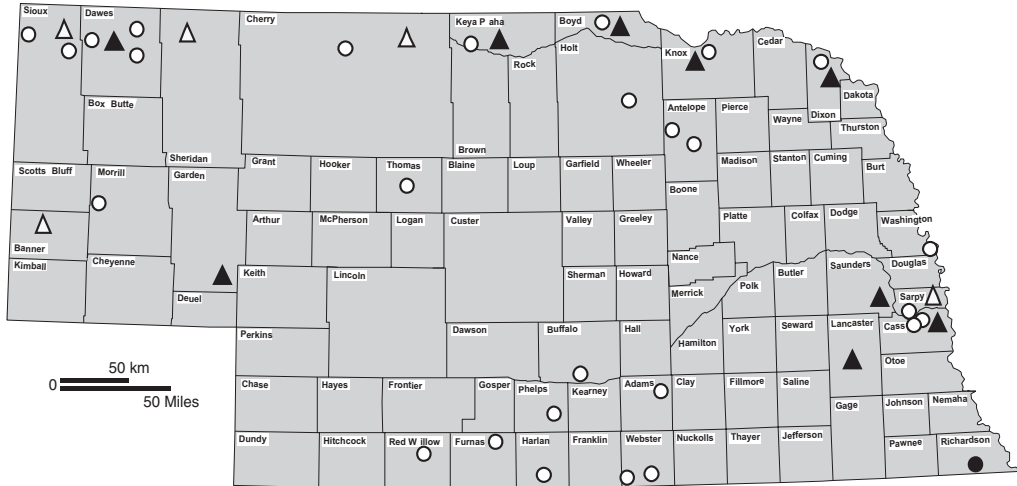


Fig. 7. New records of *Eptesicus fuscus*. Species occurs statewide. Open symbols are previously published records; closed symbols are new records presented in this paper. Circles are geographic records; triangles are reproductive records (triangles also indicate new geographic records in some cases; see text).

*Eptesicus fuscus*  
(big brown bat)

*Eptesicus fuscus* occurs statewide in Nebraska, but records are unknown from many counties (Fig. 7).

**GEOGRAPHIC RECORDS.**—New geographic records are presented from Garden, Saunders, Lancaster, and Richardson Counties (Fig. 7). These records fill in some gaps in the distribution of *E. fuscus*.

Garden County (3): 1 FYOY female and 1 adult male collected, 1 FYOY female released 16 July 1991 (UNSM 18,803–18,804, Ash Hollow State Historical Park, pond west of visitor's center, 1.8 miles S, 1.1 miles E Lewellen).

Saunders County (>150): Saw >150 females with nursing young in old coliseum 20 June 1991 (National Guard Camp, 1.6 miles N, 2.2 miles E Ashland).

Lancaster County (1): 1 adult male collected 30 June 1995 (UNSM 20,770, old channel of Salt Creek, 2.75 miles S, 0.4 miles W Lincoln). During this study 49 *E. fuscus* were captured in Lancaster county; only this voucher specimen is described.

Richardson County (2): 1 adult male and 1 adult female released 3 August 2001 (Pony Creek, 2.2 miles S, 0.4 miles E Falls City).

**REPRODUCTIVE RECORDS.**—Although *Eptesicus fuscus* is thought to breed across the state, reproductive records are known only from Ban-

ner, Sioux, Sheridan, Cherry, and Sarpy Counties (Jones 1964, Czaplewski et al. 1979, Geluso et al. 2004). New reproductive records are presented from Dawes, Garden, Keya Paha, Boyd, Knox, Dixon, Saunders, Lancaster, and Cass Counties, supporting proposed statewide reproduction by *E. fuscus*.

Dawes County (1 pregnant female, 10 lactating females): 1 pregnant female collected 30 June 1999 (UNSM 25,422, banks of West Ash Creek, 3.7 miles S, 7.8 miles E Crawford). Ten lactating females released 1 July 1999 (Big Bordeaux Creek, 7.8 miles S, 3.5 miles E Chadron).

Garden County (2 FYOY): The 2 FYOY described above (including UNSM 18,804) represent new reproductive records for Garden County.

Keya Paha County (6 lactating females): 6 lactating females released 27 July 1993 (East Middle Creek, 15.9 miles N, 0.2 miles E Johnstown).

Boyd County (7 lactating females, 2 FYOY): 7 lactating females and 2 FYOY males released 23 July 2001 (Beaver Creek, 1.6 miles E Spencer).

Knox County (1 lactating female, 2 FYOY): 1 lactating female released 22 July 2001 (Schindler Creek, 5.7 miles N, 3.5 miles W Verdigre). One FYOY female released 21 July 2001 (creek 6.5 miles N, 5.4 miles W Verdigre), and 1 FYOY male released 22 July 2001 (Schindler Creek, 5.7 miles N, 3.5 miles W Verdigre).

Dixon County (5 lactating females, 27 FYOY): 5 lactating females released 20 July 2001 (Ponca State Park, 2.5 miles N, 0.6 miles W Ponca). Six FYOY females and 8 FYOY males released 19 July 2001 (Ponca State Park, 2.9 miles N, 0.3 miles W Ponca), and 3 FYOY females and 11 FYOY males released 20 July 2001 (Ponca State Park, 2.5 miles N, 0.6 miles W Ponca).

Saunders County (>150 lactating females): The *E. fuscus* with nursing young described above represent the 1st reproductive record for this species in Saunders County.

Lancaster County (4 lactating females, 2 FYOY): 3 lactating females released 9 July 1997 (Beal Slough, 3.1 miles S, 0.3 miles W Lincoln), and 1 lactating female collected 8 June 1999 (RAB 4787, Salt Creek, 4.15 miles N, 0.3 miles W Lincoln). One FYOY female collected 16 August 1995 (UNSM 20,798, Lincoln, UNL City Campus), and 1 FYOY male and 1 FYOY female released 29 August 1995 (Salt Creek, 3.3 miles S, 0.4 miles W Lincoln).

Cass County (4 females with young, 4 lactating females, 3 FYOY): 4 females with nursing young sighted at Plattsmouth Middle School on 2 July 1991 (Plattsmouth). One lactating female released 24 July 1995, and 2 lactating females released 30 July 1995 (all from pond just S of Hidden Canyon Road, 1.9 miles S, 0.6 miles E Plattsmouth), and 1 lactating female released 1 July 1996 (mine entrance, 3 miles N, 8.9 miles W Plattsmouth). Three FYOY males released 30 July 1995 (pond just S of Hidden Canyon Road, 1.9 miles S, 0.6 miles E Plattsmouth).

**TIMING OF REPRODUCTIVE ACTIVITY.**—During this project lactating females were captured 8 June–5 August; 101 lactating females were captured on 23 nights of netting (these numbers include bats not described above because reproduction was already known from counties in which they were captured). These dates are within those reported previously for *E. fuscus* in Nebraska (31 May–5 September; Jones 1964, Geluso et al. 2004). Likewise, 197 flying-young were captured 16 July–29 August during 20 nights of netting (these numbers include bats not described above because reproduction was already known from counties in which they were captured). These dates are within the known range of dates of FYOY of *E. fuscus* in Nebraska (6 July–21 September; Geluso et al. 2004).

**SEASONAL RECORDS.**—During this project *E. fuscus* was captured 7 May–16 September; 516 individuals were captured during 54 nights of netting, 1 bat was collected from a building, and >160 *E. fuscus* were sighted in buildings. These dates are within those known for this species in Nebraska (21 March–1 November; Geluso et al. 2004).

*Lasiurus borealis*  
(eastern red bat)

*Lasiurus borealis* likely occurs statewide, but captures have not been recorded in some regions (Fig. 8).

**GEOGRAPHIC RECORDS.**—New geographic records are presented from Sheridan, Boyd, Sherman, Merrick, Dixon, and Johnson Counties (Fig. 8), filling in some gaps in the distribution of *L. borealis*.

Sheridan County (7): 1 adult female released 4 August 2000 (Larrabee Creek, 14.1 miles N, 2.5 miles W Rushville), 3 adult females and 1 adult male released 5 August 2000 (Patton Creek, 17.2 miles N, 3.2 miles W Rushville), 1 adult female released 29 July 2001 (Patton Creek, 17.1 miles N, 2.75 miles W Rushville), and 1 adult female released 30 July 2001 (Patton Creek, 17.2 miles N, 3.2 miles W Rushville).

Boyd County (4): 1 lactating female, 2 FYOY males, and 1 FYOY female released 23 July 2001 (Beaver Creek, 1.6 miles E Spencer).

Sherman County (3): 2 adult males and 1 adult female released 1 August 2001 (Muddy Creek, 1 mile S, 0.75 miles E Litchfield).

Merrick County (4): 3 lactating females and 1 FYOY female released 13 July 1999 (approximately 3 miles S Chapman).

Dixon County (21): 1 lactating female, 1 adult female, 7 FYOY females, and 4 FYOY males released 19 July 2001 (Ponca State Park, 2.9 miles N, 0.3 miles W Ponca), and 4 FYOY females and 4 FYOY males released 20 July 2001 (Ponca State Park, 2.5 miles N, 0.6 miles W Ponca).

Johnson County (1): 1 adult female released 21 May 1999 (Johnson Creek, 8.8 miles S, 7 miles E Burchard).

**REPRODUCTIVE RECORDS.**—Although reproductive records are more numerous for *L. borealis* than other species, breeding has been documented only in Sioux, Morrill, Phelps, Buffalo, Adams, Butler, Lancaster, and Sarpy Counties (Fig. 8; Czaplewski et al. 1979, Benedict et al. 2000, Geluso et al. 2004). Reproductive

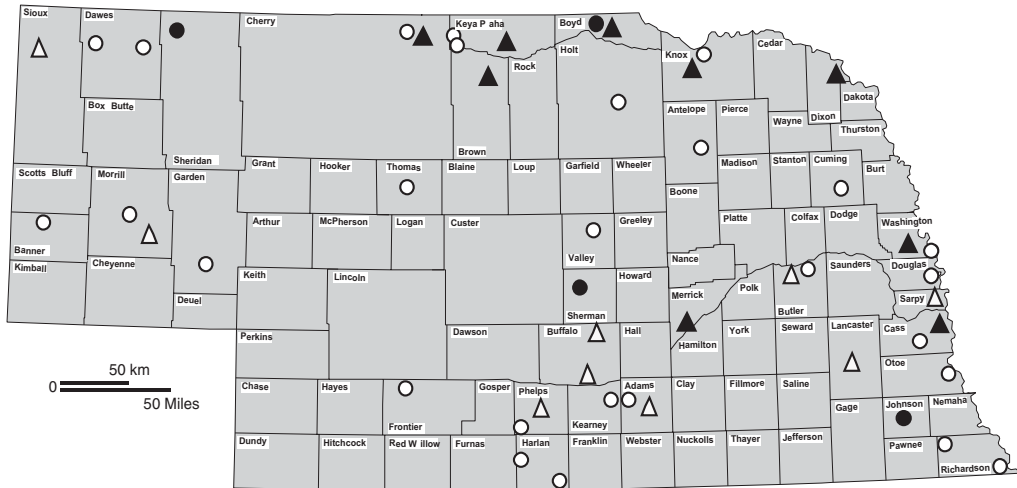


Fig. 8. New records of *Lasiurus borealis*. Species occurs statewide. Open symbols are previously published records; closed symbols are new records presented in this paper. Circles are geographic records; triangles are reproductive records (triangles also indicate new geographic records in some cases; see text).

records are presented here from Cherry, Keya Paha, Brown, Boyd, Knox, Merrick, Dixon, Washington, and Cass Counties (Fig. 8), significantly expanding the known reproductive range of *L. borealis* in Nebraska.

**Cherry County (15 FYOY):** 1 FYOY male released 28 July 2000 (Minnechaduzza Creek, 1.35 miles N, 0.9 miles E Valentine), 6 FYOY females and 5 FYOY males released 31 July 2000 (Minnechaduzza Creek, 1 mile N Valentine; 1 adult male *L. borealis* was collected this night, RAB 4966), and 3 FYOY females released 25 July 2001 (Fort Niobrara National Wildlife Refuge, 2.8 miles N, 5.8 miles E Valentine).

**Keya Paha County (1 lactating female):** 1 lactating female released 27 July 1993 (East Middle Creek, 15.9 miles N, 0.2 miles E Johnstown).

**Brown County (6 FYOY):** 3 FYOY males and 3 FYOY females released 6 August 1998 (Keller State Recreation Area, 8.5 miles N, 4.1 miles E Ainsworth).

**Boyd County (1 lactating female, 3 FYOY):** The lactating female and flying-young described above represent new reproductive records for Boyd County.

**Knox County (12 FYOY):** 2 FYOY females released 21 July 2001 (creek, 6.5 miles N, 5.4 miles W Verdigre), 1 FYOY female collected, 3 FYOY females and 6 FYOY males released 22 July 2001 (RAB 5084, Schindler Creek, 5.7 miles N, 3.5 miles W Verdigre).

**Merrick County (3 lactating females, 1 FYOY):** The lactating females and FYOY described above represent new reproductive records for Merrick County.

**Dixon County (1 lactating female, 19 FYOY):** The lactating female and FYOY reported above represent new reproductive records for Dixon County.

**Washington County (1 lactating female, 1 FYOY):** 1 lactating female released 30 May 1991, and 1 FYOY released 23 July 1992 (both from Rock Creek, 3.9 miles S, 3.7 miles E Fort Calhoun).

**Cass County (15 FYOY):** 1 FYOY male and 1 FYOY female released 23 July 1995, and 1 FYOY female collected, 6 FYOY females and 4 FYOY males released 29 July 1995 (RAB 3272, all from pond just S of Hidden Canyon Road, 1.9 miles S, 0.6 miles E Plattsmouth), and 2 FYOY females released 6 August 1995 (gravel road, 1.8 miles S, 0.8 miles E Plattsmouth).

**TIMING OF REPRODUCTIVE ACTIVITY.**—During this study 9 lactating female *L. borealis* were captured during 8 nights of netting, 30 May–27 July (these numbers include 2 lactating females captured in Lancaster County that are not reported above because reproduction is known from this county). These dates extend known dates of lactation in this species in Nebraska; previously known dates of lactating *L. borealis* are 14 June–24 July (Czaplewski et

al. 1979). Lactating eastern red bats have been caught as late as 20 August in the Black Hills of South Dakota (Jones et al. 1983). Additionally, flying-young were caught 13 July–6 August during this study; 75 FYOY were caught during 16 nights of netting (these numbers include 3 flying-young captured in Lancaster County that are not reported above because reproduction is known from this county). These dates extend the known capture dates of flying-young *L. borealis* in Nebraska; previous dates of FYOY spanned 10 August–5 September (Geluso et al. 2004).

PRESENCE OF ADULT MALES IN SUMMER.—Jones et al. (1983:87) noted the “paucity of adult males in Plains states in summer,” suggesting that most males spend summer elsewhere. During this study 16 adult male *L. borealis* were caught during 10 nights of netting in summer at sites across Nebraska (Dawes, Sheridan, Cherry, Sherman, Dixon, Lancaster, Cass, and Richardson Counties). Dates of these captures included 1, 12, 21, 25, 29, and 31 July and 1, 3, 5, and 6 August. Two of these males were collected; RAB 4820 was collected 1 July 1999 (Dawes County, Big Bordeaux Creek, 7.8 miles S, 3.5 miles E Chadron), and RAB 4966 was collected 31 July 2000 (Cherry County, Minnechaduzza Creek, 1 mile N Valentine). Although adult male *L. borealis* were present at sites across the state during summer, they were outnumbered by adult females; 42 adult females were captured during this same period.

SEASONAL RECORDS.—Eastern red bats were caught 21 May–11 September during this study; 145 *L. borealis* were caught during 38 nights of netting (not all reported above). These dates are within those reported for this species in Nebraska (26 April–1 November; Jones 1964, Geluso et al. 2004).

*Lasiurus cinereus*  
(hoary bat)

Like *Lasiurus borealis*, *L. cinereus* occurs statewide, but captures have not been reported from many counties (Fig. 9).

GEOGRAPHIC RECORDS.—New records are presented from Sheridan, Cherry, Boyd, Knox, Merrick, Dixon, and Cass Counties (Fig. 9). These specimens fill in some distributional gaps for *L. cinereus*, especially in northern Nebraska.

Sheridan County (44): 1 lactating female released 13 July 1998 (White Clay Creek, 8.7

miles N, 2.6 miles E Hay Springs), 1 FYOY male released 14 July 1998 (Beaver Creek, 7.3 miles N, 1.4 miles W Hay Springs), 1 lactating female and 1 FYOY male released 17 July 1998 (Larrabee Creek, 13.4 miles N, 2 miles W Rushville), 1 FYOY male collected 10 August 1998 (UNSM 26,037, Larrabee Creek, 14.2 miles N, 2.5 miles W Rushville), 2 females collected 11 August 1998 (RAB 4313–4314, Beaver Creek, 7.8 miles N, 1.7 miles W Hay Springs), 5 FYOY females and 1 FYOY male released, and 1 adult male collected 13 August 1998 (RAB 4320, Patton Creek, 17.1 miles N, 2.75 miles W Rushville), 1 adult male released 4 August 2000 (Larrabee Creek, 14.1 miles N, 2.5 miles W Rushville), 1 adult female and 1 adult male collected, 1 adult female, 9 adult males, 3 FYOY females, 1 FYOY male, and 3 female age unknown released 5 August 2000 (RAB 4986 and 4988, Patton Creek, 17.2 miles N, 3.2 miles W Rushville), 1 lactating female, 1 FYOY female, 1 adult female, and 3 adult males released 29 July 2001 (Patton Creek, 17.1 miles N, 2.75 miles W Rushville), and 1 adult male, 1 adult female, 1 FYOY female, and 1 female age unknown released 30 July 2001 (Patton Creek, 17.2 miles N, 3.2 miles W Rushville).

Cherry County (3): 1 FYOY male released 28 July 2000 (Minnechaduzza Creek, 1.35 miles N, 0.9 miles E Valentine), 1 FYOY male released 31 July 2000 (Minnechaduzza Creek, 1 mile N Valentine), and 1 female unknown age released 25 July 2001 (Fort Niobrara National Wildlife Refuge, 2.8 miles N, 5.8 miles E Valentine).

Boyd County (8): 4 males and 4 females released 23 July 2001 (age not checked, Beaver Creek, 1.6 miles E Spencer).

Knox County (2): 1 FYOY male and 1 male age unknown collected 21 July 2001 (RAB 5085–5086, Schindler Creek, 5.7 miles N, 3.5 miles W Verdigre).

Merrick County (2): 1 FYOY male released 9 July 1996, and 1 adult male collected 13 July 1999 (RAB 4854, roughly 3 miles S Chapman).

Dixon County (9): 1 female adult, 1 FYOY female, and 1 female age unknown released 19 July 2001 (Ponca State Park, 2.9 miles N, 0.3 miles W Ponca), and 1 FYOY female and 1 FYOY male collected, 1 adult male, 1 post-lactating female, 1 FYOY female, and 1 female age unknown released 20 July 2001 (RAB 5079–5080, Ponca State Park, 2.5 miles N, 0.6 miles W Ponca).

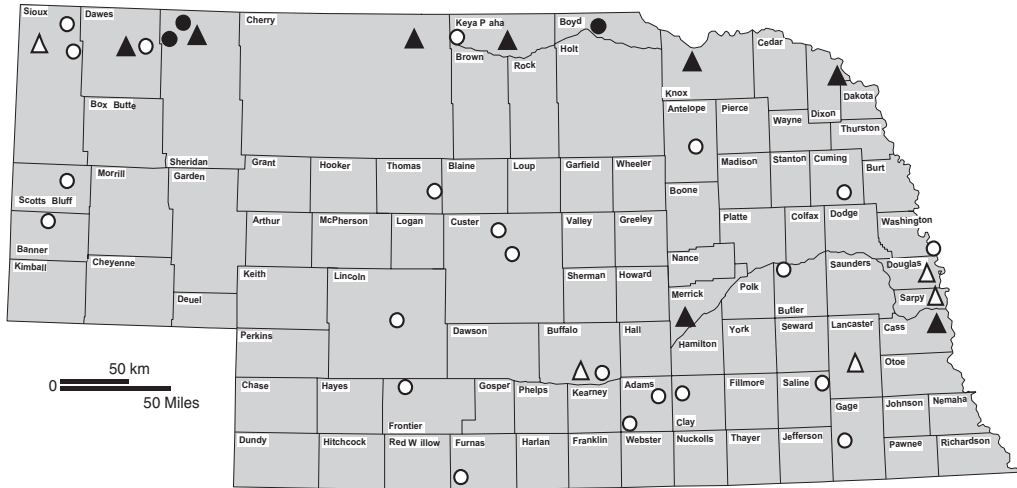


Fig. 9. New records of *Lasiurus cinereus*. Species occurs statewide. Open symbols are previously published records; closed symbols are new records presented in this paper. Circles are geographic records; triangles are reproductive records (triangles also indicate new geographic records in some cases; see text).

Cass County (2): 1 adult male released 23 July 1995, and 1 FYOY female collected 29 July 1995 (UNSM 26,039, pond just south of Hidden Canyon Road, 1.9 miles S, 0.6 miles E Plattsmouth).

REPRODUCTIVE RECORDS.—Although *L. cinereus* likely breeds throughout the state, breeding records have been reported only from Sioux, Buffalo, Lancaster, Douglas, and Sarpy Counties (Czaplewski et al. 1979, Geluso et al. 2004). New reproductive records are presented here from Dawes, Sheridan, Cherry, Keya Paha, Knox, Merrick, Dixon, and Cass Counties (Fig. 9). These records significantly expand the known breeding range of *L. cinereus* in Nebraska.

Dawes County (6 lactating females): 6 lactating females released 1 July 1999 (collected 1 adult male this night, RAB 4821, Big Bordeaux Creek, 7.8 miles S, 3.5 miles E Chadron).

Sheridan County (3 lactating females, 15 FYOY): Lactating females and flying-young described above represent new reproductive records for Sheridan County.

Cherry County (2 FYOY): Flying-young described above represent new reproductive records for Cherry County.

Keya Paha County (3 lactating females): 3 lactating females released 27 July 1993 (East Middle Creek, 15.9 miles N, 0.2 miles E Johnstown).

Knox County (1 FYOY): The flying-young described above represents a new reproductive record for Knox County.

Merrick County (1 FYOY): The flying-young described above represents a new reproductive record for Merrick County.

Dixon County (1 post-lactating female, 4 FYOY): The post-lactating female and flying-young described above represent new reproductive records for Dixon County.

Cass County (1 FYOY): The flying-young described above represents a new reproductive record for Cass County.

TIMING OF REPRODUCTIVE ACTIVITY.—During this study lactating females were caught 1 July–29 July; 15 lactating females were caught during 7 nights of netting (this includes 2 lactating females caught in Sioux County and 1 from Lancaster County that were not reported above because reproduction is known to occur in those counties). These dates are within the known dates of lactation by *L. cinereus* in Nebraska (6 June–30 July; Czaplewski et al. 1979). Additionally, flying-young were caught 9 July–13 August during this study; 26 were caught on 15 nights of netting (this includes 4 FYOY caught in Sioux County that were not reported above because reproduction is known to occur in Sioux County). This expands the known range of dates of capture of FYOY *L. cinereus* in Nebraska; previously known dates

range from “the last week of June” to 4 August (Czaplewski et al. 1979:16, Geluso et al. 2004).

PRESENCE OF ADULT MALES DURING SUMMER.—According to Jones et al. (1983), adult males of *L. cinereus* are absent from Nebraska during summer except in the Pine Ridge and Wildcat Hills; remaining areas are inhabited only by females and young at this time. Contrary to this hypothesis, adult male hoary bats were caught during summer on 4 occasions during this study at sites not near the Pine Ridge or Wildcat Hills (8 adult females were captured at these same sites during this time). On 9 July 1991 an adult male was collected in Lincoln County (UNSM 18,805, 2.5 miles N, 0.3 miles W Hershey). On 23 July 1995 an adult male was released in Cass County (described in geographic records). On 13 July 1999 an adult male was collected in Merrick County (described in geographic records), and on 20 July 2001 an adult male was released in Dixon County (described in geographic records).

SEASONAL RECORDS.—During this study 95 hoary bats were caught during 30 nights of netting (not all reported above), 1 July–6 September. These dates are within those known for activity of this migratory species in Nebraska (“May”–4 October; Czaplewski et al. 1979:15, Geluso et al. 2004).

*Nycticeius humeralis*  
(evening bat)

*Nycticeius humeralis* is thought to occupy southeastern Nebraska, extending north to Dixon County and west to at least Webster County (Fig. 1). Many records of this species have been collected recently; Jones (1964) knew of only 4 specimens, all from a site in Butler County. Adult males have not been captured in Nebraska, and none are reported in this paper.

GEOGRAPHIC RECORDS.—One new record presented from Knox County (Fig. 1) was collected 72 miles west of the nearest known capture of this species (Benedict et al. 2000). Given the apparently suitable habitat available, *Nycticeius* likely extends west along the Niobrara River at least into Boyd and Holt Counties.

Knox County (16): 1 FYOY female collected, 7 FYOY females, 5 FYOY males, 1 lactating female, 1 adult female, and 1 post-lactating female released 22 July 2001 (RAB 5083, Schindler Creek, 5.7 miles N, 3.5 miles W Verdigre).

REPRODUCTIVE RECORDS.—Reproductive

records for *N. humeralis* are known from Webster, Merrick, Butler, Lancaster, Johnson, Pawnee, and Sarpy Counties (Jones 1964, Kunz 1965, Czaplewski et al. 1979, Benedict et al. 2000, Geluso et al. 2004). New reproductive records are presented here from Knox, Dixon, and Cass Counties (Fig. 1). These new records expand the known breeding distribution of *N. humeralis*, especially in northern Nebraska.

Knox County (1 lactating female, 13 FYOY): The lactating female and flying-young reported above represent new reproductive records for Knox County.

Dixon County (8 FYOY): 1 FYOY male collected and 2 FYOY males released 19 July 2001 (RAB 5077, Ponca State Park, 2.9 miles N, 0.3 miles W Ponca), and 1 FYOY male and 4 FYOY females released 20 July 2001 (Ponca State Park, 2.5 miles N, 0.6 miles W Ponca).

Cass County (1 post-lactating female, 1 FYOY): 1 post-lactating female and 1 FYOY collected 29 July 1995 (RAB 3270, 3273, pond just south of Hidden Canyon Road, 1.9 miles S, 0.6 miles E Plattsmouth).

TIMING OF REPRODUCTIVE ACTIVITY.—During this study lactating female *N. humeralis* were caught 9 July–22 July; 17 lactating females were caught during 6 nights of netting (this includes 15 lactating females caught in Lancaster County that are not reported above because reproductive records are known from this county, and 2 females from Merrick County reported in Benedict et al. 2000). These dates are within those reported for lactating evening bats from Nebraska (16 June–24 July; Kunz 1965, Geluso et al. 2004). Likewise, 51 flying-young were caught 9 July–7 September during this study in 13 nights of netting (this includes 26 FYOY caught in Lancaster County that are not reported above because reproductive records are known from this county and 3 FYOY caught in Merrick County reported in Benedict et al. 2000). These dates extend the known range of time when FYOY can be caught in Nebraska from the previous range of 30 June–10 August (Czaplewski et al. 1979, Geluso et al. 2004).

SEASONAL RECORDS.—During this study 151 *N. humeralis* were caught 9 May–1 October during 26 nights of netting (not all reported above). The latest capture during this study consisted of 1 male collected and 2 females released in Lancaster County on 1 October 1996 (UNSM 25,282, Salt Creek, 8.15



miles S, 1.35 miles E Lincoln). This extends the known dates of activity in the evening bat in Nebraska; previously known dates of capture spanned 10 May–21 September (Czaplewski et al. 1979, Geluso et al. 2004).

#### DISCUSSION

New geographic, reproductive, and seasonal records are presented in this paper for 11 of 13 species of bats known from Nebraska. The 2 species for which no new records are reported, *Tadarida brasiliensis* and *Corynorhinus townsendii*, are vagrants that do not occur in the state on a regular basis (Czaplewski et al. 1979, Genoways et al. 2000). The large number of new records presented here is the result of 2 factors. First, the majority of Nebraska counties have not been studied by mammalogists. Second, several species inhabiting the state are expanding in geographic distribution.

The primary publication describing mammals in Nebraska, written by J.K. Jones, was published in 1964. Although Jones used all specimens available from museums across the nation, the number of bats he examined from Nebraska was not large. Jones based his predicted distributions on 465 specimens of bats, although he also cited literature records for 5 species. This relatively small number of specimens is partly attributable to the lack of effective trapping techniques for bats that existed early in the 20th century; mist nets and bat traps were not widely used for bats until the 1950s or 1960s. Most early specimens of bats were caught in insect nets, shot, or collected by hand from buildings or mines. Of 465 specimens examined by Jones (1964), 115 were collected from 3 mines along a 10-mile stretch of the Platte River in Cass and Sarpy Counties. Another 272 specimens examined were *Eptesicus fuscus*, *Lasiurus borealis*, or *L. cinereus*, the most common and widespread species in the state. Therefore, when the 3 most common species and bats collected from these geographically adjacent mines are excluded, Jones examined only 78 specimens of bats; these specimens, representing 9 species, were collected over the remaining 76,800 square miles of Nebraska. Given these small numbers, the accuracy of Jones's predicted distributions is truly impressive. A later paper by Czaplewski et al. (1979) reexamined geographic distri-

butions of bats in Nebraska. In this paper 888 bat specimens were examined, including all specimens reported in Jones (1964). However, when *E. fuscus*, *L. borealis*, and *L. cinereus*, and bats collected from the Cass and Sarpy County mines are excluded, the authors of this paper examined only 196 specimens of the remaining 9 species collected throughout the remainder of the state. Given the small sample sizes and limited geographic areas represented in earlier publications examining bats in Nebraska, additional fieldwork will inevitably turn up new records.

The 2nd factor explaining some records reported in this paper is expanding geographic distributions. To recognize an expanding geographic distribution, old records indicating the absence of the species of interest must exist from a location where a new record is captured. Unfortunately, the limited sampling conducted in Nebraska in earlier parts of the 20th century makes it difficult to distinguish range expansion from populations that were unknown because of lack of sampling.

*Myotis septentrionalis*, *Pipistrellus subflavus*, *Eptesicus fuscus*, *Lasiurus borealis*, and *Nycticeius humeralis* appear to be expanding in geographic distribution in parts of the Great Plains in response to increased forestation and construction of buildings and other artificial roost sites (Sparks and Choate 1996, Benedict et al. 2000). I believe the new geographic records of *M. septentrionalis* presented here are due to range expansion because the new specimens were captured at a site that has been studied in the past. I captured *M. septentrionalis* each of the 7 nights I netted along Minnehaduzza Creek in Cherry County (records above and Benedict et al. 2000), but none were caught when other bats were collected over this same creek in the 1970s (specimens reported in Czaplewski et al. 1979). Additionally, *Pipistrellus subflavus* reported here from Greeley County likely are due to range expansion given that mines were not present in this area 120 years ago, and this species requires mines, caves, or similar structures for hibernation (Fujita and Kunz 1984). Most of the remaining new records presented here represent specimens collected from areas where no fieldwork has been conducted before. Therefore, whether these records represent overlooked populations or range expansions cannot be determined with certainty.

### Importance of Mines in Eastern Nebraska

Mines located along the Platte River and Weeping Water Creek in Sarpy and Cass Counties have been known as important hibernacula for bats that are otherwise uncommon in eastern Nebraska, especially *Myotis lucifugus* and *Pipistrellus subflavus* (Jones 1964, Czaplewski et al. 1979). Unfortunately, these mines are being closed or otherwise modified, and their value for hibernating bats is diminishing. The mine from which many specimens examined by Jones (1964) and Czaplewski et al. (1979) were collected, described in these publications as 0.5–1 mile W Meadow, was sealed shut in the 1980s. At one time this mine contained many bats; miners claimed it had the “largest concentration north of Carlsbad, New Mexico” (Burchett and Reed 1967:53).

Likewise, a mine I netted several times (described above as 3 miles N, 8.9 miles W Plattsmouth) was substantially modified by the landowner in June 1996. His modifications involved placing a gated steel culvert in the mine entrance and then closing the remainder of the opening with soil. The culvert allowed bats to pass but prevented access by humans. When I netted the mine in August 2000, bats were using the culverts as designed, but the impact of these modifications could not be determined because data were lacking from the mine prior to the addition of the culverts. Furthermore, the mine changed ownership during the late 1990s, and the new owner is developing the surrounding land into residential acreages. Whether the new landowner will tolerate a mine and the bats inhabiting it, while attempting to attract buyers, is questionable.

Use of mines by bats in eastern Nebraska should be examined in detail. To my knowledge, the large mines located in and around Weeping Water have never been netted. I have seen bats in these mines, but the degree of use is difficult to determine because most bats are hidden in crevices in the rock. All of these mines likely represent important sites for bats in eastern Nebraska and should be a conservation priority in the state.

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