RECURRENCE OF THE SPOTTED BAT (*EUDERMA MACULATUM*) AND ALLEN'S BIG-EARED BAT (*IDIONYCTERIS PHYLLOTIS*) IN NEW MEXICO

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ABSTRACT

The spotted bat (*Euderma maculatum*) and Allen's big-eared bat (*Idionycteris phyllotis*) are 2 of the most uncommon insectivorous bats in the western United States. In New Mexico, both species have been known to raise young in the past. In recent decades, however, almost no information has been reported on reproduction because few individuals have been captured in the state. With only limited data and few recent captures, the current status of both species is unknown, and it is not known whether populations of these species have declined in New Mexico. The main objective of this study was to assess recurrence of *E. maculatum* and *I. phyllotis* at previous sites of observation in New Mexico. After 42 nights of surveys from mid-May to early July in 2006, I documented spotted bats at 69% (11 of 16 sites) of historical sites that I visited, plus I documented individuals at 4 new sites in the state. If I eliminate some historical sites with dates of occurrences that were not during seasons of my surveys (e.g., winter data), then I documented spotted bats at 92% of historical sites (11 of 12 sites). For Allen's big-eared bats, I documented individuals at 100% (7 of 7 sites) of historical sites that I visited, plus I documented individuals at 2 new sites, including a new county for the state.

In 2006, spotted bats were observed in most regions of the state with prior records. The only region lacking observations was the extreme northwestern part of the state. Allen's big-eared bats were observed in the southwestern part of the state, that is, the only region where individuals previously were known from New Mexico. Evidence of reproduction by both species, even during an extreme drought, demonstrates that reproducing populations still occur in the state. Documentation of individuals at new locations suggests distributions might be expanding in the state.

Comparison of netting effort and relative proportions of individuals captured in the 1960s to data gathered in my surveys showed relatively equal numbers of individuals per unit of effort across decades. These similarities and high rates of documentation at sites in 2006 suggest that populations of *E. maculatum* and *I. phyllotis* are stable in the state. Spotted bats and Allen's big-eared bats are 2 of the most spectacular species in New Mexico, but still much information about their natural history remains poorly understood. Additional surveys in the future will help to further delineate the status of populations.

INTRODUCTION

Spotted bats (*Euderma maculatum*) and Allen's big-eared bats (*Idionycteris phyllotis*) are 2 of the most infrequently captured, insectivorous bats that regularly occur in western parts of the United States. *Euderma maculatum* occurs from southern British Columbia to central Mexico, whereas *I. phyllotis* occurs from southern Utah to central Mexico (Hall, 1981; Tumlison, 1993). Although *E. maculatum* occurs in 11 states in the United States (Geluso, 2000), little is known about its natural history including extent of migration and winter roosts. This paucity of data is related, in part, to the relatively few specimens that exist. For example, Best (1988) discovered that only 73 specimens of *E. maculatum* existed in collections as of 1985, and Hoffmeister (1986) reported on each specimen of *E. maculatum* from Arizona because of so few records from that state. In contrast, Allen's big-eared bat appears more common than the spotted bat, but its range in the United States is limited to parts of Arizona, Utah, Nevada, and New Mexico (Tumlison, 1993). Only scant data on its natural history have been published in New Mexico and other states (e.g., Jones, 1961; Jones, 1965; Jones, 1966; Findley et al., 1975; Hoffmeister 1986).

In New Mexico both species have been captured at few sites compared to most other vespertilionid bats, and little information is known about abundance, reproduction, and seasonal activities (Findley et al., 1975; Findley, 1987; Perry et al., 1997). In recent years, few individuals have been reported from New Mexico, even though both species have been known to raise young in the state (Findley et al., 1975). For example, Perry et al. (1997) reported that only a single spotted bat was captured in New Mexico between 1985 and 1995, and for Allen's big eared-bat, no information has been published in New Mexico since 1993 (Tumlison, 1993). With such limited data and few recent reports, it is unclear whether populations of these species have declined in the state.

Spotted bats are known from 12 published locations in western and southern New Mexico (Perry et al., 1997), and Allen's big-eared bats are known from 18 locations in southwestern New Mexico (Findley et al., 1975; Tumlison, 1993). For both, it is unclear whether individuals regularly occur at those sites from year to year or whether prior captures represent transient individuals or extirpated populations. In New Mexico, spotted bats are considered threatened and Allen's big-eared bats are listed as a species of concern. The primary objective of my study was to assess recurrence of *E. maculatum* and *I. phyllotis* at previous sites of observation in New Mexico. This survey will allow for future comparisons with other comprehensive surveys. My other objectives included amassing information on natural history from past publications, museum specimens, unpublished records, and data gathered in my study. This survey represents the 1st comprehensive survey for either species in the state.

METHODS

From mainly mid-May to early July 2006, I surveyed many localities across New Mexico with prior reports of *E. maculatum*, *I. phyllotis*, or both for a total of 42 nights (Appendix 1). I compiled records of localities from published literature, unpublished reports, museum specimens, and communications with other bat researchers. Specific locations of some sites were not described in detail, and sometimes, multiple descriptions of localities were used for a single location. To reduce these ambiguities, I combined duplicate localities, and for non-descriptive sites, I noted approximate areas on maps for future exploration of netting sites. Herein, I define historical sites as any site with at least one previous observation prior to 2006. At many historical sites, I attempted to capture individuals with mist nets (Avinet Inc., Dryden, New York), observe individuals with spotlights, or listen for their distinctive audible calls.

At most sites, I placed mist nets over water, including rivers, streams, earthen ponds, and steel-rimmed stock tanks. Generally, I used multiple nets at these water sources to attempt to increase capture rates. For each bat captured, I recorded time of capture, species, sex, age, and reproductive condition. On some nights, I also recorded forearm length, body mass, number of fecal pellets (that is, if individuals were held for more than a few minutes), and time of release. A small dot of ink was placed on the wing of individuals at time of release to determine whether subsequent individuals captured represent recaptures or new individuals. I also took photographs of many spotted and Allen's big-eared bats at sites of capture prior to release. All *E. maculatum* and *I. phyllotis* captured were held for about 1 h to obtain fecal pellets of recently eaten insects (see Buchler, 1975). To determine diets, I examined fecal pellets with a dissection microscope following techniques reported in Whitaker (1988). All fecal pellets from an individual were treated as a single sample, and number of pellets collected varied from 4 to 18 pellets. Each

sample was placed in a Petri dish with 95% ethanol, and pellets were gently pulled apart to observed small fragments of insects. I identified fragments to the lowest identifiable taxonomic group. In each sample, I reported volume of each food type as a percentage. This represents the quantity visually estimated of each food type in the sample. For the sum of all samples, I reported average percentage volume, which equals sum of sample volumes for each food type divided by total volume possible multiplied by 100. I also reported percentage frequency, which represents the total percentage of samples containing that taxon. I examined fecal pellets from 6 *E. maculatum* and 13 *I. phyllotis*. Ambient temperature was recorded periodically throughout evenings on most nights.

Localities were recorded in latitude and longitude (NAD83 datum) using a global positioning system (GPS; Garmin GPS 12, Garmin International, Inc., Olathe, KS). I also classified vegetative communities directly surrounding netting sites.

In May and June 2006, drought conditions persisted in the region. Lack of precipitation prior to my study caused some earthen ponds at historic sites to be dry upon arrival. On these occasions, I generally attempted to find nearby water to set mist nets. At some sites, nets were not deployed and observations consisted of listening for audible parts of calls. At others, I totally abandoned the area because of dry conditions or threat of forest fires.

In New Mexico, 3 species of bats frequently encountered in the study area produce audible, low frequency, parts of echolocation calls that can be detected and distinguished by trained individuals (Barbour and Davis, 1969; Rabe et al., 1998). Big free-tailed bats (*Nyctinomops macrotis*) produce the highest pitched call that is distinct from calls of *E. maculatum* and *I. phyllotis*. To me, calls of *Nyctinomops* are high-pitched chirps with some length to each call (i.e., each call is drawn out compared to other audible calls). Spotted bats and

Allen's big-eared bats produce calls that are similar in pitch and duration to each other but lower in pitch than *N. macrotis*. Calls of *E. maculatum* and *I. phyllotis* can be described as two steel balls or rocks being hit together. Duration of each call is short and quick with no length to calls. Sounds produced by *E. maculatum* and *I. phyllotis* are best described as a sharp click. The most notable difference between the latter two species is frequency and loudness of calls. Spotted bats produce calls that can easily be counted when individuals fly overhead, that is, when they are not engaged in feeding or on approach to drink. Moreover, audible sounds of *E. maculatum* are considerably louder than those of *I. phyllotis*. Allen's big-eared bats produce calls that are very rapid and difficult to count, especially when counting into double digits. Calls of *I. phyllotis* also are softer than *E. maculatum*.

During this study and others, I have observed that spotted bats always produce audible calls. In contrast, *Idionycteris* can exhibit a "stealth mode," where individuals approach mist nets without producing audible parts of calls. Based on audible calls immediately prior to capture in nets or observations with spotlights, I have recognized without error at least 15 *Euderma* and over 30 *Idionycteris*. Some distant calls or calls on windy nights can not be classified to species.

RESULTS

Spotted bats.—During this study, I visited 17 of 18 historical sites where *E. maculatum* previously has been documented in New Mexico (Table 1). At 3 of these sites, I did not net for *E. maculatum* because the water source was dry (Table 1). Of the remaining 14 historical sites, I documented *E. maculatum* at 9 (64%) in 2006. However, I also documented spotted bats at 2 additional sites near historical sites that were dry (Aqua Chiquita = Rogers Ruins, Otero County

and 3.5 mi E Springtime Campground = Weir Tank, Socorro County). Because of proximity of these new sites to historical sites and lack of water at historical sites, I considered both records as support for *E. maculatum* occurring at nearby historical sites in 2006. Thus, I documented spotted bats at 69% of historical sites (11 of 16) that I visited in 2006. If I further eliminate sites with dates of occurrences outside dates of my study (see below), I documented spotted bats at 92% of historical sites (11 of 12 sites). In addition to these observations, I documented *E. maculatum* at 4 new sites. Two sites were in Catron County, and 2 were in Grant County (Table 1 and Appendix 1).

Allen's big-eared bats.—During this study, I visited 11 of 20 historical sites where *I. phyllotis* previously has been documented in New Mexico (Table 2). At 4 of these sites, I did not net for *I. phyllotis* because the water source was dry (Table 2). Of the remaining 7 historical sites, I documented *I. phyllotis* at 100% of sites (7 of 7) that I visited in 2006. In addition to observations at historical sites, I documented *I. phyllotis* at 2 new sites. One site was located in Grant County and the other was in Sierra County (Table 1 and Appendix 1). The latter site represents a new county record for this species in New Mexico.

Rank of captures.—In 2006, I deployed nets on 37 nights to attempt to capture *E. maculatum* and *I. phyllotis* in New Mexico. I captured a total 1751 bats of 20 species (Table 3). Both spotted bats and Allen's big-eared bats ranked moderately low in number of individuals captured compared to other species. *Euderma maculatum* ranked 16 of 20 and *I. phyllotis* ranked 14 of the 20 species captured (Table 3). Silver-haired bats (*Lasionycteris noctivagans*) and big brown bats (*Eptesicus fuscus*) were the most frequently captured species. The most uncommon species captured in 2006 were represented by a single capture—the eastern pipistrelle (*Pipistrellus subflavus*), Townsend's big-eared bat (*Corynorhinus townsendii*), and big free-

tailed bat (*Nyctinomops macrotis*). Prevalence of spotted bats and Allen's big-eared bats also ranked low for total number of nights that individuals were captured (Table 3).

In contrast to captures in mist nets, I detected both species at other sites by audible calls and sometimes visual observation. Although spotted bats were documented at only 2 sites (3 nights) by captures, I detected individuals at 13 additional sites by audible calls (Table 1). Similarly, I detected *I. phyllotis* at 5 sites by capture, but heard individuals at 4 additional sites (Table 2).

Other data on natural history.—*Spotted bats.*--In 2006, I observed *E. maculatum* at sites in New Mexico from 18 May to 3 July (Table 3). The only reproductive data gathered for *E. maculatum* was a lactating female captured 30 June at Mt. Taylor (Table 3). Nightly activity varied at sites, but in general, observations were made from shortly after sunset to almost dawn. At Ghost Ranch, for example, the first bat I observed on 19 June was a big-free tailed bat (*N. macrotis*) flying overhead at 2141 h which was visible without lights. Shortly after, at 2155 h, I heard and watched a spotted bat drinking over a large pool of water. I watched this individual for 8 minutes. It was light enough to observe this individual without flashlights, and it made many low passes over the water and drank at least 4 times. I noted that audible calls were faster than when it or other individuals were flying overhead. At times the individual was 5 m away, and with a small flashlight, I observed the white belly, darker color on sides, and large ears. For over an hour at this site, I heard the conspicuous audible calls of individuals, with as many as 3 flying overhead at one time.

The diet of 6 spotted bats captured in 2006 consisted almost entirely of Lepidoptera. Lepidoptera comprised 97.5% of total volume and Coleoptera comprised 2.5%. Percentage frequency was 100% for Lepidoptera and 17% for Coleoptera.

Allen's big-eared bats.--In 2006, I observed *I. phyllotis* at sites in New Mexico from 22 May to 4 July (Table 3). For *I. phyllotis*, I captured an obviously pregnant individual on 21 June and one female each on 26 May and 6 June that probably were pregnant. Lactating females were captured as early as 20 June and as late as 4 July (Table 3). Nightly activity varied at sites, but in general observations were from about 40 minutes after bats were first observed flying to almost dawn. The earliest individual captured was on 21 June at 2120 in Sierra County. On a number of occasions, 2 individuals were heard at one time. The best night for capturing *I. phyllotis* was on 20 June at a site below Weir Tank in the San Mateo Mountains, Socorro County. On this night, I captured 5 individuals, plus another one escaped from the net. The earliest capture on this night was 2247 h and the latest was 0456 h.

The diet of 13 *I. phyllotis* captured in 2006 consisted mainly of Lepidoptera. Lepidoptera comprised 97.8% of total volume, while Family Scarabaeidae was 1.9%, unidentified Coleoptera was 0.2%, and unidentified insect was 0.1%. Percentage frequency was 100% for Lepidoptera and 8% for each Scarabaeidae, unidentified Coleoptera, and unidentified insect.

DISCUSSION

Comparison of my data to historical data and conclusions from those comparisons might be problematic for several reasons. First, most historical sites were netted multiple times and for multiple years in the past. My surveys represent only a single, short period of time where I intensely netted bats for about 2 months. I netted at some historical sites only once, but others were visited multiple times. Second, historical observations occurred in all seasons, but my surveys only were conducted from about mid-May to early July. This constraint limited my ability to detect transient individuals moving between seasonal roosts or those at wintering areas.

And third, it is unclear how the drought in May and June 2006 might have affected my abilities to detect these 2 species at historical sites. Limited availability of drinking water in areas concentrates the activity of bats around remaining water sources and results in higher rates of capture (Geluso and Geluso, in preparation). On the other hand, lack of water in some areas might have forced individuals to drink at sources farther away from their usual sources.

Even considering limitations of a one-year, single-season survey, I found my rate of detection of *E. maculatum* and *I. phyllotis* higher than I originally predicted in New Mexico. Frequency of detection at historical sites was 92% for *E. maculatum* and 100% for *I. phyllotis* in 2006. I find these results very positive with respect to the current status of spotted bats and Allen's big-eared bats in New Mexico.

Results of my surveys generally allowed for detection of spotted bats or Allen's big-eared bats at historic sites but yielded only limited information concerning status of populations. In New Mexico, only scant data regarding population sizes are reported for these 2 uncommon species (see below). One type of data that might be related to population size is abundance of individuals observed at historical sites. Clearly, however, caution must be used with comparisons between these data because netting success can vary considerably between nights, seasons, and years. For both species, however, I compared my overall success in capturing these 2 species with Jones (1965; 1966) for, at least, a cursory look at status of population sizes across the sites.

SPOTTED BATS

Recent scarcity of captures.—In this survey, I detected *E. maculatum* at many historical sites throughout New Mexico (Table 1). This shows that at least some individuals still live in most areas where they have been found in the past and suggests that viable populations still

occur in these areas. Perry et al. (1997) reported a paucity of captures of *E. maculatum* in the state between 1985 and 1995, which suggests that this species might be declining in New Mexico. Results of my survey suggest that *E. maculatum* is, at least, still widespread across the state. I suspect that lack of captures reported in Perry et al. (1997) is the result of several factors, assuming that populations have not declined over the last several decades.

First, it appears that bat researchers in recent decades are not keeping vouchers or publishing data as they did in the past. For example, Jones (1965) reported on 1595 captures in New Mexico from 1958 to 1963; all of which were prepared as specimens and housed in museums. Moreover, I know there are more captures of *E. maculatum* in recent decades, but data are unavailable in field notes and not accessible. Almost all data of spotted bats come from museum specimens and publications from the 1960s and 1970s. For example, 24 of 36 records for in New Mexico are from those two decades. Since 1981, I am aware of only 3 papers that have published original information on spotted bats in New Mexico—Perry et al., 1997; Ellison et al., 2005; and Sherwin and Gannon, 2005.

Second, fewer researchers might be netting bats in New Mexico in recent decades. This might be the case for the 1980s and early 1990s, but in the last 10 years, I am aware of many people that net bats in the state. Thus I suspect, and in some cases know, that there are recent data on spotted bats tied up in reports ("gray literature") or field notebooks. Tracking down this information is difficult compared to data published in widely available scientific journals or vouchers housed in museums. I know of a number of researchers that net bats across the state, but few regularly publish on any aspect of their data, although some individuals have many years of data and are well funded by government agencies. The number of faculty mentors and their students that study and publish on the natural history of bats in the state also is on the decline.

Bat researchers, including myself, need to make a concerted effort to publish information that we gather on all bats in the state and not let our data remain in unpublished reports or go unknown in field notes. Because spotted bats are uncommon and because relatively little is known about them in the state, I suspect most captures warrant a short note or communication in a scientific journal. I also propose that summaries of intensive field studies with many captures need to be continuously published to assist tracking whether the relative of abundance of species are changing over time.

A third reason for the scant data on natural history of the spotted bat is because of infrequency of captures in mist nets. In other western states, the spotted bat appears to be rare at most locations where it is known (e.g., Hoffmeister, 1986; Geluso, 2000). There are only 2 localities where numerous individuals have been captured in the United States—the Big Bend Region in Texas (Easterla, 1973) and southern Utah (Poche, 1981). In my survey, I only captured individuals at 2 sites (Jemez Mountains and Mt. Taylor, Appendix 1). In contrast, I heard the audible calls or observed them with spotlights at 13 additional sites across the state. My observations support that the spotted bats is not abundant at most sites in New Mexico because on most nights observations consisted of only a single or few individuals passing overhead sporadically during the night. However, there were 3 locations where spotted bats were observed frequently: 1) along the East Fork of the Jemez River, 2) Ghost Ranch, and 3) Mt. Taylor. At these sites, I observed multiple individuals during the night and usually more than one at a time.

Many of my observations were of individuals flying overhead, likely moving between roosting and foraging sites. On most occasions, individuals did not attempt to drink at historical sites. Because I could hear *E. maculatum* approaching sites, I observed that most individuals that

came down to drink were captured in nets or at least hit the net. Thus, these data suggest that *E. maculatum* is not as capable as other species in maneuvering away from nets. At the completion of this survey, I observed a trend in types of water sources that were used by spotted bats and Allen's big-eared bats (see below, *Sources of water used by these bats*).

Overall lack of abundance of spotted bats at sites in New Mexico is similar to most other sites across the western United States. Because *E. maculatum* generally is not abundant at sites and not commonly captured in nets, monitoring its presence or absence by audible calls might be a plausible monitoring technique for future surveys (also see *Management suggestions of these bats in New Mexico*). I suspect that future surveys only using captures and not incorporating audible calls into protocols will show that spotted bats are absent from many sites when in fact they still are present.

Historical sites without captures.—Although I documented spotted bats at 11 of 16 historical sites that I visited in 2006, there were 5 locations where I did not detect individuals. Some sites represent areas where *E. maculatum* likely was not present because of suspected seasonal movements, but at other sites, it was not clear to why bats were absent.

In 2006, I failed to detect spotted bats in Albuquerque, Bernalillo County and near Mesilla Park in Las Cruces, Dona Ana County. Both represented sites with only late autumn or winter records. The 2 specimens known from Albuquerque are from 9 November 1971 (MSB specimen) and 28 January 1999 (Sherwin and Gannon, 2005), and the specimen from Las Cruces was documented in September 1903 (Miller, 1903). These records of individuals at lower elevations in winter, where they have not been reported in summer, suggest that *E. maculatum* moves seasonally (Findley and Jones, 1965).

In 2006, I also did not observe *E. maculatum* at Lake Roberts, Grant County on 2 occasions. The original specimen from this site was captured on 12 May 1970. This individual might have been in route to higher elevations in the Mogollon Mountains from its winter roost.

I documented spotted bats in most areas of the state with prior summer records. The only exception was the lack of observations from northwestern New Mexico. Here, I failed to record individuals from Aztec, San Juan County and Chaco Canyon, Cibola County. My initial surveys were in mid-May, possibly before individuals returned to the area, but my second trips were in mid-June and mid-July. The second night at Chaco was extremely windy and likely hampered my abilities to detect audible bats. The record from Aztec was from 21 September, thus yet another late seasonal record. This might be another example of a transient site or winter site. Additionally, neither site had many original observations suggesting that abundance and occurrence might always have been limited in the region. If I eliminate the above 4 sites because bats might not have been present during my surveys, my overall success rate in documenting spotted bats increases to 11 of 12 sites or 92% success in New Mexico.

Abundance of E. maculatum in 2006 and in the past.—Three studies comment on the relative abundance of *E. maculatum* in New Mexico (Findley and Jones, 1965; Jones, 1965; Jones, 1966). Data in Findley and Jones (1965) were incorporated in the latter 2 papers. In addition, some data in Jones (1965) and Jones (1966) clearly must represent some of the same captures. Jones (1965) reported on captures of bats from the Mogollon Mountains of New Mexico and adjacent areas in Arizona. In 101 nights of netting, he captured a total of 1595 individuals of 20 species, including 7 *E. maculatum*. Jones (1966) reported on captures of bats from 5 sites in the Mogollon and San Mateo mountains of New Mexico. In 70 nights of netting, he captured a total of 1257 bats of 19 species, including 9 *E. maculatum*. In contrast, I am not

aware of any recent publications or data on the current abundance of *E. maculatum* in the state, except for my surveys in 2006.

From Jones (1965), I calculated that he captured 0.07 *E. maculatum* per night of netting and *E. maculatum* comprised 0.4% of total captures. From Jones (1966), I calculated that he captured 0.16 *E. maculatum* per night, and *E. maculatum* comprised 1.0% of total captures. For these latter calculations, I subtracted the number of nights and bats from Bear Trap Canyon because *E. maculatum* is not known from that site. In my 37 nights throughout the state in 2006, I captured 1751 bats, including 9 *E. maculatum*. From these data, I captured 0.24 *E. maculatum* per night and *E. maculatum* comprised 0.5% of my total captures.

Comparison of individuals captured per night of netting and relative percentage of captures of *E. maculatum* show no evidence for a decrease in *E. maculatum* in New Mexico. My data on individuals captured per night of netting are higher than Jones (1965; 1966). My data on relative percentage of capture of *E. maculatum* were between that of Jones (1965; 1966). My data are based on fewer total nights of netting, but to my knowledge, these data represent the only widespread and intensive study on the subject. Another intensive field season to capture *E. maculatum* at historical sites across New Mexico would be informative to help support or refute these comparisons.

Seasonality and reproduction.—Spotted bats appear to occur in New Mexico throughout the year. There are dates of occurrence from May to November and January and February (museum records; K. Geluso, unpubl. data; Sherwin and Gannon, 2005). Seasonal dates of occurrence for volant individuals are from 12 May to 15 October (museum record; K. Geluso, unpubl. data; respectively). There are no dates of pregnant individuals from the state. Dates of lactation are known from 9 June to 30 July (Jones, 1961; Findley and Jones, 1965; Perry et al.,

1997; this study; museum records). The only reported volant young was from 21 September (Rodeck, 1961). To date, direct evidence of seasonal movements has not been documented, but indirect evidence of seasonal movements is reported from New Mexico and other states (Findley and Jones, 1965; Geluso, 2000).

Diet.—The spotted bat is known to feed mainly on moths (Ross, 1967), but this information is based on relatively few samples. In this study, I examined the diets of 6 additional individuals from New Mexico. As predicted, spotted bats in New Mexico fed almost exclusively on Lepidoptera (moths).

ALLEN'S BIG-EARED BATS

Background on sites visited.—In this survey, I detected *I. phyllotis* at 7 of 7 historical sites in southwestern New Mexico (Table 2). In addition, *I. phyllotis* was captured at 2 additional sites in the region, including a new county record. This shows that at least some individuals still live where they have been documented in the past and suggests that viable populations still persist at these historical sites. The high success of detecting *I. phyllotis* at historical sites suggests that the Gila, Mogollon, and San Mateo mountains, as well as the Black Range are strongholds for the species. One disappointment of this project was my inability to visit many backcountry sites in the Gila Wilderness. Allen's big-eared bats originally were documented at many sites in this area by extended trips with pack animals into the rugged country. I originally planned to visit a number of these sites but later decided it was not the best use of my time or I was not permitted to enter due to forest fires. As previously mentioned, New Mexico was in severe drought during most of my surveys. This had other challenges besides a lack of water at some historical sites, such as obtaining "special" Special Use Permits to enter areas closed due to the threat of fire or area with recent fires. On my first attempt to net in a

remote area, I first contacted the local Forest Service district and met in person to discuss availability of water. I specifically was assured that an earthen pond near Me Own Hill in the Aldo Leopold Wilderness would have water, "because it has always had water even during the driest of years." After hiking with equipment to net bats and camp, the pond was dry. Because of the effort to hike into such remote areas, the possibility of not finding water, and the potential to lose nights for this project, I focused my efforts on more accessible sites. On the positive side, I heard, while I was at the Willow Creek Campground, that Lyle Lewis netted last year and continues to net in 2006 in remote areas of the Gila Wilderness. This might enable us to determine whether *I. phyllotis* also still occurs at some of those remote sites. I predict that *I. phyllotis* is in those areas, and many more individuals will be heard than captured, based on my efforts in 2006. It will be interesting to track down these data on his captures and number of audible calls heard.

Abundance of I. phyllotis in 2006 and in the past.—I have heard discussions that abundance of *I. phyllotis* is much lower in recent years than in the past. As of yet, I have not discovered any publications, reports, or data that support or refute those accusations. Currently, I am aware of 3 publications that comment on the relative abundance of *I. phyllotis* in New Mexico (Findley and Jones, 1965; Jones, 1965; Jones, 1966; see comments above concerning details of these studies). Jones (1965) reported on captures of bats from the Mogollon Mountains of New Mexico and adjacent areas in Arizona. In 101 nights of netting, he captured a total of 1595 individuals of 20 species, including 31 *Plecotus* (=*Idionycteris*) *phyllotis*. Jones (1966) reported on captures of bats from 5 sites in the Mogollon and San Mateo mountains of New Mexico. In 70 nights of netting, he captured a total of 1257 bats of 19 species, including 40 *I. phyllotis*. In contrast, I am not aware of any recent publications or data on the current abundance

of *I. phyllotis* in the state to make comparisons, except for my surveys in 2006. If someone knows of other data, please contact me at gelusok1@unk.edu!

From Jones (1965), I calculated that he captured 0.3 *I. phyllotis* per night of netting and *I. phyllotis* comprised 1.9% of total captures. From Jones (1966), I calculated that he captured 0.7 *I. phyllotis* per night, and *I. phyllotis* comprised 4.4% of total captures. For these latter calculations, I subtracted the number of nights and bats from Bear Trap Canyon because *I. phyllotis* is not known from that site. In my 22 nights in the region, I captured 1125 bats, including 15 *I. phyllotis*. From these data, I captured 0.7 *I. phyllotis* per night and *I. phyllotis* comprised 1.3% of my total captures. If I calculate my data with only those locations where *I. phyllotis* has been observed, I get the following results. In 15 nights, I captured 913 bats, including 15 *I. phyllotis*. From these data, I captured 1.0 individual per night and *I. phyllotis* comprised 1.7% of total captures.

Comparisons of individuals captured per night of netting and relative percentage of captures of *I. phyllotis* show no evidence for a decrease in *I. phyllotis* in the region. My data on individuals captured per night of netting are equal to or actually higher than Jones (1965; 1966). My data on relative percentage of capture of *I. phyllotis* were slightly lower than Jones (1965; 1966). My data are based on fewer total nights of netting, but to my knowledge these data represent the only widespread and intensive study on the subject. Another intensive field season to capture bats at historical sites in southwestern New Mexico would be informative.

Seasonality and reproduction.—Allen's big-eared bats are known from southwestern parts of New Mexico throughout the year. The only months lacking observations are January, February, and November (data from Findley et al., 1975; museum records; K. Geluso, in press). Seasonal dates of occurrence for volant individuals are from 10 March to 28 September (K.

Geluso, in press and museum record, respectively). Dates of pregnancy are from 2 May to 25 June (museum records). Dates of lactation are known from 10 June to 2 August (museum record and Findley et al. 1975, respectively). No volant young are known from the state. Hibernating individuals are known from a mine and drill hole in Grant County from 27 October to 18 April (museum records). Other individuals were reported from mines as early as 19 September.

Diet.—Allen's big-eared bat is known to feed mainly on moths, although other orders of insects have been observed in its diet (Ross, 1967; Black, 1974), and this information is based mainly on samples from New Mexico. In my study, I examined the diets of 13 additional individuals from New Mexico. As predicted, Allen's big-eared bats in New Mexico fed almost exclusively on moths.

SOURCES OF WATER USED BY THESE 2 SPECIES

After visiting many historical sites of *E. maculatum* and *I. phyllotis*, I observed that almost all sites used by these species were large, open areas of water containing few surrounding obstacles, such as trees, shrubs, and cliff walls. The most common source of water consisted of human-made earthen pools in meadows or areas without trees. In 2006, some were ephemeral because of the lack of winter and spring precipitation. Spotted bats might not be affected as much as some other species of bats by a scarcity of water during droughts because individuals are known to fly long distances to forage and drink (Rabe et al., 1998). On a few occasions during this study, I netted multiple pools of water along a stream. The pools of water used by *I. phyllotis* clearly were the largest pools with the least amount of surrounding vegetation.

MANAGEMENT SUGGESTIONS FOR THESE BATS IN NEW MEXICO

At the completion of this study, I now have a better understanding of habitats and natural history of *E. maculatum* and *I. phyllotis* in New Mexico. By visiting many historical sites for both species and amassing information from other sources, such as museum records, I recognize that we know more about these species than currently is published in the scientific literature. In the next few years, I will strive to publish data from this project to better inform the scientific community, as well as management agencies, about knowledge gathered during this project. However, although new data are available for these 2 spectacular species in New Mexico (much of which is included in this report), we as researchers and stewards of natural resources still have much to learn. In the following dialog below, I highlight and propose some management strategies for these uncommon species in New Mexico.

Research ideas.—Additional studies on natural history of both species in New Mexico are needed. Two important areas where we lack information include roosting sites and seasonal movements. It would be advantageous to determine roosting habits of both species in all seasons. Where do individuals roost in summer? Are there separate roosts for males and females? Do they form large or small aggregations at these roosts? Where do they roost in winter? Are summer and winter roosts the same, or do they move seasonally? How far do individuals move between seasonal roosts? What are threats to these roosts? Do all individuals roost in cliffs, or do some roost in trees and mines that might be more exposed to human threats?

Once roosts are located, this opens up a number of other research ideas. For example, by monitoring roosts, we might be able to determine the abundance of individuals and viability of populations over time. Other areas of research in New Mexico include dates of seasonality and dates of reproductive activities. For example, it would be desirable to have a better picture of

when females are pregnant, when they are lactating, when the first young of the year begin to fly, and when males are capable of breeding. Clearly these are only a few potential topics, and other researchers with other ideas will promote other important types of research.

A note for bat researchers.—As stressed earlier in this report, all bat researchers must continue to strive to publish their findings so others can have access to data and results of projects. I also suggest that we all strive to publish in peer-review journals so data can critically be evaluated by leading researchers and scientists in the field. A lack to do so has the potential to perpetuate potentially misleading information and hearsay in discussions and unsubstantiated reports. It would always be best that the original researcher publish his or her data, rather than having other researchers try to skim information from someone else's reports. For some data concerning the natural history of bats, this information can be amassed from field notes and reports without loosing accuracy. My greatest concern is the correct identification of species. As researchers, I feel we must continue to secure voucher materials to further support our research. For these 2 uniquely looking species, voucher photographs are quite appropriate.

A note to funding agencies.—Although I support more research on these 2 species of bats in New Mexico, as well as other species, I want to make the distinction between bat researchers that publish their data and those that commonly engage in "recreational netting." I recently have been introduced to this phrase and it seems fitting to mention it in this report. Recreational netting, as I understand it, is the netting of bats with no real intention to publish the results. Thus, data are lost in reports and personal field notes, and sometimes field notes are not even collected. I am aware of a number of funding agencies, such as the Forest Service and Bureau of Land Management, that have funded multiple year projects on bats in New Mexico, and I have not seen any attempt from the researchers to publish their data. Much time and

money have been spent in the state and numerous data have been gathered. I hope all agencies will promote and support only those researchers that disseminate their work beyond the funding agencies. There is much to be learned about our bats in New Mexico, and recreational netting is not helping the cause.

I have been told by a senior scientist in my field, that if you do not publish your research, it is just a hobby, and thus, do not call your work research! Part of the scientific process is the dissemination of ideas and results in a clear and understandable format. For example, if you discover a cure for cancer and do not disseminate your findings, why bother in conducting the research. In short, funding agencies should have some real incentives for those folks that are awarded grants and publish their findings in peer-reviewed journals. Publishing takes time, effort, and money. I understand that it can be rewarding, exciting, and "fun" to net bats, and I do not want to limit netting that is conducted for educational purposes; however, if you do not make an effort to share your results in a formal, scientific manner, then you should not be able to net bats on a recreational level.

Management of water sources.—In 2006, a number of historical sites used by *E. maculatum* and *I. phyllotis* dried up during the summer. One possible management strategy for agencies is to determine critical or important sources of water for bats and insure they continually contain water, especially during dry years.

Comments on future surveys of these bats.—My data suggest that I started my survey for *E. maculatum* and possibly *I. phyllotis* too early in the season. For example, on my first visit to Ghost Ranch on 19 May, I heard no audible calls from bats; however, on 19 June, I heard calls almost continually from *E. maculatum*, and multiple individuals were present. Thus, I suggest that similar types of surveys in the future begin surveys after 1 June.

Listening for audible calls appears to be a fruitful manner in detecting these bats. Of course, I prefer to have more tangible documentation, but for these elusive species, audible calls seem useful. Use of ultrasonic detectors is another possibility for detection, but many of the individuals I heard were flying high overhead. Ellison et al. (2005) used these devices at Bandelier National Park in the Jemez Mountains to survey bats. These authors demonstrated that detecting spotted bats via this technique is possible.

Drawbacks of studying these species.—Spotted bats are known to fly long distances from day roosts to forage and drink (Rabe et al., 1998). Use of airplanes and telemetry have been employed to locate roosts of *E. maculatum* in Jemez Mountains (M. A. Bogan, pers. comm.). Thus, radio-tracking studies of these species might be expensive if planes are needed.

To survey spotted bats in New Mexico at historical sites, be prepared to obtain many Special Use permits from many different Forest Service Districts. In general, it was fairly straight forward to obtain permits, but it does add an element of time to this project and sometimes frustration. For better or worse, drought conditions will also have you checking in at many District Offices just prior to netting on lands administered by the Forest Service to obtain additional permits. This can lead to headaches on weekends and holidays. In the future, I will investigate whether a researcher could get a blanket permit for all Forest Service Lands. This would save much time. Also beware of fires. If fires start up, do not expect to get permission to get in the area for awhile.

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Table 1. List of localities where spotted bats (*Euderma maculatum*) have been documented in New Mexico. The original source for this site is shown in parentheses. Other data below include the approximate number of sightings and captures at each historical site. Also included is information from my survey of *E. maculatum* in 2006; documentation of my surveys includes whether individuals were captured, observed with spotlights (=sighting), or detected via audible calls.

County	Site (Source)	Historic *n* =	Visited in 2006	Capture	Sighting	Audible
Bernalillo	Albuquerque (Findley et al. 1975)	2	Yes	--	No	No
Catron	9 mi E of Mogollon (Jones 1961)	4	Yes (Dry)			
	Willow Creek (Findley et al. 1975)	4	Yes	No	No	Yes
	Woodland Park (Best 1988)	1	No			
	Burnt Cabin Cienega (New site, this study)		Yes	No	No	Yes
	Glenwood Fish Hatchery (New site, this study)		Yes	No	No	Yes
Cibola	Mount Taylor (Reynolds 1981)	1	Yes	Yes	Yes	Yes
	El Malpais National Monument (Field Crew of M. A. Bogan)	1	Yes	--	No	Yes
Dona Ana	Mesilla Park, Las Cruces (Miller 1903)	1	Yes	--	No	No
Grant	Lake Roberts (Best 1988)	1	Yes	No	No	No
	Lichty Farm, Gila River (K. Geluso unpublished)	1	Yes	No	No	Yes
	Gila River, 10 mi E Buckhorn (K. Geluso unpublished)	1	Yes	No	No	Yes
	Gila River, Gila Bird Area, Big Burro Mtns. (New site, this study)		Yes	No	No	Yes
	Black Canyon Campground (New site, this study)		Yes	No	No	Yes
Otero	Rogers Ruins, Sacramento Mountains (Perry et al. 1997)	6	Yes (Dry)			
	Agua Chiquita, Sacramento Mountains (New site, this study)		Yes	No	No	Yes
Rio Arriba	Ghost Ranch (Constantine 1961)	2	Yes	No	Yes	Yes
Sandoval	East Fork Jemez River (Findley et al. 1975)	10	Yes	Yes	Yes	Yes
	Bandelier National Monument (Field Crew of M. A. Bogan)	Many	Yes	--	No	Yes
San Juan	Aztec (Rodeck 1961)	1	Yes	No	No	No
	Chaco Culture National Historical Park (K. Geluso unpublished)	1	Yes	No	No	No
Socorro	Weir Tank, San Mateo Mountains (Findley et al. 1975)	10+	Yes (Dry)			
	3.5 mi E Springtime Campground (New site, this study)		Yes	No	No	Yes
	Tank south of Bingham (A. Hope pers. comm.)	1	Yes	No	Yes	Yes

Table 2. List of localities where Allen's big-eared bats (*Idionycteris phyllotis*) have been documented in New Mexico. The original source for this site is shown in parentheses. Other data below include the approximate number of sightings and captures at each historical site. Also included is information from my survey of *I. phyllotis* in 2006; documentation of my surveys includes whether individuals were captured, observed with spotlights (=sighting), or detected via audible calls.

County	Site (Source of locality)	Historic *n* =	Visited in 2006	Capture	Sighting	Audible
Catron	9 mi E of Mogollon (Jones 1961)	15	Yes (Dry)			
	Willow Creek (Jones 1961)	5	Yes	Yes	Yes	Yes
	Taylor Creek, 2 mi NE Wall Lake (Jones 1961)	9	Yes	No	No	Yes
	Glenwood Fish Hatchery (Jones 1961)	3	Yes	No	No	Yes
	6 mi E Bear Wallow Lookout, Burnt Cabin Cienega (MSB specimen)	1	Yes	Yes	Yes	Yes
	Head of McKenna Creek (Tumlison 1993)	2	No			
	McKenna Park (Tumlison 1993)	1	No			
	Iron Creek, T11S, R17W, Sec. 2 (Tumlison 1993)	2	No			
	Little Creek Fire Cabin, T12S, R15W, Sec. 33 (Tumlison 1993)	2	No			
	Little Turkey Park, T13S, R14W, Sec. 20 (Tumlison 1993)	1	No			
	West Fork Corral, T11S, R16W, Sec. 20 (Tumlison 1993)	1	No			
	Woodland Park, T11S, R15W, Sec. 35 (Tumlison 1993)	1	No			
	Me Own Helitack Base, 10 mi E Cliff dwellings (Tumlison 1993)	1	Yes (Dry)			
	2 mi N, 1 mi W Mogollon, Mineral Creek (Tumlison 1993)	1	Yes (Dry)			
Grant	Saddle Rock, Big Burro Mountains (K. Geluso in press)	1	Yes	No	No	Yes
	Cora Miller Mine, 7 mi S Cliff (Tumlison 1993)	6	No			
	5 mi NW Silver City, Little Bear Mtn. (Tumlison 1993)	1	No			
	Mimbres River, Cooney Place (Tumlison 1993)	1	Yes	No	No	Yes
	Black Canyon Campground (New site, this study)		Yes	Yes	Yes	Yes
Sierra	Burnt Canyon Flat (New site, this study)		Yes	Yes	Yes	Yes
Socorro	Weir Tank, San Mateo Mountains (Findley et al. 1975)	15+	Yes (Dry)			
	3.5 mi E Springtime Campground (K. Geluso unpublished)	1	Yes	Yes	Yes	Yes

Table 3. Species and total numbers of bats captured from 11 May to 8 August 2006 in New Mexico at historical and potential sites for spotted bats (*Euderma maculatum*) and Allen's big-eared bats (*Idionycteris phyllotis*). Number of individuals captured include those removed from nets and those positively identified in the net but escaped. Prevalence represents the total number of nights that species was documented in nets out of 37 nights that nets were deployed.

Species	Number of individuals captured	Prevalence
Lasionycteris noctivagans	587	22
Eptesicus fuscus	258	26
Myotis volans	131	19
Myotis californicus/*ciliolabrum*	114	19
Myotis occultus	110	15
Tadarida brasiliensis	101	20
Lasiurus cinereus	93	14
Myotis evotis	87	12
Myotis thysanodes	80	17
Myotis yumanensis	54	14
Myotis auriculus	38	8
Pipistrellus hesperus	30	9
Antrozous pallidus	28	10
Idionycteris phyllotis	15	7
Myotis velifer	11	3
Euderma maculatum	9	3
Lasiurus blossevillii	2	1
Pipistrellus subflavus	1	1
Corynorhinus townsendii	1	1
Nyctinomops macrotis	1	1
TOTALS	1751	

Table 4. Notes on spotted bats (*Euderma maculatum*) and Allen's big-eared bats (*Idionycteris phyllotis*) captured in 2006 in New Mexico. Individuals below are listed by date of capture.

Species	Sex	Age	Reproductive status	Time captured	Forearm length (mm)	Body mass (g)	Date captured	County	Locality[1]
E. maculatum	male	Adult		2240	50.5	13.9	18 May	Sandoval	Jemez River
E. maculatum	unknown						18 May	Sandoval	Jemez River
I. phyllotis	female	Adult	prob preg	2232	48.0	15.2	26 May	Grant	Black Canyon
I. phyllotis	female	Adult		2210	48.0	13.2	5 June	Catron	Willow Creek
I. phyllotis	unknown			2142			5 June	Catron	Willow Creek
I. phyllotis	female	Adult	prob preg	2216	49.0	13.5	6 June	Catron	Burnt Cabin Cienega
E. maculatum	male	Adult		2158	52.0	14.4	17 June	Sandoval	Jemez River
E. maculatum	male	Adult		2233	51.0	15.2	17 June	Sandoval	Jemez River
E. maculatum	unknown			0003			18 June	Sandoval	Jemez River
I. phyllotis	female	Adult	lactating	2247	47.0	12.5	20 June	Socorro	San Mateo Mountains
I. phyllotis	male	Adult		2305	50.0	12.2	20 June	Socorro	San Mateo Mountains
I. phyllotis	male	Adult		0245	50.5	14.4	21 June	Socorro	San Mateo Mountains
I. phyllotis	male	Adult		0348	49.0	12.3	21 June	Socorro	San Mateo Mountains
I. phyllotis	female	Adult	lactating	0438	47.0	14.2	21 June	Socorro	San Mateo Mountains
I. phyllotis	unknown			0456			21 June	Socorro	San Mateo Mountains
I. phyllotis	female	Adult	pregnant	2120	48.0	14.9	21 June	Sierra	Burnt Canyon Flat
I. phyllotis	female	Adult	lactating	2113	49.0	11.7	28 June	Grant	Black Canyon
I. phyllotis	female	Adult	lactating	0004	47.5	13.1	28 June	Grant	Black Canyon
E. maculatum	female	Adult	lactating	2219	54.0	16.9	30 June	Cibola	Mt. Taylor
E. maculatum	female	Adult	non-repro	2224	53.0	15.3	30 June	Cibola	Mt. Taylor
E. maculatum	male	Adult		2240	50.0	14.9	30 June	Cibola	Mt. Taylor
E. maculatum	female	Adult		0327	54.5	17.8	1 July	Cibola	Mt. Taylor
I. phyllotis	female	Adult	lactating	2223	49.0	13.9	3 July	Catron	Burnt Cabin Cienega
I. phyllotis	female	Adult	lactating	0100	49.0	13.7	4 July	Catron	Burnt Cabin Cienega

[1]See Appendix 1 for additional details on localities.

APPENDIX 1—Locations visited in New Mexico from May to August 2006 during a survey of historical sites of *Euderma maculatum* and *Idionycteris phyllotis*. Type of water source follows specific locality, and habitat immediately surrounding water is shown next in parentheses. Dates of capture for each locality are followed by parentheses that contain the number of males and females of each species captured, "unk" represents individuals of unknown sex that either escaped from mist nets without determining sex or where investigators forgot to include data in notebook. Abbreviations for species are as follows in order of frequency captured (Table 3): *Lasionycteris noctivagans* (LANO), *Eptesicus fuscus* (EPFU), *Myotis volans* (MYVO), *Myotis californicus*/*ciliolabrum* (MYCA/CI), *Myotis occultus* (MYOC), *Tadarida brasiliensis* (TABR), *Lasiurus cinereus* (LACI), *Myotis evotis* (MYEV), *Myotis thysanodes* (MYTH), *Myotis yumanensis* (MYYU), *Myotis auriculus* (MYAU), *Pipistrellus hesperus* (PIHE), *Antrozous pallidus* (ANPA), *Idionycteris phyllotis* (IDPH), *Myotis velifer* (MYVE), *Euderma maculatum* (EUMA), *Lasiurus blossevillii* (LABL), *Pipistrellus subflavus* (PISU), *Corynorhinus townsendii* (COTO), and *Nyctinomops macrotis* (NYMA).

BERNALILLO COUNTY: Albuquerque, Rio Grande Nature Center State Park, Rio Grande, river (riparian/city), 11 May 2006 (no nets, only listened).

CATRON COUNTY: 1.5 mi NNE Wall Lake, 33°22.701′N, 108°04.103′W, no water source (piñon/juniper woodland), 27 May (no nets, only listened); Mogollon Mountains, Willow Creek Campground, pool in mountain stream (meadow in mixed coniferous forest), 5 June (LANO 35♂ 1♀, MYOC 7♂ 3♀, LACI 4♂, EPFU 3♂ 1♀, IDPH 1♀ 1 unk, TABR 1♂), 4 July (MYOC 4♂, LANO 1♂); Mogollon Mountains, Burnt Cabin Cienega, earthen pond (meadow in ponderosa pine forest), 6 June (MYOC 14♂ 32♀, LANO 37♂ 4♀, MYEV 16♂ 2♀ 2 unk, EPFU 9♂ 4♀, MYVO 6♂ 5♀, TABR 5♂ 4♀, MYTH 4♀, LACI 4♂, MYCA/CI 2♂, MYAU 1♀, IDPH 1♀), 3 July (MYOC 17♂ 2♀, LANO 17♂, MYEV 13♂ 1♀, EPFU 9♂ 2♀, MYVO 5♂ 1♀, IDPH 2♀, MYCA/CI 1♂ 1♀, TABR 2♂, LACI 2♂, MYTH 1♂); Gwynn Canyon, 33°32.227′N, 108°31.820′W, earthen pond (ponderosa pine forest), 7 June (MYTH 2♂ 5♀, EPFU 1♂ 5♀, MYOC 1♂ 3♀, MYEV 1♂ 2♀, MYAU 2♂, MYVO 1♂, LANO 1♂, MYCA/CI 1♂); Glenwood, Glenwood Fish Hatchery, earthen pond (riparian woodland), 8 June (MYYU 1♂ 7♀, MYVE 4♂ 1♀, LABL 1♂ 1♀, TABR 1♀), 24 June (MYYU 1♀, MYVE 1♀, TABR 1♂).

CIBOLA COUNTY: Mt. Taylor, Junction Forest Service Roads 451 and 453, American Canyon Spring, steel-rimed tank (meadow in mixed coniferous forest), 17 May (LANO 10♂, EPFU 1♀, MYVO 6♂ 3♀, MYEV 1♂ 2♀ 1 unk, MYTH 3♂); Mt. Taylor, T12N, R8W, SW1/4 Sec. 22, earthen pond (ponderosa pine forest), 30 June (LANO 73♂, MYVO 20♂ 12♀, EPFU 22♂ 9♀, MYCA/CI 16♂ 8♀, MYEV 7♂ 8♀, MYTH 5♂ 3♀ 1 unk, LACI 5♂, EUMA 1♂ 3♀, MYYU 1♂, TABR 1♂); La Ventana Arch, no water (scrubland), 1 July (no nets, only listened).

DOÑA ANA COUNTY: Las Cruces, Rio Grande, NM HWY 80, 32°18.608′N, 106°49.557′W, river (city), 26 June (no nets, only listened).

EDDY: Carlsbad Caverns National Park, Rattlesnake Springs, Rattlesnake Spring, rock-lined pond (desert oasis), 29 May (MYVE 6♀, TABR 3♂ 1♀, PIHE 1♂ 2♀, ANPA 2♂, MYCA

1♂, PISU 1♂, EPFU 1♂, COTO 1♀), 17 August (TABR 15♂ 4♀, ANPA 3♂ 3♀, EPFU 2♀, MYTH 1♀, MYCA/CI 1♂).

GRANT COUNTY: Black Range, Junction Cooney Canyon and Mimbres River, 33°02.521′N, 107°58.794′W, small river (riparian woodland), 22 May (LANO 22♂ 2 unk, MYVO 1♂ 6♀, EPFU 2♂ 4♀, MYEV 3♀, MYAU 2♂, MYTH 1♀, LACI 1♂, TABR 1♂, MYYU 1♂, MYCA/CI 1♂); Black Range, NM HWY 152, 0.3 mi SE Railroad Canyon Campground, intermittent mountain stream (piñon/juniper and ponderosa pine woodlands), 23 May (LANO 93♂, LACI 12♂ 1♀, EPFU 2♂ 6♀, MYEV 2♂ 4♀, MYVO 1♂ 1♀ 1 unk, MYCA/CI 2♂); Gila River, XXXXX Farm, river (riparian woodland), 24 May (LANO 7♂ 7♀, TABR 2♂, EPFU 1♀, PIHE 1♀); Lake Roberts, Upper End Campground, 33°01.718′N, 108°09.205′W, lake (riparian), 25 May (LANO 8♂ 2♀, EPFU 2♀, MYOC 2♂, MYAU 1♀, TABR 1♂, MYYU 1♀), 5 July (MYYU 2♂ 2♀, ANPA 2♀, MYOC 1♂); Lake Roberts, Below Dam, stream (riparian woodland), 5 July (EPFU 1♂ 1♀, MYYU 1♂, MYCA/CI 1♀); Black Canyon Creek, Black Canyon Campground, stream (piñon/juniper and ponderosa pine woodlands) 26 May (LANO 6♂, MYCA/CI 1♀ 1 unk, IDPH 1♀, MYVO 1♀, MYOC 1♂, EPFU 1♂), 28 June (EPFU 2♂ 13♀, LANO 4♂, MYOC 2♂, MYYU 2♂, IDPH 2♀, MYVO 1♀, ANPA 1♀); Big Burro Mountains, Junction Saddle Rock and Black Hawk canyons, T17S, R16W, SE1/4 Sec. 23, steel-rimed tank (scrubland), 4 June (EPFU 5♂ 14♀, MYTH 11♀, PIHE 2♂ 3♀, MYCA/CI 1♂ 3♀, LANO 3♂, ANPA 3♂, TABR 1♂ 2♀) 23 June (EPFU 4♂ 15♀, MYCA/CI 4♂ 3♀, ANPA 3♂ 3♀, MYTH 4♀, PIHE 2♂ 1♀, MYVO 1♀, TABR 1 unk, MYAU 1♀); 10 E Buckhorn, Gila River, river (riparian woodland), 25 June (TABR 5♂ 2♀, MYYU 5♂, MYOC 2♂, PIHE 1♂, LACI 1♂); Big Burro Mountains, Gila Bird Area, Gila River, 32°50.108′N, 108°36.481′W, river (riparian woodland), 27 June (MYYU 7♂ 12♀, PIHE 5♀, TABR 1♂ 1♀, MYOC 2♂).

LOS ALAMOS COUNTY: Bandelier National Monument, NM HWY 4, no water (ponderosa pine and piñon/juniper woodlands), 2 July 2006 (no nets, only listened).

OTERO COUNTY: Sacramento Mountains, Agua Chiquita Creek, down canyon of Rogers Ruins, mountain stream (mixed coniferous forest), 20 May (LANO 9♂ 2♀, LACI 3♂ 1♀ 1 unk, EPFU 4♂, MYOC 1♂ 1♀, TABR 1♀, MYVO 1♂), 22 June (LANO 21♂, EPFU 2♂ 8♀, LACI 6♂, MYOC 3♂ 2♀, MYVO 4♀).

RIO ARRIBA COUNTY: Ghost Ranch, Sewage Ponds, cement lined ponds (scrubland), 19 May (LANO 2♂ 1♀, MYYU 1♂ 5♀, MYCA/CI 1♀); Ghost Ranch, Upper Earthen Pond, 36°20.446′N, 106°28.002′W, earthen pond (scrubland), 19 May (no bats captured), 19 June (ANPA 1♂, MYYU 1♂).

SANDOVAL COUNTY: Jemez Mountains, East Fork Jemez River, 35°49.624′N, 106°35.110′W, small river (mixed coniferous forest), 18 May (LANO 29♂ 1♀, LACI 6♂, MYTH 1♂, EPFU 2♀, MYVO 2♀), 17 June (LANO 24♂ 1 unk, TABR 4♂ 2♀, LACI 4♂, EUMA 2♂ 1 unk, MYEV 2♂, MYVO 1♂, NYMA 1♀), 2 July (LANO 27♂, LACI 2♂, MYVO 1♂ 1♀, EPFU 1♀, MYTH 1♀, MYEV 1♂, MYYU 1♂); Jemez Mountains, East Fork Jemez River, small river (mixed coniferous forest), 18 May (LANO 35♂ 4♀ 6 unk, LACI 9♂ 1 unk, MYTH 3♂ 2♀, EPFU 1♂ 1♀, MYVO 1♀, EUMA 1♂ 1 unk, MYCA/CI 1♂, MYEV 1♂), 17

June (LANO 35♂, LACI 15♂, EPFU 3♂ 3♀, MYVO 1♂ 5♀, TABR 1♂ 3♀, MYCA/CI 3♂, MYTH 2♂, MYEV 1♀).

SAN JUAN COUNTY: Aztec, Las Animas River, river (riparian, city, agricultural), 15 May (MYYU 2♀) 18 June (no bats captured); Chaco Cultural National Historical Park, Maintenance Area, no water (scrubland), 16 May (no bats captured), 17 July (no nets, only listened).

SIERRA COUNTY: Black Range, Burnt Canyon Flat, earthen pond (meadow in ponderosa pine forest), 2 June (EPFU 9♂ 32♀ 3 unk, LANO 26♂ 2♀, TABR 2♂ 11♀, MYTH 6♂ 1♀, MYEV 2♂ 4♀, LACI 6♂, MYOC 3♂ 1♀ 1 unk, MYVO 1♂ 1♀ 1 unk, ANPA 1♂, MYAU 1♂, MYCA/CI 1♀), 21 June (LANO 29♂, EPFU 7♂ 18♀, MYEV 3♂ 8♀, TABR 1♂ 9♀, LACI 9♂, MYTH 6♂ 1♀, MYVO 4♂ 2♀, MYOC 5♂, MYCA/CI 2♂, IDPH 1♀).

SOCORRO COUNTY: San Mateo Mountains, 3.5 mi E (by road) Springtime Canyon, 33°33.827′N, 107°21.152′W, cement tank (piñon/juniper and oak woodland), 21 May (MYCA/CI 11♂ 7♀ 1 unk, MYAU 5♂ 7♀, MYVO 2♂ 2♀ 2 unk, MYTH 3♂, EPFU 1♂ 1♀, ANPA 1♀, PIHE 1♂), 20 June (MYCA/CI 27♂ 10♀, MYVO 18♂ 8♀ 1 unk, EPFU 14♂ 6♀, MYAU 7♂ 11♀, MYTH 8♂ 4♀, PIHE 10♂, IDPH 3♂ 2♀ 1 unk, ANPA 5♂, MYYU 1♂); 3 mi S Bingham, near N end of Oscura Mountains, earthen pond (desert grassland/scrubland), 1 June (TABR 2♂ 10♀, MYCA/CI 1♂ 1♀, MYTH 1♂, PIHE 1♀).