

New records of three species of bats from Nowata, Rogers, and Ottawa counties, Oklahoma

Rachel E. Eguren and Karen McBee

Department of Zoology and Collection of Vertebrates, Oklahoma State University, Stillwater, OK 74078-3051

Abstract:

This study reports the first voucher specimens for three species of bats from three counties in northeastern Oklahoma. Mist nets were used to collect specimens of *Lasiurus borealis* from Rogers and Nowata counties, *Lasiurus cinereus* from Ottawa Co., and *Myotis lucifugus* from Nowata Co. Voucher specimens are deposited in the Oklahoma State University Collection of Vertebrates. Although none of these records represent significant changes in known ranges for these species, they do represent valuable contributions to verified chiropteran distributions for Oklahoma. Continued studies conducted across Oklahoma will expand our knowledge of bat distributions. ©2013 Oklahoma Academy of Science.

INTRODUCTION

Twenty-three species of bats have been recorded within Oklahoma (Caire et al. 1989; Caire and Loucks 2013). Due to annual migrations, seasonal differences in roosting sites, and varying weather conditions the distributions of bats throughout Oklahoma fluctuate seasonally as well as annually (O'Shea and Bogan 2003). We mist netted bats in two locations within the Oologah Wildlife Management Area (OWMA). The first site is located on the border of Nowata and Rogers counties along Plum Creek (N 36° 31.120', W 095° 33.610'), and the second is along Panther Creek (N 36° 37.747', W 095° 31.372') in Nowata Co. We also mist netted within Tar Creek Superfund Site in Ottawa Co. along Beaver Creek (N 36° 48.194', W 094° 45.484'). This study reports for the first time voucher specimens for *Lasiurus borealis* from Rogers and Nowata counties, *Lasiurus cinereus* from Ottawa Co., and *Myotis lucifugus* from Nowata Co. in extreme northeastern Oklahoma. Vouchers are deposited in the Collection of Vertebrates at Oklahoma State University.

EXPERIMENTAL PROCEDURES

Bats were collected in June–September 2012 by use of 3 mist nets of varying length (18.3 m, 9 m, 6 m, 2.6 m, and all 2.6 m tall) placed across Plum Creek, Panther Creek, and Beaver Creek. Total net nights for each of these locations was: Plum—27, Panther—29, and Beaver—37. Nets were opened at 2100 hr. and left in place until no bats had been caught for one hour or until 0100 hr. Nets were checked every 15 min to prevent injury to the animals. While in hand, weight, sex, reproductive condition (scrotal / nonscrotal; pregnant / not pregnant; lactating / not lactating), and approximate age (as determined by shining a flash light through the extended fingers of the wing to determine degree of epiphyseal ossification) were recorded. Animals were anesthetized with isoflurane and euthanized via thoracic compression. Hair, blood, and selected tissues were preserved in liquid nitrogen and are deposited in the Frozen Tissue Collection of OSU Collection of Vertebrates (Table 1). Standard external measurements total length (TTL), tail length (TL), forearm length (FA), ear length (EL),

Table 1: Data for 7 *Lasiurus borealis* captured within Oklahoma during 2012.

Location	Date	Time	*OSU # OK#	Sex	Weight (g)	Total (mm)	Tail (mm)	Forearm (mm)	Ear (mm)	Tragus (mm)	Hindfoot (mm)
Rogers Co.	16 June	9:45 pm	OSU13310 OK7458	□	8	98	43	38.5	13	5	11
Rogers Co.	16 June	10:30 pm	OSU13311 OK7459	□	7.5	99	45	40.1	12	6	9
Rogers Co.	16 June	10:45 pm	OSU13312 OK7460	□	11	102	48	38.3	10	5	8
Rogers Co.	16 June	11:37 pm	OSU13313 OK7461	□	9.5	108	51	41.0	11	4	7
Rogers Co.	16 June	12:15 am	OSU13314 OK7462	□	7.5	93	43	38.6	9	5	8
Rogers Co.	17 June	11:00 pm	OSU13315 OK7463	□	9	102	47	49.3	9	4	7
Nowata Co.	8 Sept	8:30 pm	OSU13297 OK7480	□	9	101	48	39.9	10	5	8

symbols did not transfer, please send pdf of this table

* The OSU# is associated with the voucher specimen, while the OK# is associated with the following tissues collected from these animals: heart, liver, kidney, spleen, skeletal muscle, hair, and blood.

tragus length (TRL), and hind foot length (HFL) were measured postmortem with digital calipers. All methods were approved by the Oklahoma State University (OSU) Institutional Animal Care and Use Committee (ACUP# AS129). All nets and collecting equipment were cleaned before being used at each of these sites. Euthanized animals were prepared as voucher specimens and deposited in the OSU Collection of Vertebrates.

RESULTS AND DISCUSSION

Lasiurus borealis (Eastern Red Bat).—This foliage roosting bat is widespread across North America. Caire et al. (1989) reports *Lasiurus borealis* as occurring in 39 of the 77 counties of Oklahoma: Adair, Alfalfa, Blaine, Bryan, Choctaw, Cleveland, Comanche, Custer, Delaware, Dewey, Garfield, Greer, Harmon, Johnston, Kay, Kiowa, Latimer, Le Flore, Logan, Marshall, Mayes, McCurtain, Murray, Muskogee, Oklahoma, Osage, Ottawa, Pawnee, Payne, Pittsburg, Pontotoc, Pushmataha, Seminole, Sequoyah, Texas, Tulsa, Washington, Woods, and Woodward. Roehrs et al. (2008) noted records of *L. borealis* from Caddo Co., Oklahoma. See Figure 1 for a summary of the distribution of *L. borealis* in Oklahoma.

L. borealis from Caddo Co., Oklahoma. See Figure 1 for a summary of the distribution of *L. borealis* in Oklahoma.

We collected 6 *Lasiurus borealis* from Rogers Co. (OSU 13310-13315) and 1 *L. borealis* from Nowata Co. (OSU 13297; See Table 1). These specimens verify the occurrence of *L. borealis* in Rogers and Nowata counties, which is not surprising, as 3 bordering counties (Washington, Mayes, and Tulsa) have documented occurrences of this species (Caire et al. 1989).

Lasiurus borealis was identified based on its reddish color and size. Table 1 shows data collected from each specimen. Mean measurements with ranges in parentheses for all 7 *L. borealis* specimens include TTL 100.4 mm (93-108), TL 46.4 mm (43-51), FA 40.8 mm (38.3-49.3), EL 10.6 mm (9-13), TRL 4.9 mm (4-6), and HFL 8.3 mm (7-11). The 6 *L. borealis* caught in June were volant subadults; therefore measurements reported for those, except forearm length, are slightly smaller than those recorded by Shump and Shump (1982a). These individuals were not reproductively active and we assume that they would not be until the fall of that same year. The male *L. borealis* taken in September

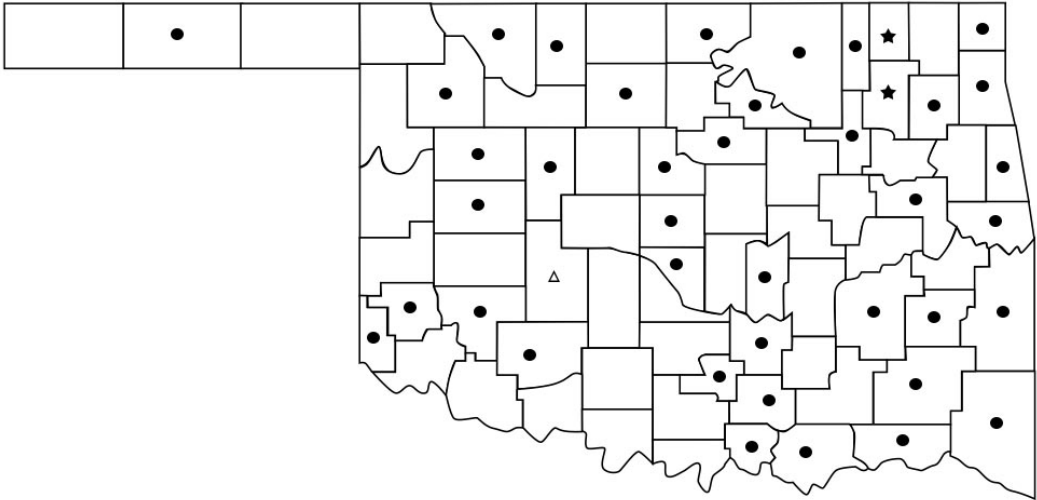


Figure 1. Distribution of *Lasiurus borealis* in Oklahoma. Filled circles represent occurrences recorded by Caire et al. (1989), the open triangle is from Roehrs et al. (2008), and the filled stars are the records from this study.

from Nowata Co., although having smaller TTL, and TL measurements than recorded by Shump and Shump (1982a), was scrotal. *Lasiurus borealis* breed annually in August and September (Shump and Shump 1982a), and individuals born in June are believed to breed during the fall of their first year of life.

Eastern Red Bats are common in the Ouachita Mountains of eastern Oklahoma and western Arkansas (Perry et al. 2010; Saughey et al. 1989). Caire et al. (1988) recorded a sex ratio of 4:9 (male:female) in June from southeastern Oklahoma, and Perry et al. (2010) also found a female (62%) dominated sex ratio (3.8:6.2) in June from eastern Arkansas. We recorded a sex ratio of 4:2 from Plum Creek (June 2012), which is different from that of the above-mentioned studies. This difference might be due to our smaller sample size. Using museum records, Ford et al. (2002) showed a relationship between an average maximum temperature exceeding 28.5°C in June, and the likelihood of a female-dominated sex ratio across the U.S. These authors hypothesized that warmer roosts allow for less energy to be expended for thermoregulation, during gestation and parturition, and for developing juveniles and therefore suggest that this is a primary

factor behind this relationship (Ford et al. 2002). The average maximum temperature for the month of June 2012 recorded from the Nowata, Oklahoma Mesonet weather station was 31.6°C (Oklahoma Mesonet 2013). Although, at no point during our study were mean maximum high temperatures below 28.5°C, we did not see a female-dominated sex ratio as predicted by Ford et al. (2002) during high temperatures; however, our sample size was small.

Lasiurus cinereus (Hoary Bat).—This migratory, tree-roosting bat is the largest widely occurring bat from Oklahoma, although an individual greater mastiff bat (*Eumops perotis*), the largest bat in the U.S., was recently collected in Oklahoma (Caire and Loucks 2013). Caire et al. (1989) reports *L. cinereus* occurring in 10 counties in Oklahoma: Beaver, Bryan, Cimarron, Cleveland, Comanche, McCurtain, Oklahoma, Payne, Texas, and Tulsa. Braun and Revelez (2005) report a specimen from Woodward Co., while Tyler and Scott (1982) note additional occurrences of *L. cinereus* from Garfield, Nobel, and Oklahoma counties. Caire et al. (1986) collected 16 individuals from Le Flore and Pushmataha counties. We collected a *L. cinereus* from Ottawa Co. (OSU 13316). This

adult, female *L. cinereus* was captured at 2330 hr on 19 August 2012. Measurements (mm) were: TTL—133, TL—53, FA—54.3, EL—19, TRL—7, HFL—11, and weight 31 g. See Figure 2 for a summary of the distribution of *L. cinereus* in Oklahoma.

This species ranges throughout most of the U. S. including Hawaii, much of Canada, and parts of Central and South America (Shump and Shump 1982b). Hart et al. (1993) notes that *L. cinereus* is not as common as *L. borealis*, but is fairly common in forested habitats in south central Pennsylvania. Although Glass and Halloran (1961) note that *L. cinereus* can be found throughout Oklahoma during summer, distribution of this species throughout Oklahoma has been difficult to determine due to the paucity of specimens. Early findings suggested that absence of this species in certain areas might be due to its tendency to fly later at night, therefore making it more difficult to capture (Barbour and Davis 1969). It was previously believed that female *L. cinereus* were distributed in central and eastern Oklahoma during the summer for parturition, while males were found primarily in

western Oklahoma (Tyler and Scott 1982; Findley and Jones 1964). However, Caire et al. (1986) report capture times and sex ratios of 16 *L. cinereus* from Le Flore and Pushmataha counties. Capture times ranged between 2055 to 0440 hr. Both adult and juvenile males and females were captured in eastern Oklahoma in May–August 1985 (Caire et al. 1986). In Arkansas, 13 *L. cinereus* were captured between 2040 hr and 0123 hr, with 76% of captures occurring before midnight (Saughey et al. 1989). These data suggest that *L. cinereus* is not necessarily a late flier, but that the use of high mist nets, ~7.5 m high, might increase the capture of *L. cinereus* (Caire et al. 1986). Interestingly, the individual captured in this study (Ottawa Co.) was taken in a net less than 3 m in height, which was set over a pond about 18 m at its widest point.

Myotis lucifugus (Little Brown Bat).—These bats use caves as winter hibernacula, but are known to roost in trees, under rocks, and in or on man-made structures as day roosts (Fenton and Barclay 1980). This species' range covers much of North America, reaching north into Alaska and south into

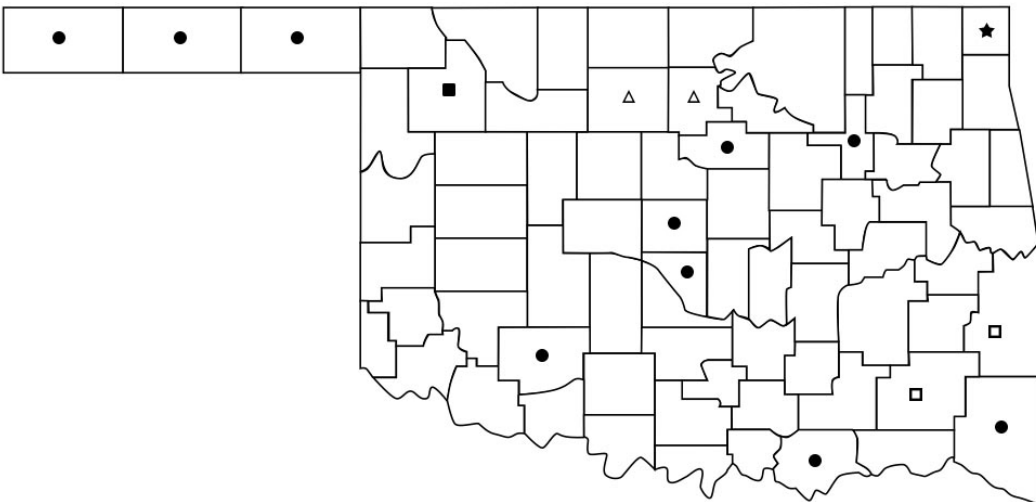


Figure 2. Distribution of *Lasiurus cinereus* in Oklahoma. Filled circles represent occurrences recorded by Caire et al. (1989), open triangles are additional occurrences from Tyler and Scott (1982), open squares are additional occurrences from Caire et al. (1986), the closed square is an additional occurrence from Braun and Revelez (2005), and the filled star is the record from this study.

Central Mexico (Barbour and Davis 1969; Fenton and Barclay 1980). Sasse et al. (2011) describes the distribution of *M. lucifugus* in Arkansas as being rare compared to numbers reported in the northeastern U.S. These authors also comment on winter hibernacula in Arkansas, and mention difficulty in catching this species during mist net surveys even when known populations are in the area (Sasse et al. 2011). Caire et al. (1989) records occurrence of *M. lucifugus* in 2 counties in Oklahoma: Delaware and McCurtain counties. Searches of Mammal Networked Information System (MaNIS; MaNIS 2001) on 11 March 2013 indicate that a vouchered specimen of *M. lucifugus* from Cleveland Co. is deposited in the Museum of Southwestern Biology, Albuquerque, NM; however, we were not able to verify the identification of this specimen. We collected a single *M. lucifugus* from Nowata Co. (OSU 13317). This adult, male *M. lucifugus* was captured at 2100 hrs on 8 September 2012. Measurements are as follows (mm): TTL—88, TL—32, FA—24, EL—10, TRL—4, HFL—7, and weight 8 g. See Figure 3 for a summary of the distribution of *M. lucifugus* in Oklahoma.

Only three species of bats have been deposited in collections (Oklahoma State University, University of Oklahoma, University of Central Oklahoma) as voucher specimens from Ottawa Co. (*Myotis grisecens*, *Perimyotis subflavus*, and *L. borealis*), two from Rogers Co. (*P. subflavus*, and *L. borealis*), and none from Nowata Co. (Caire et al. 1986). Our records add the first documented evidence with voucher specimens for *L. borealis* from Rogers and Nowata counties, *L. cinereus* from Ottawa Co., and *M. lucifugus* from Nowata Co. As more surveys continue to be conducted and numbers of vouchered records increase, gaps in the distribution data of Oklahoma bats will be reduced. Specifically, due to the high variability and lack of information on bat movements we must obtain distributional data on verified occurrences of species, rather than assuming that a species is broadly distributed throughout a historical range.

This is especially important because of the steady spread of White Nose Syndrome southeastward from the Atlantic coast (Bat Conservation International 2013). The current westernmost suspected occurrence of the disease is in Woodward Co., Oklahoma.

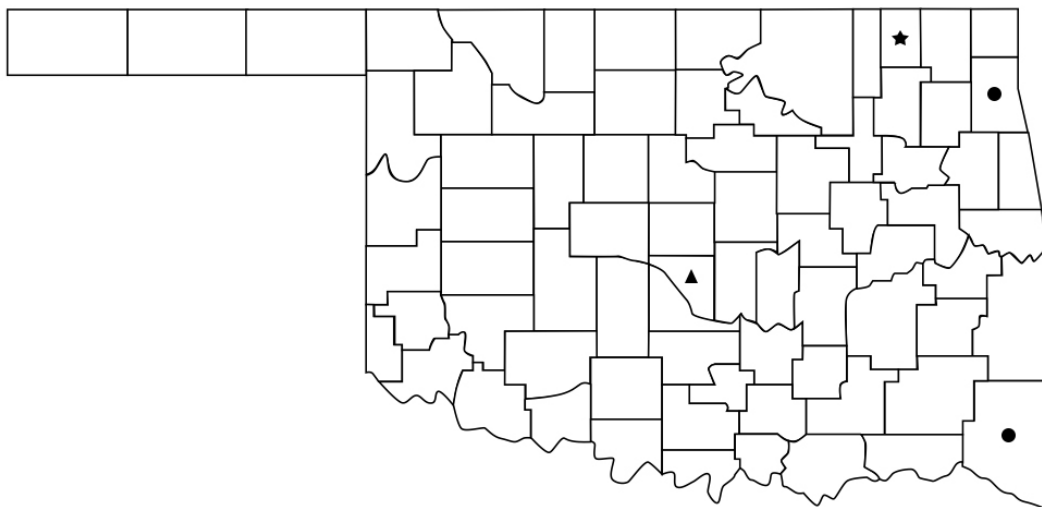


Figure 3. Distribution of *Myotis lucifugus* in Oklahoma. Circles represent occurrences recorded by Caire et al. (1989), the triangle is an occurrence recorded from MaNIS which is stored at the Museum of Southwestern Biology, and the star is the record from this study.

The closest area to Oklahoma at which multiple mortalities have been documented is eastern Missouri (Missouri Department of Conservation 2012) and the fungus responsible for this disease has been found in two caves in northwestern Arkansas (Arkansas Game and Fish Commission 2013; USFWS 2013). We have seen the devastation of populations affected by this fungus and recognize that this projected path eventually includes Oklahoma. Filling in the gaps of the distribution of Oklahoma bats is vital if we are to determine levels of mortalities in Oklahoma due to this disease.

ACKNOWLEDGEMENTS

We thank two anonymous reviewers for feedback and suggestions on the manuscript. Thanks to the OSU Collection of Vertebrates for providing field equipment and Bat Conservation International for funding this project. Also, thanks to Jonathan Dunnum and the Museum of Southwestern Biology for specimen information. We also thank Tara Blasier, William Couch, Chelsea Highfill, and Megan Reidy for field assistance.

REFERENCES

- Arkansas Game and Fish Commission, 2013. White Nose Syndrome [on-line]. Available from: <http://www.agfc.com/species/Pages/WhiteNoseSyndrome.aspx>. (Accessed October 22, 2013).
- Barbour RW, Davis WH. 1969. Bats of America. Lexington (KY). University of Kentucky Press. 286 pp.
- Bat Conservation International, White Nose Syndrome and Bat Hibernation Areas. 2013. [on-line]. Available from: <http://www.batcon.org/index.php/what-we-do/white-nose-syndrome/subcategory/intro.html>. (Accessed April 9, 2013).
- Braun JK, Revelez MA. 2005. Distributional records and comments on Oklahoma mammals. *Tex J Sci* 57:3-24.
- Caire W, Hardisty RM, Lacy KE. 1986. Ecological notes on *Lasiurus cinereus* (Chiroptera: Vespertilionidae) in Oklahoma. *Proc Okla Acad Sci* 66:41-42.
- Caire W, Hardisty RM, Lacy KE. 1988. Capture heights and times of *Lasiurus borealis* (Chiroptera: Vespertilionidae) in southeastern Oklahoma. *Proc Okla Acad Sci* 68:51-53.
- Caire W, Tyler JD, Glass BP, Mares MA. 1989. Mammals of Oklahoma. Norman (OK) University of Oklahoma Press. 567 pp.
- Caire W, Loucks L. 2013. The greater mastiff bat *Eumops perotis* (Chiroptera: Molossidae) in Oklahoma. *The Southw Nat* 58:102-104.
- Fenton MB, Barclay RMR. 1980. *Myotis lucifugus*. *Mammalian Species* 142:1-8.
- Findley JS, Jones C. 1964. Seasonal distribution of the hoary bat. *J Mammal* 45:461-470.
- Ford WM, Menzel MA, Menzel JM, Welch, DJ. 2002. Influence of summer temperature on sex ratios in eastern red bats (*Lasiurus borealis*). *Am Midl Nat* 147:179-184.
- Glass BP, Halloran AF. 1961. The small mammals of the Wichita Mountains Wildlife Refuge, Oklahoma. *J Mammal* 42:234-239.
- Hart JA, Kirkland Jr. GL, Grossman SC. 1993. Relative abundance and habitat use by tree bats, *Lasiurus* spp., in southcentral Pennsylvania. *Can Field-Nat* 107:208-212.
- Mammal Networked Information System (MaNIS). 2001. [on-line]. Available from: <http://manisnet.org>. (Accessed March 11, 2013).
- Missouri Department of Conservation, Three cases of bat disease discovered in Missouri. 2012. [on-line]. Available from: <http://www.batcon.org/index.php/what-we-do/white-nose-syndrome/subcategory/468.html>. (Accessed April 9, 2013).
- Oklahoma Mesonet. 2013. [on-line]. Available from: http://www.mesonet.org/index.php/weather/category/past_data_files. (Accessed March 15, 2013).
- O'Shea TJ, Bogan MA. 2003. Introduction. In: O'Shea, TJ, and MA Bogan, editors. *Monitoring trends in bat populations of the United States and Territories: Problems and Prospects*, U.S. Geological Survey Information and Technology Report No. 003. pp 1-5.
- Perry RW, Carter SA, Thill RE. 2010. Temporal patterns in capture rate and sex ratio of forest bats in Arkansas. *Am Midl Nat* 164:270-282.
- Roehrs ZP, Coyner BS, King KN, Martinez DL, Braun JL, Hamilton MJ, Leslie Jr. DM, Van Den Bussche RA. 2008. New records of mammals from western Oklahoma. *Occasional Papers of the Museum, Texas Tech University* 271:1-16.
- Sasse DB, Saugey DA, Perry RW. 2011. Distribution, conservation, and current status of the little brown bat (*Myotis lucifugus*) in Arkansas. *J Arkansas Acad Sci* 65:180-182.
- Saugey DA, Heath DR, Heidt GA. 1989. The bats of the Ouachita Mountains. *Proc Arkansas Acad Sci* 43:71-77.
- Shump Jr. KA, Shump AU. 1982a. *Lasiurus borealis*. *Mammalian Species* 183:1-6.
- Shump Jr. KA, Shump AU. 1982b. *Lasiurus cinereus*. *Mammalian Species* 185:1-5.
- Tyler JD, Scott CM. 1982. Status and distribution of *Lasiurus cinereus* (Chiroptera: Vespertilionidae) in Oklahoma. *Proc Okla Acad Sci* 62:91-92.
- USFWS (United States Fish and Wildlife Service.) 2013. White-Nose syndrome, Where is it now? [on-line]. Available from: <http://whitenosesyndrome.org/about/where-is-it-now>. (Accessed October 22, 2013.)

Received: May 35, 2013, Accepted: November 3rd, 2013