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RECURRENCE OF MEXICAN LONG-TONGUED BATS (*CHOERONYCTERIS MEXICANA*) AT HISTORICAL SITES IN ARIZONA AND NEW MEXICO

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ABSTRACT.—The Mexican long-tongued bat (*Choeronycteris mexicana*) is a nectar-eating species that seasonally inhabits the southwestern United States. Since 1906, fewer than 1500 individuals of *C. mexicana* have been documented throughout the range of the species. We conducted a field survey in Arizona and New Mexico during summer 1999 to check historically occupied areas for recurrence of *C. mexicana*. We observed *C. mexicana* occupying a majority (75%, n = 18) of visited sites. Multiple individuals were observed at many sites, including young-of-year. *Choeronycteris mexicana* roosted in lighted areas close to entrances within mine adits, abandoned buildings, wide rock crevices, and caves. All occupied sites were in Madrean evergreen woodlands or semidesert grasslands where species of *Agave* were present. Most sites were located near a water source and, with the exception of a single site, near areas of riparian vegetation. Sites at which we did not encounter *C. mexicana* were frequently disturbed, difficult to search, or historically occupied by single individuals. Based on the relatively high rate of bat recurrence, we do not believe that populations of *C. mexicana* in the region have declined dramatically over the past several decades.

Key words: Mexican long-tongued bat, Choeronycteris mexicana, *roosts, habitat, New Mexico, Arizona.*

The Mexican long-tongued bat (*Choeronycteris mexicana*) is 1 of 3 migratory, nectarivorous bats that seasonally occur in the extreme southwestern United States (U.S.); the other 2 species are *Leptonycteris curasoae* and *L. nivalis*. Unlike *Leptonycteris* spp., *C. mexicana* is not known to form large maternity colonies and is rarely encountered in groups of more than 12 individuals (Hoffmeister 1986). Possibly because of the small size of roosting groups, the number of *C. mexicana* historically encountered is relatively low compared to other bat species. Although the range of *C. mexicana* extends from the southwestern U.S. into Honduras, less than 1500 individuals have been documented since its discovery in 1844 (Petryszyn and Cockrum in preparation). Roosting and habitat needs of *C. mexicana* are poorly understood, and it is unclear how such requirements might influence the apparent scarcity of this bat.

Choeronycteris mexicana is known to roost in a variety of situations, typically in shallow caves or near entrances of more extensive structures (Arroyo-Cabrales et al. 1987). Roost sites have been reported from various vegetation zones, including tropical deciduous forests at southern latitudes (Davis and Russell 1954), but roosts are frequently found in oak-conifer woodlands in the northern part of this bat's range (Hoffmeister 1986). Mexican long-tongued bats are known to feed on nectar, pollen, or fruit of various flowering plants throughout their range (Gardner 1977). Although mutualistic relationships likely exist between *C. mexicana* and its food plants, very little is known about the role this species plays as a pollinator or seed-disperser of such plants. Identification and elucidation of mutualistic relationships are necessary steps toward effectively conserving ecosystems in the southwestern U.S. (Allen-Wardell et al. 1998). Given the potential importance of *C. mexicana* as a pollinator and its apparent scarcity in the southwestern U.S., current status and habitat requirements of the species need to be determined. Furthermore, the majority of *C. mexicana* historically encountered north of Mexico were adult females and young (Petryszyn and Cockrum in preparation), indicating that the southwestern U.S. is an important breeding area. The objective of this study was to assess recurrence of *C. mexicana* at historical roost sites in Arizona and New Mexico, count numbers of bats present, and gather data on roost and habitat characteristics.

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MATERIALS AND METHODS

Between 13 April and 9 August 1999, we surveyed sites in New Mexico and Arizona historically occupied by *C. mexicana.* We compiled historical locality records from literature and communications with other researchers in the region. Specific locations of historical records were often not described in detail and, in some cases, we suspected that multiple locality descriptions were used for the same location. To account for such ambiguities, we defined a site as any point within a 5-km radius of where we estimated an observation of *C. mexicana* was originally recorded. For example, if the historical record listed "2 mi. W, 5 mi. N of Patagonia" as a locality, we considered any potential or occupied roost within a 5-km radius of that point as the same site. Field visits to sites coincided with the date (month and day) of original observation. If bats were not observed at a site on the initial visit, we made return visits between 14 and 30 days later.

We approached potential roosts as quietly as possible and inspected roost entrances with binoculars from a distance >10 m. If bats were not observed from >10 m, we entered the potential roost. Bats were visually identified within roosts using lights and binoculars; the distinct profile of *C. mexicana* renders identification possible without capture (see photos in Hoffmeister 1986). We chose not to capture and handle bats due to the scarcity of known roosts and the potential for roost abandonment. When we did not encounter bats during the initial search of a historically occupied roost, we monitored it for 30 minutes in case we flushed bats upon our arrival. We classified individuals attached to adult bats as young-of-year.

Locality data for each roost were recorded in UTM (NAD27 datum) coordinates using a global positioning system (GPS; Rockwell PLGR, Rockwell Collins, Inc., Cedar Rapids, IA). Because *C. mexicana* is listed as threatened by the states of Arizona and New Mexico, specific locality data are restricted but available from the authors. In addition to roost locality data, we classified vegetative communities directly surrounding sites (Brown 1994). Distance from the nearest source of water and the presence of flowering plants were recorded for each site. We characterized roosts by measuring height and width of entrances, depth of roost, depth of bats within roost, height of bats above ground, and aspect of roost opening.

RESULTS

We located and accessed 24 historical sites from an initial list of 39 in Arizona and New Mexico (Table 1, Fig. 1). We found *C. mexicana* occupying 75% (n = 18) of the sites we visited. On several occasions *C. mexicana* returned to roosts after being flushed by our approach. A total of 104 bats was observed and average group size was 4.5 (range 1–17). We noticed multiple individuals at 83% (n = 15) of the occupied sites, and young-of-year at 71% (n = 12) of occupied sites. Young-of-year bats comprised 23% (n = 24) of the total number encountered. We first observed young on 17 June and evidence that young were flying on 26 July (indicated by presence of pollen on muzzle). Mean number of roosts encountered at each site was 1.6 (range 1–3) and mean roost elevation was 1477.5 m (range 975–1846). *Choeronycteris mexicana* roosted in mine adits (n = 12), wide rock crevices (n = 6), caves (n = 6), and abandoned buildings (n = 3). Fifty-two percent of occupied structures had multiple entrances. Bats typically roosted in relatively well lit areas close to entrances (mean = 2.7 m). All occupied sites were in Madrean evergreen woodlands (n = 11; sensu Brown 1994) or semidesert grasslands (n = 7; sensu Brown 1994). All sites were within 1 km of streams and, with the exception of a single site, within or near (<0.5 km) riparian deciduous vegetation. Species of *Agave* were present in the vicinity of all occupied roosts; flowering *A. schottii* was observed near all but a single occupied site prior to the blooming of *A. palmeri* in mid-June. Sites where we did not encounter *C. mexicana* were frequently disturbed (e.g., recreational caves with high visitation), difficult to search (e.g., extensive caves with high, inaccessible ceilings), or historically occupied by single individuals.

DISCUSSION

The number of bats we observed at historical sites was approximately half the number of individuals originally recorded at those sites (Table 1). However, comparison of present occurrences to historical records is problematic because in many cases the number of bats originally occupying a site was totaled over

TABLE 1. Sites historically occupied by *Choeronycteris mexicana*. Sites listed by state and county with information pertaining to number of *C. mexicana* historically encountered (Historic *n*), whether the site was found during the 1999 survey, number of *C. mexicana* encountered during this survey (1999 *n*), and whether young were present. Values marked by an asterisk reflect the number of bats observed on multiple visits.

State/ County	Site	Historic *n* =	Visited	1999 *n* =	1999 young
ARIZONA					
Cochise	Green Canyon, Chiricahua Mts.	1	—	—	—
	Cave Creek/South Fork, Chiricahua Mts.	18*	X	11	X
	Silver Creek, Chiricahua Mts.	12*	X	1	—
	Old Fort Bowie, Chiricahua Mts.	1	X	—	—
	Miller Canyon, Huachuca Mts.	19	X	1	—
	Dragoon, Dragoon Mts.	1	—	—	—
	Little Dragoons, Little Dragoon Mts.	1	—	—	—
	Rodeo, Chiricahua Mts.	1	—	—	—
	Kartchner, Whetstone Mts.	1	X	4	X
	Hilltop, Chiricahua Mts.	12	X	0	—
	North Huachuca Mts.	1	—	—	—
	Ramsey Canyon, Huachuca Mts.	29*	X	9	X
Graham	Pinaleño Mts.	1	—	—	—
	Redfield Canyon, Galiuro Mts.	1	X	0	—
Pima	Alamo Canyon, Santa Catalina Mts.	4*	—	—	—
	Sabino Canyon, Santa Catalina Mts.	3*	X	4	—
	Madera Canyon, Santa Rita Mts.	1	—	—	—
	Colossal Cave, Rincon Mts.	2*	—	—	—
	Topowa, Baboquivari Mts.	1	—	—	—
	Helvetia, Santa Rita Mts.	2*	X	1	—
	Peppersauce, Santa Catalina Mts.	7*	X	0	—
	Arivaca, San Luis Mts.	1	X	0	—
	Sasabe, Baboquivari Mts.	26	X	6	X
	Saguaro N.P., Rincon Mts.	3*	X	5	X
	Box Canyon, Santa Rita Mts.	1	X	3	X
	Papago Springs Cave, Canelo Hills	6	X	17	X
Santa Cruz	Peñña Blanca Spring, W of Nogales	11*	X	0	—
	Patagonia, Santa Rita Mts.	7*	—	—	—
	North of Patagonia, Santa Rita Mts.	3*	X	9	X
	Turner Ranch, Canelo Hills	1	—	—	—
	Agua Caliente, Santa Rita Mts.	1	—	—	—
	Ruby, Tumacacori Mts.	7*	—	—	—
	Gooding Research Area, Astascosa Mts.	4	X	2	X
NEW MEXICO					
Hidalgo	Cloverdale, Peloncillo Mts.	11*	X	14	X
	North Peloncillo Mts.	4*	—	—	—
	Deer Creek, Animas Mts.	Present	X	9	X
	Pine Canyon, Animas Mts.	2	X	2	—
	Guadalupe Canyon, Peloncillo Mts.	11*	X	4	X
	Skeleton Canyon, Peloncillo Mts.	1	X	2	—
TOTAL		219	24	104	12

multiple visits. The total number of individuals we encountered during our survey is roughly equal to 20% of the number previously documented north of the Mexican border (Petryszyn and Cockrum in preparation). Considering the number of individuals we encountered and the relatively high rate of recurrence at historical sites, we do not have sufficient evidence to conclude that *C. mexicana* populations have increased or decreased in recent years.

Our observations of young-of-year bats at 71% of the sites we visited suggest that the species is successfully reproducing in the northern part of its range. Although nearly 25% of the bats we observed were young-of-year, this count is likely conservative due to the limitation of our survey method in assessing the age of bats. We classified individuals as young only during the time in which they were nonvolant and attached to their mothers;

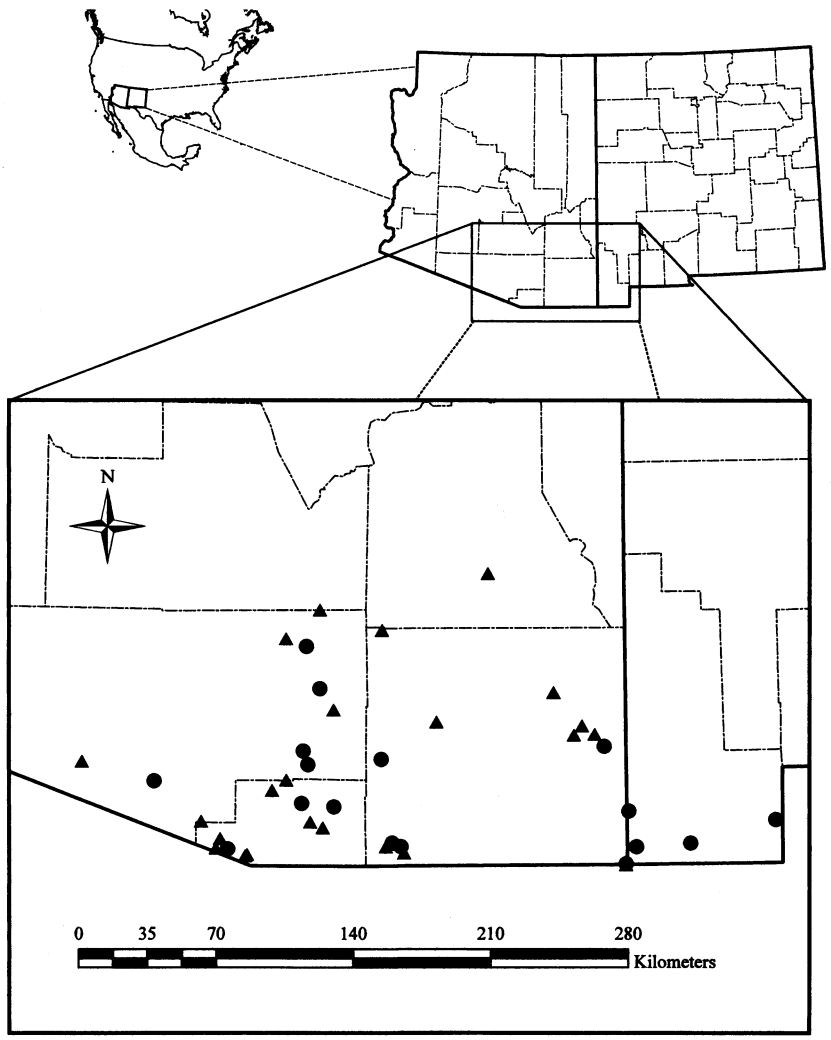

Fig. 1. Map showing the survey area and distribution of sites at which *Choeronycteris mexicana* has been encountered in Arizona and New Mexico. Dashed lines represent county boundaries. Circles indicate sites visited during summer 1999 when new data were obtained. Triangles indicate previously occupied sites that were not visited during 1999.

hence, independent juveniles were not counted. Furthermore, mothers with attached young were frequently observed rotating as they hung by a single leg so that their ventral surfaces were opposite the observer, thus obscuring their young from view. Such behavior may have limited our ability to accurately assess the presence of young.

In accordance with observations of previous researchers, we found *C. mexicana* forming relatively small groups (Goodwin 1946, Hoffmeister 1986). Bats were rarely seen clustering and we did not observe adults in close contact (<5 cm) with each other. On several occasions individuals were flushed from roosts and led us to other nearby sites occupied by conspecifics. Searches of rock crevices and shelters in historical roost areas often revealed multiple roosting groups of *C. mexicana*. These observations suggest that aggregations of *C. mexicana* are dispersed among several proximate sites.

Groups of *C. mexicana* have been observed occupying the same roost within (Mumford et al. 1964) and between years (Campbell 1934). The relatively high incidence of *C. mexicana*

we observed at historical localities suggests year-to-year site fidelity. The first record of occupancy at sites for which we had data (n = 16; some historical records did not include year of capture) ranged between 3 and 77 years before our study, with a mean span of 21 years. This apparent long-term fidelity indicates that some need is fulfilled at occupied sites which is not met elsewhere.

Choeronycteris mexicana is opportunistic in its roosting habits, and there is no clear indication that it is dependent on a particular type of roost structure. Unlike species such as *L. curasoae,* which favor deeper caves and mines that conserve the metabolic heat of roosting bats (Fleming et al. 1998), roosts used by *C. mexicana* were shallow, relatively well lit, and typically exposed to external ambient temperatures. In contrast to the limited availability of deeper roosts in suitable caves and mines where *L. curasoae* congregate, *C. mexicana* is apparently able to exploit a wider range of structures as roosts, possibly resulting in the dispersed nature of their aggregations. Based on our observations, we believe it is unlikely that availability of roost structures limits distribution of *C. mexicana.*

Choeronycteris mexicana may be selecting roosts in relatively mesic areas. Nearly all occupied sites we encountered were within or very near (<0.5 km) areas of riparian vegetation. In the southwestern U.S., riparian vegetation likely buffers associated microclimates against fluctuations in temperature and humidity relative to surrounding desert habitats. By occupying riparian zones, bats could utilize spatially abundant, shallow roost structures without exposing themselves to lethal temperatures or desiccation. Preference for riparian zones and need for edible plants likely combine to limit distribution of *C. mexicana* in semiarid Arizona and New Mexico. Given the wary nature of *C. mexicana* and its propensity for moving between roosts in a small area, we believe that loss of riparian vegetation may be a greater threat to the species than disturbance at a particular roost.

In Mexico, *C. mexicana* is known to feed on nectar and pollen of various cacti (e.g., *Lemaireocereus, Myrtillocactus*), *Agave,* and other flowering plants such as *Ipomoea* and *Ceiba* (Villa-R. 1967, Alvarez and Gonzalez-Q. 1970). In Arizona, Van de Water and Peachey (1997) found that *C. mexicana* near Tucson feed predominantly on cactus and *Agave* species. While flowering cacti were present near (<10 km) some occupied sites we visited, species of *Agave* were the consistent floral characteristic of all sites. *Agave schottii* was the only species of that genus observed blooming at occupied sites before mid-June, after which blooming *A. palmeri* was also encountered. The co-occurrence of early- and late-blooming species of *Agave* may be another factor influencing site occupancy by *C. mexicana.*

This survey established a body of information that will be useful to future population monitoring efforts. Considering their ecological importance and susceptibility to population decline, bat populations should be effectively monitored (O'Shea and Bogan 2000). Because of the limited number of roost sites involved in this study, we recommend that these areas be surveyed every 2 to 3 years and protected from disturbance. In addition, further research into the habitat needs, food habits, pollination role, survivorship, and distribution of *C. mexicana* would enhance our understanding of these potentially important migratory pollinators.

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