

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

The Prairie Naturalist

Great Plains Natural Science Society

3-2006

Bats in a Human-made Forest of Central Nebraska

Keith Geluso

University of Nebraska at Kearney, gelusok1@unk.edu

Follow this and additional works at: <https://digitalcommons.unl.edu/tpn>

 Part of the [Biodiversity Commons](#), [Forest Biology Commons](#), [Forest Management Commons](#), and the [Terrestrial and Aquatic Ecology Commons](#)

Geluso, Keith, "Bats in a Human-made Forest of Central Nebraska" (2006). *The Prairie Naturalist*. 463.
<https://digitalcommons.unl.edu/tpn/463>

This Article is brought to you for free and open access by the Great Plains Natural Science Society at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in The Prairie Naturalist by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Bats in a Human-made Forest of Central Nebraska

KEITH GELUSO¹

Department of Biology, University of New Mexico, Albuquerque, NM 87131

ABSTRACT -- Increases in wooded habitats have led to expansion in distributions of woodland mammals in the Great Plains. Herein, I report on the occurrence of bats in a human-made forest consisting of over 8,000 hectares in central Nebraska. The forest consisted of monocultures of ponderosa pine (*Pinus ponderosa*), eastern red cedar (*Juniperus virginiana*), and jack pine (*Pinus banksiana*). Individuals of the eastern red bat (*Lasiurus borealis*) and hoary bat (*L. cinereus*) were captured in coniferous plantations during summer, and females of both species bore and raised young in the area. The silver-haired bat (*Lasionycteris noctivagans*) also was captured in plantations but only in spring and early autumn, which suggests that plantations were used as stopover sites during migration. The big brown bat (*Eptesicus fuscus*) was observed roosting on human-made structures from April to November in riparian woodlands, and none was captured in plantations. Lastly, captures of two western small-footed myotis (*Myotis ciliolabrum*) on a building in a riparian woodland represent the first records of this species in central Nebraska. Thus, afforestation of grassland habitats in the Sandhill Region of central Nebraska has provided habitat for migratory species such as *L. borealis*, *L. cinereus*, and *L. noctivagans*.

Key words: bats, *Eptesicus fuscus*, human-made forest, *Lasionycteris noctivagans*, *Lasiurus borealis*, *Lasiurus cinereus*, *Myotis ciliolabrum*, Nebraska.

Since Europeans settled the Great Plains in the late 1800's, changes in land use have altered habitats in the region. Besides conversion of native prairies to agricultural lands, wooded habitats have spread throughout the region especially along rivers and streams (Johnson 1994). In the Sandhill Region of central

¹Current address: Department of Biology, 905 West 25th Street, University of Nebraska at Kearney, Kearney, NE 68849. E-mail address: gelusok1@unk.edu

Nebraska, an undertaking commenced in 1902 that resulted in the formation of the largest human-made forest in the National Forest System of the United States (Hunt 1965). Over large expanses of grassland, monocultures of ponderosa pine (*Pinus ponderosa*), eastern red cedar (*Juniperus virginiana*), and jack pine (*Pinus banksiana*) were planted to supply forest products (i.e., fence posts and lumber) and to diversify local habitats for wildlife and recreational purposes. Today these forests cover more than 8,000 hectares and consist of many plantations varying in size, shape, and distance from nearby riparian habitats.

From 1978 to 1988, Manning and Geluso (1989) examined how 45 native species of mammals responded to afforestation of native grasslands on the Bessey Ranger District of the Nebraska National Forest. They determined that 38% of species were influenced negatively, 40% were influenced positively, and 22% were unaffected by afforestation of grasslands. These authors reported that the mammals that responded positively to plantations were primarily woodland species. Although they concluded that four species of bats were influenced positively because of afforestation, this conclusion was based only on seven records from the area (Jones 1964, Manning and Geluso 1989). The present study further investigates the response of bats to these human-made plantations as well as to nearby forested habitats along the Middle Loup River.

METHODS

From 1999 to 2002, I periodically censused bats on the Bessey Ranger District of the Nebraska National Forest, Thomas County, Nebraska, in the Sandhill Region, which is characterized by rolling sand dunes covered with native grasses and forbs. I captured volant individuals in mist nets and examined buildings and bat houses for day-roosting individuals. Nets were used from May to September, and structures were inspected from April to November. To capture bats, I placed nets over metal stock tanks, over earthen ponds, under canopies of trees, and near structures containing bats. Adjacent to or within plantations of eastern red cedar, I netted a total of 7 evenings (a total of 13 nets); adjacent to or within plantations of ponderosa pine, I netted 5 evenings (8 nets); within riparian woodlands, I netted 2 evenings (3 nets); adjacent to both jack pine and ponderosa plantations, I netted 2 evenings (2 nets); adjacent to both ponderosa pine and eastern red cedar plantations, I netted 1 evening (1 net); and in grasslands lacking plantations, I netted 1 evening (1 net).

Mist nets were deployed before sunset and tended continuously until activity of bats declined significantly. On some evenings after bat activity had declined, nets were left open all night and checked periodically. For each bat captured, I recorded time of capture, species, sex, reproductive condition, and age.

Except for individuals kept as voucher specimens, bats were released at site of capture. Voucher material was deposited in the United States Geological Survey, Biological Survey Collection at the Museum of Southwestern Biology (MSB), University of New Mexico, Albuquerque. Information also was gathered from previous investigators and from specimens deposited at the University of Nebraska State Museum, University of Nebraska-Lincoln (UNSM) and Museum of Natural History, University of Kansas (KU).

RESULTS

I documented five species of bats on the Bessey Ranger District of the Nebraska National Forest (Table 1). Three species [eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasiorycteris noctivagans*)] were documented in the human-planted part of the forest, whereas two species [western small-footed myotis (*Myotis ciliolabrum*) and big brown bat (*Eptesicus fuscus*)] were documented only in riparian habitats along the Middle Loup River. Additional details concerning each species on the Bessey Ranger District are provided in the following accounts:

Myotis ciliolabrum (Western Small-footed Myotis)

I captured two western small-footed myotis by hand on a cement building used to store seeds at cold temperatures in the Charles E. Bessey Nursery. On 24 August 2000, a post-lactating female was discovered roosting on the south-facing, outside wall of this building in a small space under wood-paneling that had separated from the cement wall. On 6 August 2001, a male western small-footed myotis was captured inside the building; this individual had testes measuring 4 mm in length.

In Nebraska, the western small-footed myotis is known from areas containing rocky cliffs and outcroppings in northern and western parts of the state (Czaplewski et al. 1979, Benedict et al. 2000, Benedict 2004). My individuals were captured in the heart of the Sandhill Region where natural rocky situations are absent. These western small-footed myotis probably were attracted to the area because of human-made structures. The western small-footed myotis is known to roost in buildings in the state (Czaplewski et al. 1979, Keith Geluso, unpublished data) and likely was influenced positively by construction of buildings throughout western Nebraska. Due to the paucity of captures in the Sandhill Region, it is unclear whether the western small-footed myotis is a resident of this region. My records represented a modest expansion in distribution of this species into central Nebraska. The nearest previously reported specimen was obtained 85 km northwest of the Bessey Ranger District at Hackberry Lake, Valentine National Wildlife Refuge, Cherry County (Czaplewski et al. 1979). To my knowledge, records

Table 1. Species of bats known to occur on the Bessey Ranger District, Nebraska National Forest and number of individuals captured, observed, or discovered on the ground from 1999 to 2002.

Species	Captures in nets	Captures by hand	Sightings on structures *	Discovered on ground
<i>Myotis ciliolabrum</i>	--	2	--	--
<i>Lasiurus borealis</i>	5	--	--	--
<i>Lasiurus cinereus</i>	14	--	--	--
<i>Lasionycteris noctivagans</i>	1	--	--	--
<i>Eptesicus fuscus</i>	5	1	35	3
TOTAL	25	3	35	3

*includes buildings and bat houses.

from the Bessey Ranger District and Hackberry Lake are the only records of the western small-footed myotis in the Sandhill Region of Nebraska.

Localities of occurrence: Charles E. Bessey Nursery, Seed Storage Building, T22N, R26W, SW ¼ Sec. 2 (MSB 124458 and MSB 124459).

***Lasiurus borealis* (Eastern Red Bat)**

I captured five eastern red bats on the Bessey Ranger District, including one lactating female (26 July 2000), three non-reproductive adult females (25, 29, and 30 July 2000), and one adult male (27 July 2000). All individuals were netted over metal stock tanks or earthen ponds adjacent to or within plantations of ponderosa pine (1 individual), eastern red cedar (3 individuals), or both ponderosa pine and jack pine (1 individual). This relatively small, fast-flying species also was observed foraging in and above canopies of deciduous trees near the Middle Loup River. Besides these records, three additional males were captured over a metal stock tank or earthen pond in a clearing surrounded by ponderosa pine on 16 and 17 October 1982 (Manning and Geluso 1989).

Captures of adult male and female eastern red bats in July demonstrates that both sexes are summer residents on the Bessey Ranger District, and capture of a lactating female provides evidence that females bear and raise young in the area. Prior to my study, records of the eastern red bat from the Bessey Ranger District were based solely on autumn captures of males (Manning and Geluso 1989). Benedict (2004) reported that both males and females occur across Nebraska in summer, and dates of seasonal activity and reproduction of the eastern red bat reported in my study occur within the range

of dates previously reported for this species (Benedict 2004, Geluso et al. 2004a). My record of a lactating female in the Sandhills provides the first evidence that this species raises young in central Nebraska (see Fig. 8 in Benedict 2004).

The eastern red bat commonly roosts in deciduous trees throughout its range (Menzel et al. 1998, Hutchinson and Lacki 2000); however, this species has been documented to roost in coniferous trees in the southeastern United States (Elmore et al. 2004). Based on individuals captured in plantations, the eastern red bat in the Bessey Ranger District also might roost in them; however, individuals still might travel to riparian habitats along the Dismal and Middle Loup rivers to roost in deciduous trees during the day. Examination of day roosts of the eastern red bat on the Bessey Ranger District would be informative in this non-native, human-made forest.

Localities of occurrence: Windmill #229, T21N, R26W, NE ¼ Sec. 4 (1 captured and released by KG; MSB 124444 and MSB 124445); Windmill #200, T21N, R26W, NW ¼ Sec. 16 (MSB 124453); Windmill #201, T22N, R26W, SW ¼ Sec. 10 (MSB 124454); T22N, R26W, Sec. 21 (1 captured and released by Kenneth N. Geluso, University of Nebraska at Omaha, personal communication; UNSM 17394 and UNSM 19353, Manning and Geluso 1989).

***Lasiurus cinereus* (Hoary Bat)**

I captured 14 individuals of the hoary bat on the Bessey Ranger District, including 3 lactating females (two on 22 June 2001 and one on 25 July 2000), 1 post-lactating female (26 July 2000), 1 non-reproductive female (23 August 2000), 2 adult males (2 August 2000 and 24 August 2000), and 7 volant young (one male on 24 July 2000, one male on 25 July 2000, four males on 26 July 2000, and one female on 31 July 2000). All individuals were netted over metal stock tanks or earthen ponds in coniferous plantations (11 individuals in eastern red cedar and 2 individuals in ponderosa pine), except one that was captured under a canopy of deciduous trees in the Bessey Recreation Complex near the Middle Loup River. An additional five individuals are reported from the Bessey Ranger District. Jones (1964) collected a lactating female along the Middle Loup River on 6 July 1957, Manning and Geluso (1989) captured a pregnant female containing two well-developed fetuses (crown-rump lengths were 33 mm) in a ponderosa pine plantation on 5 June 1988, and Dave Stricklan (Nebraska National Forest, in litt.) observed an adult female with two young in a maple tree by a residence near the Nursery from 2 to 4 August 1990.

Captures of female hoary bats in June and July demonstrate that this species is a summer resident on the Bessey Ranger District, and captures of lactating females and volant young provide evidence that female hoary bats bear and raise young in the area. These reproductive records from central Nebraska add to our knowledge of reproductive activity of the hoary bat in this

part of the state (see Benedict 2004). Adult males are known to occur in summer throughout the state (Czaplewski et al. 1979, Benedict 2004). I suspect my captures of males in August represent summer residents, but they also might represent early autumn migrants. Dates of seasonal activity and reproduction of the hoary bat reported in my study are within previously reported dates for this species in Nebraska (Benedict 2004).

The hoary bat is known to roost in foliage of trees and apparently use both deciduous and coniferous trees (Jones et al. 1983). The family group reported above provides direct evidence that the hoary bat roosts in deciduous trees on the Bessey Ranger District. Although the hoary bat has been captured within coniferous plantations, it is uncertain whether individuals roost in them. Examination of day roosts in this forest would provide a unique opportunity to observe selection of day roosts by this species.

Localities of occurrence: Bessey Recreation Complex, near swimming pool, T22N, R26W, SW ¼ Sec. 2 (MSB 124443); Windmill #229, T21N, R26W, NE ¼ Sec. 4 (7 captured and released by KG; MSB 124446, MSB 124447, MSB 124448, and MSB 124450); Windmill #187, T22N, R26W, NW ¼ Sec. 26 (MSB 124451 and MSB 124452); T22N, R26W, Sec. 21 (UNSM 17396, Manning and Geluso 1989); 1 mi W Halsey (KU 73246, Jones 1964); Residence area near Nursery (sighting of 3 individuals by Dave Stricklan).

***Lasionycteris noctivagans* (Silver-haired Bat)**

Three records of the silver-haired bat are reported from the Bessey Ranger District. On 28 September 2000, I captured a female silver-haired bat over a metal stock tank in a plantation of eastern red cedar. This individual probably represents an autumn migrant (see Geluso et al. 2004b). On 5 June 1988, a male was captured over an earthen pond surrounded by plantations of ponderosa pine (Manning and Geluso 1989); this individual was thought to represent a late spring migrant. On 5 May 1990, an adult female was captured over this same earthen pond (Russell A. Benedict, Central College, Iowa, personal communication). These results suggest that the silver-haired bat uses plantations as stopover sites during migration, as do birds (Bray 1994, Keith Geluso, personal observation). Dates of seasonal activity of the silver-haired bat reported in my study are within previously reported dates for this species in Nebraska (Benedict 2004, Geluso et al. 2004b).

A lack of captures in July on the Bessey Ranger District suggests that this species is uncommon or does not reside in the forest during summer. Originally, the silver-haired bat was thought to occur in the state only during migration (Jones 1964, Czaplewski et al. 1979), but reproductively active females recently have been discovered in both eastern and western Nebraska (Benedict 2004, Geluso et al. 2004a, Geluso et al. 2004b). Whether these reproducing populations historically have occurred in the state or represent a recent change in breeding distribution of the silver-haired bat is unknown.

The silver-haired bat is known to roost behind bark and in cavities of coniferous trees (Mattson et al. 1996, Vonhoff and Barclay 1996). Mattson et al. (1996) discovered that maternity roosts of the silver-haired bat occur exclusively in tree cavities (e.g., woodpecker holes), but solitary individuals generally roost under loose bark or in cracks or crevices of trees. Although I have observed woodpecker holes in plantations in the Bessey Ranger District, adult females or volant young have not been captured within this forest. Continued investigations of the silver-haired bat on the Bessey Ranger District would be informative to determine whether this species might eventually use trees in plantations for maternity roosts during summer.

Localities of occurrence: Windmill #229, T21N, R26W, NE ¼ Sec. 4 (MSB 124449); T22N, R26W, Sec. 21 (UNSM 17397, Manning and Geluso 1989; 1 captured and released, Russell A. Benedict, personal communication).

***Eptesicus fuscus* (Big Brown Bat)**

I regularly observed the big brown bat in two structures on the Bessey Ranger District, including 15 sightings on the cement seed-storage building in the Nursery and 20 sightings in bat houses in the Nebraska State 4H Camp. On the storage building, the big brown bat was located behind wood paneling on the west-facing, outside wall. On this building, I observed one or two individuals on the following dates: 30 July; 1, 3, 4, 28, and 31 August; 28 September; 1 October; 1-6 November (2000); 19 and 20 April (2001); and 27 May (2002). In the 4H Camp, individuals were located in two bat houses positioned on the south-facing side of a cabin. Each bat house was 2.8 m from the ground, had a single chamber 4 cm wide that opened on the bottom, was 55 cm in height and 40 cm in length, and contained a vent 40 cm down on the front. In bat houses, I observed two, three, or four individuals on 20 April; 18 May; 2 and 18 June; and 20, 24, and 28 September 2001. Sightings of these day-roosting bats on the seed-storage building and in bat houses likely represents a few individuals being observed on multiple occasions.

On two occasions, I placed nets near these day roosts to capture individuals exiting at dusk. On 4 August 2000, I captured an adult male and adult female (non-reproductive) in the Nursery, and on 28 September 2001, I captured one adult male and two adult females (non-reproductive) in the 4H Camp. An adult female (non-reproductive) also was captured by hand on the seed-storage building in the Nursery on 1 August 2000. During my visits to the Bessey Ranger District, additional individuals occasionally were discovered by Forest Service personnel in buildings, including the west maintenance building (30 August 2000, dead on ground), a nursery building (7 November 2000, alive on ground) and an unspecified building (10 August 2000, dead on ground). I suspect the individual discovered on 7 November 2000 represents the individual I observed in the seed-storage building from 1 to 6 November 2000. Additionally, Manning and Geluso (1989) obtained a male (April 1984) from a "cavelike, concrete storage building," which represents the

same cement building described above in the Nursery (Kenneth N. Geluso, personal communication).

My results demonstrate that the big brown bat is a summer resident on the Bessey Ranger District, although Manning and Geluso (1989) reported no records of the big brown bat in summer from the area. I observed no evidence of reproduction in this species on the Bessey Ranger District. Earliest and latest seasonal dates of observation were 19 April and 7 November. The autumn date extends the known date of capture for non-hibernating individuals in the state (21 March-1 November, Geluso et al. 2004a). During winter, individuals likely hibernate in nearby structures.

The big brown bat was not captured over water sources in plantations during my survey or those by other investigators. Absence from plantations probably is attributable to a lack or scarcity of suitable roosting sites in the forest for this species. Trees in many plantations are not large, plus many dead snags continually have been cut for firewood throughout the years (John Baldwin, Nebraska National Forest, personal communication). I predict that as trees continue to age and die, some might provide suitable roosting sites in the future because the big brown bat is known to roost in hollow cavities of dead trees (Brigham 1991). During my study, managers at the Bessey Ranger District stopped removal of dead trees, unless they were a potential hazard (John Baldwin, personal communication). This change in management policy might eventually increase numbers of cavity-roosting bats as well as other species, such as cavity-nesting birds, that depend on this resource.

Localities of occurrence: Charles E. Bessey Nursery, Seed Storage Building, T22N, R26W, SW ¼ Sec. 2 (MSB 124457; UNSM 17395, Manning and Geluso 1989; 15 sightings; 2 captured and released by KG); Building in Nursery (MSB 124456); no specific locality (MSB 124455); West Maintenance Building (MSB 124460); Nebraska State 4H Camp, bat houses (20 sightings; 3 captured and released by KG).

DISCUSSION

Manning and Geluso (1989) reported that many woodland species of mammals have benefitted because of afforestation of native grasslands on the Bessey Ranger District. My results further support their conclusion that afforestation has benefitted migratory bats such as the red bat, hoary bat, and silver-haired bat. These species probably would not use such areas of the Sandhills if forests were not present. To date, species that rely more on cavities in trees or crevices in rocks, such as the big brown bat and western small-footed myotis, appear limited to habitats along riparian woodlands because of the lack or scarcity of roosting sites in plantations and the presence of anthropogenic structures in riparian habitats at this site.

Planting of native and exotic trees (such as those on the Bessey Ranger District) as well as other changes in land use (such as the suppression of prairie fires, elimination of native grazers, and alteration of flow regimes in rivers) have increased forests and woodlands in the Great Plains (Johnson 1994). In fact, wooded habitats along the Middle Loup River in the Bessey Ranger District were much smaller or not present in the past (Keith Geluso, personal observation of photographs from mid and early 1900's). Increases in forested habitats have led to changes in distributions of woodland species of mammals in the Great Plains. To date, a number of other studies have documented changes in distributions of bats as a result of newly forested areas (Sparks and Choate 1995, Benedict et al. 2000, Sparks and Choate 2000, Benedict 2004, Geluso et al. 2005).

ACKNOWLEDGMENTS

I thank J. Baldwin, M. Dickman, L. Dickman, D. Stricklan, M. Thomas, and many other personnel of the Bessey Division of the Nebraska National Forest for logistical assistance and for providing information concerning bats. I thank the Jonas family of the Arrowhead Lodge and Cafe in Thedford, Nebraska for their friendship and hospitality while I was conducting research at the forest. I thank R. Benedict and an anonymous reviewer for helpful suggestions on an earlier version of my manuscript. R. Benedict and K. N. Geluso provided additional information concerning bats at the forest. C. Ramotnik (United States Geological Survey, Museum of Southwestern Biology, University of New Mexico), T. Labedz (University of Nebraska State Museum, University of Nebraska at Lincoln), and T. Holmes, Jr. (Museum of Natural History, University of Kansas) assisted in museum matters with my project.

LITERATURE CITED

- Benedict, R. A. 2004. Seasonal activity and distribution of bats in Nebraska. *Western North American Naturalist* 64:231-248.
- Benedict, R. A., H. H. Genoways, and P. W. Freeman. 2000. Shifting distributional patterns of mammals in Nebraska. *Transactions of the Nebraska Academy of Sciences* 26:55-84.
- Bray, T. C. 1994. Habitat utilization by birds in a man-made forest in the Nebraska Sandhills. M.S. Thesis. University of Nebraska at Omaha.
- Brigham, R. M. 1991. Flexibility in foraging and roosting behaviour by the big brown bat (*Eptesicus fuscus*). *Canadian Journal of Zoology* 69:117-121.

- Czaplewski, N. J., J. P. Farney, J. Knox Jones, Jr., and J. D. Druecker. 1979. Synopsis of bats of Nebraska. Occasional Papers of the Museum, Texas Tech University 61:1-24.
- Elmore, L. W., D. A. Miller, and F. J. Vilella. 2004. Selection of diurnal roosts by red bats (*Lasiurus borealis*) in an intensively managed pine forest in Mississippi. *Forest Ecology and Management* 199:11-20.
- Geluso, K. N., R. A. Benedict, and F. L. Kock. 2004a. Seasonal activity and reproduction in bats of east-central Nebraska. *Transactions of the Nebraska Academy of Sciences* 29:33-44.
- Geluso, K., J. J. Huebschman, J. A. White, and M. A. Bogan. 2004b. Reproduction and seasonal activity of silver-haired bats (*Lasionycteris noctivagans*) in western Nebraska. *Western North American Naturalist* 64:353-358.
- Geluso, K., T. R. Mollhagen, J. M. Tigner, and M. A. Bogan. 2005. Westward expansion of the eastern pipistrelle (*Pipistrellus subflavus*) in the United States, including new records from New Mexico, South Dakota, and Texas. *Western North American Naturalist* 65:405-409.
- Hunt, J. C. 1965. The forest that men made. *American Forests* 71:32-35, 48-50.
- Hutchinson, J. T., and M. J. Lacki. 2000. Selection of day roosts by red bats in mixed mesophytic forests. *Journal of Wildlife Management* 64:87-94.
- Johnson, W. C. 1994. Woodland expansion in the Platte River, Nebraska: patterns and causes. *Ecological Monographs* 64:45-84.
- Jones, J. K., Jr. 1964. Distribution and taxonomy of mammals of Nebraska. *Publications of the Museum of Natural History, University of Kansas* 16:1-356.
- Jones, J. K., Jr., D. M. Armstrong, R. S. Hoffman, and C. Jones. 1983. *Mammals of the Northern Great Plains*. University of Nebraska Press, Lincoln, Nebraska.
- Manning, R. W., and K. N. Geluso. 1989. Habitat utilization of mammals in a man-made forest in the Sandhill Region of Nebraska. *Occasional Papers, The Museum Texas Tech University* 131:1-34.
- Mattson, T. A., S. W. Buskirk, and N. L. Stanton. 1996. Roost sites of the silver-haired bat (*Lasionycteris noctivagans*) in the Black Hills, South Dakota. *Great Basin Naturalist* 56:247-253.
- Menzel, M. A., T. C. Carter, B. R. Chapman, and J. Laerm. 1998. Quantitative comparison of tree roosts used by red bats (*Lasiurus borealis*) and Seminole bats (*L. seminolus*). *Canadian Journal of Zoology* 76:630-634.
- Sparks, D. W., and J. R. Choate. 1995. New distributional records for mammals in Kansas. *Prairie Naturalist* 27:185-192.
- Sparks, D. W., and J. R. Choate. 2000. Distribution, natural history, conservation status, and biogeography of bats in Kansas. Pp. 173-228 in *Reflections of a Naturalist: Papers Honoring Professor Eugene D. Fleharty* (J. R. Choate, editor). Fort Hays Studies, Special Issue 1.

Vonhoff, M. J., and R. M. R. Barclay. 1996. Roost-site selection and roosting ecology of forest-dwelling bats in southern British Columbia. *Canadian Journal of Zoology* 74:1797-1805.

Received: 19 February 2005 Accepted: 3 July 2006

Associate Editor for Mammalogy: Brock R. McMillan