

## NOTES

**NORTHERNMOST RECORD OF THE LONG-NOSED BAT (*LEPTONYCTERIS* SP.)  
IN NEW MEXICO: CONSERVATION IMPLICATIONS****JAMES LAWS<sup>1</sup>, MICHAEL T. HILL<sup>2</sup>, AND JENNIFER K. FREY<sup>3,4</sup>**<sup>1</sup>*P.O. Box 245, Glenwood, New Mexico 88039*<sup>2</sup>*2219 Sea Foam Street Northwest, Albuquerque, New Mexico 87120*<sup>3</sup>*Department of Fish, Wildlife and Conservation Ecology, New Mexico State University, Las Cruces, New Mexico 88003*<sup>4</sup>*Corresponding author; email: jfrey@nmsu.edu*

**Abstract.**—Three species of nectar feeding bats (Phyllostomidae: Glossophaginae) reach the northern edge of their geographic range in southwestern New Mexico. We report observations of bats drinking from a hummingbird feeder in Glenwood, Catron County, which is 46 km north of the next nearest record. We confirmed the bat as *Leptonycteris*, based on external morphology, and concluded that it likely represented the Lesser Long-nosed Bat (*L. yerbabuena*), which was recently delisted from the Endangered Species Act. Our observations occurred from 29 September to 20 October 2022, which is consistent with the fall migratory period. This and other northern records from Grant County, New Mexico, corroborate a previously published species distribution model that predicted occurrence in this region during fall. Contrary to recent speculation that this species has expanded its range in New Mexico, we concluded that the occurrences of the species in Catron and Grant counties is not unexpected given that these locations occur within a large contiguous area of Madrean Woodland that contains *Agave* spp. (food resource) and the adjacent mountain ranges contain high densities of caves and mines (roost sites). Renewed mining activities in the region could pose a threat to these bats.

**Key Words.**—distribution; *Leptonycteris yerbabuena*; Lesser Long-nosed Bat; Madrean Encinal; Madrean Pinyon-juniper Woodland; Mogollon Mountains; range expansion

Three species of nectar-feeding bats, Mexican Long-tongued Bat (*Choeronycteris mexicana*), Mexican Long-nosed Bat (*Leptonycteris nivalis*), and Lesser Long-nosed Bat (*Leptonycteris yerbabuena*; all Phyllostomidae: Glossophaginae), reach their northern distributional limits in southern Arizona and New Mexico (Hoffmeister 1986; Frey 2004; Burke et al. 2019). These bats roost colonially in caves and mines and are migratory in the northern portion of their range. In New Mexico, these bats occur in the southwestern portion of the state, but specifics about patterns of distribution, abundance, and habitat are poorly understood due to low densities, migratory behavior, and paucity of field survey work in most parts of this region. *Leptonycteris nivalis* is listed as Endangered by New Mexico and Endangered under the U.S. Endangered Species Act, whereas *L. yerbabuena* is listed as Threatened by New Mexico and was recently removed from protections under the U.S. Endangered Species Act (New Mexico Department of Game and Fish [NMDGF]. 2022. Threatened and endangered species of New Mexico: 2022 biennial review. NMDGF. Available from <https://www.wildlife.state.nm.us/download/conservation/threatened-endangered-species/biennial-reviews/2022-Biennial-Review.pdf> [Accessed 15 November 2022]). Most specimen records of these three species of bats are from the years 1963–1966, with virtually no collections prior to 1958 and only sporadic collections in the years since (<https://doi.org/10.15468/dl.zjgyc6>). Over the past decade there has been renewed research focused on *Leptonycteris*. In part, this is

due to completion of a 5-y review on the status of *L. yerbabuena* in 2007 that recommended downlisting (New Mexico Department of Game and Fish. 2022. *op. cit.*). Further, the ubiquity of digital cameras and remote camera technology, public awareness that these bats can be attracted to hummingbird feeders, and citizen science programs aimed at documenting bats and other wildlife, has provided additional information about the occurrence and behavior of these species (Buecher and Sidner 2013; <https://www.azcentral.com/story/news/local/arizona-science/2017/05/26/arizona-volunteers-help-rescue-lesser-long-nosed-bat/338194001/>). Here we describe the northernmost record of one of these bats in New Mexico.

One of us (JL) first observed a bat drinking from a hummingbird feeder on 29 September 2022 at a residence in Glenwood, Catron County, New Mexico (elevation about 1,430 m). A video of the bat drinking at the feeder was taken 4 October 2022 and posted to YouTube (<https://youtu.be/Ub9ZtAOD144>). We identified the bat as *Leptonycteris* sp. on the basis of the shape of the rostrum and uropatagium (Fig. 1). Glenwood is a small town located at the junction of the San Francisco River and Whitewater Creek in the valley between the Brushy Mountains to the west and the Mogollon Mountains to the east. There is a high density of abandoned mines in the adjacent Mogollon Mountains, particularly the Mogollon mining district located about 12 km northeast of Glenwood (<http://mindat.org>). Within Glenwood, dominant vegetation consists of exotic trees and



**FIGURE 1.** Still photographs taken from a video showing a long-nosed bat (*Leptonycteris* sp.) feeding from a hummingbird feeder in Glenwood, Catron County, New Mexico, 5 October 2022. The reduced uropatagium and shape of the rostrum confirm it as *Leptonycteris* sp. versus Mexican Long-tongued Bat (*Choeronycteris mexicana*).

cottonwoods (*Populus* sp.) in the riparian zones. The surrounding uplands are dominated by Madrean Encinal and Madrean Pinyon-Juniper (*Pinus* spp. - *Juniperus* spp.) Woodland, with smaller patches of Apacherian-Chihuahuan Semi-desert Grassland and Steppe and Mogollon Chaparral (NatureServe. 2004. Landcover descriptions for the southwest regional GAP analysis project. NatureServe. Available from <https://slco.org/globalassets/1-site-files/watershed/watershed-library/landcoverswregionalgapanalproj2004.pdf> [Accessed 16 November 2022]). The residence had abundant vegetation including morning glories (*Ipomoea* sp.), hollyhocks (*Alcea* sp.), native sunflowers (*Helianthus* sp.), and Millet (*Panicum miliaceum*) planted to attract birds. The residence maintained five hummingbird feeders that were deployed annually, generally from mid to late March to mid to late October depending on hummingbird activity. The feeders had their bee guard removed to facilitate use by hummingbirds. A remote baby monitoring video camera was aimed at one of the feeders under the eve

of the house in an attempt to photograph hummingbirds and had been in place for about 3 y. After the first observation, a bat regularly visited the feeder each night, including during thunderstorms, generally arriving prior to 2230 and no later than 0400. The last observation of a bat at the feeder was 20 October 2022.

*Leptonycteris nivalis* has only been confirmed in New Mexico from the so-called bootheel in extreme southern Hidalgo County (Bogan et al. 2017). A bat identified as *L. nivalis* from the lower Gila River, Hidalgo County (Lewis 2001) was likely a misidentified *L. yerbabuena* (Geluso and Geluso 2021). Ramsey and Whiteman (2011) reported capturing *L. yerbabuena* in the Big Burro Mountains, Grant County. Other northern records of *L. yerbabuena* in New Mexico are from near the base of the Mogollon Mountains in Grant County, including Silver City in 2021 (Laverty and Stoner 2022) and the valley of the Gila River in vicinity of Gila and Cliff in 2014, 2016, 2018, and 2019 (Jones et al. 2021; Geluso and Geluso 2021). In 2021 a *Leptonycteris* sp. was

identified via acoustic recording from near Bear Creek, 7 km west of Gila, Grant County (Rachel Burke, pers. comm.). The nearest of these records to Glenwood was about 46 km south-southeast in the Gila-Cliff Valley. It seems likely that the bat observations in Glenwood were referable to *L. yerbabuenae* given their proximity to other verified records of the species in the same biogeographic region, although we cannot refute the possibility that it was a vagrant *L. nivalis*. All of the Gila-Cliff Valley and Silver City records were in September and October, which corresponds to the fall migration period, and were associated with hummingbird feeders. The dates of our observations are also consistent with the fall migratory period for *Leptonycteris* in New Mexico (Geluso and Geluso 2021).

*Leptonycteris* are closely associated with columnar cacti and paniculate *Agave* species, both following a corridor of blooming phenology of these species during migration and serving as the principal pollinator of them (Fleming et al. 1993; Burke et al. 2019). Although much of the literature on *Leptonycteris* centers on their specializations for feeding on the nectar and pollen of these plants, their diet may be more catholic outside of the maternal period during which they may require columnar cacti for pregnancy and lactation (Petit 1997; but see Laverty and Stoner 2022). For instance, emerging data indicate *L. yerbabuenae* regularly consume insects in New Mexico (Sellers 2018; Kathryn Stoner et al., unpubl. report), which has also been observed for *Leptonycteris* in other regions (Petit 1997), and *Leptonycteris* uses fleshy fruits from a diversity of cacti and diverse taxa of broadleaf plants (Petit 1997; Rojas-Martinez et al. 2012). Fruits may go unrecognized in their diet because the bats spit out the seeds at temporary feeding roosts (Godinez-Alvarez and Valiente-Banuet 2000; Rojas-Martinez et al. 2012). Thus, in the U.S., maternal colonies of *L. yerbabuenae* are limited to the Sonoran Desert in Arizona, which is the only region to contain columnar cacti. Following the maternal period, these bats may leave the maternal roosts to spread out more widely to use Chihuahuan Desert and Madrean ecological communities that harbor agaves (Buecher and Sidner 2013).

In New Mexico, *Leptonycteris* are thought to be associated with agaves and they may travel long distances (40 km) from day roosts to accesses foraging areas (Buecher and Sidner 2013; Bogan et al. 2017). Burke et al. (2019) found that while the overall distribution of *L. yerbabuenae* was primarily predicted by high richness of cacti, the fall distribution of *L. yerbabuenae* was predicted by diversity of food plants, especially agave. The distribution models predicted that *L. yerbabuenae* seasonally expands its distribution during fall and fall-to-winter migration well into the Mogollon Mountains in Catron and Grant counties, largely coincident with the distribution of agaves (Burke et al. 2019, 2021). Thus, the September and October records of *L. yerbabuenae*

from Catron and Grant counties provide strong independent support for the species distribution models presented by Burke et al. (2019), which were based on independent data sources. Parry's Agave (*Agave parryi*) occurs at elevations up to about 2,400 m in the montane coniferous forest zone on the southern and southwestern aspects of the Mogollon Mountains, and northward in the San Francisco River drainage to the northern part of the Gila National Forest.

Given the recent population recovery of *L. yerbabuenae*, presence of abundant potential roost sites (mines and caves) and agave food resources in vicinity of Glenwood, and data suggesting that *L. yerbabuenae* may exhibit dietary plasticity, particularly within the nonmaternal periods, the fall occurrence of *L. yerbabuenae* in southern Catron County is not unexpected. Based on the available evidence, we disagree with the argument by Geluso and Geluso (2021) that records in northern Grant County, immediately south of Catron County, represent a recent range expansion. Geluso and Geluso (2021) appear to have based their conclusion of range expansion on the lack of prior records of *L. yerbabuenae* in the region. They cited Jones et al. (2014) as an example of a mammal that had altered migration pattern due to supplemental feeding, but that study did not demonstrate a range expansion, which is the establishment of new populations beyond the species historical range (Pacifi et al. 2020). Hummingbird feeders and gardens have been implicated in altering the winter distribution of Anna's Hummingbird (*Calypte anna*; Grieg et al. 2017). In the case of *Calypte anna*, the overarching pattern is one in which the birds remain on or near their summer range during winter (instead of migrating), thereby resulting in changed winter distribution. This is a fundamentally different process than supplemental food luring bats into a novel region that they did not previously occupy, as suggested by Geluso and Geluso (2021). Many other species that use anthropogenic foods have not substantially changed their geographic range. Buecher and Sidner (2021) found that *L. yerbabuenae* used hummingbird feeders in an urban area within a valley that contained few agaves or other traditionally recognized food resources, but this finding does not presuppose a shift in their geographic range. *L. yerbabuenae* shift core use areas within their expansive seasonal home ranges around day roosts to take advantage of temporarily and spatially variable food resources, returning to the same foraging areas nightly until the resource is depleted (Ober et al. 2018). This is consistent with our observations of nightly visitation over several weeks. Such foraging areas must be in proximity (within 40 km) of the day roost. Day roosts are relatively rare, used generationally, and roost site selection appears to be highly constrained given that population increases result in more bats per roost rather than the proliferation of new roosts (U.S.

Fish and Wildlife Service 2016). Further, roosts are often abandoned when disturbed, requiring up to two decades for *L. yerbabuena* to recolonize abandoned roosts (U.S. Fish and Wildlife Service 2016). Thus, the determinant of geographic range in *L. yerbabuena* is suitable roost site (coupled with availability of food resource). The association of *L. yerbabuena* with hummingbird feeders in the autumn is likely a result of shifting core use areas around roosts as agave and other food resources dwindle. Because bird feeders are associated with humans, they make the presence of the bats easily detectable. Use of hummingbird feeders for food is a novel behavior, but it is unknown if the behavior is readily self-taught or socially transmitted via diffusion in a population (Duboscq et al. 2016). The manner and ease of bats learning to use feeders would dictate the speed and geographic distribution of the behavior making it an unreliable metric for ascertaining when a population started using a location.

Our record fills an important void in knowledge about the distribution of *Leptonycteris*. Most records of *L. yerbabuena* in New Mexico are from areas dominated by the Madrean Lowland Evergreen Woodland (macrogroup ecosystem M010), which contains agaves (U.S. Geological Survey [USGS]. 2011. GAP/Landfire National Terrestrial Ecosystems 2011. USGS. Available from <https://maps.usgs.gov/terrestrial-ecosystems-2011/> [Accessed 15 November 2022]). In southwestern New Mexico, this Madrean ecosystem occurs in the isolated mountain ranges of southern Hidalgo County and as a large continuous area around the southern periphery of the Mogollon Plateau, including the Burro Mountains. A northern peninsula of this ecosystem that includes Gila-Cliff and Glenwood extends northward along the San Francisco River to at least vicinity of Reserve, New Mexico (Catron County), and we anticipate that improved autumn sampling will reveal sporadic occurrence of *L. yerbabuena* northward along the San Francisco River to the vicinity of Reserve. Similarly, we anticipate that future research may reveal sporadic autumn occurrence of *L. yerbabuena* eastward to the Mimbres River and southern portion of the Black Range (Sierra and Luna counties).

Human disturbance of roosts is perhaps the greatest threat to populations of *Leptonycteris* and conservation efforts over the past several decades to close caves and abandoned mines to human entry has allowed some populations to recover (U.S. Fish and Wildlife Service 2018). One of the densest concentrations of abandoned mines in New Mexico is the Mogollon mining district (Ferguson 1927) located a short distance from Glenwood. Mining in this area largely ceased around 1950 (Eveleth 1978), which has allowed several decades of mine inactivity for bats to establish roosts. Because research typically focuses on places where a species is known to occur, and the occurrence of *Leptonycteris* in this region has not been previously recognized, no surveys

have been conducted to determine presence of post-maternal roosts in the mining districts of the Mogollon Mountains region. Recent plans to develop silver mines in the Mogollon Mining District could pose a threat to any *Leptonycteris* roosts that may be present (<https://nmpoliticalreport.com/2022/09/20/advocates-say-new-mining-claim-near-mogollon-threatens-ecosystem-and-sacred-sites/>). Surveys are needed to ascertain the status of *Leptonycteris* in the Mogollon Mountains, and specifically in the Mogollon mining district.

*Acknowledgments.*—We thank Debbie Buecher and Rachel Burke for helpful information about the ecology and distribution of *Leptonycteris*. We also thank James Stuart of the New Mexico Department of Game and Fish for helpful comments on a previous version of this paper.

#### LITERATURE CITED

- Bogan, M.A., P.M. Cryan, C.D. Weise, and E.W. Valdez. 2017. Landscape movements by two species of migratory nectar-feeding bats (*Leptonycteris*) in a northern area of seasonal sympatry. *Western North American Naturalist* 77:317–330.
- Buecher, D.C., and R. Sidner. 2013. Long distance commutes by Lesser Long-nosed Bats (*Leptonycteris yerbabuena*) to visit residential hummingbird feeders. Pp. 427–433 in *Merging Science and Management in a Rapidly Changing World: Biodiversity and Management of the Madrean Archipelago III*; 2012 May 1–5; Tucson, AZ. Proceedings. Gottfried, G.J., P.F. Ffolliott, B.S. Gebow, G. Lane, and L.C. Collins (Comps.). RMRS-P-67, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado.
- Burke, R., J.K. Frey, A.C. Ganguli, and K.E. Stoner. 2019. Species distribution modeling supports “nectar corridor” hypothesis for migratory nectarivorous bats and conservation of tropical dry forests. *Diversity and Distributions* 25:1399–1415.
- Burke, R., J.K. Frey, and K.E. Stoner. 2021. Using species distribution modeling to delineate richness patterns of chiropterophyllic plants and allocate conservation efforts in Mexico and the southwestern United States. *Natural Area Journal* 41:85–92.
- Duboscq, J., V. Romano, A. MacIntosh, and C. Sueur. 2016. Social information transmission in animals: lessons from studies of diffusion. *Frontiers in Psychology* 7:1147. <http://dx.doi.org/10.3389/fpsyg.2016.01147>.
- Eveleth, R.W. 1978. New methods of working an old mine: case history of the Eberle Group, Mogollon, NM. *New Mexico Geology* 1:7–10.
- Fleming, T.H., R.A. Nuñez, and L. da S. L. Sternberg. 1993. Seasonal changes in the diets of migrant and non-migrant nectarivorous bats as revealed by carbon stable isotope analysis. *Oecologia* 94:72–75.

- Frey, J.K. 2004. Taxonomy and distribution of the mammals of New Mexico: an annotated checklist. Occasional Papers, Museum of Texas Tech University 240:1–32.
- Geluso, K., and K.N. Geluso. 2021. Lesser long-nosed bat (*Leptonycteris yerbabuenae*) range expansion into northern Grant County, New Mexico. *Western North American Naturalist* 81:273–279.
- Godinez-Alvarez, H., and A. Valiente-Banuet. 2000. Fruit-feeding behavior of the bats *Leptonycteris curasoae* and *Choeronycteris mexicana* in flight cage experiments: consequences for dispersal of columnar cactus seeds. *Biotropica* 32:552–556.
- Hoffmeister, D.F. 1986. *Mammals of Arizona*. University of Arizona Press, Tucson, Arizona.
- Jones, A.K., S.W. Liphardt, J.L. Dunnum, T.W. Perry, J. Malaney, and J.A. Cook. 2021. An overview of the mammals of the Gila region, New Mexico. *Therya* 12:213–236.
- Jones, J.D., M.J. Kauffman, K.L. Monteith, B.M. Scurlock, S.E. Albeke, and P.C. Cross. 2014. Supplemental feeding alters migration of a temperate ungulate. *Ecological Applications* 24:1769–1779.
- Laverty, T.M., and K.E. Stoner. 2022. In search of bachelorettes: observations of male *Leptonycteris yerbabuenae* with dorsal patches across its range. *Therya* 13:163–170.
- Lewis, L. 2001. Eighty mile range extension for *Leptonycteris nivalis*. *Bat Research News* 42:17.
- Ober, H.K., R.J. Steidl, and V. M. Dalton. 2005. Resource and spatial use patterns of an endangered vertebrate pollinator, the lesser long-nosed bat. *Journal of Wildlife Management* 69:1615–1622.
- Pacifici, M., C. Rondinini, J.R. Rhodes, A.A. Burbidge, A. Cristiano, J.E.M. Watson, J.C.Z. Woinarski, and M. Di Marco. 2020. Global correlates of range contracts and expansions in terrestrial mammals. *Nature Communications* 11:2840. <https://doi.org/10.1038/s41467-020-16684-w>
- Petit, S. 1997. The diet and reproductive schedules of *Leptonycteris curasoae curasoae* and *Glossophaga longirostris elongata* (Chiroptera: Glossophaginae) on Curacao. *Biotropica* 29:214–223.
- Ramsey, M., and K. Whiteman. 2011. Range extension for the Lesser Long-nosed Bat in New Mexico. *Western Bat Working Group Newsletter* 7:11.
- Rojas-Martínez, A., H. Godinez-Alvarez, A. Valiente-Banuet, M. del Coro Arizmendi, and O. S. Acevedo. 2012. Frugivory diet of the Lesser Long-nosed Bat (*Leptonycteris yerbabuenae*), in the Tehuacán Valley of central Mexico. *Therya* 3:371–380.
- Sellers, S. 2018. Metabarcoding indicates increased arthropod consumption at the northern range extent of long-nosed bats (*Leptonycteris* spp.). M.S. Thesis, New Mexico State University, Las Cruces, New Mexico. 83 p.
- U.S. Fish and Wildlife Service. 2016. Species status assessment for the Lesser Long-nosed Bat. U.S. Fish and Wildlife Service, Southwest Region, Albuquerque, New Mexico. 96 p.
- U.S. Fish and Wildlife Service. 2018. Removal of Lesser Long-nosed Bat from the federal list of endangered and threatened wildlife. *Federal Register* 83:17093–17110.



**JAMES LAWS** embraces the weird wherever he goes. He played music for a number of years and then went to university and graduated after 15 y of persistence. He worked as a Forestry Aid, Social Worker, Child Protection Investigator, Miner, and is now retired. James loves the outdoors, photography, and animals he does not know the names of yet. He is a ravenous reader and now a YouTuber. (Photographed by Katherine Murray).



**MICHAEL T. HILL** is a Herpetologist who has worked extensively with the herpetofauna of New Mexico and surrounding states. He has worked in southeastern New Mexico alongside landowners, agencies, and industry to conserve Dunes Sagebrush Lizards (*Sceloporus arenicolus*) and their habitat for nearly 20 y. Collaborative conservation, education, and natural history are of particular interest to him. (Photographed by Debra Hill).



**JENNIFER K. FREY** is a Professor in the Department of Fish, Wildlife and Conservation Ecology and curator of the Wildlife Museum at New Mexico State University, Las Cruces. She received her B.S. and M.S from Emporia State University in Kansas and Ph.D. from the University of New Mexico, Albuquerque in 1994. Her research has primarily focused on the ecology, biogeography, and conservation of mammals in New Mexico and elsewhere in western North America. (Photographed by Andres Leighton).