Mammals of the Active Floodplains and Surrounding Areas along the Gila and Mimbres Rivers, New Mexico

Final Report

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Preface

The following report contains three chapters associated with a mammalian survey of sections of the Gila and Mimbres rivers in New Mexico, specifically those reaches with active and dynamic flood plains. Chapter 1 contains the main emphasis of this research that includes an overall look at each species documented in the area via a systematic account. Chapter 2 represents a manuscript that will be submitted for publication that stemmed from our capture of a new bat species for the state of New Mexico during this inventory. Colleagues and I will submit a paper on the Evening Bat (*Nycticeius humeralis*) after the 2016 field season in New Mexico. Chapter 3 represents our first draft of a manuscript investigating roost site selection of Western Red Bats (*Lasiurus blossevillii*) in southern New Mexico. This research stemmed from a side project last summer for which we gathered more data in May and June 2016. A more in depth analysis of this research will be completed and prepared for publication submission by late 2016 or early 2017.

Initiation of this research project began in summer 2014 with a 10-day period of preliminary surveys on a few properties on both rivers. Documentation of a great number of species in a relatively short amount of time, with some unexpected findings, was the impetus for submitting a Share with Wildlife grant for the 2015 field season. The major objective for this submission was to determine how many species of mammals occur and use these active flood plains, a limited and important habitat in the state. Conservation efforts have continued and are needed into the future due continued threats to such habitats. Although this report summarizes findings during a limited amount of time in the field in 2014, 2015, and through March 2016, it is striking how many species I confirmed in this relatively small area in New Mexico. By writing and submitting this report, I am not finished with this research project, as I will continue to attempt to fill in some missing species that should occur within the study areas. This report only contains data collected through March 2016, except where specifically noted when I documented additional species for the area after the Draft Final Report was submitted in April 2016. Additionally, some photographs included herein were taken in May and June 2016 while editing the Draft Final Report for this Final Report. In the future I plan to conduct additional projects related to mammals now that I better understand the diversity and relative abundance of species in the area and habitats used by them. I have not determined the ultimate fate of Chapter 1 and how it will be disseminated to the scientific community beyond this report. I suspect it will lead to a number of published outlets that time and money will ultimately help to determine.

I greatly appreciate the New Mexico Department of Game and Fish with their Share with Wildlife program and matching funds through State Wildlife Grants T-32-4, 6 to allow me and my colleagues to continue to explore and learn more about mammals in this amazingly diverse and wild area of the state, as well as the land owners that have allowed my colleagues and me to inventory their lands for mammals. I have enjoyed the field aspects of this project, as well as compiling this report, to study the amazing species of mammals that inhabit and use these active river flood plains and adjacent habitats.

Chapter 1

Mammals of the Active Flood Plains and Surrounding Areas along the Gila and Mimbres Rivers, New Mexico: Occurrence, Habitat Association, and Abundance

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Abstract

Rivers with natural flow regimes contain a diversity of terrestrial habitats in their flood plains due to floods that continually create and modify landforms. In southwestern New Mexico, the Gila River is a large river and part of the Colorado River system west of the continental divide, whereas the Mimbres River is a small river and prominent feature of an endorheic watershed that lies east of the continental divide. Both rivers have relatively natural flow regimes, as they are not regulated by large dams or other large diversions. Mammalian diversity in the region is great, driven by convergence and proximity of diverse ecoregions and variation in elevation and vegetational communities. Due to the paucity of mammalian research on these rivers and the potential for a high diversity of species, I initiated a survey of mammals specifically along two reaches of these rivers with active, broad flood plains to establish a baseline inventory of species present on some of the last remaining river reaches in the southwestern United States with natural flow regimes. These river ecosystems are still threatened, which is further motivation for this research. Moreover, I predicted that these areas support a number of mammalian species of interest or concern, and my survey would yield new information on distributional limits and habitat associations of mammals in New Mexico. From June 2014 to March 2016, a total of 74 mammal species was detected along two reaches of these rivers and surrounding areas. After the Draft Final report was submitted in April 2016, two additional species were added yielding a grand total of 76 species. An additional three species were observed to reside in the area via the literature or discussions with residents of the area. Much new data on mammalian distributions, habitat association, and natural history were gained with this survey. Some highlights included documentation of the first record of an Evening Bat (*Nycticeius humeralis*) in New Mexico, capture of an Eastern Red Bat (*Lasiurus borealis*) along the Gila River that represents the first record west of the continental divide in the southwestern United States, northward range expansion of an endangered bat (one of the species of Long-nosed Bat, *Leptonycteris*, in the state), 27 county records of mammals in Grant and Luna counties based on Findley et al. (1975), new information on a number of species regarding timing of reproductive activities and seasonality in New Mexico, interesting observations on the role and importance of a diversity of habitats along these rivers with natural flow regimes for many mammalian species, new habitat associations for species, and a range expansion for the Northern Pygmy Mouse (*Baiomys taylori*) in southwestern New Mexico. Overall, about 48% of the total diversity of native mammals known from New Mexico was documented in these two narrow threads of land along the Gila and Mimbres rivers. Moreover, in the upper Gila River watershed, 100 native species currently are known from a region encompassing southeastern Arizona and southwestern New Mexico that spans from 3,476 m (11,404 ft) to 1,008 m (3,306 ft) in elevation hosting subalpine conifer forests to Sonoran desert scrublands. My survey of mammals only spanned 540 m (1,770 ft) from desert scrublands to piñon-juniper woodlands and

covered a limited area but documented 75% of the native mammals known from this watershed, with additional species known from published records and conversations from local residents. My survey ultimately demonstrates the importance the Gila and Mimbres river ecosystems and their natural flow regimes in housing mammalian faunal diversity in the region. I suspect that nowhere else in North America, beyond the tropics, have so many species of mammals been documented residing in such a limited area. These active flood plains host one of the best hotspots of mammalian diversity in North America. Continued efforts must endure to protect the Gila and Mimbres rivers and their natural flow regimes for all the species inhabiting and depending on them.

Introduction

Freely flowing rivers are those rivers not regulated by large dams or other large diversions. Remaining freely flowing rivers represent important and threatened ecosystems throughout the world (Tockner and Stanford 2002). River flood plains with natural flow regimes contain a diversity of terrestrial habitats due to floods that continually create and modify landforms (e.g. Whited et al. 2007). Landforms range from newly deposited sediments to various aged stands of vegetation that support a diversity of organisms. Local habitat diversity created and maintained by the dynamic nature rivers with natural flow regimes promotes floral and faunal diversity (Tochner et al. 1999, Tockner and Stanford 2002, Tochner et al. 2006). Most rivers, however, no longer interact with their surrounding landscape due to regulation of flows by major dams, diversions, and levees (Benke 1990, Dynesius and Nilsson 1994). Regulation of rivers results in habitat loss for plant and animal species (Crawford et al. 1996).

The Gila and Mimbres rivers in southwestern New Mexico largely are freely flowing, with only small irrigation diversions in both systems, but both rivers maintain natural flow regimes during periods of high flows. The Gila River is a larger river and part of the Colorado River system west of the continental divide. Parts of upper Gila watershed reside in the first designated wilderness area in the United States. The Mimbres River represents a smaller river that is part of an endorheic watershed that lies east of the continental divide. Native deciduous riparian habitats in both New Mexico valleys are in need of conservation as non-native species, habitat alterations, and threats of large water withdrawals continue to affect them (NMDGF 2006, Gori et al. 2014). These diverse riverine habitats, as well as habitats in the surrounding areas from mountains tops to deserts, support many species of native mammals (Findley et al. 1975, Frey 2010).

Southwestern New Mexico and southeastern Arizona represent one of the most diverse areas for mammals in the United States (Simpson 1964, Frey 2010) and is likely among the most diverse areas in all of North America, especially for terrestrial, non-volant mammals. The region is at the confluence of a number of diverse ecoregions, having a Rocky Mountain, Chihuahuan Desert, Sonoran Desert, and Sierra Madre Occidental influence. Moreover, vegetational communities vary from subalpine and mixed coniferous forests at higher elevations, to encinal and piñon/juniper woodlands and forests at mid elevations, and semi-desert grasslands at the lowest landforms (Brown et al. 2007, Catron 2010). Diversity and proximity of such ecoregion affinities and vegetational communities account, in part, for the diverse mammalian fauna in the region. Local habitat diversity created and maintained by the dynamic nature of rivers with natural flow regimes also promote floral and faunal diversity (Tochner et al. 1999, Tockner and Stanford 2002, Tochner et al. 2006). Both rivers represent important reference systems from which baseline inventories and ecological associations of fauna are largely lacking.

The objective of this study was to provide a baseline inventory of mammals and their habitat associations along parts of the active, broad flood plains of the Gila and Mimbres rivers and immediate surrounding areas to serve as a benchmark for future research. This is especially valuable given that habitats and/or these river ecosystems are still threatened. For example, current proposals are in place to divert water from the Gila River near the boundary of the Gila Wilderness (Gori et al. 2014). If implemented, such flow alterations could have profound effects on downstream ecosystems due to disruptions in the hydrology of the area. On the Mimbres River, native deciduous riparian habitats and spring/marsh habitats in the Mimbres Valley are in need of conservation efforts as water withdrawal, non-native species, and habitat alterations continue to affect native flora and fauna in the valley (NMDGF 2006). Scientists and agencies managing wildlife and habitat need to understand abundances, habitat associations, and occurrences of organisms to better allocate resources for management, especially in areas that house a diversity of rare or species in need of conservation. I predicted that the area supports a number of mammalian species of interest or concern, and my survey would yield new information on distributional limits, natural history, and habitat associations of mammals in New Mexico. This project will better enable the New Mexico Department of Game and Fish, as well as other conservation partners, to direct future restoration and conservation efforts for these critical areas of high biodiversity for New Mexico (i.e., NMDGF 2006).

Study Area

Gila River.—The Gila River is a relatively large river with three major tributaries, the East, West, and Middle forks, with headwaters arising in the Mogollon, Black, and Pinos Altos mountains (Benke and Cushing 2005). The three forks form the main-stem of the Gila River that flows westward as well as southward in New Mexico until it enters Arizona. The New Mexico portion of the Gila River lies in the Upper Gila River basin. The entire watershed catchment, including Arizona, encompasses an area of about 149,000 km^2 (Benke and Cushing 2005). This catchment lies west of the continental divide, and in New Mexico, the main-stem Gila River and its tributaries have its watershed in parts of Catron, Grant, Hidalgo, and Sierra counties. In New Mexico, the Gila River mainly is perennial and goes underground near Verdin, Hidalgo County. The section of the main-stem Gila River that was the focus of my inventory stretches from an area called the Upper Gila Box, where a USGS gage is located about 11 km northeast of Gila, to the US Forest Service "Bird Area" located about 15 km south-southwest of Gila. This section of the river has a wide and active river flood plain with a diversity of habitats dominated by cottonwoods (*Populus*) and other deciduous species along the active river corridor. As mentioned earlier, this flood plain and the diversity of flora and fauna within is in need of conservation and protection as continued threats of large water withdrawals could impact many species of conservation need as well as some species listed as threatened or endangered under the Endangered Species Act (Gori et al. 2014).

I conducted surveys on seven main properties along the Gila River, three owned by The Nature Conservancy (hereafter, TNC) referred to as the TNC-1GB, TNC-2IB, and TNC-3LC properties; two owned by US Forest Service referred to as the Gila Box Forest Service and Gila Bird Area Forest Service; one property owned by the New Mexico Department of Game and Fish (hereafter, NMDGF) referred to as the Double E Ranch; and one privately owned ranch property. Except for the Double E Ranch, properties lie within or adjoin the active flood plain of the Gila River along an elevational gradient with the highest-elevation sites at the TNC-1GB and Gila Box Forest Service down to the lowest site the Gila Bird Area Forest Service. The Double

E Ranch property owned by the NMDGF lies on Bear Creek, a small tributary that enters the Gila River near Cliff.

Mimbres River.—The small Mimbres River has its headwaters mostly arising along the western and southern sides of the Black Range and some arising from eastern slopes of the Pinos Altos Range in southwestern New Mexico. This watershed, which has an area of about 13,000 km^2, lies east of the continental divide and encompasses the southeastern part of Hidalgo County, southeastern and southern tip of Grant County, effectively all of Luna County, extreme southwestern Sierra County, and western Dona Ana County, as well as northern parts of Chihuahua, Mexico. The Mimbres River flows southward towards Deming with its basin mainly east of Deming in Luna County. The Mimbres River has perennial water mainly in Grant County and some in northern Luna County (NMDGF 2006). In the Mimbres valley, flows are intermittent and likely affected by numerous wells and use of surface water for irrigation. Prior to European settlement, the valley was comprised more of marshy habitats with springs, seeps, and cienegas (NMDGF 2006). Today, the river mainly is maintained as a single channel throughout the Mimbres Valley, which periodically experiences high-intensity floods. Native deciduous riparian habitats and spring/marsh habitats in the Mimbres Valley are in need of conservation efforts as water withdrawal, non-native species, and habitat alterations continue to affect native flora and fauna in the valley, most notably the Chihuahua Chub (*Gila nigrescens*) and Chiricahua Leopard Frog (*Lithobates chiricahuensis*) (NMDGF 2006). These and other habitats likely support a diversity of mammals, including some species of concern or for which limited information is known about their ecology and natural history in the region.

I conducted surveys on three properties along the Mimbres River, two owned by TNC and one owned by the New Mexico Department of Game and Fish (hereafter, NMDGF) referred to as the River Ranch. The TNC Preserve on the Mimbres River consists of three separate properties, with the goal of the organization to restore the river's natural communities, native flora and fauna, and ecological processes that promote them. On TNC lands, I mainly conducted surveys on their northern-most property located about 5 km NNE of the small town of Mimbres (hereafter, TNC-4NM). I also visited the TNC property in the town of San Juan on two occasions (hereafter, TNC-5SJ). Both TNC properties are located in Grant County and consist of deciduous riparian habitats surrounded by uplands dominated by open piñon-juniper woodlands. The other main property visited was the River Ranch property of the NMDGF located about 7 km SW of Faywood in northwestern Luna County and parts of southeastern Grant County about 6 km E of the City of Rocks State Park. The River Ranch property consists of deciduous riparian habitats surrounded by uplands consisted of desert grassland dominated by small honey mesquite (*Prosopis glandulosa*) shrubs. Unique to the River Ranch, the area houses one of the largest areas of alkali sacaton grasslands.

Methods

To date, no systematic survey has been conducted specifically on mammals along the Mimbres and Gila rivers nor none specifically in areas along the active river flood plains described above. In the Gila and Mimbres river valleys, there is a paucity of prior published mammalian records in the local area, especially for smaller mammalian species. In the Gila River valley, few mammalian records are known along the river especially for small species as demonstrated by Geluso (2009a, b). The region of the Gila River surveyed for this study was from about 11 km NE Gila to 15 km SSW of Gila. This reach of the Gila River is dominated by a wide flood plain. Along the Mimbres River, Findley et al. (1975), for example, reported on 33

species from along and near the Mimbres River, most of which were larger species or those documented at higher elevations near the river's headwaters. For purposes of my survey, the Mimbres River valley examined extended from about 5 km NNE of Mimbres to 7 km SW of Faywood, see above Study Area section for more details.

I initiated an inventory of mammals in June 2014 and ended in March 2016 (I included additional species for which I documented after I turned in the Draft Final Report during field work in summer 2016). Using available published literature, mainly Findley et al. (1975) and Frey (2010), I developed a working species list to help determine the possible species in the area. My goal was to document the occurrence of as many species as possible in this limited time. I did not use randomly-chosen sites but rather sites selected based on presences of specific habitats types to increase the likelihood of documenting the most species. Common and scientific names of mammals used throughout this report, as well as the order of "Species Accounts," follow Bradley et al. (2014).

Field efforts focused on sites that provided coverage of major habitat types. Field efforts via mist net for bats and traps for small mammals focused on the most species-rich groups with the greatest promise of documenting the most species, that is, rodents and bats. I also invested significant effort in recording observations of medium-sized and large mammals with use of camera traps (trail cameras) set up along natural corridors such as dry arroyos and along heavily used game trails in both river systems without use of baits or attractants. Specific inventory methods included setting trap lines of Sherman Live Traps (H. B. Sherman Traps, Tallahassee, FL), deploying mist nets (Avinet Inc., Dryden, NY), setting up camera traps (i.e., trail cameras; Models PC800 and XR6, Reconyx Inc., Holmen, WI, and Browning Recon Force, Model BTC-2XR, Birmingham, AL), and recording opportunistic observations of tracks, scat, and other diagnostic sign of mainly larger or diurnal mammals. A single camera traps was used from June 2014 to May 2015, whereas 5 cameras were continually deployed from June 2015 to March 2016. Occasionally, I used other methods or traps to document other species, such as dissecting owl pellets to document hard-to-capture species such as shrews.

Small mammals captured in traps, mist nets, or by hand were identified to species, assessed for age, gender, and reproductive condition. Most individuals were released unharmed at sites of capture, but some individuals were kept as vouchers that have been or will be deposited at the Museum of Southwestern Biology (MSB), University of New Mexico, Albuquerque. During intensive sampling efforts (May and June 2015 and March 2016), liquid nitrogen was obtained from MSB to also secure frozen tissue samples of voucher materials for future genetic studies not associated with this project. I attempted to photograph most of the species to provide photographic documentation of their occurrence in the area and capture photographs demonstrating diagnostic characteristics for this report and other venues. I missed a few species, and I will continue to work on obtaining local photographs for future products associated with this research. Photographs used in this report were all taken in the Mimbres and Gila river valleys, except where specifically noted.

Most localities of occurrence were recorded using hand-held Global Positioning System (GPS; Garmin 12, Olathe, KS) units set to decimal degrees using map datum North American Datum 1983 (NAD83). Occasionally, I used Google Earth (map datum WGS84) when I failed to record the locality in the field. I initially recorded data into a personal field journal, and from this journal, I entered trapping and mist netting data into an Excel spreadsheet to assist in analyses. I visited or queried the mammal collections at Western New Mexico University as well as MSB to seek out unpublished specimens housed in those museums. I will eventually also

examine online databases, such as MaNIS, for additional specimens not housed in the two museums listed above. To facilitate completing this initial report on time, I did not include published and unpublished records in the report unless those records represented the only documentation for the species in either river system, but focused this report mainly on my recent observations in 2014, 2015, and 2016, except were otherwise noted. This decision also was made in part due to how complete my initial survey was at obtaining evidence of species occurring along both rivers. The winter 2014-2015 and spring of 2015 was wet and rodent populations were high when I arrived in May 2015, enabling me to document a greater proportion of mammal species in the region than I was expecting. Eventually, I will incorporate those previous museum records in manuscripts submitted for publication.

Capture and handling of animals was performed in accordance with a written protocol approved by the Animal Care and Use Committee at the University of Nebraska at Kearney (#020614).

Results and Discussion

During mainly an eight-day period in June 2014 and a month period in May and June 2015, along with a few other short trips during breaks or by colleagues on my behalf to the area through March 2016, I entered 1452 records of mammals in my database, excluding many large mammal observations and all camera trap data. For five camera traps that were deployed in May and June 2015 and were running through March 2016, I recorded thousands, if not a few tens of thousands of pictures of animals, most of which were mammals. My efforts yielded a total of 74 species of mammals, 73 were native species and 1 was an exotic species (House Mouse, *Mus musculus*) (Table 1, Table 2). Additionally, I added the American Badger (*Taxidea taxa*) on 6 April 2016 via a camera trap and the Long-eared Myotis (*Myotis evotis*) on 6 July 2016, after the draft final report was turned in, yielding 76 total species documented during my field efforts. Due to the sheer amount of information gathered in this relatively short amount of time, I have incorporated much of this data into the *Accounts of Species* below. Instead of attempting to put all the highlights into paragraphs here, I decided to present bullet points on noteworthy observations from my survey along these two river systems. These observations include information on distribution, habitat association, seasonality, behaviors, reproduction, etc., but more in-depth data also can be found below in the *Accounts of Species*.

- County record of 27 species including Crawford's Desert Shrew (Grant, Luna), Big Free-tailed Bat (Grant, Luna), Big Brown Bat (Luna), Spotted Bat (Grant), Western Red Bat (Grant, Luna), Eastern Red Bat (Grant), Southwestern Myotis (Luna), Western Small-footed Myotis (Luna), Long-eared Myotis (Luna), Southwestern Little Brown Myotis (Luna), Fringed Myotis (Luna), Yuma Myotis (Luna), Evening Bat (Grant), Coyote (Luna), White-backed Hog-nosed Skunk (Luna), American Badger (Grant), Bighorn Sheep (Grant), Wapiti (Luna), Collared Peccary (Grant and Luna), American Beaver (Grant), Northern Pygmy Mouse (Grant and Luna), and Common Muskrat (Grant). [Note well, I am aware of unpublished museum specimens of some of these species from these counties. These records are based on Findley et al. (1975)]
- Earliest capture of a pregnant female Big Free-tailed Bat in New Mexico (10 June 2014).

- Spotted Bats commonly were heard along the Gila River during summer, representing a new localities for this uncommon species in the state.
- Latest capture of a female Silver-haired Bat during spring on 12 June 2014.
- Captures of many male Silver-haired Bats in early June at low-elevation sites; this species generally is thought to occur at high-elevation, montane sites in coniferous forests June-August.
- Documentation of deciduous roost trees used by Western Red Bats as well as the observation that the species generally roosts in small clusters, a behavior rarely reported for any of the Lasiurid species of bat.
- Earliest date of lactation for Western Red Bats in New Mexico.
- Capture of an Eastern Red Bat along the Gila River represents a range expansion for this species in the state and the first record for this species west of the Continental Divide in southwestern parts of the United States.
- Earliest date of pregnancy and lactation in the state for the Southwestern Myotis.
- Earliest date of pregnancy for the Fringed Myotis.
- First dates of pregnancy for the Yuma Myotis in New Mexico.
- New river system (Mimbres) for the Yuma Myotis in the state.
- State record for the Evening Bat in the state.
- Earliest date of pregnancy for the Canyon Bat in the state.
- New river drainages for the American Beaver in the Gila and Mimbres rivers based on Findley et al. (1975).
- Over a 100 km range expansion for the Northern Pygmy Mouse into northern Grant County.
- Captures of the Mogollon Vole with arid grassland species of mammals at possibly the lowest elevation the species has been recorded in the state along the Mimbres River.
- Occurrence and abundance of Brush Deermice in riparian cottonwood habitats lacking oaks and rocks appears to represent a new habitat for this species in New Mexico.
- Captures of Merriam’s Kangaroo Rats northeast of Gila represent the northernmost record for this species along the Gila River extending the known distribution 13.6 km northeast from the closest previously published record 5 mi S Cliff.
- Observations from the NMDGF River Ranch in Luna County represent the farthest south observations have been made for the Arizona Gray Squirrel in New Mexico.

Table 1. Mammals documented June 2014-March 2016 during an inventory of mammals along sections of the Gila and Mimbres rivers in Grant and Luna counties, New Mexico, USA, except where otherwise noted. Observations are given for each river separately, whether I documented the species as a "Yes" or "No" and then the number of individuals captured/observed along study areas in each river according to my database. The last column represents the "Total number" of individuals on both rivers combined. For mainly diurnal and larger species, many observations were not entered in the database, hence I report on whether the species was commonly observed (C), uncommonly observed (U), or rarely observed (R) via sightings or via camera traps data.

Common Name	Scientific Name	Gila	#	Mimbr.	#	Total
1. Black-tailed Jackrabbit	*Lepus californicus*	Yes	C	Yes	C	C
2. Desert Cottontail	*Sylvilagus audubonii*	Yes	C	Yes	C	C
3. Crawford's Desert Shrew	*Notiosorex crawfordi*	Yes[1]	R	Yes[2]	U	--
4. Big Free-tailed Bat	*Nyctinomops macrotis*	Yes[3]	U	Yes	1	1
5. Brazilian Free-tailed Bat	*Tadarida brasiliensis*	Yes	20	Yes	21	41
6. Long-nosed Bat	*Leptonycteris spp.*	Yes	R	No	--	--
7. Pallid Bat	*Antrozous pallidus*	Yes	9	Yes	3	12
8. Townsend's Big-eared Bat	*Corynorhinus townsendii*	No	--	Yes	4	4
9. Big Brown Bat	*Eptesicus fuscus*	Yes	14	Yes	5	19
10. Spotted Bat	*Euderma maculatum*	Yes[3]	U	No	--	--
11. Silver-haired Bat	*Lasionycteris noctivagans*	Yes	7	Yes	36	43
12. Western Red Bat	*Lasiurus blossevillii*	Yes	3	Yes	14	17
13. Eastern Red Bat	*Lasiurus borealis*	Yes	1	No	--	1
14. Hoary Bat	*Lasiurus cinereus*	Yes	37	Yes	58	95
15 Southwestern Myotis	*Myotis auriculus*	Yes	3	Yes	11	14
16. California Myotis	*Myotis californicus*	Yes	14	Yes	17	31
17.Western Small-footed Myotis	*Myotis ciliolabrum*	No	--	Yes	3	3
18. Long-eared Myotis[4]	*Myotis evotis*	No	--	Yes	1	1
19. Southwestern Little Brown Myotis	*Myotis occultus*	Yes	45	Yes	124	169
20. Fringed Myotis	*Myotis thysanodes*	No	--	Yes	38	38
21. Cave Myotis	*Myotis velifer*	Yes	13	No	--	13
22. Long-legged Myotis	*Myotis volans*	Yes	1	Yes	2	3
23. Yuma Myotis	*Myotis yumanensis*	Yes	84	Yes	29	113
24. Evening Bat	*Nycticeius humeralis*	No	--	Yes	1	1
25. American Parastrelle	*Parastrellus hesperus*	Yes	7	Yes	4	11
26. Coyote	*Canis latrans*	Yes	C	Yes	C	C
27. Common Gray Fox	*Urocyon cinereoargenteus*	Yes	C	Yes	C	C
28. Bobcat	*Lynx rufus*	Yes	U	Yes	U	U
29. Mountain Lion	*Puma concolor*	Yes	U	Yes	U	U
30. White-backed Hog-nosed Skunk	*Conepatus leuconotus*	Yes	R	Yes	R	R
31. Hooded Skunk	*Mephitis macroura*	Yes	R	No	--	R
32. Striped Skunk	*Mephitis mephitis*	Yes	U	Yes	U	U
33. Western Spotted Skunk	*Spilogale gracilis*	Yes	R	Yes	U	R
34. American Badger[4]	*Taxidea taxa*	No	--	Yes	R	R
35. Ringtail	*Bassariscus astutus*	Yes	R	Yes	U	R
36. White-nosed Coati	*Nasua narica*	Yes	U	No	--	U
37. Northern Raccoon	*Procyon lotor*	Yes	U	Yes	C	U

38. American Black Bear	*Ursus americanus*	Yes	U	Yes	U	U
39. Bighorn Sheep	*Ovis canadensis*	Yes	R	No	--	R
40. Wapiti	*Cervus canadensis*	Yes	R	Yes	U	U
41. Mule Deer	*Odocoileus hemionus*	Yes	U	Yes	C	C
42. White-tailed Deer	*Odocoileus virginianus*	Yes	R	No	--	R
43. Collared Peccary	*Pecari tajacu*	Yes	C	Yes	C	C
44. American Beaver	*Castor canadensis*	Yes	U	Yes	R	U
45. Northern Pygmy Mouse	*Baiomys taylori*	Yes	6	Yes	3	9
46. Mogollon Vole	*Microtus mogollonensis*	No	--	Yes	16	16
47. Western White-throated Woodrat	*Neotoma albigula*	Yes	25	Yes	34	59
48. Mexican Woodrat	*Neotoma mexicana*	No	--	Yes	2	2
49. Common Muskrat	*Ondatra zibethicus*	Yes[5]	R	No	--	R
50. Chihuahuan Grasshopper Mouse	*Onychomys arenicola*	No	--	Yes	5	5
51. Northern Grasshopper Mouse	*Onychomys leucogaster*	No	--	Yes	1	1
52. Southern Grasshopper Mouse	*Onychomys torridus*	Yes	5	No	--	5
53. Brush Deermouse	*Peromyscus boylii*	Yes	62	Yes	64	126
54. Cactus Deermouse	*Peromyscus eremicus*	Yes	26	Yes	3	29
55. White-footed Deermouse	*Peromyscus leucopus*	Yes	85	Yes	34	119
56. North American Deermouse	*Peromyscus maniculatus*	Yes	10	Yes	9	19
57. Western Harvest Mouse	*Reithrodontomys megalotis*	Yes	20	Yes	53	73
58. Plains Harvest Mouse	*Reithrodontomys montanus*	No	--	Yes	1	1
59. Tawny-bellied Cotton Rat	*Sigmodon fulviventer*	Yes	7	Yes	21	28
60. Hispid Cotton Rat	*Sigmodon hispidus*	Yes	22	Yes	17	39
61. Yellow-nosed Cotton Rat	*Sigmodon ochrognathus*	Yes	3	No	--	3
62. North American Porcupine	*Erethizon dorsatum*	No	--	Yes	R	R
63. Botta's Pocket Gopher	*Thomomys bottae*	Yes	1	Yes	2	3
64. Bailey's Pocket Mouse	*Chaetodipus baileyi*	Yes[5]	--	No	--	--
65. Chihuahuan Desert Pocket Mouse	*Chaetodipus eremicus*	No	--	Yes	25	25
66. Hispid Pocket Mouse	*Chaetodipus hispidus*	Yes	1	No	--	1
67. Rock Pocket Mouse	*Chaetodipus intermedius*	Yes	34	Yes	2	36
68. Merriam's Kangaroo Rat	*Dipodomys merriami*	Yes	6	Yes	74	80
69. Ord's Kangaroo Rat	*Dipodomys ordii*	Yes	41	Yes	18	59
70. Banner-tailed Kangaroo Rat	*Dipodomys spectabilis*	No	--	Yes	9	9
71. Silky Pocket Mouse	*Perognathus flavus*	Yes	2	Yes	24	26
72. House Mouse	*Mus musculus*	Yes	1	No	--	1
73. Rock Squirrel	*Otospermophilus variegatus*	Yes	C	Yes	C	C
74. Arizona Gray Squirrel	*Sciurus arizonensis*	Yes	C	Yes	C	C
75. Cliff Chipmunk	*Tamias dorsalis*	Yes	U	Yes	3	3
76. Spotted Ground Squirrel	*Xerospermophilus spilosoma*	No	--	Yes	1	1

[1]Detected via captures by a domestic cat along the Gila River, Grant County.
[2]Detected via analysis of Barn Owl pellet on the River Ranch Property, Luna County.
[3]Detected via audible calls heard at night along the Gila River at a number of localities.
[4]Detected after March 2016 and after the Draft Final Report was submitted but included herein as it represented a new species for the inventory.
[5]Detected on previous trips to the study area prior to 2014.

Table 2. Observations of mammals with camera traps (trail cameras) at various sites in my study areas along the Gila and Mimbres rivers, Grant and Luna counties, New Mexico. All but 2 cameras were set out in May 2015; the TNC-1GB camera was set out in June 2015 and the River Ranch desert wash camera was set out in early January 2016. All cameras were set on motion detection until I last downloaded the cameras in mid-March 2016. I lost the month of September and half of October on the TNC-1GB camera due to a bear knocking the camera off the tree. I also lost half of August, all of September, and half of October on the TNC-3LC camera due to dead batteries. The letters in columns refer to how frequently I observed photographs of species at each site on cameras. A = Abundant, observed every month camera functioning; C = Common, observed over half the months the camera was functioning (but not all months); U = Uncommon, observed less than half the months the camera was functioning (but not just one month); and R = Rare, observed only during one month camera was functioning. Due to the reduced time the River Ranch desert wash camera was recording data, that column has the following index: A = all three months with observations, C = two of three months with observations, and U = one month of observation.

Species	Gila TNC-1GB Woodland[1]	Gila TNC-3LC Arroyo[2]	Mimbres TNC-4NM p/j canyon[3]	Mimbres River Ranch river edge[4]	Mimbres River Ranch riparian trees[5]	Mimbres River Ranch desert wash[6]
1. Black-tailed Jackrabbit						U
2. Desert Cottontail	R	A	A		C	A
3. Coyote		R	U	C	U	U
4. Common Gray Fox	C	C	A			
5. Bobcat	U	U		C	U	A
6. Mountain Lion	U		U			
7. White-backed Hog-nosed Skunk	U	R			U	
8. Hooded Skunk		R				
9. Striped Skunk	C	R	U	R	C	U
10. Western Spotted Skunk	R		U			
11. Ringtail	R		U			
12. White-nosed Coati	U					
13. Northern Raccoon	U	R		C	C	
14. American Black Bear	U		U			
15. Wapiti			U	U	U	
16. Mule Deer		U	U	C	A	C
17. White-tailed Deer	R	U				
18. Collared Peccary	A		C	A	A	
19. Western White-throated Woodrat	R		U		U	
20. North American Porcupine						U
21. Rock Squirrel	U	R	U		R	
22. Arizona Gray Squirrel	U		U		U	
23. Cliff Chipmunk	U		U			

SPECIES ACCOUNTS

Order Lagomorpha

Lepus californicus – Black-tailed Jackrabbit

The Black-tailed Jackrabbit (*Lepus californicus*) occurs throughout New Mexico in habitats generally below ponderosa pine forests (Findley et al. 1975). Lightfoot et al. (2010) observed the species was more abundant in grasslands than scrublands in central New Mexico. The species is known from along the Gila River by Redrock south and east of my study area, and near Glenwood in Catron County north of the study area (Findley et al. 1975). Black-tailed Jackrabbits also are known from the Mimbres River valley by Faywood, head of Mimbres River, and by the City of Rocks State Park in Grant County (Findley et al. 1975).

In the Gila River valley, I frequently observed jackrabbits in upland arid grasslands and open mesquite scrublands. These lagomorphs commonly were observed while driving roads at night in areas near disturbed and open agricultural fields in the Gila River valley above the active flood plain. On the Mimbres River, I observed individuals on the River Ranch, New Mexico Highway 61, and New Mexico Highway 35 in the Mimbres River valley. Although I did not observe *L. californicus* on the TNC-4NM property, I suspect they occur there in the open habitats. On the NMDGF River Ranch, this species was observed commonly in open areas of mesquite scrublands and a few were observed in the flood plain in sacaton grasslands. More observations of jackrabbits were observed than recorded below in the "Records of occurrence." I observed a noticeably smaller individuals in May.

Records of occurrence: Gila River: Grant Co., TNC-1GB; private ranch. Mimbres River: Grant Co., Hwy 35 N San Lorenzo; Hwy 61 N San Juan; River Ranch.

Fig. A Black-tailed Jackrabbit (*Lepus californicus*) captured on a camera trap in a desert wash on the NMDGF River Ranch Property in Grant County, 22 March 2016. This is the only long-eared jackrabbit in the area.

Sylvilagus audubonii – Desert Cottontail

The Desert Cottontail (*Sylvilagus audubonii*) is statewide in distribution in New Mexico and generally inhabits piñon-juniper woodlands, grasslands, and deserts (Findley et al. 1975). This species is known from Grant County but not specifically in my study areas along the Gila and Mimbres river valleys. The nearest locality to my study area in the Gila River valley is Redrock and 20 mi N of Cliff, whereas and the nearest locality in the Mimbres is 2 mi SE of the City of Rocks State Park (Findley et al. 1975). I frequently observed individuals along roadways in both study areas in early morning and night. While setting traps in grasslands and desert scrublands, individuals were frequently observed on both rivers. Many individuals were captured in trail camera in a variety of habitats, especially in desert scrublands (Table 2).

Records of occurrence: Gila River: Grant Co., TNC-1GB; TNC-3LC; private ranch. Mimbres River: Grant Co., TNC-4NM Property; Luna Co., River Ranch.

Fig. A Desert Cottontail (*Sylvilagus audubonii*) captured on a camera trap on the TNC-4NM Property north of Mimbres in Grant County in canyon bottom in an oak, piñon-juniper woodland.

Fig. A Desert Cottontail (*Sylvilagus audubonii*) at private ranch, Grant County, in a small arroyo that contained mesquite and desert willows in desert scrubland on 12 May 2016.

Order Soricomorpha

Notiosorex crawfordi – Crawford's Desert Shrew

Crawford's Desert Shrews are suspected to occur throughout lower elevations and more arid environments throughout New Mexico, although some have been taken at higher elevations (Findley et al. 1975). Findley et al. (1975) considered this species rare in the state, as only eight total specimens were available at the time of publication. Those researchers, however, suspected that the species was more common than their records indicated. More recently, researchers along the Rio Grande in central parts of the state reported over 2,000 captures in seven summers in pitfall traps located in floodplain habitats dominated by cottonwoods (*Populus deltoides*; Chung-MacCoubrey et al. 2009). Riparian habitats in arid regions appear to support relatively great numbers of individuals (Duncan and Corman 1991; Chung-MacCoubrey et al. 2009). No published records are known from either river system and no published localities of occurrence are known from Grant and Luna counties (Findley et al. 1975).

I did not capture or document this species in either river system by conventional trapping methods such as Sherman live traps, but I obtained records of this species along both rivers by other methods. Along the Gila River, domestic house cats at a personal residence have been known to capture these mammals in Grant County. On the Mimbres River, examination of regurgitated Barn Owl (*Tyto alba*) pellets yielded that Crawford's Desert Shrews are common on the NMDGF River Ranch, Luna County. These observations represent new counties of occurrence in New Mexico for both counties (Findley et al. 1975). Crawford's Desert Shrews

certainly are more common along these two rivers, although the species previously was not known from either river system in published accounts.

Records of occurrence: Gila River: Grant Co., 2.1 km N, 1.2 km E Gila P.O. Mimbres River: Luna Co., River Ranch.

Fig. A dead Crawford's Desert Shrew (*Notiosorex crawfordi*) captured by a house cat in the Gila Valley at a personal residence in Grant County. The overall gray coloration and relatively large ears help to distinguish this species from other shrew species in the state.

Order Chiroptera

Nyctinomops macrotis – Big Free-tailed Bat

The Big Free-tailed Bat (*Nyctinomops macrotis*) generally has the same ecology and distribution as the smaller Brazilian Free-tailed Bat (*Tadarida brasiliensis*), but Big Free-tailed Bats are less common throughout the state (Findley et al. 1975). This crevice-roosting species generally is known to roost in cliffs or other large rock formations. To my knowledge, there are no published records of Big Free-tailed Bats from Grant and Luna counties, but records for the species are known from the Mogollon Plateau in Catron County (Findley et al. 1975).

During the study, I only captured a single individual along the Mimbres River but heard the diagnostic audible calls of the species on both river systems. I captured a female on 10 June 2014 over the Mimbres River on the TNC-5SJ Property in Grant County. The female represents the earliest record of a pregnant individual in New Mexico, as the only other record of a pregnant female was captured 30 June (Findley et al. 1975). It is unknown whether this individual represented a summer resident or a late migrant. Audible calls of this species heard in June and July demonstrate at least some individuals remain and forage over both rivers in summer. The capture in Grant County and the audible calls heard over the River Ranch in Luna County also represent new counties of occurrence in New Mexico.

Records of occurrence: Gila River: Grant Co., TNC-3LC; private ranch; Gila Box Forest Service; Double E Ranch. Mimbres River: Grant Co., TNC-5SJ Property; Luna Co., River Ranch.

Fig. A female Big Free-tailed Bat (*Nyctinomops macrotis*) captured on the TNC-5SJ Property on 10 June 2014. Photograph demonstrates the attachment of ears posterior to the rostrum.

Fig. A female Big Free-tailed Bat (*Nyctinomops macrotis*) captured on TNC-5SJ on 10 June 2014. Right photograph depicts elongated hairs on toes that aid in locomotion and tactile senses when moving in crevices.

Tadarida brasiliensis – Brazilian Free-tailed Bat

Statewide in distribution, this small-sized free-tailed bat occurs mainly at lower elevations from piñon-juniper woodlands to deserts (Findley et al. 1975). Brazilian Free-tailed Bats are active throughout the year in the state (Constantine 1967, Geluso 2007, Geluso 2008b), but large numbers roosting in caves have been documented November-February on some years (Constantine 1967, Geluso 2008b). Besides caves, this species frequently uses bridges as day roosts along the Rio Grande in south-central New Mexico (Geluso 2009), as older wooden bridges provided small spaces for maternity colonies in the Rio Grande Valley. Brazilian Free-tailed Bats are known from four localities in Grant County: Silver City, Iron Canyon in the Black Range, Big Burro Mountains, and southwest of Glenwood (Findley et al. 1975; Geluso 2007).

During my survey, I captured individuals at multiple sites along the Gila River and at all three sites on the Mimbres River. Individuals included both males and females, with pregnant females documented from 27 May to 12 June based on enlarged abdomens and gently palpating the region for the head of young. The single female kept as a voucher contained a fetus that measured 16 mm in crown-rump length on 13 May 2015. The single male kept as a voucher had testes that measured 4 x 2 mm on 20 June 2014. We suspect this species is a common summer resident and uncommon winter resident throughout the study areas.

Records of occurrence: Gila River: Grant Co., TNC-3LC; Double E Ranch; TNC-2IB; Bird Area. Mimbres River: Grant Co., TNC-4NM Property; TNC-5SJ Property; Luna Co., River Ranch.

Fig. A male Brazilian free-tailed bat (*Tadarida brasiliensis*) captured on private ranch along the Gila River, Grant County, 13 May 2016.

Fig. A male Brazilian Free-tailed Bat (*Tadarida brasiliensis*) captured on TNC-4NM Property, Grant County, 9 June 2014. Top arrow demonstrates this is a male, and the lower arrow shows the characteristic "free-tail" of this species. To distinguish this species from the larger Big Free-tailed Bat (*Nyctinomops macrotis*), the Brazilian Free-tailed Bat does not have attached ears in the center of the head behind the rostrum (see picture of attached ears in account above) and a much smaller forearm.

Fig. A Brazilian Free-tailed Bat (*Tadarida brasiliensis*) captured in the Big Burro Mountains, Grant Couny, 28 June 2016. This photographs demonstrates the unattached ears directly behind the rostrum.

Long-nosed Bat -- *Leptonycteris* spp.

Two species of Long-nosed Bats (*Leptonycteris*) are known from southwestern New Mexico in Hidalgo County, *L. yerbabuenae* (formerly known as *L. curasoae and L. sanborni*); and *L. nivalis* (Arita and Humphrey 1988, Hoyt et al. 1994). Because of similar external morphological characteristics, Findley et al. (1975) originally referred to all specimens known from New Mexico as *L. yerbabuenae*; however, two of those specimens actually represented *L. nivalis* from Guadalupe Canyon in the Peloncillo Mountains (Arita and Humphrey 1988). To date, both species are known from southern Hidalgo County in the Peloncillo and Animas mountains (Hoyt et a. 1994, Frey 2004). I am aware of reports of *L. yerbabuenae* from the Big Burro Mountains north of where published accounts are known (M. Ramsey, in litt.).

In 2014 and 2015, I received word from local residents in and around the Gila River valley by Gila, Grant County, that bats were drinking and draining hummingbird feeders at night. I have since secured photographs from one of the residents which demonstrates that these nectar-feeding bats are *Leptonycteris* and not the Mexico Long-tongued Bat (*Choeronycteris mexicana*), another nectar-feeding bat known from southern Hidalgo County. This upcoming year I will attempt to secure a permit to be able to first identify these bats to species and second to further study nectar-feeding bats in southwestern New Mexico and southeastern Arizona. These observations represent a substantial range extension for the species in New Mexico, and I find it warranted to better understand the timing of use of the area and delineate their distribution at their northern extent of their range in the state.

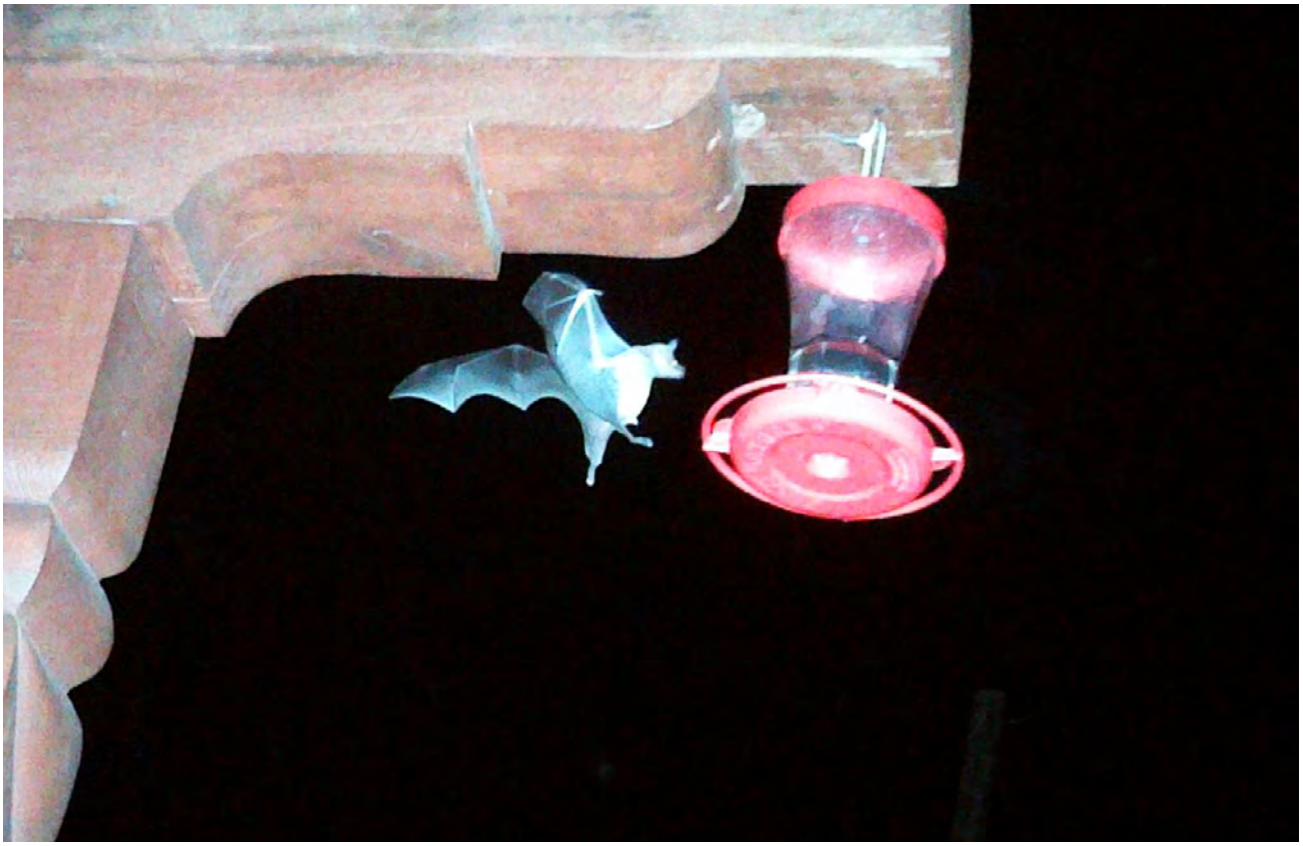

Fig. Photograph of nectar-feeding bat (*Leptonycteris*) from Grant County near the Gila River.

Antrozous pallidus – Pallid Bat

The Pallid Bat occurs throughout much of New Mexico at lower elevations in arid and semi-arid habitats (Findley et al. 1975). Pallid Bats are common in rocky areas in deserts and grasslands (Findley et al. Choate 1997). Geluso (2007) observed that this is one of five species regularly captured during winter outside of roosts in southern parts of the state. Unlike the four other bat species commonly captured in winter, Pallid Bats were the only species not observed to feed from November to March. Pallid Bats are known from along or near both river systems near my current survey areas (3 mi S Cliff and City of Rocks State Park; Findley et al. 1975).

In this study, Pallid Bats occurred along both rivers. I captured individuals at a number of sites in the Gila River valley but only at one site along the Mimbres River, that is, at the NMDGF River Ranch. Individuals were observed at a couple of residences night roosting under porches of buildings in the Gila River valley. One female kept as a voucher contained 2 fetuses (crown-rump length was 23 mm) on the 8 June 2015. This date is within the known period of pregnancy for Pallid Bats in the state (15 May-15 June; Findley et al. 1975). In New Mexico, Pallid Bats give birth to one or two young (Findley et al. 1975, Choate 1997).

Records of occurrence: Gila River: Grant Co., personal residence; Double E Ranch; private ranch; USFS Bird Area. Mimbres River: Luna Co., River Ranch.

Fig. Pallid Bats (*Antrozous pallidus*) from the Gila River valley and a nearby location in the Big Burro Mountains. The left photograph was taken at the private ranch along the Gila River in Grant County where a number of individuals were observed night roosting in the porch of a building (photograph taken on 25 May 2015). The right picture is of an individual captured from Saddle Rock Canyon in the Big Burro Mountain, Grant County, 20 March 2016.

Fig. A close up of the face of a Pallid Bat (*Antrozous pallidus*) captured from Saddle Rock Canyon in the Big Burro Mountain, Grant County, 20 March 2016. The pig-like nostrils on this large-eared bat help to identify it from Townsend's Big-eared Bat (*Corynorhinus townsendii*), another species with pale coloration and big ears (see next account).

Corynorhinus townsendii – Townsend's Big-eared Bat

Townsend's Big-eared Bats (*Corynorhinus townsendii*) are reported from throughout the state, except the eastern plains, and occur from deserts to spruce-fir forests (Findley et al. 1975, Choate 1997). This species commonly is captured in shelters, especially caves, mines, and other rock-like structures (Findley et al. 1975). In winter, individuals occasionally have been captured over water sources but are not known to be actively feeding during colder months in New Mexico (Geluso 2007). Townsend's Big-eared Bats are known from near the Mimbres River valley (2 mi W San Lorenzo) and near the Gila River in Grant County (Findley et al. 1975).

I first observed this species on 8 June 2014 when I discovered a dead individual in the large wooden barn, lower level, at TNC-4NM Property. It is unclear what caused the death of this individual as the carcass was fully intact and relatively fresh. I subsequently have examined the barn for bats in 2015 and 2016 and generally observe at least one *C. townsendii* roosting in the open on ceiling beams in the lower level. In 2015, the solitary individual roosting in the barn in May and June was a male, whereas one of the two solitary individuals observed on 23 March

2016 was a female. On 22 March 2016, I entered the barn only at night. The two individuals were fully active and flew around after I approached them to photograph them, again on the lower level. The following morning, I re-entered the barn to find both *C. townsendii* roosting solitary and in a state of torpor with ears curled back on the ceiling of the lower level. I did not capture this species in the study area along the Gila River, but I suspect this species occurs there too. Townsend's Big-eared Bats are known to be rarely captured in mist nets compared to other species (Findley et al. 1975).

Records of occurrence: Mimbres River: Grant Co., TNC-4NM Property.

Fig. A male Townsend's Big-eared Bat (*Corynorhinus townsendii*) observed on 18 May 2015 in the lower level of a barn on the TNC-4NM Property, Grant County. The large ears and the two bumps on the nose help to identify this large-eared bat from similar species.

Eptesicus fuscus – Big Brown Bat

The Big Brown Bat likely occurs throughout most of New Mexico but is most common in ponderosa pine (*Pinus ponderosa*) forests (Findley et al. 1975). At Carlsbad Caverns National Park, Big Brown Bats frequently were captured at low-elevation sites at a desert oasis containing deciduous trees and in arid desert habitats (Geluso and Geluso 2004). In Grant County, there are no records of Big Brown Bats near either river system, but records are known from nearby areas (Findley et al. 1975). I captured relatively few *E. fuscus* throughout the study, with the majority of individuals captured on a single night at the NMDGF Double E Ranch on 19 June 2015 (10 individuals). The capture of a Big Brown Bat at the NMDGF River Ranch in Luna County represents a county record. Four of five individuals captured along the Mimbres River were captured at the TNC-4NM Property, which represents the highest elevation of my study. I captured more females (13) than male (6) during the study. One of two females taken as vouchers was pregnant and contained a single embryo with a uterine swelling that measured 6 mm on 1 June 2015; the other female was not pregnant. Another obviously pregnant female

released was captured on 21 May 2015. These dates of pregnancy are within the known dates of pregnancy within the state (15 May-15 July; Findley et al. 1975 and Cook 1986, respectively). In New Mexico, most Big Brown Bats are reported to have a single young, but some are known to have two young (Choate 1997, Geluso and Geluso 2004). Two lactating females were captured on 17 July on the TNC-4NM Property by Mimbres. The male taken as a voucher on 10 June 2015 had testes that measured 5 x 3 mm.

Records of occurrence: Gila River: Grant Co., Double E Ranch; Gila Box Forest Service; TNC-3LC. Mimbres River: Grant Co., TNC-4NM Property. Luna Co., River Ranch.

Fig. A Big Brown Bat from along the Gila River, Grant County, New Mexico, captured on 14 May 2016 in the Gila Box Campground on US Forest Service lands. The tragus (see arrow) at the base of the ear is short and rounded unlike the narrow elongated tragus of all the bats in the genus *Myotis*. The short tragus and the large glands on the rostrum help to distinguish the Big Brown Bat from other species in the state. Individuals captured on this project had forearm lengths that ranged from 46 to 52 mm (n = 18).

Euderma maculatum – Spotted Bat

The Spotted Bat (*Euderma maculatum*) is known from 12 published locations in western and southern parts of New Mexico (Findley et al. 1975, Perry et al. 1997). To date, still little is understood about the natural history of the species in New Mexico and throughout its distribution in North America (Rodhouse et al. 2005, Chambers et al. 2011). Spotted Bats are considered a species of concern in New Mexico (NMDGF 2006). This species is known from only one published locality in Grant County, that is, from Lake Roberts (Best 1988b). During my survey 2014-2016, I did not capture a single individual in mist nets, but I did hear the diagnostic audible calls at multiple sites along the Gila River. I have heard the species along the Gila River in the survey area during past summer visits to the area. Although I was always listening for audible bat calls during mist netting for bats along the Mimbres River, I never heard an audible call that remotely sounded like a Spotted Bat.

Records of occurrence (audible calls only): Gila River: Grant Co., private ranch; TNC-3LC; Gila Box Forest Service.

Fig. A female Spotted Bat (*Euderma maculatum*) captured on Mt. Taylor, Cibola County, 5 June 2007 (Geluso 2008a). Spotted Bats easily can be recognized by their large ears and three white spots on the back of the bat.

Lasionycteris noctivagans – Silver-haired Bat

The Silver-haired Bat is a migratory, tree-roosting species in North America (Cryan 2003). During winter and migratory periods, both sexes occur in New Mexico, whereas from June to September, females migrate out of the state to more northerly areas as only males remain in the state (Findley et al. 1975, Geluso 2007). A winter bat survey in southern New Mexico demonstrated that both sexes commonly occur and are captured at water sources in desert habitats, with some individuals actively feeding during this season (Geluso 2007). In summer, male Silver-haired Bats can be abundant in high-elevation, montane habitats (Findley et al. 1975). Previously, Silver-haired Bats were known from a number of published localities in Grant County, but the species is not known from the along the Mimbres River or from Luna County (Findley et al. 1975, Geluso 2007). Silver-haired Bats are known from the Gila River, as I captured a male on 30 March 2004 in the Gila Bird Area in the Big Burrow Mountains (Geluso 2007).

During the current survey, I captured Silver-haired Bats at two localities on the Gila River and along the Mimbres River on TNC-4NM property. [In May 2016, I also captured this species on the NMDGF River Ranch.] Of 43 captures, 40 were males with 18 males captured from 1 to 9 June. Three females were captured, one on 18 May 2015 (Gila River), one on 20 May 2015 (Mimbres River), and one on 12 June 2014 (Gila River). Findley et al. (1975) reported that the few females captured in the state were migratory, as none has been captured June-August in the state. Females captured in this study are best referred to as late migrants and my capture on 12 June represents the latest spring date that females are known in New Mexico. Our captures of males during the first week of June first suggested that male Silver-haired Bats might also remain at lower elevations along some rivers in New Mexico during summer. More data are needed to support or refute this initial observation. However, I suspect that most of those males are late migrants that will head to higher elevations in the weeks to come. The only data I have to support such a prediction is that my colleagues and I netted along the Mimbres River at TNC-4NM Property on one night in July 2015 without capturing this species where we had captured them earlier. Findley et al. (1975) stated that male Silver-haired Bats occur at higher elevations during summer. Observations from the Gila and Mimbres rivers demonstrate that Silver-haired Bats likely use these deciduous riparian areas at mid elevations during June as corridors or stopover sites while in route to summer habitats. The one female kept as a voucher showed no obvious signs of being pregnant and a male captured on 1 June 2015 had testes that measured 4 x 2 mm.

Records of occurrence: Gila River: Grant Co., TNC-3LC; Gila Box Forest Service. Mimbres River: Grant Co., TNC-4NM Property.

Fig. A Silver-haired Bat from along the Mimbres River, Grant County, New Mexico, captured on 8 June 2014 on TNC-4NM Property. This species has a short, rounded tragus and a light-colored area on the front of their ears.

Fig. Silver-haired Bats from along the Mimbres River, Luna County, New Mexico, captured on 20 May 2016 on NMDGF River Ranch. Silver-haired Bats also are recognized by their black fur highlighted with silver tips on the dorsal surface, but see pictures of the Hoary Bat (*Lasiurus cinereus*).

Lasiurus blossevillii – Western Red Bat

Until recently, the Western Red Bat (*Lasiurus blossevillii*) was considered a subspecies of the Eastern Red Bat (*Lasiurus borealis*), but now the Western Red Bat has been elevated to a distinct species (Baker et al. 1988, Morales and Bickham 1995). In New Mexico, Western Red Bats occur in riparian habitats along the San Francisco River and oak/sycamore/cottonwood forests of major drainages in southern Hidalgo County (Findley et al. 1975, Cook 1986). Valdez et al. (1999) considered a specimen collected from Las Cruces along the Rio Grande valley (MSB #30894) to be of the western species, although Findley et al. (1975) referred to it as the eastern species. I recently have examined the specimen and find it best referred to as an Eastern Red Bat based on coloration (K. Geluso, unpublished data). I hope to verify the identification of the Las Cruces individual using molecular techniques in the near future to substantiate that minor coloration differences exist between these two morphologically similar species that are not yet described in the literature. Based on my suspicions of red bat identification in New Mexico, the Western Red Bat, thus far, only is known from Catron and Hidalgo counties in New Mexico, and it has not been documented in Grant or Luna counties via published accounts. The Western Red Bat is considered a Species of Greatest Conservation Need in New Mexico (NMDGF 2006).

I captured a total of 17 individuals during the survey, three individuals (two males and one female) from the Gila River and 14 individuals (two males and 12 females) from along the Mimbres River. The best place to capture this species was along the Mimbres River on the NMDGF River Ranch in Luna County. There, colleagues and I consistently captured an individual or two each night we attempted to capture bats on the property. Due to a general lack of roosting ecology on this species throughout its distribution, we initiated a radio-telemetry study to learn more about the roost trees used by this species, where the roost trees are situated on the river flood plain, and how far individuals feed and drink from roost trees. See Chapter 3 of this report for preliminary details on observations from our first season of research. In May 2016, we plan to track another 10 individuals to increase our sample size. The results from that initial project demonstrated that 1) Western Red Bats roost in a variety of deciduous trees, 2) roost trees are situated in a number of places in the flood plain (open solitary trees, trees along the active river, and trees in rather densely forested patches), and 3) this species commonly roosts in clusters of up to three adult individuals in May (Chapter 3 of this report). Overall, the Mimbres River appears to be a stronghold for the species, as we captured almost the same number of individuals in this brief survey as reported by Findley et al. (1975). Another explanation for our results is that Western Red Bats now are more abundant than in the past due to some environmental change.

Findley et al. (1975) did not report the capture of adult males in New Mexico for *L. blossevillii*, but now a few adults are known from the Animas Mountains in southern Hidalgo County (Cook 1986). Captures of the species on both river systems represent new river drainages for the species as well as new county records for both Grant and Luna counties. Captures along the Mimbres River represent the farthest east the species is known to occur in New Mexico, although the species occurs farther east in the United States in Texas (Ammerman et al. 2012). Natural history information for this species is scant in the United States, and more detailed studies on diet, seasonality, and roost sites are warranted to better understand this uncommon North American species. Riparian forests along the Gila and Mimbres rivers provide one of the few areas in the state for this species. Maintaining and promoting riparian forests will be of importance to this species if warming trends continue and lack of precipitation prevail throughout the region or if future large-scale water diversions affect downstream riparian forests.

Two females kept as vouchers on 14 May 2015 both contained three fetuses, with the crown-rump lengths of the largest young measuring 13 mm and 8 mm. Other obviously pregnant females were captured on the 27 May 2015 and 3 June 2015. Females are known to be pregnant in New Mexico previously from 15 May to 30 June (Findley et al. 1975, Cook 1986). Lactating females were captured on 3 and 6 June 2015, representing the earliest dates of lactation for this species in the state (Findley et al. 1975, Cook 1986). The former earliest date of lactation was from 13 June (Findley et al. 1975). An extremely pale, almost white, individual was captured on 14 May 2015 and was kept as a voucher specimen. It is unclear if this represents another color phase for the species or is an aberrant coloration for the species.

Records of occurrence: Gila River: Grant Co., Gila Box Forest Service; Gila Bird Area. Mimbres River: Grant Co., TNC-4NM Property; Luna Co., River Ranch.

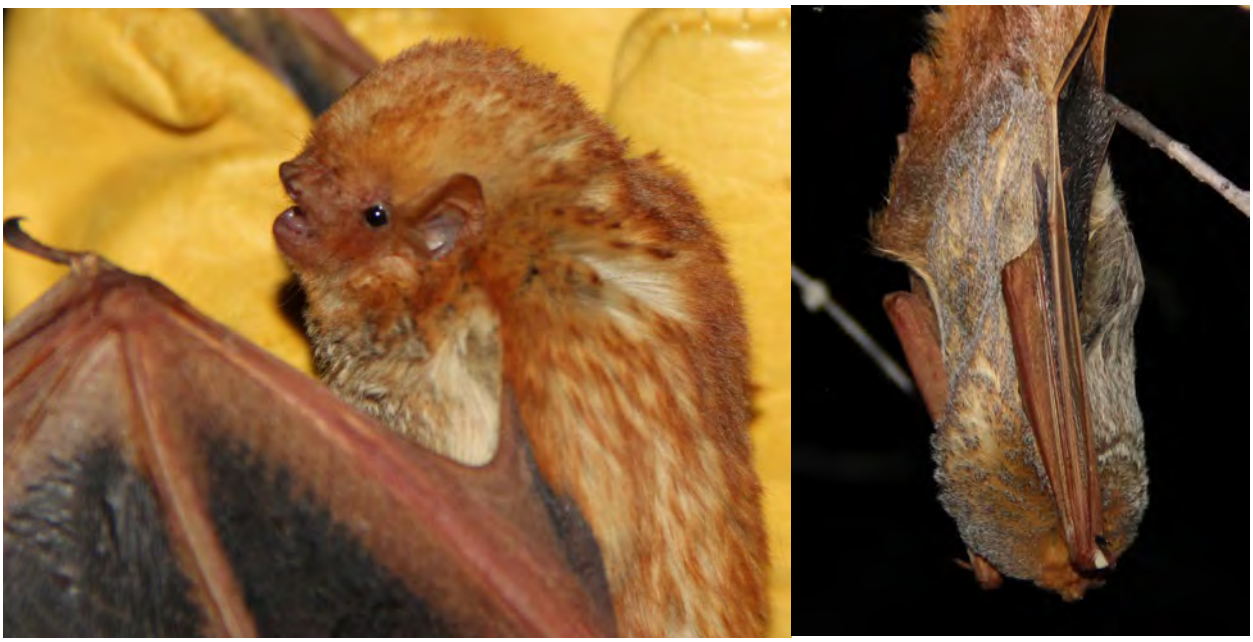

Fig. Left photo: An adult male Western Red Bat (*Lasiurus blossevillii*) captured along the Mimbres River on TNC-4NM Property, Grant County, New Mexico, 9 June 2014. Right photo: A female Western Red Bat captured along the Gila River in the U.S. Forest Service Bird Area in the Big Burro Mountains on 27 May 2015.

Fig. Comparison of an adult Western Red Bat (*Lasiurus blossevillii*) captured along the Mimbres River on the NMDGF River Ranch, Luna County, New Mexico, 14 May 2015 (Top photograph) and an adult Eastern Red Bat (*Lasiurus borealis*) captured in Kimball County, Nebraska, on 1 August 2010 (Bottom photograph). Notice the difference in coloration in breast hair color, that is, the color below the white-frosted tips. In Western Red Bats, coloration is dark brown whereas in Eastern Red Bats coloration is reddish orange.

Lasiurus borealis – Eastern Red Bat

The Eastern Red Bat only is known from a few localities in eastern and southern parts of New Mexico (Findley et al. 1975, Cook 1986, Valdez et al. 1999, Geluso and Geluso 2004). In eastern parts of New Mexico, the species is known from the town of Portales and a desert oasis, Rattlesnake Springs, at Carlsbad Caverns National Park. The species also is known from along the Rio Grande in central parts of the state from Bosque Del Apache National Wildlife Refuge and from Las Cruces (Findley et al. 1975, Valdez et al. 1999); see comment above in the account for Western Red Bats regarding the identification of the individual from Las Cruces. Eastern Red Bats are not known from west of the Rocky Mountains in southwestern parts of the United States, hence, there are no known records from the Gila and Mimbres rivers in Grant and Luna counties.

On 20 May 2015, colleagues and I captured an adult male Eastern Red Bat along the Gila River in Grant County. This records represents a 180 km range expansion for the species from the closest previously published records in Las Cruces, Doña Ana County, and Bosque del Apache, Socorro County (Findley et al. 1975, Valdez et al. 1999). Moreover, this represents the first observation of this eastern bat species west of the continental divide in southwestern parts of the United States. Identification in the field was originally based on coloration of fur on the ventral side of the neck and belly (see Fig. above with Western Red Bats), whereas once the skull was cleaned, shape and large size of this specimen confirmed the identification as an Eastern Red Bat. We hope to further confirm the identification of this individual with molecular techniques. Not too much can be stated about the capture of this migratory species beyond former distributional limits, as it might represent a wandering/exploratory individual. The possibility exists, however, that this species might be overlooked in the region because of similar appearances to Western Red Bats. I have examined all other Eastern Red Bat specimens housed at MSB from New Mexico and there were no misidentified specimens based on coloration and skull characteristics, except the individual from Las Cruces. Eastern Red Bats appear to be expanding westward in distribution across the Great Plains (Benedict et al. 2000, Geluso et al. 2015), thus care should be taken to learn how to identify Eastern Red Bats from Western Red Bats in New Mexico and other places in the Southwestern United States. The male had testes that measured 4 x 2 mm, weighed 11 g, and had a forearm measurement of 40.5 mm.

Record of occurrence: Gila River: Grant Co., Gila Box Forest Service.

Lasiurus cinereus – Hoary Bat

As with Eastern Red, Western Red, and Silver-haired Bats, the Hoary Bat (*Lasiurus cinereus*) is a migratory, tree roosting species in North America (Cryan 2003). Most Hoary Bats are suspected to reside south of the United States during winter (Cryan 2003). Geluso (2007) did not observe Hoary Bats in New Mexico from December to March. During warmer months, Hoary Bats can be found in the state, with both sexes occurring during migratory periods (April-May and August-October) and only males residing in summer months. Findley et al. (1975) commented that males only occur in forested habitats at high elevations in northern parts of the state in July. Previously Hoary Bats were known from two locations in western Grant County, with one individual from Gila (Findley et al. 1975). Not a single published observation is known from along the Mimbres River or from Luna County.

I captured a total of 95 Hoary Bats during my survey including 37 individuals in along the Gila River and 58 along the Mimbres River. Hoary Bats were one of the most commonly captured bats across all sites in May (73 individuals; 50 females, 22 males, and 1 unknown sex) and June (21 individuals; 20 males and 1 unknown). A single male was captured on TNC-4NM Property on the one night of netting in July at that site. This suggests that some male Hoary Bats remain both at lower elevations as well as in southern parts of the state in summer (July). Pregnant females were observed from 13-27 May, with the three females kept as vouchers all containing two young (13 May and 16 May, largest uterine swelling measured 11 mm; 18 May, fetal crown-rump length measured 13 mm).

Records of occurrence: Gila River: Grant Co., Bear Creek, Double E Ranch; Bird Area Forest Service; Gila Box Forest Service; TNC-3LC; TNC-2IB. Mimbres River: Grant Co., TNC-4NM Property; TNC-5SJ Property; Luna Co., River Ranch.

Fig. Left photo: A male Hoary Bat (*Lasiurus cinereus*) captured along the Mimbres River on TNC-4NM Property, Grant County, New Mexico, 8 June 2014. Right Photo: Hoary Bat captured along the Gila River at the private ranch, Grant County, 13 May 2016. This large, uniquely colored species allows for easy identification.

Myotis auriculus – Southwestern Myotis

The Southwestern Myotis (*Myotis auriculus*) generally occurs in southwestern New Mexico, but populations are known from some central mountains in the state such as the Sandia and Jemez mountains (Findley et al. 1975, Cook 1986, Gannon 1998). Geluso (2002) captured a pregnant female in Harding County in 1999 demonstrating that our understanding of the distribution for this species may be incomplete in the state. This species generally is associated with ponderosa pine forests, but specimens from Glenwood, Catron County, and the Animas Mountains, Hidalgo County, were captured in a cottonwood and sycamore dominated riparian habitats. This species is known from Grant County at two localities not associated with the Gila or Mimbres rivers. No records of the Southwestern Myotis are known from Luna County.

I captured a total of 14 individuals, with three captures along the Gila River in Grant County and 11 captures along the Mimbres River in Luna County. As supported by other accounts, the Southwestern Myotis inhabits deciduous riparian habitats throughout southwestern New Mexico (Findley et al. 1975, Cook 1986, this study). The captures in Luna County represent a new county record for the species in New Mexico. Most of the individuals captured throughout the study area were female (12 females, 1 male, and 2 unknown). I captured pregnant females from 13 May to 10 June in the study area. The three females kept as vouchers all contained a single fetus with crown-rump lengths that measured 14 mm (13 May and 1 June) and 20 mm (10 June). A single lactating female was captured on 3 June 2015 on the River Ranch in Luna County. Previously, pregnant females in New Mexico were known from 4 June to 23 June (Cook 1986). Our capture of a pregnant female on 13 May 2015 expands the known period of pregnancy for this species in New Mexico. A single young is the norm for the species in the state (Findley et al. 1975, Cook 1986). Our capture of a lactating female represent the earliest lactation record for this species in the state. Previously, the earliest date of lactation was on 21 June (Cook 1986).

Records of occurrence: Gila River: Grant Co., Gila Box Forest Service; Bear Creek, Double E Ranch. Mimbres River: Luna Co., River Ranch.

Fig. A female Southwestern Myotis (*Myotis auriculus*) captured on the 18 May 2016 in the Big Burro Mountains, Grant County, New Mexico. The long, light-colored ears help to identify this species from other long-eared myotis in the state. This species also lacks conspicuous fringe along the trailing edge of the uropatagium.

Fig. An adult Southwestern Myotis (*Myotis auriculus*) captured on the 20 May 2016 on the NMDGF River Ranch in Luna County, New Mexico. Another feature that appears diagnostic for this species compared to the other long-eared myotis is the conspicuous yellow gland near the eye. The entire face of this species is light in color and the base of the ears are light colored too.

Fig. Comparison of a Southwestern Myotis (*Myotis auriculus*), left photograph, to that of a Long-eared Myotis (*Myotis evotis*), right photograph, both captured in the Mogollon Plateau on 3 June 2016. *Myotis evotis* has much darker ears and a dark face compared to *M. auriculus*. *Myotis evotis* also does have a fringe of hair on the uropatagium, although less conspicuous as the Fringed Myotis (*Myotis thysanodes*).

Myotis californicus – California Myotis

The California Myotis (*Myotis californicus*) generally is considered a desert and grassland species in New Mexico (Bogan 1975, Geluso and Geluso 2004). The species also is known to occur with frequency in habitats up to and dominated by ponderosa pine (Findley et al. 1975). The California Myotis resides throughout much of the state, except few records are

known from the eastern plains (Findley et al. 1975, Choate 1997). This species is relatively small with forearm lengths generally ≤36 mm and have keeled calcars on their tail membrane by their hind foot (see Fig. below). This species can be difficult to distinguish from the Western Small-footed Myotis (*Myotis ciliolabrum*). Many Western Small-footed Myotis have a few mm of free tail beyond the uropatagium (see Fig. in account for that species), among a few other challenging traits. California Myotis do not have a free tail, have a narrow rostrum when viewed from above (see Fig.), and have a narrow gap between upper cheek teeth. The California Myotis is not known from the Gila and Mimbres river valleys in Grant and Luna counties but is known from scattered localities in the surrounding areas (Findley et al. 1975, Geluso 2007).

I captured a total of 31 individuals, including 14 from along the Gila River and 17 from along the Mimbres River. Females outnumbered males about 2 to1, with 20 females captured compared to 10 males; one individual was not sexed. Pregnant females were captured 14, 16, 16, and 18 May with all females containing a single young; uterine swelling measured 11, 10, 9, and 7 mm, respectively. A flying young containing cartilage in finger joints was captured on 18 July 2015. Dates of pregnancy fall within the known span of time for this species in New Mexico from 1 May (Geluso and Geluso 2004) to 18 June (Cook 1986). Our capture of a volant young on 18 July appears to be the earliest published record in the state, with former dates ranging from 25 July to 16 August (Geluso and Geluso 2004). One young is the usual number for this species (Findley et al. 1975).

Records of occurrence: Gila River: Grant Co., Gila Box Forest Service; Bird Area Forest Service; Bear Creek, Double E Ranch. Mimbres River: Grant Co., TNC-4NM Property; Luna Co., River Ranch.

Fig. A California Myotis (*Myotis californicus*) captured in March 2016 in the Big Burro Mountains. This species can be very difficult to distinguish from the Western Small-footed Myotis (*Myotis ciliolabrum*). Fur coloration of both these species can vary considerably as well as the amount of black pigment on ears and face.

Myotis ciliolabrum – Western Small-footed Myotis

The Western Small-footed Myotis occurs from deserts to coniferous forests, although most captures were reported from ponderosa pine forests by Findley et al. (1975). This species likely occurs throughout the state, although few records are known from the eastern plains (Findley et al. 1975, Choate 1997). Two published records for *M. ciliolabrum* are known from Grant County, neither are from along the Gila or Mimbres rivers. Not a single record of this species is known from Luna County. I identify the Western Small-footed Myotis in my study area using the following characteristics, as most individuals have a few mm of a free tail beyond the uropatagium, a broader rostrum when viewed from above (see Fig. below), seemingly wider ears, and a wider span between upper teeth when they open their mouths compared to the California Myotis.

I captured three individuals throughout this survey, one on TNC-4NM Property, Grant County, and two on the NMDGF River Ranch, Luna County. Two females were captured on 22 May (Luna County) and 9 June (Grant County). A pregnant female was captured on 3 June containing one fetus that had a crown-rump length of 14 mm (Luna County). The records for Luna County represent a county record for this species in New Mexico. This date of a pregnant female fall within the known dates for this species in New Mexico (24 May to 29 June; Choate 1997 and Findley et al. 1975, respectively).

Records of occurrence: Mimbres River: Grant Co., Grant Co., TNC-4NM Property; Luna Co., River Ranch.

Fig. A Western Small-footed Myotis (*Myotis ciliolabrum*) captured over the Mimbres River at the NMDGF River Ranch in Luna County on 20 June 2016.

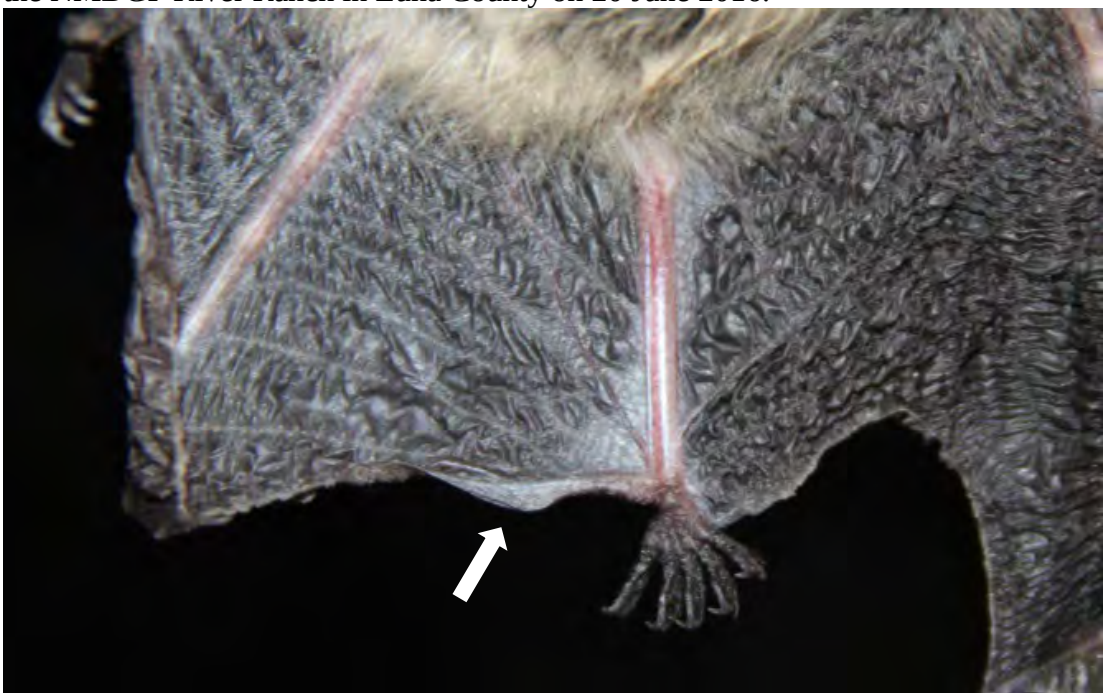

Fig. A Western Small-footed Myotis (*Myotis ciliolabrum*) captured over the Mimbres River on TNC-4NM Property, Grant County, New Mexico. Photograph demonstrates a keeled calcar. The calcar is the bone extending from the ankle part way towards the tip of the tail along the edge of the uropatagium. The "keeled" aspect of the calcar represents a small cartilaginous spur extending distally/posteriorly, causing a small flap of skin projecting off the edge of the uropatagium. Three species of *Myotis* without long ears contain a keeled calcar in the state, the Western Small-footed Myotis, California Myotis (*Myotis californicus*), and Long-legged Myotis (*Myotis volans*).

Fig. Left photographs demonstrates the few mm of free tail that many Western Small-footed Myotis (*Myotis ciliolabrum*) have extending from the uropatagium. Right photograph demonstrates the wider rostrum (left individual) when viewed from above of a Western Small-footed Myotis compared to that of a narrow rostrum of the California Myotis (*M. californicus*) (right individual). Note also the seemingly bigger ears on the *M. ciliolabrum*.

Myotis evotis – Long-eared Myotis

The Long-eared Myotis (*Myotis evotis*) occurs in ponderosa pine forests and at higher life zones in northern and western mountain ranges in New Mexico (Findley et al. 1975, Frey 2004). In southwestern parts of the state, this species is known from the Mogollon Plateau and the Black Range in Catron and Grant counties, respectively. Previously, this species was not known from Luna County (Findley et al. 1975). This species is identified by large black ears that are longer and darker than other Myotis with long ears, such as the Fringed Myotis and the Southwestern Myotis. Long-eared Myotis has a fringe of hairs on the trailing edge of the uropatagium, but hairs are rather difficult to observe and are not as obvious as those on the Fringed Myotis. For most individuals the pigment around the face is dark or black and the fur near the shoulder has a much more pronounced patch of black fur than the Fringed Myotis.

Although I did not capture this species from June 2014 to March 2015 during the official survey period for this project, I captured an adult, non-reproductive female on the NMDGF River Ranch in Luna County on July 2016, one of my last outings in the field before finalizing my Final Report. I did not expect to capture this species during the survey, but if I did, I predicted it would be at some of the highest elevations within my survey areas, such as at the Gila Box on the Gila River and the TNC-4NM Property on the Mimbres River. The habitat at both those sites consisted of pinon/juniper woodlands, the life zone below ponderosa pine. It is unclear if this species commonly uses riparian habitats in desert scrublands in the region. My record represents a new county record for Luna County, a new habitat for the species in the area, and the southernmost record in the state.

Fig. A Long-eared Myotis (*Myotis evotis*) captured on 3 June 2016 in the Mogollon Plateau, Catron County, New Mexico. The large black ears and black pigment around the face help to identify this species from other species of Myotis with long ears.

Fig. The shoulder region of a Long-eared Myotis (*Myotis evotis*) demonstrating the extensive black fur at the base of the shoulder. The Fringed Myotis also has some back in the same region but it is not as extensive.

Myotis occultus – Southwestern Little Brown Myotis

The Southwestern Little Brown Myotis (*Myotis occultus*), also known as the Arizona Myotis, commonly is associated with permanent bodies of water such as rivers, lakes, and ditches throughout much of New Mexico (Findley et al. 1975). Interestingly, the species is absent from along the Pecos River (Findley et al. 1975, Geluso and Geluso 2004). Individuals occur from desert habitats to coniferous forests in montane situations. Summer roosts mainly include buildings (Findley et al. 1975), but Geluso and Mink (2009) observed maternity colonies in wooden bridges along the Rio Grande in southern and central New Mexico. Reproductively active females and adult males were both observed under bridges, with most males roosting away from maternity groups (Geluso and Mink 2009). The species is suspected to hibernate in the state. The earliest record of spring emergence is 30 March, when I captured an individual over the Gila River in the "Bird Area" of the Big Burro Mountains, Grant County (Geluso 2007). Variation in body size and skull morphology is known across the state, with most variation seen between montane and lower elevation populations, such as along the Rio Grande (Findley et al. 1975). The Southwestern Little Brown Myotis previously has been documented along the Gila and Mimbres rivers (Findley et al. 1975, Geluso 2007), representing one of few species with prior documentation along both river valleys. The Southwestern Little Brown Myotis is considered a Species of Greatest Conservation Need in New Mexico (NMDGF 2006).

The Southwestern Little Brown Myotis was the most frequently captured bat species during my survey, with 169 total captures, 45 individuals along the Gila River and 124

individuals along the Mimbres River. I captured *M. occultus* at almost every site surveyed during the study. The species was the most common species of bat captured on TNC-5SJ and at the NMDGF River Ranch along the Mimbres River. I suspect maternity colonies exist in the vicinity, but the one night of netting in July on the River Ranch yielded only a single female *M. occultus* and she was not reproductively active. Additional netting needs to be conducted to determine whether the species remains in the local vicinity to give birth in June or July. It is unclear whether populations along the Gila and Mimbres rivers most closely resemble montane or low-elevation populations. Pregnant females were documented from 28 May to 10 June. The two females kept as vouchers both contained a single young with uterine swelling that measured 3 mm on 28 May and 9 mm on 10 June. The one male retained on 15 May had testes that measured 3 mm in length. Captures in Luna County represent a new county record for the species in the state.

Records of occurrence: Gila River: Grant Co., Bird Area Forest Service; Double E Ranch; Gila Box Forest Service; TNC-3LC; TNC-2IB. Mimbres River: Grant Co., TNC-4NM Property; TNC-5SJ Property; Luna Co., River Ranch.

Fig. A Southwestern Little Brown Myotis (*Myotis occultus*) captured along the Gila River at TNC-2IB property on 28 May 2015. Photograph demonstrates the lack of a keeled calcar on the trailing edge of the uropatagium (tail membrane) with a relatively large hind foot.

Fig. A Southwestern Little Brown Myotis (*Myotis occultus*) captured in the Mogollon Plateau on 2 June 2016. This species generally has a rich brown coloration on the dorsum and lighter buffy coloration on the venter. This species lacks a keeled calcar and has a forearm length generally 34-42 mm in length with an average length of 37 mm (n = 141) in the study area. Both the Cave Myotis (*Myotis velifer*) and Yuma Myotis (*M. yumanensis*) have a paler dorsum and lighter venter coloration. *Myotis velifer* generally had forearm lengths 39.5 mm and above (n = 12), whereas *M. yumanensis* had forearm lengths 29-36 mm (average of 34 mm, n = 105).

Myotis thysanodes – Fringed Myotis

The Fringed Myotis occurs throughout most of the state from deserts to ponderosa pine forests, but the species is absent from the eastern plains (Findley et al. 1975, Choate 1997). Buildings are commonly used by Fringed Myotis in the state (Findely et al. 1975, O'Farrell and Studier 1973, Cook 1986). Geluso and Mink (2009) observed a single individual in bridges along the Rio Grande valley. The Fringed Myotis is easily recognized by its conspicuous fringe of tan/yellow hairs on the trailing/posterior edge of the uropatagium (i.e., tail membrane; see Fig. below). The Fringed Myotis is not known from the Gila and Mimbres river valleys but from two localities in western and central Grant County (Findley et al. 1975). There is no record for this species in Luna County (Findley et al. 1975).

I captured a total of 38 Fringed Myotis in the Mimbres River valley and 34 were females. Numerous other individuals were observed in a barn on TNC-4NM Property. I observed bats in large groups in crevices behind rafters in the day and night roosting in open areas on the ceiling of the first level of the structure in the evening. I suspect this is a maternity colony. Not a single Fringed Myotis was captured along the Gila River. I suspect with additional netting or seeking out bats in buildings that the species also occurs along the Gila River. Captures in Luna County represent a new county for this species in the state. A female on 15 May contained a single fetus with a crown-rump length of 11 mm and others captured on 6 June were obviously pregnant. A lactating individual was captured on the TNC-4NM Property on 17 July 2015. My capture of a pregnant female on 15 May represents the earliest date of pregnancy for the species in the state. The former range of dates for pregnant individuals spanned from 24 May (Geluso and Geluso 2004) to 29 June (Cook 1986). Lactating females are known in New Mexico from 17 June (Geluso and Geluso 2004) to 25 August (Findley et al. 1975).

Records of occurrence: Mimbres River: Grant Co., TNC-4NM Property; Luna Co., River Ranch.

Fig. A Fringed Myotis (*Myotis thysanodes*) captured in a large wooden barn on TNC-4NM Property on 8 June 2014. Arrow demonstrates a tragus, a flap of skin inside the ear that aids in echolocation. For all *Myotis* species, the tragus is long and tapered.

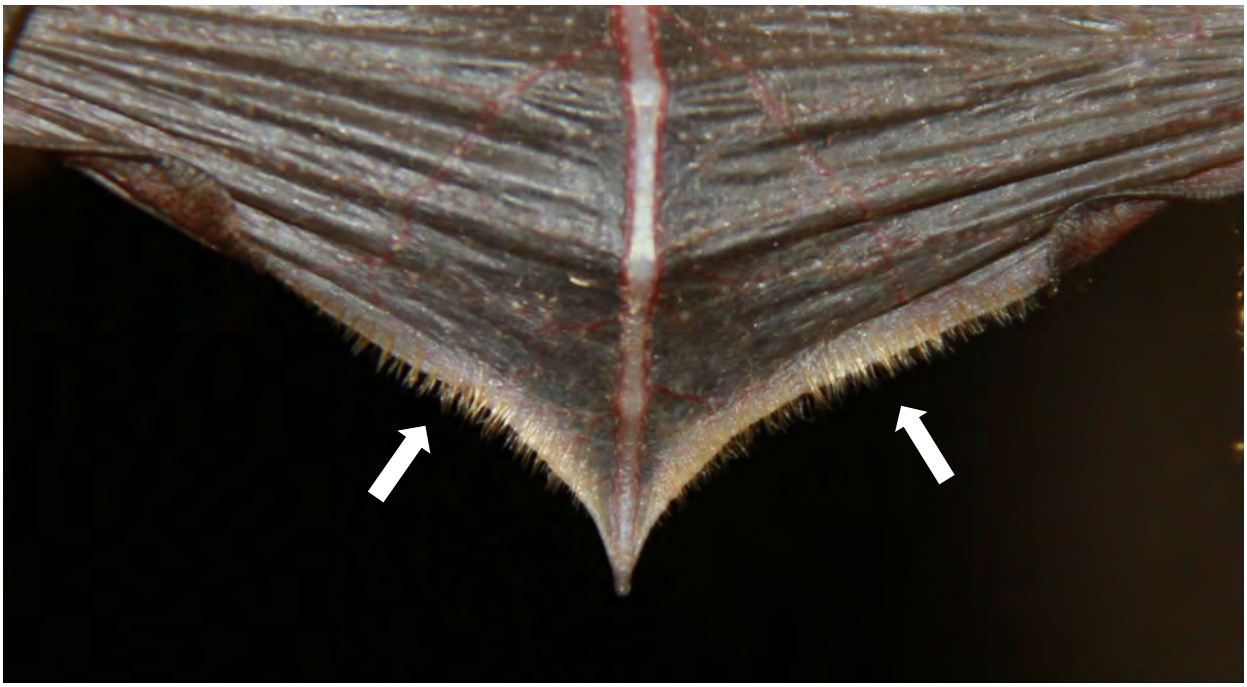

Fig. A Fringed Myotis (*Myotis thysanodes*) with arrows demonstrating the conspicuous dense fringe of tan-colored hairs on uropatagium for which its common name is based upon.

Fig. A cluster of night-roosting Fringed Myotis (*Myotis thysanodes*) in a barn on TNC-4NM Property, Grant County, on 3 June 2015.

Myotis velifer – Cave Myotis

The Cave Myotis (*Myotis velifer*) is a low-elevation, desert and grassland species in New Mexico (Findley et al. 1975, Cook 1986. Geluso and Geluso 2004). This species known from only southern parts of the state, but conspicuously absent from the lower Rio Grande valley (Findley et al. 1975). This species is known from the lower parts of the Gila River by Redrock in Grant County but absent from the Mimbres River (Findley et al. 1975). This species is one of three *Myotis* species that lacks a keeled calcar without long ears. Forearm lengths generally are 40 mm and greater and has an overall pale coloration. The closest species resembling the Cave Myotis is the Yuma Myotis (*Myotis yumanensis*), but the Yuma Myotis has a much smaller forearm, generally < 37 mm.

I captured a total of 13 individuals (8 males and 4 females) from two sites along the Gila River, representing the lowest elevations along my study area. Pregnant females were captured on 27 and 28 May 2015, each containing a single embryo with uterine swellings that measured 8 mm and 3 mm, respectively. Males taken as vouchers had testes 4 x 2 mm on 27 May 2015 and 4 x 2 and 2 x 1 mm on 28 May 2015. Pregnant females are known from New Mexico from 24 April to 3 July (Geluso and Geluso 2004).

Records of occurrence: Gila River: Grant Co., TNC-2IB; Bird Area Forest Service.

Myotis volans – Long-legged Myotis

The Long-legged Myotis (*Myotis volans*) generally occurs in montane habitats in ponderosa pine forests and in vegetative communities at higher elevations (Findley et al. 1975). In the Animas Mountains of Hidalgo County, the Long-legged Myotis was captured in good numbers in the piñon-juniper life zone (Cook 1986). This species is known from throughout New Mexico, except in eastern parts of the state. Some individuals have been captured at lower elevations including desert and grassland habitats (Findley et al. 1975, Geluso and Geluso 2004). I captured a total of three individuals during this study, one at the highest elevation site of my study along the Gila River and two at the highest elevation site along the Mimbres River. The single female taken as a voucher was not pregnant (4 June 2015) and the male captured on 20 May had testes that measured 3 mm in length.

Records of occurrence: Gila River: Grant Co., Gila Box Forest Service. Mimbres River: Grant Co., TNC-4NM Property.

Fig. A Long-legged Myotis (*Myotis volans*) captured in the Mogollon Plateau in Catron County, New Mexico, 2 June 2016. This species has a keeled calcar and generally a forearm length greater (>37 mm) which is larger than that of the California Myotis (*M. californicus*) and Western Small-footed Myotis (*M. ciliolabrum*). The Long-legged Myotis also has a small ear.

Fig. A Long-legged Myotis (*Myotis volans*) captured in the Mogollon Plateau in Catron County, New Mexico, 2 June 2016.

Myotis yumanensis – Yuma Myotis

The Yuma Myotis (*Myotis yumanensis*) occurs along permanent watercourses throughout mainly the Canadian, Cimarron, and Gila rivers from deserts to pinon-juniper woodlands (Findley et al. 1975, Dalquest et al. 1990, Geluso 2002). This species commonly inhabits human-made structures during summer months, including buildings and bridges in New Mexico (Findley et al. 1975, Geluso and Mink 2009). Yuma Myotis are known from a single locality in Grant County (Redrock) along the Gila River, whereas no records are known along the Mimbres River in Grant and Luna counties (Findley et al. 1975).

I captured a total of 113 Yuma Myotis, including 84 individuals along the Gila River and 29 individuals along the Mimbres River. Captures of males (60) and females (52) were about equal across the study region, however, at one site, TNC-2IB property, 17 females were captured compared to only two males on 28 May 2015, suggesting a maternity colony in the immediate area. Along the Mimbres River, only a single individual was captured in the more northerly sites, whereas all other individuals were captured in riparian habitats on the NMDFG River Ranch in Luna County. Pregnant females were captured from 16 May to 12 June, which represents the first dates for pregnant females in New Mexico. A pregnant female captured on 16 May contained a single embryo; the uterine swelling measured 7 mm. Captures on the NMDGF River Ranch in Luna County represent a county record and a new river system for this species in the state (Findley et al. 1975).

Records of occurrence: Gila River: Grant Co., Bear Creek, Double E Ranch; Bird Area Forest Service; Gila Box Forest Service; TNC-3LC; TNC-2IB. Mimbres River: Grant Co., TNC-4NM Property; Luna Co., River Ranch.

Fig. A Yuma Myotis (*Myotis yumanensis*) captured at the private ranch along the Gila River, Grant County, on 13 May 2016. This small species can be identified by its small size, pale coloration on the dorsum, lack of a keeled calcar, and whitish coloration on the venter.

Nycticeius humeralis – Evening Bat

The Evening Bat (*Nycticeius humeralis*) resides throughout eastern parts of North America from the Great Plains to the Atlantic Coast (Hall 1981). Western distributional limits occur in Nebraska, Kansas, Oklahoma, and Texas (Hall 1981). Prior to my survey, there were no records of the Evening Bat in New Mexico. On 18 May 2015, colleagues and I captured an adult male Evening Bat over the Mimbres River on TNC-4NM Property, Grant County, New Mexico. This record represents the first record of the species in the state. It is unclear whether this represents a lost/wandering individual, a species that has always occurred in the region but remained undetected/misidentified, or represents a recent expansion in the distribution of this species. Andersen et al. (in prep., see Chapter 2 of this report) has shown evidence that this species has expanded its distribution westward in recent decades in the Great Plains and also might occur in eastern Colorado and eastern New Mexico. See Chapter 2 for more information about this species and our capture in the state.

Records of occurrence: Mimbres River: Grant Co., TNC-4NM Property.

Fig. An adult male Evening Bat (*Nycticeius humeralis*) captured along the Mimbres River on 18 May 2015. This individual represents the first record for this species in New Mexico. The rounded and relatively short tragus, large glands/bumps on the rostrum, and relatively short forearm help to distinguish this species from other bats in New Mexico.

Fig. Comparison of an Evening Bat (*Nycticeius humeralis*) on the left and a Southwestern Little Brown Myotis (*Myotis occultus*) on the right. Notice the large glands on the rostrum of the Evening Bat. Close attention should be taken on the identification of all small brown bats lacking a keeled calcar from New Mexico, paying close attention for additional Evening Bats in the state.

Parastrallus hesperus – Canyon Bat

The Canyon Bat (*Parastallus hesperus*) formally was known as the Western Pipistrelle (*Pipistrellus hesperus*). This small, tan-colored bat with black face and short, rounded tragus is most common in deserts and grasslands and is less abundant in piñon-juniper woodlands and ponderosa pine forests in New Mexico (Findley et al. 1975). This species appears to require and roost in rocky habitats across the state, except in the eastern plains (Findley et al. 1975, Dalquest et al. 1990, Choate 1997). This bat is commonly observed over stock tanks before dark foraging and drinking. Geluso (2007) discovered that the Canyon Bat was the most frequently captured bat species in southern New Mexico from November to March. Those data suggest that least some individuals do not hibernate throughout the entire winter. This species previously was not known from the Mimbres River valley but was known from central and western parts of Grant County, including along the Gila River (Findley et al. 1975, Geluso 2007).

I captured 11 individuals during the project including seven along the Gila River and four along the Mimbres River. I captured roughly equal numbers of males (5) and females (6). Pregnant females were captured on 27 May, 1 June, and 10 June, with both voucher females containing 2 young (9 mm on 27 May and 10 mm on 10 June). Our capture of a pregnant female on 27 May is the earliest a pregnant individual has been recorded in New Mexico, with the former span of dates for pregnancy extending from 30 May (Geluso and Geluso 2004) to 30 July (Findley et al. 1975). A majority of Canyon Bats in the state are reported to have two young (Findley et al. 1975, Cook 1986).

Records of occurrence: Gila River: Grant Co., TNC-3LC; Gila Box Forest Service; Bird Area Forest Service. Mimbres River: Grant Co., TNC-5SJ Property; Luna Co., River Ranch.

Fig. Canyon Bat (*Parastrellus hesperus*) captured in the Big Burro Mountains, Grant County, New Mexico, on 20 March 2016. The arrow points to round, short tragus that helps to distinguish canyon bats from all *Myotis* species in the state. This species also can be identified by its pale coloration and back ears and face.

Order Carnivora

Canis latrans – Coyote

The Coyote (*Canis latrans*) is a common inhabitant of grasslands but occurs in all habitats throughout New Mexico (Findley et al. 1975). Individuals have been documented from Grant County, albeit there are no published records from along the Gila and Mimbres river valleys (Findley et al. 1975). Camera traps at the NMDGF River Ranch in Luna County captured the most pictures of Coyotes of all camera locations. I report Coyotes as common throughout both river systems as individuals were heard on most nights while at the River Ranch, Luna County, and private ranch in Grant County. Observations of Coyotes in Luna County represent a new county record.

Fig. A Coyote (*Canis latrans*) near the Gila River, Grant County, on 14 June 2014.

Fig. A Coyote (*Canis latrans*) captured on a camera trap on the NMDGF River Ranch in Luna County, 18 May 2015.

Urocyon cinereoargenteus – Common Gray Fox

The Common Gray Fox (*Urocyon cinereoargenteus*) occurs throughout New Mexico, except in a few areas on the eastern plains (Findley et al. 1975, Choate 1997). Common Gray Foxes are common in woodlands, such as oak, piñon-juniper associations, but are rare or absent from grasslands without rocks and mixed coniferous forests and higher elevations (Findley et al. 1975). There are records of *U. cinereoargenteus* on both river systems in Grant County, but none was reported from my two study areas. This species commonly was captured on camera traps in the study along both the Gila and Mimbres rivers in Grant County, except none was documented on the NMDGF River Ranch. On many occasions, pairs or small groups of foxes were observed traveling together at sites.

Fig. A Common Gray Fox (*Urocyon cinereoargenteus*) captured on a camera trap in the TNC-1GB property in Grant County.

Lynx rufus – Bobcat

The Bobcat (*Lynx rufus*) occurs throughout the state in most habitats but are most common in rocky habitats from deserts to ponderosa pine forests (Findley et al. 1975). This felid is known from along the Mimbres River but not the Gila River in Grant County (Findley et al. 1975). I documented Bobcats on most camera traps, with the exception at the TNC-4NM Property. Overall, Bobcats were uncommon to common based on the number of months observed on camera traps (Table 2). Along the Gila River, I documented Bobcats at TNC-3LC in a rocky wash in mesquite scrubland only from October to February but not May to August. Upstream at the TNC-1GB in an oak, piñon-juniper woodland, I only documented Bobcats June

to November but not December to March. These data are only represented by a single site in each habitat, so further data will be needed to determine whether such observations represent an actual trend in occurrence between habitats.

Fig. A Bobcat (*Lynx rufus*) captured on a camera trap in the TNC-1GB Area in Grant County.

Fig. A heavily spotted Bobcat (*Lynx rufus*) captured on a camera trap on the NMDGF River Ranch in Grant County in a rocky wash surrounded by a desert scrubland on 21 February 2016.

Puma concolor – Mountain Lion

Mountain Lions (*Puma concolor*) are large cats with long tails and solid coloration without spots as adults. This species is known from across the western two-thirds of the state in rough county (Findley et al. 1975). Records for this species are still lacking from the Llano Estacado in the eastern plains (Choate 1997). Records of Mountain Lions are known from areas in or near the Gila and Mimbres rivers in Grant County (Findley et al. 1975). I captured images of Mountain Lions only on two of my camera traps, one in the Gila Box Area just north of where Mogollon Creek enters the Gila River and on TNC-4NM Property. This species was a regular but uncommon visitor along game trails near rocky areas in woodlands. With the number of Mule Deer (*Odocoileus hemionus*) and Collared Peccary (*Pecari tajacu*) as well as the remoteness of the NMDGF River Ranch, I expected to photograph a Mountain Lion on the ranch. [I finally detected the species on the River Ranch in May 2016.]

Fig. A Mountain Lion (*Puma concolor*) captured on a camera trap on TNC-4NM Property in Grant County in canyon bottom in an oak, piñon-juniper woodland on 1 June 2015.

Fig. A Mountain Lion (*Puma concolor*) captured on a camera trap on TNC-1GB Property along the Gila River in Grant County in a woodland.

Conepatus leuconotus – White-backed Hog-nosed Skunk

The White-backed Hog-nosed Skunk (*Conepatus leuconotus*) occurs mainly throughout the southern half of New Mexico in desert, grassland, and woodland habitats (Findley et al. 1975, Cook 1986, Geluso and Geluso 2004). This species has an all-white back and tail that is relatively short as well as an elongated snout (Findley et al. 1975). Findley et al. (1975) only report a single record from Grant County from the head of the Mimbres River. I documented the species via camera traps at three sites, including the TNC-1GB property, TNC-3LC property, and the NMDGF River Ranch property. Overall the species was uncommon to rare at those sites (Table 2). Observations in Luna County represent a new county record for the species in New Mexico.

Fig. A White-backed Hog-nosed Skunk (*Conepatus leuconotus*) captured on a camera trap on the NMDGF River Ranch property in Luna County in a riparian woodland dominated by cottonwood and ash trees.

Mephitis macroura – Hooded Skunk

Hooded Skunks (*Mephitis macrouta*) occur in mainly desert and grassland habitats only in southwestern New Mexico and closely resemble Striped Skunks (*Mephitis mephitis*). Hooded Skunks, however, have longer tails and rarely have a dorsal white stripe that divides on the back (Findely et al. 1975, Cook 1986). Specimens are known from Grant County including from the town of Gila along the Gila River and along the Mimbres River, 7 mi north of Mimbres (Findley et al. 1975). Little is known about this species in the state. This skunk species is variable in patterns having white and black on its back and tail, but unlike the Striped Skunk, the Hooded Skunk generally either has an all-white back or a black back with lateral stripes down low on the sides. Due to the photographic nature of many observations, which were not always the best angle or quality, I was conservative with designating observations to this species. The photograph below is one of two definitive observations I captured during this project. One observation was on 13 February 2016 at TNC-3LC in a wash in desert scrubland. I also documented the species on TNC-3LC property along the Gila River at night in an area dominated by large cottonwoods on 23 June 2014.

Fig. A Hooded Skunk (*Mephitis macroura*) captured on a camera trap on TNC-3LC property near the Gila River, Grant County, in desert scrubland wash above the river flood plain.

Fig. A Hooded Skunk (*Mephitis macroura*) captured on a camera trap on TNC-1GB area along the Gila River, Grant County, in mixed woodland.

Mephitis mephitis – Striped Skunk

The Striped Skunk (*Mephitis mephitis*) occurs statewide across a variety of habitats from deserts to mountain tops (Findley et al. 1975). This species has a white stripe down the back that divides into two but the pattern can be quite variable. Although the most abundant skunk species across the state and susceptible to mortality on roads, relatively few specimen records are known from the state. There are records in the vicinity of both of my study areas along the Gila and Mimbres rivers (Findley et al. 1975). Striped Skunks represent the only species documented on all camera traps throughout the study (Table 2). At some sites, observations were common but at others they were rare or uncommon (Table 2). As described by Findley et al. (1975), this species occurs across a variety of habitats in New Mexico.

Fig. A Striped Skunk (*Mephitis mephitis*) captured on a camera trap on TNC-4NM Property in Grant County in canyon bottom in an oak, piñon-juniper woodland.

Spilogale gracilis – Western Spotted Skunk

The Western Spotted Skunk (*Spilogale gracilis*) occurs mainly throughout the western two-thirds of the state in rocky habitats generally associated with deserts, grasslands, and woodlands (Findley et al. 1975, Geluso and Geluso 2004). This species of skunk is easily recognizable by its small size and many narrow white stripes throughout the entire upper and lateral areas of its body. I only documented the Western Spotted Skunk at two sites, TNC-1GB by the confluence of the Gila River and Mogollon Creek and at TNC-4NM Property in a rocky wooded canyon bottom. Photographic documentation was made in June 2015 at both sites and at the TNC-4NM Property also in November and December. This uncommonly observed species likely occurs throughout the study sites in appropriate rocky, brushy habitats.

Fig. A Western Spotted Skunk (*Spilogale gracilis*) captured on a camera trap on TNC-4NM Property in Grant County in canyon bottom in an oak, piñon-juniper woodland.

Taxidea taxa – American Badger

The American Badger is known across a range of elevations in New Mexico from deserts to alpine habitats in areas lacking trees (Findley et al. 1975). This species is most common at lower elevations in grasslands where it feeds on a variety of small mammals (Findley et al. 1975). This species is absent from wooded and forested areas. This mustelid has short legs and a diagnostic facial pattern of white and dark, with a white stripe extending from the nose back to the neck as well as a white stripe through the eye back to the ear. This species is known from eastern Grant County, but no records are reported for Luna County (Findley et al. 1975).

Although I did not document this species from June 2014 to March 2015 during the official survey period for this project, I captured photographs on a number of occasions from March-June 2016 on the NMDGF River Ranch in Grant County prior to finalizing my Final Report. Moreover, I did not document this species along the Gila River during the survey, but a long-time resident of the area has observed American Badgers near Cliff and a number of other areas in the region.

Fig. An American Badger (*Taxidea taxa*) from the NMDGF River Ranch in a wash situated in an arid scrubland dominated by honey mesquite, Grant County.

Bassariscus astutus – Ringtail

Ringtails (*Bassariscus astutus*) live in rocky habitats statewide and are most common in southern parts of New Mexico (Findley et al. 1975, Choate 1997, Geluso and Geluso 2004). Its distinctive long, ringed tail and small body with short legs are diagnostic characteristics to identify this species, as Northern Raccoons (*Procyon lotor*) have a shorter ringed tail and a black mask across the face. Ringtails are known from along the Gila River by Redrock in Grant County (Findley et al. 1975). There are no records from along the Mimbres River (Findley et al. 1975). On camera traps, I documented Ringtails at two sites, TNC-1GB Area by the confluence of the Gila River and Mogollon Creek and at TNC-4NM Property in a rocky wooded canyon bottom. Those observations were documented only in November and December 2015. I also have observed individuals walking through a cottonwood-dominated riparian forest at night along the Gila River at TNC-3LC property and TNC-4NM Property in summer.

Fig. A Ringtail (*Bassariscus astutus*) captured on a camera trap on the TNC-4NM Property in Grant County in canyon bottom in an oak, piñon-juniper woodland.

Nasua narica – White-nosed Coati

The White-nosed Coati (*Nasua narica*) originally was reported from a single location in extreme southwestern New Mexico from the Animas Mountain in Hidalgo County (Findley et al. 1975). Cook (1986) reported that the White-nosed Coati was common in the Animas Mountains, but he noted that in a prior report from the region, researchers suspected that the species was expanding its distributional range northward. Kaufmann et al. (1976) reported individuals from the Pinos Altos Range in northern parts of Grant County. Geluso (2009) reported multiple records from the Big Burro Mountains in Grant County. White-nosed Coatis, as their name suggests, can be identified by white rostrum behind the black fleshy parts of the nose, an indistinctly ringed tail, and fairly long legs compared to Northern Raccoons and Ringtails.

In my current survey, I only documented White-nosed Coatis from TNC-1GB near the confluence of the Gila River and Mogollon Creek in Grant County. At that locality, I recorded observations of *N. narica* in August 2015, October 2015, and January 2016. Local residents in the Cliff-Gila valley have observed this species in the Gila Box Area for some time as well as in other reaches of the river. On 5 August 2015, at least five individuals were recorded foraging in the late afternoon at about 5:00 pm Daylight Savings Time. On 12 August 2015, five individuals were observed foraging at 2:00 pm, on 13 August, 2015, three individuals were observed foraging at 11:00 am, on 28 October 2015, five individuals were observed at 1:00 pm, on 29 October 2015, at least nine individuals were observed at 1:00 pm (see photograph below) but the troop size easily was many more, and on 12 January 2016, one individual was observed at 4:30 pm. Based on camera trap data, this species usually moves in groups during the day in the region. I have no documentation of this species along the Mimbres River in Grant and Luna counties but suspect this species might easily occur in the area. I have heard about unconfirmed reports of the species in the Mimbres River valley.

Fig. White-nosed Coatis (*Nasua narica*) captured on a camera trap on the TNC-1GB Property along the Gila River in Grant County in a woodland.

Fig. White-nosed Coatis (*Nasua narica*) captured on a camera trap on the TNC-1GB Property along the Gila River in Grant County in a woodland. By my count there are nine different Coatis in this photograph. Can you find the all?

Procyon lotor – Northern Raccoon

Northern Raccoons (*Procyon lotor*) are common along all permanent waterways in New Mexico from deserts to montane forests (Findley et al. 1975). This species is known from Grant County by Redrock along the Gila River, but no published records exist along the Mimbres River (Findley et al. 1975). This species can be identified by a distinctly ringed tail and black mask across the face. I occasionally documented Northern Raccoons along the Gila River in camera traps, but observed diagnostic footprints in the mud along the river on many occasions. Along the Mimbres River, Northern Raccoons were abundant on the NMDGF River Ranch Property in Luna County, but both camera traps were placed within 50 m of the Mimbres River. I did not document the Northern Raccoon in a dry wash in a scrubland at the River Ranch about 170 m away from the river, but the camera was only in place from early January to mid-March 2016. I also observed footprints in mud along the Mimbres River on the TNC-5SJ Property. I cannot recall observing sign of Northern Raccoons at the TNC-4NM Property, but I suspect the species occurs on the property.

Fig. Raccoons (*Procyon lotor*) captured on a camera trap on the NMDGF River Ranch property in Luna County in a riparian woodland dominated by cottonwood and ash trees.

Ursus americanus – American Black Bear

The American Black Bear (*Ursus americanus*) is montane species in New Mexico and occurs in all mountains in the state (Findley et al. 1975). American Black Bears are known from montane areas surrounding the Gila and Mimbres rivers in Grant County (Findley et al. 1975). On camera traps, I documented American Black Bears at two sites, TNC-1GB by the confluence of the Gila River and Mogollon Creek in July and August and at TNC-4NM Property in a rocky wooded canyon near the Mimbres River, June-September. I also observed old scat of American Black Bears on TNC-4NM Property along a two-track dirt road on the eastern side of the property. I suspect use of the property by American Black Bears depends on season and food availability, as the fecal matter appeared to be dominated by juniper berries.

Fig. American Black Bear (*Ursus americanus*) scat from the TNC-4NM Property, Grant County. Scat contained juniper berries among other items.

Fig. An American Black Bear (*Ursus americanus*) captured on a camera trap on the TNC-4NM Property in Grant County in canyon bottom in an oak, piñon-juniper woodland.

Fig. American Black Bear (*Ursus americanus*) captured on a camera trap on TNC-1GB Property along the Gila River in Grant County in a woodland.

Order Artiodactyla

Ovis canadensis – Bighorn Sheep

Bighorn Sheep (*Ovis canadensis*) inhabit rugged habitats associated with scattered mountains throughout the state. In the Gila area, a more northern subspecies was introduced where populations still persist (Findley et al. 1975). I observed Bighorn Sheep on the NMDGF Double E Ranch and heard reports of them in the rugged foothills in the Gila Box Area along the Gila River.

Cervus canadensis – Wapiti

Wapiti (*Cervus canadnsis*), also formally called Elk, were greatly reduced by the early 1900s and extirpated throughout much of the state. Reintroductions have reestablished Wapiti throughout much of the mountainous areas in New Mexico (Findley et al. 1975). Findley et al. (1975) reported no specimen records from Grant County but included both study areas in Grant County within the occupied range of the species as of 1965. Wapiti are not reported from Luna County (Findley et al. 1975).

I observed Wapiti along the Gila River at TNC-3LC (October 2014) and at both major study sites along the Mimbres River, that is, the TNC-4NM Property and NMDGF River Ranch Property. I documented Wapiti via a camera trap on TNC-4NM Property in June, August, September, October, and March. At the River Ranch, I documented Wapiti in May, June, July, August, and October. Antlers in velvet were observed in May, June, and August. I would have expected more records of Wapiti along these rivers in winter rather than in summer. The observations from Luna County represent a new county for New Mexico for this species.

Fig. Wapiti (*Cervus canadensis*) observed on TNC-4NM Property (Left photograph; June 2014) and the NMDGF River Ranch (Right photograph, 3 June 2015) along the Mimbres River, in Grant and Luna counties, respectively.

Odocoileus hemionus – Mule Deer

Mule Deer (*Odocoileus hemionus*) occur statewide, except in parts of the eastern plains, and reside in all habitats across the state (Findley et al. 1975). Mule Deer are known from Grant County, but no records were reported from either of my two study areas; however, both study areas were included in areas occupied by Mule Deer in 1965 (Findley et al. 1975). Mule Deer were observed across both study areas and were recorded on all camera traps except one, that is, the camera trap located on TNC-1GB, which was in an area of dense trees and shrubs; Mule Deer were observed nearby in more open habitat. I observed Mule Deer in my study in many habitats including deserts, scrublands, weedy fields, riparian forests, and piñon-juniper oak woodlands. Small herds were most frequently observed in the evening on both river systems in open areas. Mule Deer were abundantly documented on the NMDGF River Ranch throughout the year. Antlers in velvet were documented June-September, and some males still retained antlers into March. Spotted fawns were observed August-October.

Fig. Mule Deer (*Odocoileus hemionus*) captured on a camera trap on the TNC-4NM Property in Grant County in canyon bottom in an oak, piñon-juniper woodland.

Fig. Mule Deer (*Odocoileus hemionus*) fawns captured on a camera trap on TNC-3LC Property in Grant County in a desert scrubland wash on 22 October 2015.

Odocoileus virginianus – White-tailed Deer

White-tailed Deer (*Odocoileus virginianus*) likely occur as disjunct populations mainly in southern and eastern parts of New Mexico (Findley et al. 1975, Frey 2004). In southwestern and west-central parts of the state, a separate subspecies of White-tailed Deer (*O. v. couesi*) occurs in brushy, rugged country (Cook 1986, Frey 2004). This subspecies has larger ears and smaller overall body than White-tailed Deer occurring farther east in the state. Findley et al. (1975) demonstrated that much of northern and eastern Grant County are inhabited by this species although records of occurrence are lacking from my two study areas. I only documented White-tailed Deer at two localities during my survey, both from along the Gila River. The most productive area for this species was at TNC-3LC Property where I captured camera trap observations in May, August, October, November, and March from a scrubland wash that leads into the floodplain of the Gila River within 100 m. Interestingly, I have never observed a White-tailed Deer on this property during the daytime, so their habits appear fairly secretive at this site. I also observed White-tailed Deer in the Gila Box Area by flushing individuals from wooded habitats while setting traps as well as the capture of individuals on a video camera trap placed by the other camera noted in Table 2. Antlers on males were observed in October 2015 and in February 2016.

Fig. A male White-tailed Deer (*Odocoileus virginianus*) captured on a camera trap on TNC-3LC Property in Grant County in a desert scrubland wash 18 October 2015.

Fig. White-tailed Deer (*Odocoileus virginianus*) captured on a camera trap on the private ranch in Grant County in a deciduous riparian woodland adjacent to the active channel of the Gila River (15 June 2016). Photographs demonstrate the tail of this species which is brown on the dorsal side and white on the ventral bottom side, a distinguishing feature for this species.

Pecari tajacu – Collared Peccary

The Collared Peccary (*Pecari tajacu*) formerly was known only from southwestern and southeastern New Mexico (Findley et al. 1975). More recently, the Collard Peccary has been documented in northwestern parts of the state in McKinley and Cibola counties (Albert et al. 2004) as well as in Socorro County (Frey 2004). Findley et al. (1975) showed the occupied distribution as of 1965 along the Gila River but not along the Mimbres River in Grant County. I commonly observed the Collared Peccary on both river systems in a variety of habitats, including riparian woodland, grasslands, desert scrublands, and woodlands. Thousands of photographs of this species were captured on a number of camera traps during the course of this study. I captured photographs or observed them in both the day and night throughout the study. Very small young were observed on camera traps in January, July, and September. This species always seemed to be moving in groups of individuals. According to Findley et al. (1975) observations in both Grant and Luna counties represent county records for the state.

Fig. A Collared Peccary (*Pecari tajacu*) captured on a camera trap on the TNC-1GB Property along the Gila River in Grant County in a woodland.

Fig. A Collared Peccary (*Pecari tajacu*) smiling on a camera trap on the NMDGF River Ranch property in Luna County in a riparian woodland dominated by cottonwood and ash trees.

Order Rodentia

Castor canadensis – American Beaver

The American Beaver (*Castor canadensis*) is a large, semi-aquatic rodent that occurs along large rivers to small streams as well as ditches throughout the state (Findley et al. 1975). Although once abundant throughout the state, trapping during the 1800s and early 1900s greatly reduced and eliminated beavers from many areas. According to Findley et al. (1975), populations of American Beavers were decimated in most mountains in New Mexico because of the fur trade, and reintroductions took place in the 1940s and 1950s by the New Mexico Department of Game and Fish. Subsequently, American Beavers have made a comeback throughout the state, yet few published records exist from many regions. Moreover, it is unclear in which mountains American Beavers survived in and were not extirpated. American Beavers were not reported from Grant County by Findley et al. (1975), although individuals and their sign have been known from the region for decades via specimens at Western New Mexico University. I observed sign of beavers on TNC-5SJ Property on 10 June 2014, including numerous dams on the Mimbres River (see Fig. below). I did not observe American Beavers on TNC-4NM Property and on the NMDGF River Ranch. [In May 2016, I observed fresh sign of American Beavers on the NMDGF River Ranch.] On the Gila River, I observed diagnostic sign of individuals throughout the study area. Beavers are a Species of Greatest Conservation Need in the state (NMDGF 2006). Observations here represent a county record for the species and a new river drainages for New Mexico based on Findley et al. (1975).

Fig. A dam constructed by an American Beaver (*Castor canadensis*) along the Mimbres River on the TNC-5SJ Property, Grant County, 10 June 2014.

Fig. A recent cutting by an American Beaver (*Castor canadensis*) along the Gila River at the TNC-2IB Property, Grant County, 21 March 2016.

Fig. An American Beaver (*Castor canadensis*) along the Gila River, Grant County, 22 June 2016.

Baiomys taylori – Northern Pygmy Mouse

The Northern Pygmy Mouse (*Baiomys taylori*) is one of the smallest mice in North America. This species inhabits grasslands in southwestern New Mexico in Hidalgo and Luna counties and is known from relatively few localities (Findley et al. 1975, Cook 1986, Stuart and Scott 1992). Northern Pygmy Mice have been captured frequently in association with multiple species of cotton rats in southern Hidalgo County (Cook 1986). Cook (1986) noted that 37 individuals were captured in a sacaton grassland. There are no published records of occurrence near the two study sites in Grant and Luna counties along either river system.

I captured a total of nine individuals, including captures on both river systems. I captured six individuals along the Gila River, most in a narrow strip of Johnson grass along an edge of a hayfield irrigated regularly by flood irrigation on TNC-3LC Property as well as in an area with friable soils with dense herbaceous cover at the confluence of the Gila River and Mogollon Creek. These records expand the known distribution of the Northern Pygmy Mouse 114 km to the northwest from the prior published record near Nutt, Luna County, New Mexico, and 142 km north of the prior record 13 mi S Animas, Hidalgo County (Cook 1986, Stuart and Scott 1992). My records represent a new county record suggesting that the distribution of this small mouse likely is more expansive than records currently represent in southwestern New Mexico. In Texas, the distribution of this mouse species has expanded northward and westward in recent decades likely associated with habitats created by roads (Choate 1997).

I captured individuals in areas of dense grass and herbaceous forbs on both river systems. On 15 May 2015, I captured one individual swimming across the Mimbres River while I was mist netting for bats. The surrounding habitat was sacaton grasslands. I captured pregnant females on 27 May 2015, 4 June 2015 (3 fetuses with crown-rump 17 mm), and 22 June 2014 (two individuals, one with 3 embroys with uterine swelling of 5 mm). One of the pregnant individuals on 22 June was also lactating. A male taken as a voucher on 22 June 2015 had testes that measured 6 x 4 mm.

Records of occurrence: Gila River: Grant Co., TNC-3LC; TNC-1GB. Mimbres River: Luna Co., River Ranch.

Fig. A Northern Pygmy Mouse (*Baiomys taylori*) captured in a narrow strip of Johnson grass along a hayfield in the flood plain of the Gila River at the TNC-3LC Property, Grant County, 24 June 2014.

Microtus mogollonensis – Mogollon Vole

The Mogollon Vole (*Microtus mogollonensis*) inhabits many mountain ranges throughout the state and occurs mainly in grasslands associated with ponderosa pine and mixed coniferous forests (Findley et al. 1975, Frey and LaRue 1993). In years of abundance, Findley et al. (1975) reported the species descends into piñon-juniper woodlands. The Mogollon Vole can be identified by its short tail (about 30 mm) and lighter dorsal coloration, especially in southwestern New Mexico. Although this species is not known from river reaches in my survey, the species is known at higher elevations in adjacent areas to the Gila and Mimbres river valleys in Grant County (Findley et al. 1975, Frey and LaRue 1993).

I captured a total of 16 individuals from along the Mimbres River in Grant County. Individuals were captured in grassy areas in floodplain habitats and along a spring and stream dominated by willows on the TNC-4NM Property. This species was captured in traplines with the Hispid Cotton Rat (*Sigmodon hispidus*), Tawny-bellied Cotton Rat (*Sigmodon fulviventer*), Mexican Woodrat (*Neotoma mexicana*), Western White-throated Woodrat (*Neotoma albigula*), Western Harvest Mouse (*Reithrodontomys megalotis*), Brush Deermouse (*Peromyscus boylii*), and White-footed Deermouse (*Peromyscus leucopus*). The elevation of lowest site of capture was 1,842 m, which might be one of the lowest elevations for this species in the state. Pregnant females were captured on 22 March 2016 (4 embryos with uterine swelling 13 mm) and 23 March 2016 (5 embryos with uterine swellings 8 mm). These dates of pregnancy might be the earliest known from the state. A male captured on 22 March 2016 had testes that measured 10 mm in length whereas males captured on 23 March 2016 had testes of 11, 10, 10, 10, and 9 mm in length. A male captured on 20 July 2015 had testes length of 9 mm.

Records of occurrence: Mimbres River: Grant Co., TNC-4NM Property.

Fig. A Mogollon Vole (*Microtus mogollonensis*) captured on the TNC-4NM Property in July 2015. Photograph by Kenneth N. Geluso.

Neotoma albigula – Western White-throated Woodrat

The Western White-throated Woodrat (*Neotoma albigula*) occurs throughout western New Mexico, west of the Rio Grande, in various habitats from deserts to mixed coniferous forests (Findley et al. 1975, Frey 2004). As its name implies, the throat hairs are white, even to the base. This species has been recorded from the Gila and Mimbres river valleys in Grant County (Findley et al. 1975). I observed houses built by this species as well as captured this species in about every habitat trapped during the survey on both river systems, including mesquite scrublands, cottonwood riparian forests, mesic willow habitat by a small stream, rocky scrubland, rocky slope, piñon-juniper woodlands, and sacaton grassland. I captured a total of 59 individuals, including 25 on the Gila River and 34 on the Mimbres River. The species was not captured abundantly in any single trapline, but one or a few were captured in many traplines. Lactating females were captured on 22 March, 12, 16, 19 May, and 2 June.

Records of occurrence: Gila River: Grant Co., TNC-3LC; TNC-1GB; private ranch; TNC-2IB. Mimbres River: Grant Co., TNC-4NM Property; River Ranch; Luna Co., River Ranch.

Fig. A Western White-throated Woodrat (*Neotoma albigula*) photographed in a large wooden barn on TNC-4NM Property, Grant County, on 8 June 2014. The barn was situated in a grassy, weedy field surrounded by a cottonwood-dominated, riparian woodlands and piñon-juniper woodlands.

Fig. A Western White-throated Woodrat (*Neotoma albigula*) photographed in a large wooden barn on the TNC-4NM Property, Grant County, on 8 June 2014. The barn was situated in a grassy, weedy field surrounded by a cottonwood-dominated, riparian woodlands and piñon-juniper woodlands.

Neotoma mexicana – Mexican Woodrat

The Mexican Woodrat (*Neotoma mexicana*) is most commonly associated with mixed coniferous forests, although the species is known from other habitats at lower elevations throughout the state (Findley et al. 1975). In the Animas Mountains of southern Hidalgo County, Cook (1986) observed the species restricted to the high-elevation forests and chaparral of the mountain range and have been taken as low as 1,814 m in Black Bill Canyon. Findley et al. (1975) suggests that at lower elevations, the species seeks out more mesic sites that perhaps provide a suitable cooler microclimate for the species. The Mexican Woodrat is not known from the vicinity of either river in my study areas but is known from higher-elevation sites in the Black Range and Mogollon Plateau (Findley et al. 1975). There is a reported locality 23 mi NW Lordsburg in Hidalgo County that appears close to the Gila River near the Arizona border. Personally, this locality looks a little suspicious, I would like to verify the identity of that specimen.

I captured a total of two Mexican Woodrats during this survey, both on located on TNC-4NM Property on the Mimbres River. On 19 May 2015, individuals were captured along a small stream associated with a spring in lush grass under willows. Other species of rodents captured at this site in the same habitat included the Hispid Cotton Rat (*Sigmodon hispidus*), Tawny-bellied Cotton Rat (*Sigmodon fulviventer*), Mogollon Vole (*Microtus mogollonensis*), Western White-throated Woodrat (*Neotoma albigula*), Western Harvest Mouse (*Reithrodontomys megalotis*), and White-footed Deermouse (*Peromyscus leucopus*). The elevation of this site was 1,842 m. The combination of higher elevation species such as the Mexican Woodrat and Mogollon Vole

along with more arid grassland species demonstrates the unique combination of species associated with the diverse habitats associated with this unique river system. The male kept as a voucher had testes that measured 19 x 11 mm.

Records of occurrence: Mimbres River: Grant Co., TNC-4NM Property.

Fig. A Mexican Woodrat (*Neotoma mexicana*) demonstrating the gray bases to throat hairs of an individual captured in Catron County on 30 June 2016.

Ondatra zibethicus – Common Muskrat

The Common Muskrat (*Ondatra zibethicus*) is a semi-aquatic mammal that commonly inhabits rivers, streams, and marshes (Findley et al. 1975). In New Mexico, *O. zibethicus* inhabits watercourses along the Rio Grande, Pecos, and San Juan rivers, as well as some other scattered localities throughout the state (Findley et al. 1975, Findley 1987). Few museum records of this fur bearing species exist in the state, but Findley et al. (1975) noted that this species likely is more widespread than records demonstrate. There are no published records reported in Grant and Luna counties along the Gila and Mimbres rivers to my knowledge (Findley et al. 1975).

During my current study in these river valleys, I did not observe any Common Muskrats. However during previous visits to the study area, I have observed Common Muskrats along the Gila River and nearby areas. On 22 April 2005, I observed a single Common Muskrat in a human-made pond in the flood plain of the Gila River on TNC-3LC Property. On 6 October 2005, colleagues and I observed multiple Common Muskrats in the same pond. On 27 June 2006, I watched a Common Muskrat in the Gila River in the US Forest Service Bird Area. The individual appeared to enter holes in the bank at the water level. A local resident has observed Common Muskrats at the TNC-3LC pond since the 1980s (pers. comm. S.D. MacDonald).

I also have observed Common Muskrats in the region beyond the current survey boundary demonstrating that they are more widespread than records demonstrate. For example, I have observed individuals swimming in the Glenwood Fish Hatchery on 8 June 2006 (one

individual) and 24 June 2006 (three individuals) as well as along Willow Creek in the Willow Creek Campground area in Catron County. I am unaware of any records or sighting of Common Muskrats along the Mimbres River, although I would suspect that they might occur in that drainage.

Records of occurrence: Gila River: Grant Co., TNC-3LC, Bird Area Forest Service.

Onychomys arenicola – Chihuahuan Grasshopper Mouse

The Chihuahuan Grasshopper Mouse (*Onychomys arenicola*) occurs in southern New Mexico in low-elevation deserts and scrublands (Findley et al. 1975, Frey 2004, Geluso and Geluso 2004). Substrate type can vary for this species from dusty friable soils to areas containing many rocks (Geluso and Geluso 2004). The Chihuahuan Grasshopper Mouse is not known along the Mimbres River in Grant and Luna counties, but the species is known from nearby localities in both counties (Findley et al. 1975). I captured a total of five individuals during my survey all on the NMDGF River Ranch. Individuals were captured in a mesquite scrubland with many *D. merriami* and in a sacaton grassland in Grant County. One obviously pregnant individual was captured on 3 June 2015.

Records of occurrence: Mimbres River: Grant Co., River Ranch.

Onychomys leucogaster – Northern Grasshopper Mouse

The Northern Grasshopper Mouse (*Onychomys leucogaster*) inhabits grasslands and scrublands that contain sandy or friable soils (Findley et al. 1975). This species commonly is associated with Ord's Kangaroo Rats (*Dipodomys ordii*) and sand-loving pocket mice (*Chaetodipus eremicus* and *C. penicillatus*; Findley et al. 1975, Cook 1986). The Northern Grasshopper Mouse is known from the Gila River by Redrock in Grant County but not along the Mimbres River in Grant and Luna counties (Findley et al. 1975). I captured a single individual on 4 June 2015 in an area of friable soils with scattered shrubs and herbaceous forbs in the flood plain of the Mimbres River. It was a scrotal, adult male with testes that measured 15 x 7 mm. Other species captured frequently on this trapline included Ord's Kangaroo Rats and Chihuahuan Desert Pocket Mice. I suspect that the Northern Grasshopper Mouse occurs along the Gila River in my study area in appropriate habitats. I will need to seek out such areas along the Gila, as did not set traps in what I would deem the most suitable habitat for this species.

Records of occurrence: Mimbres River: Luna Co., River Ranch.

Fig. A Northern Grasshopper Mouse (*Onychomys leucogaster*) captured in southeastern Arizona. This species has a larger body size and a relatively shorter tail than the other two species of grasshopper mice in New Mexico.

Onychomys torridus – Southern Grasshopper Mouse

The Southern Grasshopper Mouse (*Onychomys torridus*) occurs in desert habitats west of the Continental Divide and south of the Mogollon Plateau in southwestern New Mexico (Frey 2004). This species has a relatively long tail for grasshopper mice and lacks white tufts of hair at the anterior base of their ears (Frey 2007). This species is known from along the Gila River in Grant County near Redrock (Findley et al. 1975). I captured five total individuals at two sites in the flood plain near the confluence of the Gila River and Mogollon Creek. Both sites contained friable soils with one site dominated by many herbaceous forbs and the other site considered a scrubland with various species of shrubs. On 27 May 2015, I captured a juvenile male that had testes that measured 7 x 3 mm and a body weight of 10 g.

Records of occurrence: Gila River: Grant Co., TNC-1GB.

Fig. A Southern Grasshopper Mouse (*Onychomys torridus*) captured in southeastern Arizona.

Peromyscus boylii – Brush Deermouse

Nine species of *Peromyscus* occur in New Mexico (Frey 2004). The Brush Deermouse (*Peromyscus boylii*) inhabits most of the state, except the eastern plains in east-central and southeastern New Mexico (Findley et al. 1975, Choate 1997). This species dominates habitats containing oak, especially rocky slopes, and is especially abundant in canyon bottoms, on slopes, and in arroyos in New Mexico (Findley et al. 1975, Cook 1986, Choate 1997, Geluso and Geluso 2004). Cook (1986) made the observation that this species was the most commonly trapped mouse in the Animas Mountains, and only at one site was did the species occur with other *Peromyscus* species. Identification of *Peromyscus* can be challenging, but Brush Deermice generally can be distinguished from other similar species by long tails, relative to head and body length, and moderately large ears but not huge. Distinguishing Brush Deermice from Northern Rock Deermice (*Peromyscus nasutus*) usually must take into account age of mice and comparison of series of museums specimens. Most Rock Deermice occur in extremely rocky areas such as lava flows or cliffs, but not always (Findley et al. 1975). The Brush Deermouse is not known from the Gila or Mimbres river valleys in Grant and Luna counties (Findley et al. 1975).

I captured a total of 126 Brush Deermice during this survey, including 62 individuals along the Gila River and 64 individuals along the Mimbres River. This was the most commonly captured rodent during my survey, a similar result as Cook (1986) in the Animas Mountains. However, I captured this mouse in association with all other *Peromyscus*, except *P. maniculatus*, as well as in many habitats in the river valleys. The most interesting finding was their abundance in riparian forests dominated by deciduous trees such as cottonwoods in areas with no rocks. To my knowledge, occurrence of Brush Deermice in riparian habitats lacking oaks and rocks appears to represent a new habitat of occurrence for this species in New Mexico. For example, on the River Ranch, Brush Deermice occurred in the riparian habitats, that is, in sacaton under cottonwoods, ashes, box elder trees with the surrounding habitats outside the riparian forests dominated by sacaton grasslands in flood plains and mesquite scrublands once above the flood plain. Dominance of riparian forests with Brush Deermouse was observed throughout both study areas from the northernmost to southernmost parts of the flood plain. I originally predicted that the White-footed Deermouse (*Peromyscus leucopus*) would be the *Peromyscus* species occurring in cottonwood riparian forests. Other habitats with Brush Deermouse included oak, piñon-juniper woodlands, along the edges of fallow fields near junipers and deciduous trees, in the tall grass by seeps and springs, and herbaceous weedy areas. Pregnant females were captured on 13, 15, 26, and 27 May, and lactating females were captured on 26 May, 27 May, and 1 June.

Records of occurrence: Gila River: Grant Co., TNC-2IB; private ranch; TNC-1GB. Mimbres River: Grant Co., TNC-4NM; Luna Co., River Ranch.

Fig. A Brush Deermouse (*Peromyscus boylii*) captured on TNC-4NM Property in Grant County, June 2014.

Fig. Brush Deermice (*Peromyscus boylii*) captured on TNC-4NM Property in Grant County, June 2014.

Peromyscus eremicus – Cactus Deermouse

The Cactus Deermouse (*Peromyscus eremicus*) occurs throughout southern New Mexico and up into the Rio Grande valley in central parts of the state (Findley et al. 1975). This species inhabits xeric rocky foothills and desert mountain ranges (Findley et al. 1975, Cook 1986, Geluso and Geluso 2004). Cactus Deermice are known from lower reaches of the Gila River in Grant County by Redrock, but the species has not been documented along the Mimbres River in Grant and Luna counties (Findley et al. 1975).

I captured a total of 29 individuals, with 26 captures along the Gila River and three captures along the Mimbres River. Cactus Deermice were captured in rocky habitats containing shrubs from rocky slopes to rather flat areas with a rocky substrate. I only capture *P. eremicus* at the River Ranch on the Mimbres River, but suspect the species occurs farther up the valley. I have not had the chance to trap appropriate habitats yet at such locations to date. I captured two pregnant females on 13 May 2015, with one individual containing two fetuses with a crown-rump length of 30 mm.

Records of occurrence: Gila River: Grant Co., private ranch; TNC-1GB; TNC-3LC; TNC-2IB. Mimbres River: Luna Co., River Ranch.

Fig. Cactus Deermice (*Peromyscus eremicus*) captured on TNC-2IB Property, 13 May 2015.

Fig. Cactus Deermice (*Peromyscus eremicus*) captured on the TNC-2IB Property on 13 May 2015. The photograph on the left shows the short wide penis characteristic of males of this species. Other *Peromyscus* species have a much narrow, longer penis. The photograph on the right demonstrates the gray face of adults.

Peromyscus leucopus – White-footed Deermouse

The White-footed Deermouse (*Peromyscus leucopus*) occurs throughout New Mexico, except in northwestern portions of the state. The mouse species inhabits areas with friable soils at lower elevations in grasslands and deserts (Findley et al. 1975, Geluso and Geluso 2004). This species also occurs in lowland wooded habitats such as along rivers or desert springs (Findley et al. 1975, Geluso and Geluso 2004). This species previously was known from along the Gila River in Grant County by Gila and Redrock, whereas the species was not known from along the Mimbres River in Grant and Luna counties (Findley et al. 1975).

I captured a total of 119 individuals of this species, including 85 along the Gila River and 34 along the Mimbres River. I captured this species in various habitats including cottonwood riparian forests, sacaton grasslands, arid grasslands with herbaceous cover, open scrubland with areas of grasses, marshes, seeps, springs, hayed field, weedy disturbed areas, rocky slopes (rare), and mesquite scrublands. At the TNC-4NM Property, I expected to capture this species in the wooded riparian forests with much fallen trees as well in disturbed weedy areas with much herbaceous cover and friable soils. At that site, however, I only captured this species in lush habitats associated with a spring on the southern end of the property. See the list of other species captured at this spring in the account for Mexican Woodrat and Mogollon Vole, two species that I find uniquely associated with the White-footed Deermouse at this location. This species is difficult to distinguish from the North American Deermouse (*Peromyscus maniculatus*). Pregnant females were captured on 12, 15, 19, and 27 May and 2 and 9 June. The female captured on 19 May 2015 contained 3 fetuses that measured 23 mm in crown-rump length. Lactating females were observed on 15 and 31 May and 1, 9, and 22 June.

Records of occurrence: Gila River: Grant Co., TNC-3LC; TNC-1GB; private ranch; TNC-2IB; private ranch; Gila Box Area Forest Service. Mimbres River: Grant Co., TNC-4NM Property; River Ranch; Luna Co., River Ranch.

Fig. A White-footed Deermouse (*Peromyscus leucopus*) captured at the River Ranch on 16 May 2015 in Grant County on a small rocky enbankment surrounded by a sacaton grassland on one side and a mesquite scrubland on the other side.

Fig. A White-footed Deermouse (*Peromyscus leucopus*) captured at TNC-3LC along the Gila River in Grant County, 23 June 2014. The individual was from a riparian woodland dominated by cottonwoods with a friable substrate. White-footed Deermice do not have the bright ochraceous orange fur on the shoulder and along the lateral side, as do other species of *Peromyscus*, except for the North American Deermouse (*Peromyscus maniculatus*).

Peromyscus maniculatus – North American Deermouse

The North American Deermouse (*Peromyscus maniculatus*) occurs from deserts to spruce-fir forests across the state but is most common in ponderosa pine forests and habitats at higher elevations (Findley et al. 1975). This species, along with the White-footed Deermouse,

lack a bright ochraceous orange coloration in the shoulder region and on their sides, unlike the other *Peromyscus* species in the region, including the Cactus Deermouse and Brush Deermouse. Identification between *P. maniculatus* and *P. leucopus* is challenging, and out of all the species of mammals on this survey, I am least confident in distinguishing between these two species, as some of the individuals captured and recorded as *P. maniculatus* might in fact represent *P. leucopus*. Generally the North American Deermouse is a smaller mouse with a shorter tail than the White-footed Deermouse. There are records of the North American Deermouse from along the Gila River at Redrock in Grant County and there are no records for this species along the Mimbres River in Grant and Luna counties (Findley et al. 1975).

I captured a total of 19 individuals during my survey, 10 along the Gila River and 9 along the Mimbres River. I recorded North American Deermice from mesquite scrublands, arid grasslands with herbaceous forbs, weedy areas, and narrow band of riparian shrubland bordered by sacaton grassland. I captured pregnant females on 14 May (four embryos with uterine swellings that measured 5 mm in length), 2 June, 3 June, and 17 October. Lactating females were observed on 2 and 4 June 2015. Two subspecies occur in the region. At the NMDGF River Ranch, I captured individuals represented by *P. m. blandus* that are grayish in color (see Fig. below). I also captured individuals that I also called this species on the ranch that had the more typical brown coloration of more northern populations. On the Gila River, individuals only had the brown coloration of the more northern subspecies, *P. m. rufinus*. I will continue to learn to identify these two species in the area.

Records of occurrence: Gila River: Grant Co., TNC-3LC; TNC-1GB; private ranch. Mimbres River: Grant Co., River Ranch; Luna Co., River Ranch.

Fig. A North American Deermouse (*Peromyscus maniculatus blandus*) from southeastern AZ.

Reithrodontomys megalotis – Western Harvest Mouse

The ubiquitous Western Harvest Mouse (*Reithrodontomys megalotis*) inhabits almost all habitats across New Mexico, except mixed coniferous and spruce-fir forests at higher elevations in mountains (Findley et al. 1975). Geluso and Geluso (2004) documented this species to be in weedy and dense grassy habitats at Carlsbad Caverns National Park. To identify this species, this small mouse has grooved upper incisors (all *Reithrodontomys* spp.), ears are proportional to their size (that is, not greatly enlarged), and individuals have a small tuft of orange hairs at the base of their ears as well as sparse orange hairs on the inside surface of the ears. I identify this species from the Plains Harvest Mouse (*Reithrodontomys montanus*) as *R. megalotis* has a longer tail, longer hind foot, and broader dark stripe on the top of its tail. This species is known from the Gila River in Grant County but not from the Mimbres River valley (Findley et al. 1975).

In the two river systems, Western Harvest Mice were frequently captured in grassy or areas with dense herbaceous cover in my survey. Twenty individuals were captured along the Gila River and 53 individuals captured along the Mimbres River. Individuals were captured from under trees in riparian areas to arid scrublands, include seeps, springs, marshes, and ditches. This species was captured from friable to rocky substrates. Pregnant individuals were observed 12 May 2015, 8 June 2014 (8 embryos with uterine swelling 9 mm in length), and 10 June 2014. I captured a lactating female on 18 July 2015.

Records of occurrence: Gila River: Grant Co., TNC-3LC; private ranch; TNC-1GB; TNC-2IB. Mimbres River: Grant Co., TNC-4NM Property; River Ranch; Luna Co., River Ranch.

Fig. Western Harvest Mouse (*Reithrodontomys megalotis*) from a fallow field on TNC-4NM Property on 9 June 2014.

Fig. Western Harvest Mouse (*Reithrodontomys megalotis*) from a fallow field on TNC-4NM Property on 10 June 2014. Notice the small tuft of orange hair at the base of the ear that aids in identification of this species from *Peromyscus* species.

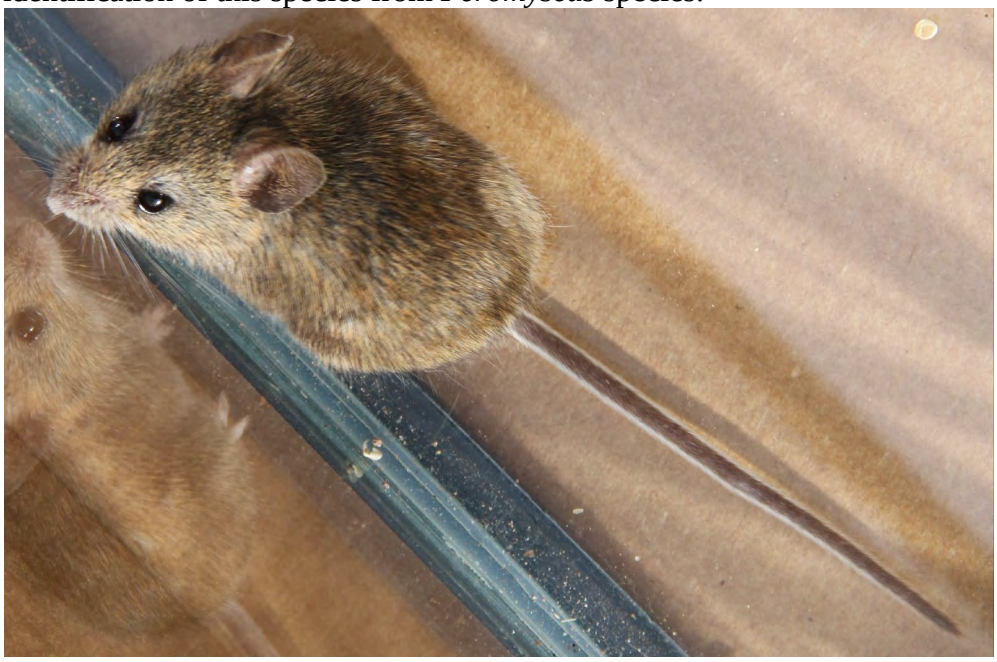

Fig. Western Harvest Mouse (*Reithrodontomys megalotis*) from TNC-3LC on 21 May 2015. This species has a longer tail, larger hind foot, and broader stripe on the dorsal side of the tail, which helps in telling this species apart from the Plains Harvest Mouse.

Reithrodontomys montanus – Plains Harvest Mouse

The Plains Harvest Mouse (*Reithrodontomys montanus*) inhabits open short- and mixed-grass prairies in New Mexico (Findley et al. 1975). The species has been captured most frequently on the eastern plains, but some records are known along the Rio Grande (Findley et al. 1975, Geluso and Geluso 2004). Only a single record is known from southwestern New Mexico in southern Hidalgo County. Overall, this species is captured less frequently than the Western Harvest Mouse (*Reithrodontomys megalotis*). Not a single record is reported from Grant or Luna counties (Findley et al. 1975). I captured only a single individual during this survey. On 14 May 2015, an adult female was captured in a grassland dominated by sacaton. Standardized measurements were the following: 125-59-15-14≡8. I suspect that with additional trapping in arid grasslands along the Gila River that this species will be documented there. Difficulty in identifying this species from the Western Harvest Mice has been mentioned (Findley et al. 1975), but a combination a features has readily assisted me in identifying these mice throughout the years. The features I use to distinguish a Plains Harvest Mouse include a narrow stripe down the dorsal side of the tail, shorter tail, short hind foot (≤ 16 mm), lighter overall coloration on the dorsum, and an often indistinct broad dark stripe down the center of the dorsum from the head to the base of the tail (see Fig. below).

Records of occurrence: Mimbres River: Grant Co., River Ranch.

Fig. A Plains Harvest Mouse (*Reithrodontomys montanus*) captured on 14 May 2015 along the Mimbres River in a sacaton grassland in Grant County. This species can be distinguish from other harvest mice by its relatively short tail, short hind foot, and narrower dorsal stripe on the top of the tail.

Sigmodon fulviventer – Tawny-bellied Cotton Rat

The Tawny-bellied Cotton Rat (*Sigmodon fulviventer*) is one of four species of cotton rats known from New Mexico (Frey 2004). Cotton rats primarily inhabit grasslands (Findley et al. 1975). The Tawny-bellied Cotton Rat is easily identifiable by its tawny- or buff-colored venter. Tawny-bellied Cotton Rats have a disjunct distribution in the state and are known from southwestern parts (Mohlhenrich 1961, Findley et al. 1975, Geluso 2009a) and central parts mainly along the Rio Grande and Rio San Jose (Mohlhenrich 1961, Findley et al. 1975, Geluso et al. 2005). In southwestern New Mexico, Mohlhenrich (1961) observed that Tawny-bellied Cotton Rats tended to occupy denser stands of grasses at slightly higher elevations than Hispid Cotton Rats (*Sigmodon hispidus*). This species previously was not known from the Gila and Mimbres river valleys in Grant County (Findley et al. 1975), but Geluso (2009) documented the species along the Gila River near the town of Gila in Grant County in 1967 and 2005.

I captured a total of 28 individuals, including seven from along the Gila River and 21 along the Mimbres River. Most individuals were associated with dense grasses but some were associated with dense herbaceous cover. At TNC-4NM Property, the species was abundant in June 2014 where I captured many individuals in a fallow field containing dense grasses and perennial and annual herbaceous plants as well as in tall grasses by a small spring. In May 2015, I captured a number of individuals along pools and small streams associated with a spring in dense grasses under willows. Captures on the Mimbres River on the TNC-4NM Property represent a modest range extension into the river valley. Along the Gila River, I captured individuals in dense grasses associated with a marsh, hayed fields, and upland arid herbaceous area. Two pregnant females were taken as vouchers. On 4 June 2015, a female contained 6 fetuses with a crown-rump length of 21 mm, and on 9 June 2014, a female contained 4 fetuses, crown-rump length was 33 mm.

Records of occurrence: Gila River: Grant Co., TNC-3LC; private ranch. Mimbres River: Grant Co., TNC-4NM Property ; Luna Co., River Ranch.

Fig. Tawny-bellied cotton rat (*Sigmodon fulviventer*) captured on TNC-4NM Property in June 2014.

Fig. Tawny-bellied Cotton Rat (*Sigmodon fulviventer*) captured on TNC-4NM Property in June 2014. This photograph demonstrates the orange coloration on the belly.

Sigmodon hispidus – Hispid Cotton Rat

The Hispid Cotton Rat (*Sigmodon hispidus*) generally occurs from southwestern parts of the state in Hidalgo County diagonally across the state to northeastern New Mexico in Union County (Findley et al. 1975). A few recent studies demonstrate this species appears to be on the move in the state moving northward, for example, into Valencia County and northern Grant County (Geluso et al. 2005, Geluso 2009a). This species is considered a grassland species but occurs in various habitats with dense grass or vegetative cover from desert scrublands and desert grasslands to a subalpine meadow in the Magdalena Mountains (Mohlhenrich 1961, Hoffmeister 1986, Dunnum et al. 2002, Geluso and Geluso 2004). Hispid Cotton Rats are known within the study areas along the Gila River (by Gila) and along the Mimbres River (by Faywood) in Grant County (Findley et al. 1975, Geluso 2009a).

During this survey, I captured a total of 39 individuals, 22 individuals along the Gila River and 17 individuals along the Mimbres River. Hispid Cotton Rats inhabited a wide range of habitats with dense vegetation. I captured the species in dense stands of alkali sacaton (*Sporobolus airoides*), marshy habitats, weedy areas with herbaceous forbs and grasses, dense grasses in cottonwood dominated riparian forested habitats, and dense grasses in desert scrublands. I captured lactating females on 15 and 21 May 2015 and a scrotal male with testes that measured 20 mm in length on 19 May 2015. Two juveniles were capture on 22 and 23 March 2016 that had body weights of 17 and 18 g, respectively.

Records of occurrence: Gila River: Grant Co., TNC-3LC; private ranch; Gila Box Forest Service. Mimbres River: Grant Co., TNC-4NM Property; River Ranch; Luna Co., River Ranch.

Fig. A Hispid Cotton Rat (*Sigmodon hispidus*) captured at TNC-3LC Property along the Gila River on 24 June 2014. Notice the white belly on this individual and the lack of a yellow nose.

Sigmodon ochrognathus – Yellow-nosed Cotton Rat

The Yellow-nosed Cotton Rat (*Sigmodon ochrognathus*) previously was only known from extreme southern Hidalgo County in southwestern New Mexico (Findley et al. 1975, Cook 1986). Yellow-nosed Cotton Rats inhabit upper grasslands to pine-oak forests mainly on rocky slopes (Findley and Jones 1960, Findley et al. 1975, Cook 1986). On 31 March 2003, I captured an adult female on the north end of the Big Burro Mountain in the US Forest Service Bird Area (Geluso 2009b). Subsequently, I captured two additional individuals, with the northernmost one captured near the confluence of Mogollon Creek and the Gila River on the TNC-1GB Property (26 June 2006), representing the new northernmost record for the species in New Mexico (Geluso 2009b).

During the current survey, I captured three individuals in the same area where I documented the species in 2006, near the confluence of Mogollon Creek and the Gila River. A lactating female and juvenile male (weight of 26 g) was captured on 18 October 2015. I do not expect to find this species in the Mimbres River valley at this time, however, I suspect the species likely has a broader distribution in the area than currently understood, possibly at higher elevations and farther north.

Records of occurrence: Gila River: Grant Co., TNC-1GB.

Fig. A Yellow-nosed Cotton Rat (*Sigmodon ochrognathus*) captured at the TNC-1GB Area in Grant County which represents that farthest known locality in the state. Individual in photograph was captured on 18 October 2015. The yellow nose on this species aids in identification from the other cotton rat species in the area. This species also has a white belly.

Erethizon dorsatum – North American Porcupine

North American Porcupines (*Erethizon dorsatum*) occur throughout New Mexico in a variety of habitats spanning from deserts to montane forests (Findley et al. 1975). They are known from Grant County but not specifically along the Gila or Mimbres rivers (Findley et al. 1975). I did not document this species along the Gila River. A long-time resident of the valley, however, remembers seeing them frequently along the river in cottonwoods in winter, one ever few miles in the 1980s. Today, the North American Porcupine is rarely observed in the valley (pers. comm. S.D. MacDonald). Along the Mimbres River, I documented a single individual on the NMDGF River Ranch Property in a desert was within a few 100 m of the Mimbres River on 7 March 2016 (see photograph below).

Records of occurrence: Mimbres River: Grant Co., River Ranch.

Fig. A North American Porcupine (*Erethizon dorsatum*) captured on a camera trap in a narrow arroyo leading down to the Mimbres River in Grant County, 7 March 2016. The surrounding habitat at this locality was a mesquite scrubland.

Thomomys bottae – Botta's Pocket Gopher

Botta's Pocket Gopher (*Thomomys bottae*) occurs across the state, except in the eastern plains (Findley et al. 1975). This small gopher inhabits deserts to mixed coniferous forests. This species is known from along the Gila and Mimbres rivers in Grant County (Findley et al. 1975). I specifically trapped for this species twice to secure voucher specimens for the survey, however this species was abundant, and I likely encountered the species on most trap lines set throughout the study along both river systems. I observed them from rocky to friable soils and from the river flood plains to the slopes adjacent to the flood plains. I detected the species by observing their characteristic mounds created when soils are thrown from burrows during tunnel construction. On two occasions, while driving the roads at night searching for mesocarnivores and large mammals, colleagues and I came across adult gophers crossing roadways. One of these events was following a large rain event on 8 June 2015. A female captured on 3 June 2015 contained three embryos with uterine swellings that measured 14 mm.

Records of occurrence: Gila River: Grant Co., private ranch. Mimbres River: Luna Co., River Ranch.

Fig. Mound of soil created by Botta's Pocket Gopher (*Thomomys bottae*) in a field on TNC-3LC in the Gila River valley on 9 January 2014.

Fig. Mounds of soil created by Botta's Pocket Gophers (*Thomomys bottae*) in a field on TNC-3LC Property, Grant County, on 25 June 2014.

Fig. A Botta's Pocket Gopher (*Thomomys bottae*) captured crossing road at night after day of large rains on 8 June 2015 in Grant County.

Fig. A Botta's Pocket Gopher (*Thomomys bottae*) captured crossing road at night after day of large rains on 8 June 2015 in Grant County. In this photograph, you can observe that the upper incisors are smooth lacking groves which is characteristic to identify all species of *Thomomys* from other genera of gophers in the state.

Chaetodipus baileyi – Bailey's Pocket Mouse

Bailey's Pocket Mouse (*Chaetodipus baileyi*) previously was known from only four localities along the western edge of Hidalgo County bordering Arizona, three in xeric shrubby hillsides in canyons and one at the San Simon Cienaga (Findley et al. 1975, Hayward et al. 1997). Geluso (2009) reported individuals in the US Forest Service Bird Area in the Big Burro Mountains in Grant County. Those individuals were captured in areas of dense, large mesquite and catclaw acacia (*Acacia greggii*) on slopes adjacent to the Gila River flood plain. Those captures represent the northernmost records in New Mexico. During this current survey, I did not trap habitats where this large pocket mouse likely occurs at more northerly locations, such as at TNC-2IB property.

Records of occurrence: Gila River: Grant Co., Gila Bird Area (Geluso 2009).

Fig. A Bailey's Pocket Mouse (*Chaetodipus baileyi*) from southeastern Arizona. This is a large pocket mouse with a penicillate/tufted tail and large hindfoot.

Chaetodipus eremicus – Chihuahuan Desert Pocket Mouse

The Chihuahuan Desert Pocket Mouse (*Chaetodipus eremicus*) occurs in extreme southern New Mexico in deserts east of the Continental Divide (Findley et al. 1975). This species once was considered a subspecies of the Desert Pocket Mouse (*Chaetodipus penicillatus*) that generally inhabits deserts west of the Continental Divide. The Chihuahuan Desert Pocket Mouse generally inhabits fine, friable substrates but occasionally occurs on coarser soils (Findley et al. 1975, Geluso and Geluso 2015). This is a smaller pocket mouse, compared to Bailey's Pocket Mouse, with a penicillate tail and lacking spines on the rump. This species was not known from along the Mimbres River, except near Deming in Luna County (Findley et al. 1975). I captured 25 individuals on the NMDGF River Ranch in mesquite scrublands and sacaton grasslands. At one site along a low rocky shelf, individuals were captured on coarser soils. No reproductive activities were observed on females captured during my survey. In 2016, I trapped for this species on a number of occasions in traplines where the species was abundant in 2015. I failed to captured the species in 2016 to secure a photograph.

Records of occurrence: Mimbres River: Grant Co., River Ranch; Luna Co., River Ranch.

Chaetodipus hispidus – Hispid Pocket Mouse

The Hispid Pocket Mouse (*Chaetodipus hispidus*) is known from scattered localities throughout the New Mexico, except in northwest and west central parts of the state (Findley et al. 1975, Choate 1997). This species generally inhabits dense grassy habitats at low elevations and is most common in eastern parts of the state (Findley et al. 1975, Choate 1997, Geluso and Geluso 2004). This pocket mouse is rather large, lacks a penicillate tail, and has orange hairs interspersed throughout its dorsum. This species is known from the study area along the Gila River, but no records are known along the Mimbres River (Findley et al. 1975). I captured a single juvenile Hispid Pocket Mouse during my survey. It was captured on 12 May 2015 in a desert scrubland comprised of widely scattered mesquite and patches of dense grasses and herbaceous forbs on TNC-3LC Property. I expect this species along the Mimbres River on the NMDGF River Ranch.

Records of occurrence: Gila River: Grant Co., TNC-3LC.

Fig. A Hispid Pocket Mouse (*Chaetodipus hispidus*) captured in a desert scrubland on 12 May 2015 at TNC-3LC Property along the Gila River.

Chaetodipus intermedius – Rock Pocket Mouse

The Rock Pocket Mouse (*Chaetodipus intermedius*) occurs in rocky habitats only in southwestern New Mexico and into central parts of the state along Rio Grande valley (Findley et al. 1975). This species is known from along the Gila River by Redrock in Grant County, but no records are known from along the Mimbres River in Grant and Luna counties. This species is fairly easy to identify, as the species usually has elongated guard hairs on the rump that resemble spines (see Fig. below), but juveniles lack such spines. I captured a total of 36 individuals with 34 captures along the Gila River and two captures along the Mimbres River. To no surprise all individuals were captured in rocky habitats, from the bottom of large slopes and small rocky ledges to relatively flat arroyo bottoms. I observed a pregnant female on 27 May 2015 and lactating females on 13, 27, and 31 May and 9 June. The species likely occurs farther up the Mimbres River valley on slopes, but I was not able to trap for the species in those habitats during this survey.

Records of occurrence: Gila River: Grant Co., private ranch; TNC-1GB; TNC-2IB. Mimbres River: Luna Co., River Ranch.

Fig. A Rock Pocket Mouse (*Chaetodipus intermedius*) captured on TNC-2IB Property on a rocky slope, 13 May 2015. This species is distinguished from other pocket mice in the area by having conspicuous long guard hair protruding from the rump as shown in this photograph.

Fig. Left photograph demonstrates the long coarse guard hairs on the rump of the Rock Pocket Mouse (*Chaetodipus intermedius*) whereas the Right photograph demonstrates the external, fur-lined check pouches that are diagnostic of the families Heteromyidae (kangaroo rats, pocket mice, and kangaroo mice) and Geomyidae (gophers). These individuals were capture on 13 May 2015 on TNC-2IB Property in the Gila River valley.

Dipodomys merriami – Merriam's Kangaroo Rat

Merriam's Kangaroo Rat (*Dipodomys merriami*) occurs throughout southern New Mexico, with its distribution extending northward into the Rio Grande and Pecos river valleys (Findley et al. 1975). This small kangaroo rat species, with four toes on hind feet, resides in desert and grassland habitats from fine to coarse soils (Findley et al. 1975). Originally, Findley et al. (1975) reported this species only along the lower reaches of the Gila River by Redrock in Grant County, but more recently, I described the species from a xeric slope above the flood plain in the Bird Area of the Big Burro Mountains and nearby localities (Geluso 2009). Along the Mimbres River, there are no records of occurrence in Grant and Luna counties (Findley et al. 1975).

I captured 80 Merriam's Kangaroo Rats throughout the course of this survey, with six individuals captured at one site along the Gila River and 74 individuals at a number of sites on the NMDGF River Ranch Property and adjacent areas. This species was commonly captured in mesquite scrublands on the River Ranch, where in 2015 populations were extremely great. I also captured this species on a low-lying rocky slope with lot of grass and in sacaton grasslands on the River Ranch. Along the Gila River, I capture six individuals on the private ranch in an arid grassland with many herbaceous forbs. Captures on the private ranch represent the northernmost record for this species along the Gila River and extend the known distribution 13.6 km northeast from the closest previously published record 5 mi S Cliff (Geluso 2009).

Records of occurrence: Gila River: Grant Co., private ranch. Mimbres River: Grant Co., BLM next to River Ranch; River Ranch; Luna Co., River Ranch.

Fig. Merriam's Kangaroo Rats (*Dipodomys merriami*) captured along the Mimbres River on the NMDGF River Ranch Property in Grant County, 16 May 2015 (Top photograph) and along Gila River on the private ranch in Grant County, 1 June 2015 (Bottom photograph). The lower photograph demonstrates the lack of the small fifth toe on the inside part of the hind foot.

Dipodomys ordii – Ord's Kangaroo Rat

Ord's Kangaroo Rat (*Dipodomys ordii*) is a common desert and grassland species that inhabits low-elevation sites containing loose, friable soils across New Mexico (Findley et al. 1975, Cook 1986, Choate 1997). This species is distinguished from Merriam's Kangaroo Rat (*Dipodomys merriami*), the other small kangaroo rat in the state, by having five toes on each hind foot (see Fig.). Ord's Kangaroo Rat previously was known from both the Gila and Mimbres rivers in the study area in Grant County. I captured 59 total individuals, 41 from the Gila River valley and 18 from the Mimbres River valley. In the Mimbres valley, Ord's Kangaroo Rats only were captured on friable soils, including in stands of sacaton. In the Gila valley, I captured this species mainly on friable soils but also in areas with coarser soils, likely because of the general absence of many *D. merriami*. Pregnant females were captured on 31 May and 2 June 2015 whereas lactating females were captured on 27 May, 31 May, and 4 June 2015. Pregnancy and lactation have been reported every month except December in New Mexico (Findley et al. 1975).

Records of occurrence: Gila River: Grant Co., TNC-1GB; TNC-3LC; private ranch. Mimbres River: Grant Co., River Ranch; Luna Co., River Ranch.

Fig. An Ord's Kangaroo Rat (*Dipodomys ordii*) captured on the private ranch, Grant County, New Mexico on 13 May 2016. You can actually see the fifth toe in this photograph.

Fig. A male Ord's Kangaroo Rat (*Dipodomys ordii*) captured on the private ranch along the Gila River in Grant County, 1 June 2015. This photograph demonstrates the fifth toes on the hind feet that help to identify this species of kangaroo rat from the other two species in the state.

Dipodomys spectabilis – Banner-tailed Kangaroo Rat

The Banner-tailed Kangaroo Rat (*Dipodomys spectabilis*) is a large kangaroo rat species bearing a diagnostic white-tipped tail that occurs over much of the state in deserts and grasslands with clay or coarse soils (Findley et al. 1975, Choate 1997). The species is absent from the northeastern parts of New Mexico (Findley et al. 1975). This species builds large mounds which are occupied by a single adult and used by many other vertebrates and invertebrates (Best 1988a). Banner-tailed kangaroo rats are known from south of my study area on the Gila River by Redrock, but the species is not known along the Mimbres River (Findley et al. 1975).

I captured a total of nine *D. spectabilis* during the course of this project on or adjacent to the NMDGF River Ranch at two localities in Grant County. However, I also observed the conspicuous mounds of this species at a number of sites on the Luna County side of the River Ranch. In 2015, there were many active mounds on the River Ranch in the mesquite scrubland where eight of the nine individuals were documented. In March 2016, I could not find a single active mound of an individual in the same area. Just to the west of the River Ranch on the adjacent BLM property, large expanses of grazed areas contained numerous active mounds of this species in March 2016. On the Gila River, I have never observed the conspicuous mounds constructed by this species in the study reach of the river or in surrounding areas. It is unclear if a geographic barrier is limiting the species to reach this far north, as desert grasslands to the north of the Gila River seem like potential habitat. Cold temperatures likely are not a factor in inhabiting the region, as the species is abundant in the Plains of San Agustin in Catron County to

the north and east of my study site (Frey and Burt 2001). I will continue to examine whether this species occurs in or around the Gila River in Grant County, as the species might be in the region, as it is known just to the south (Findley et al. 1975).

Records of occurrence: Mimbres River: Grant Co., River Ranch; BLM next to River Ranch.

Fig. A Banner-tailed Kangaroo Rat (*Dipodomys spectabilis*) from Carlsbad Caverns National Park. The large size and white-tipped tail distinguish this species from the two other smaller species of kangaroo rats that occur in New Mexico.

Fig. An active mound of a Banner-tailed Kangaroo Rat (*Dipodomys spectabilis*) from the BLM property adjacent and west of the NMDGF River Ranch Property along the Mimbres River in Grant County, 22 March 2016. Kenneth N. Geluso is standing next to the mound to demonstrate how large these mounds can be on landscape.

Perognathus flavus – Silky Pocket Mouse

Silky Pocket Mice (*Perognathus flavus*) are statewide in distribution inhabiting grasslands, deserts, and piñon-juniper woodlands on friable soils (Findley et al. 1975, Frey 2004). This small pocket mouse generally has a large, light-colored fur patch above ears compared to similar species (see Fig. below). Silky Pocket Mice are known from extreme southern Grant County, but none are known from the Gila and Mimbres river valleys.

I captured a total of 26 individuals, including two from the Gila River flood plain at a single locality and 24 along the Mimbres River at a number of sites. Most individuals were captured on sandy substrates in mesquite scrublands, sacaton grasslands, and areas dominated by herbaceous forbs. On two occasions, I captured a Silky Pocket Mouse on a rocky slope. One of these sites was on a grassy slope with scattered junipers on TNC-4NM Property where I also captured a number of Brush Deermice (*Peromyscus boylii*). The other site was located on the River Ranch on a slope containing lots of gramma grass and a few shrubs. On this trapline, I also captured Western White-throated Woodrats (*Neotoma albigula*), Merriam's Kangaroo Rat (*Dipodomys merriami*), and Rock Pocket Mice (*Chaetodipus intermedius*). At Carlsbad Caverns National Park, Geluso and Geluso (2004) documented a few individuals up on the rocky reef portion of the park. I captured a pregnant female on 27 May 2015 and lactating females on 10 June 2014. Males kept as vouchers had testes that measured 7 x 5 mm on 15 May 2015 and 7 x 4 mm on 27 May 2015.

Records of occurrence: Gila River: Grant Co., TNC-1GB Property. Mimbres River: Grant Co., TNC-4NM Property; River Ranch; Luna Co., River Ranch.

Fig. Silky Pocket Mouse (*Perognathus flavus*) from TNC-4NM Property trapped in a flat area with friable soils that contained herbaceous forbs and grasses, 10 June 2014. One distinguishing feature of this species is the large auricular patch of light fur by the ear.

Mus musculus – House Mouse

The House Mouse (*Mus musculus*) is an introduced species that occurs throughout the state usually at lower elevations (< 2,134 m; 7,000 ft) especially in arid grasslands and deserts (Miller and Doll 1967, Findley et al. 1975, Findley 1987, Frey 2004). This species commonly is associated with human dwellings or habitats associated with agricultural practices. House Mice are known from the Gila River by Redrock in Grant County, but no records are known from the Mimbres River in Grant or Luna counties. I captured a single House Mouse at the private ranch in an arid grassland with many herbaceous forbs on 9 June 2015. Although the individual was not directly captured near any human-made structures, such buildings were about 100 m away. I would expect to capture House Mice in the Mimbres River valley if I set traps near human developments such as near San Lorenzo or other small communities in the valley.

Records of occurrence: Gila River: Grant Co., private ranch.

Fig. A House Mouse (*Mus musculus*) captured in an arid grassland with herbaceous forbs above the flood plain of the Gila River in Grant County, 9 June 2015. House Mice can be distinguished from native mice by their long, sparsely haired tails with scales, lack of grooved upper incisors, and relatively uniform coloring for most individuals on their back and belly.

Fig. A House Mouse (*Mus musculus*) captured in an arid grassland with herbaceous forbs above the flood plain of the Gila River in Grant County, 9 June 2015.

Otospermophilus variegatus – Rock Squirrel

The Rock Squirrel (*Otospermophilus variegatus*) occurs in rocky habitats throughout New Mexico across a wide elevational gradient (Findley et al. 1975). These large squirrels resemble tree squirrels due to their large bushy tails and affinity to climb trees, but this species can be distinguished by the mottled pattern on their backs. Rock Squirrels are known from habitats on both the Gila and Mimbres rivers in Grant County (Findley et al. 1975). I observed Rock Squirrels in both river systems at many sites. If I did not directly see individuals, I commonly heard their loud calls while walking through areas. As others have observed in the state, I detected this species commonly in rocky habitats, but occasionally I would detect them in the cottonwood riparian habitats with lots of fallen trees and no rocks. Some photographs were captured on camera traps throughout this survey. I have either observed or detected via camera traps Rock Squirrels in March, May, June, July, September, October, November, and December in the study area. Preliminary data from camera traps suggest Rock Squirrels might not be active during some winter months (January and February). Further data will help to delineate seasonality of this species, as many of my camera traps did not record large numbers of squirrels even during warms months.

Records of occurrence: Gila River: Grant Co., Gila Box Forest Service; TNC-1GB Property; TNC-3LC; private ranch; TNC-2IB; Gila Bird Area Forest Service. Mimbres River: Luna Co., River Ranch.

Fig. A Rock Squirrel (*Otospermophilus variegatus*) captured on a camera trap at TNC-3LC Property by the research station along the Gila River, 12 May 2015.

Sciurus arizonensis – Arizona Gray Squirrel

The Arizona Gray Squirrel (*Sciurus arizonensis*) is an endemic tree squirrel of Arizona, New Mexico, and Sonora, where it occurs in mid-elevation riparian habitats (Frey et al. 2008). Prior to Frey et al. (2008), Arizona Gray Squirrels only were known from Catron County in New Mexico from the San Francisco River drainage (Findley et al. 1975). Frey et al. (2008), however, recently concluded that the distribution of this secretive, uncommon species likely has been more widespread than previously reported in the state. This tree squirrel is now known from the Gila, Mimbres, and parts of the Rio Grande drainages in southwestern parts of the state. This species is lacks ear tufts, unlike the Abert's Squirrel (*Sciurus aberti*), and the Arizona Gray Squirrel is uniform gray across the dorsum, unlike the Rock Squirrel (*Otospermophilus variegatus*) which has a variegated pattern of white and gray from which it can easily be confused. Confusion, in part, also easily can arise because Rock Squirrels often are observed in trees. The Arizona Gray Squirrel is considered a Species of Greatest Conservation Need in the state (NMDGF 2006).

I observed Arizona Gray Squirrels throughout the study area on the Gila River and on all three properties sampled along the Mimbres River. Squirrels were common in both river drainages in cottonwood riparian habitats as well as walnut, oak, piñon-juniper habitats along the

edge of the river flood plains. Observations from the NMDGF River Ranch in Luna County represent the farthest south this species has been observed in the Mimbres Valley as well as the farthest south this species has been documented in New Mexico. The closest previous record in the Mimbres Valley was from TNC-4NM Property (Frey et al. 2008). My records of the species on the River Ranch extends its distribution 36 km southeast along the Mimbres River. Based on images from Google Earth, I predict that the distribution of this species only continues another 5-6 km south from the River Ranch on the Mimbres River. Frey et al. (2008) predicted that the distribution of the species is more widespread in New Mexico than currently understood, hence why, in part, surveys such as this are important to conduct. Via three camera traps with observations of this species, I noticed a trend in seasonality of squirrels on the ground. At the TNC-4NM Property in the canyon bottom in an oak, piñon-juniper woodland, Arizona Gray Squirrels were observed September-February, with no observation May-August and March. At the NMDGF River Ranch, a camera within the riparian forest recorded this squirrel November, January, and February. At the TNC-1GB Area, squirrels were observed on the camera trap November and January, with no observations June-August, October, December, February, and March. I am interested to learn more about these squirrels in the years to come to better understand their natural history.

Records of occurrence: Gila River: Grant Co., Gila Box Forest Service; TNC-1GB Property; TNC-3LC; Gila Bird Area Forest Service. Mimbres River: Grant Co., TNC-4NM Property, TNC-5SJ Property. Luna Co., River Ranch.

Fig. Arizona Gray Squirrels (*Sciurus arizonensis*) from TNC-3LC along the Gila River, Grant County, 10 January 2014.

Fig. Arizona Gray Squirrels (*Sciurus arizonensis*) from TNC-3LC along the Gila River, Grant County, 21 May 2015. The squirrel is carrying a walnut in its mouth.

Tamias dorsalis – Cliff Chipmunk

The Cliff Chipmunk (*Tamias dorsalis*) is one of five chipmunks inhabiting New Mexico and occurs throughout southwestern parts of the state (Findley et al. 1975). Habitat associations for this species depend on whether other chipmunks co-occur on mountains. If no other species of chipmunk inhabits a mountain range, Cliff Chipmunks inhabit up to mixed coniferous and spruce forests. If another species is present, however, Cliff Chipmunks generally occur at lower elevations in ponderosa pine forests and piñon-juniper woodlands (Findley et al. 1975). In Grant County, Cliff Chipmunks are expected to reside at lower-elevation habitats due to presence of Gray-collared Chipmunks (*Tamias cinereicollis*). Cliff Chipmunks are easily identified by their single dark pronounced stripe running down the center of their back. This single, black-colored stripe is bordered by gray and sometimes faint lateral stripes are present. Cliff Chipmunks are known from near the Mimbres River valley from multiple localities and is known from near the Gila River in Grant County (Findley et al. 1975).

I only captured or observed Cliff Chipmunks in piñon-juniper, oak associations along the slopes and small canyons adjacent to the floodplain along the Mimbres River on TNC-4NM Property. Mary Harner, on this same property, observed a chipmunk in the cottonwood, alder woodlands along the Mimbres River flood plain, which likely also was this species. I did not trap much in this habitat but captured a total of three individuals. I did capture a number of photographs of this species via camera traps in this same vicinity. Further field efforts will delineate the types of habitats where this species inhabits on the TNC properties and in the Mimbres River valley. Due to the close proximity of the TNC-4NM Property to ponderosa pine forests, the Gray-collared Chipmunk might also exist in the vicinity; however, Gray-collared Chipmunks can easily be recognized by many prominent stripes on their back compared to Cliff

Chipmunks. Along the Gila River, I did not capture any Cliff Chipmunks in traps but did capture photographs on a camera trap in the TNC-1GB Property in piñon-juniper, oak associations along the edge of the Gila River flood plain. Based on camera trap observations, this species was observed during the months of October-January. I find it interesting that I did not document this species during the warmer months on the camera traps.

Records of occurrence: Gila River: Grant Co., TNC-1GB Property. Mimbres River: Grant Co., TNC-4NM Property.

Fig. Cliff Chipmunk (*Tamias dorsalis*) captured in piñon-juniper, oak associations on TNC-4NM Property, Grant County, on 11 June 2014.

Fig. Cliff Chipmunk (*Tamias dorsalis*) photographed in southeastern Arizona June 2016. This is the only species of chipmunk in New Mexico that only has a single prominent stripe on its dorsum.

Xerospermophilus spilosoma – Spotted Ground Squirrel

The Spotted Ground Squirrel (*Xerospermophilus spilosoma*) occurs in arid grasslands and deserts throughout the state, especially in sandy substrates (Findley et al. 1975, Cook 1986, Choate 1997, Dalquest et al. 1990). Many authors report that this secretive species is more abundant than some surveys document (Choate 1997, Dalquest et al. 1990). This small squirrel has not been reported from along the Gila River but is known from Faywood along the Mimbres River in Grant County (Findley et al. 1975). I captured a single individual in a clump mesquite with considerable grasses nearby on the NMDGF River Ranch in Grant County on 22 March 2016. While a colleague and I were checking Sherman live traps in the early morning, we observed an individual run to a clump of small mesquites. We set traps immediately but did not catch the individual until around noon. The burrow entrance measured 3.8 cm in height and 6.4 cm in width. Others have reported the affinity for the species to place burrows near the base of brushy vegetation, as we observed in this study (Choate 1997, Geluso and Geluso 2004). I suspect with more time that I will detect the species in appropriate habitats along the Gila River. A long-time resident of the Cliff-Gila valley reported that he occasionally has observed this squirrel along Arena Road, along Duck Creek, a tributary of the Gila River. The areas is a mixture of small agricultural fields, some abandoned and a scrubland with friable soils. The female capture in this study was not reproductively active.

Records of occurrence: Mimbres River: Grant Co., River Ranch.

Fig. A Spotted Ground Squirrel (*Xerospermophilus spilosoma*) from Carlsbad Caverns National Park. This squirrel is easily identifiable by short, non-bushy tail and spots covering its dorsum, although some individuals have less discernable spots. Photograph taken by Kenneth N. Geluso.

Conclusions

This report summarizes my survey of mammals along two reaches of the Gila and Mimbres rivers in southwestern New Mexico with active, broad flood plains. Although my total number of days in the area was rather limited, about 6 weeks of field work, I am amazed at the total diversity of mammals that I documented. In the end, including observations from the five camera traps deployed for a year, I recorded 76 total species in the area. I have further determined that another three species are present and two more are certainly are probable in the area (Table 3). Thus, 79 species are known already using these rivers and adjacent areas. I find the great diversity of mammals observed in this survey, in part, reflects the diversity of habitats created and maintained by these river systems with natural flow regimes in such a small physical area of the state.

Frey (2004) reported on 164 total native species of mammals from the entire state of New Mexico, thus about 48% (78/164) of the total diversity of mammals in the state reside in these two narrow threads of area along these rivers. I eventually want to calculate the total area of my study areas; this will further highlight the importance of these active rivers for maintaining habitats for mammals and other organisms.

The region is rich in mammalian diversity as Frey et al. (2010) reported that 107 native species of mammals occur or have occurred in the upper Gila River watershed, which includes parts of Arizona and New Mexico and extends from the upper reaches of the watershed down to the confluence of the San Francisco River with the Gila River. Frey's study included a large area of land in the region across a wide elevational gradient, as well as a number of life zones not represented in my survey area (Frey et al. 2010). Those life zones ranged from subalpine conifer forests to Sonoran desert scrublands. Thus, the upper Gila River watershed, according to Frey et al. (2010), spans in elevation from Mount Baldy at 3,476 m (11,404 ft) to 1,008 m (3,306 ft) at the confluence of the San Francisco and Gila rivers for an elevational range of 2,468 m (8,098 ft). My study spanned from 1,860 m (6,100 ft) to 1,319 m (4,330 ft) for an elevational range of only 540 m (1,770 ft). My limited elevational range spanned many fewer biotic communities, from desert scrublands and semiarid grasslands to piñon-juniper woodlands. So if I calculate the number of mammalian species within my limited elevation and span of biotic communities compared to the number that I could have potentially detected throughout the entire watershed, this will give us an indication of the overall importance the Gila and Mimbres river ecosystems for mammals. Although Frey et al. (2010) reported 107 native species, this included 7 extirpated species that have not been reintroduced, effectively reducing the total number of extant species to 100 species. My 75 native species detected, plus the literature occurrences of Kit Fox, Long-tailed Weasel, and Pronghorn (Table 3), yields a total of 78 native species. This represents 78% of all the mammals known from the region, a truly amazing array and diversity of species in a limited area along these two rivers. Frey et al. (2010) determined the upper Gila River watershed represents one of two hotspots of mammalian diversity in North America outside the tropics. Needless to say, these active flood plains along these rivers support likely the highest diversity of mammals in anywhere in North America outside the tropics, and we should continue to protect the Gila River and Mimbres River and their natural flow regimes for all the species, including humans, that depend on them.

Table 3. A list of present and potential mammals that were not observed during my survey along parts of the Gila and Mimbres rivers with active, broad flood plains in New Mexico. A designation of "Present" represents a species with prior documentation that I have did not observe but is known from published accounts or local residents, "Probable" represents a species that likely occurs in the area along the flood plain, and "Possible" is a species that might occur in the survey area. These designations likely will change with additional knowledge of habitat types in the area, additional surveys, and communication with other long-time residents of the region. As of now these are my best hypotheses for species occurrences based on my experiences with mammals in New Mexico and surrounding states.

Common Name	Scientific Name	Likelihood of Occurrence
1. Mexican Long-nosed Bat	*Leptonycteris nivalis*	Possible
2. Allen's Big-eared Bat	*Idionycteris phyllotis*	Probable
3. Western Yellow Bat	*Lasiurus xanthinus*	Possible
4. Kit Fox	*Vulpes macrotis*	Present (Findley et al. 1975)
5. Long-tailed Weasel	*Mustela frenata*	Present (in litt., local resident)
6. Pronghorn	*Antilocapra americana*	Present (in litt., local resident)
7. Southern Plains Woodrat	*Neotoma micropus*	Probable
8. Piñon deermouse	*Peromyscus truei*	Possible
9. Desert Pocket Mouse	*Chaetodipus penicillatus*	Possible
10. Harris's Antelope Squirrel	*Ammospermophilus harrisii*	Possible

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Appendix. Photographs of habitats surveyed for mammals. GPS coordinates were determined via Google Earth and many are close to actual trapping sites.

Fig. Riparian habitat along the Mimbres River on the TNC-4NM Property east and a bit south of the large wooden barn. This is just downstream of the netting site on 8 June 2014 and adjacent to the riparian trapline on 10 June 2014. Mammals observed near this site included the Silver-haired Bat (*Lasionycteris noctivagans*), Hoary Bat (*Lasiurus cinereus*), Ringtail (*Bassariscus astutus*), and Arizona Gray Squirrel (*Sciurus arizonensis*).

Fig. Netting site for bats on the Mimbres River where a small two-track road fords the river near the Christian Camp on TNC-4NM Property, 10 June 2014. Mammals captured or observed at this site included the Silver-haired Bat (*Lasionycteris noctivagans*), Evening Bat (*Nycticeis humeralis*), Western Red Bat (*Lasiurus blossevillii*), Hoary Bat (*Lasiurus cinereus*), California Myotis (*Myotis californicus*), Southwestern Little Brown Myotis (*Myotis occultus*), Brazilian Free-tailed Bat (*Tadarida brasiliensis*), and Mule Deer (*Odocoileus hemionus*).

Fig. Old field on the east side of the Mimbres River on TNC-4NM Property. Mammals captured or observed in this habitat included the Western Harvest Mouse (*Reithrodontomys megalotis*), Tawny-bellied Cotton Rat (*Sigmodon fulviventer*), Botta's Pocket Gopher (*Thomomys bottae*), Silky Pocket Mouse (*Perognathus flavus*), and Mule Deer (*Odocoileus hemionus*).

Fig. Grassy seep trapped on TNC-4NM Property. Mammals captured in this habitat included the Brush Deermouse (*Peromyscus boylii*), Western Harvest Mouse (*Reithrodontomys megalotis*), and Tawny-bellied Cotton Rat (*Sigmodon fulviventer*).

Fig. Juniper, oak slope trapped on east side of TNC-4NM Property on 9 June 2014. Mammals captured or observed in this habitat included the Silky Pocket Mouse (*Perognathus flavus*), Brush Deermouse (*Peromyscus boylii*), and Western White-throated Woodrat (*Neotoma albigula*).

Fig. Riparian woodland dominated by cottonwoods along the east side of the Mimbres River east and a bit south of the large wooden barn on TNC-4NM Property. Mammals observed or captured in this habitat included the Ringtail (*Bassariscus astutus*), Brush Deermouse (*Peromyscus boylii*), Western White-throated Woodrat (*Neotoma albigula*), and Arizona Gray Squirrel (*Sciurus arizonensis*).

Fig. Piñon juniper, oak flats between old field and slopes on the eastern side of the Mimbres River on TNC-4NM Property. Mammals captured or observed in this habitat included American Black Bear (*Ursus americanus*), Cliff Chipmunk (*Tamias dorsalis*), Arizona Gray Squirrel (*Sciurus arizonensis*), and Brush Deermouse (*Peromyscus boylii*).

Fig. Sacoton grasslands with scattered cottonwoods on the NMDGF River Ranch on the Grant/Luna county line. Mammals captured in this habitat included Chihuahuan Grasshopper Mouse (*Onychomys arenicola*), White-footed Deermouse (*Peromyscus leucopus*), Western White-throated Woodrat (*Neotoma albigula*), Plains Harvest Mouse (*Reithrodontomys montanus*), Western Harvest Mouse (*Reithrodontomys megalotis*), Hispid Cotton Rat (*Sigmodon hispidus*), Chihuahuan Desert Pocket Mouse (*Chaetodipus eremicus*), Merriam's Kangaroo Rat (*Dipodomys merriami*), Ord's Kangaroo Rat (*Dipodomys ordii*), and Silky Pocket Mouse (*Perognathus flavus*).

Fig. Short rocky slope habitat just above the sacaton grasslands on the NMDGF River Ranch on the Grant/Luna county line. Mammals captured in this habitat included Cactus Mouse (*Peromyscus eremicus*), White-footed Deermouse (*Peromyscus leucopus*), Western White-throated Woodrat (*Neotoma albigula*), Western Harvest Mouse (*Reithrodontomys megalotis*), Chihuahuan Desert Pocket Mouse (*Chaetodipus eremicus*), and Merriam's Kangaroo Rat (*Dipodomys merriami*).

Fig. Deciduous riparian habitat consisting of cottonwoods, willow, and *Baccharis* spp. bordering the Mimbres River on the NMDGF River Ranch on the Luna County. Mammals captured in this habitat included White-footed Deermouse (*Peromyscus leucopus*), Western White-throated Woodrat (*Neotoma albigula*), and Western Harvest Mouse (*Reithrodontomys megalotis*). At least 14 species of bats drink water from the Mimbres River in areas such as this on the property (Table 4).

Fig. Deciduous riparian habitat consisting of cottonwoods, boxelder, mulberry, velvet ash, and walnut trees as well as sacaton near the Mimbres River on the NMDGF River Ranch on the Luna County. Mammals captured in this habitat included Brush Deermouse (*Peromyscus boylii*), White-footed Deermouse (*Peromyscus leucopus*), Western White-throated Woodrat (*Neotoma albigula*), Western Harvest Mouse (*Reithrodontomys megalotis*), and Hispid Cotton Rat (*Sigmodon hispidus*).

Fig. Arid rocky slope on east side of NMDGF River Ranch, Luna County. Mammals captured in this habitat included Cactus Mouse (*Peromyscus eremicus*), White-footed Deermouse (*Peromyscus leucopus*), Western White-throated Woodrat (*Neotoma albigula*), and Rock Pocket Mouse (*Chaetodipus intermedius*).

Fig. Arid scrubland on the private ranch above the flood plain of the Gila River in May 2016, Grant County. Mammals captured and observed in this habitat at this site included Black-tailed Jackrabbit (*Lepus californicus*), Desert Cottontail (*Sylvilagus audubonii*), Cactus Mouse (*Peromyscus eremicus*), White-footed Deermouse (*Peromyscus leucopus*), North American Deermouse (*Peromyscus maniculatus*), Western White-throated Woodrat (*Neotoma albigula*), Western Harvest Mouse (*Reithrodontomys megalotis*), Hispid Cotton Rat (*Sigmodon hispidus*), Rock Pocket Mouse (*Chaetodipus intermedius*), Ord's Kangaroo Rat (*Dipodomys ordii*), Merriam's Kangaroo Rat (*Dipodomys merriami*), and House Mouse (*Mus musculus*).

Table 4. List of mammalian species observed on the New Mexico Department of Game and Fish River Ranch Property in Grant and Luna counties, in southwestern New Mexico.

Common Name	Scientific Name	River Ranch
1. Black-tailed Jackrabbit	*Lepus californicus*	Yes
2. Desert Cottontail	*Sylvilagus audubonii*	Yes
3. Crawford's Desert Shrew	*Notiosorex crawfordi*	Yes
4. Big Free-tailed Bat	*Nyctinomops macrotis*	Yes
5. Brazilian Free-tailed Bat	*Tadarida brasiliensis*	Yes
6. Pallid Bat	*Antrozous pallidus*	Yes
7. Big Brown Bat	*Eptesicus fuscus*	Yes
8. Western Red Bat	*Lasiurus blossevillii*	Yes
9. Hoary Bat	*Lasiurus cinereus*	Yes
10. Silver-haired Bat	*Lasionycteris noctivagans*	Yes[1]
11. Southwestern Myotis	*Myotis auriculus*	Yes
12. California Myotis	*Myotis californicus*	Yes
13.Western Small-footed Myotis	*Myotis ciliolabrum*	Yes
14. Southwestern Little Brown Myotis	*Myotis occultus*	Yes
15. Long-eared Myotis	*Myotis evotis*	Yes[1]
16. Fringed Myotis	*Myotis thysanodes*	Yes
17. Yuma Myotis	*Myotis yumanensis*	Yes
18. American Parastrelle	*Parastrellus hesperus*	Yes
19. Coyote	*Canis latrans*	Yes
20. Bobcat	*Lynx rufus*	Yes
21. Mountain Lion	*Puma concolor*	Yes[1]
22. White-backed Hog-nosed Skunk	*Conepatus leuconotus*	Yes
23. Striped Skunk	*Mephitis mephitis*	Yes
24. American Badger	*Taxidea taxa*	Yes[1]
25. Northern Raccoon	*Procyon lotor*	Yes
26. American Black Bear	*Ursus americanus*	Yes[1]
27. Wapiti	*Cervus canadensis*	Yes
28. Mule Deer	*Odocoileus hemionus*	Yes
29. Collared Peccary	*Pecari tajacu*	Yes
30. Northern Pygmy Mouse	*Baiomys taylori*	Yes
31. Western White-throated Woodrat	*Neotoma albigula*	Yes
32. Chihuahuan Grasshopper Mouse	*Onychomys arenicola*	Yes
33. Northern Grasshopper Mouse	*Onychomys leucogaster*	Yes
34. Brush Deermouse	*Peromyscus boylii*	Yes
35. Cactus Deermouse	*Peromyscus eremicus*	Yes
36. White-footed Deermouse	*Peromyscus leucopus*	Yes
37. North American Deermouse	*Peromyscus maniculatus*	Yes
38. Western Harvest Mouse	*Reithrodontomys megalotis*	Yes
39. Plains Harvest Mouse	*Reithrodontomys montanus*	Yes
40. Tawny-bellied Cotton Rat	*Sigmodon fulviventer*	Yes
41. Hispid Cotton Rat	*Sigmodon hispidus*	Yes
42. North American Porcupine	*Erethizon dorsatum*	Yes

43. Botta's Pocket Gopher	*Thomomys bottae*	Yes
44. Chihuahuan Desert Pocket Mouse	*Chaetodipus eremicus*	Yes
45. Rock Pocket Mouse	*Chaetodipus intermedius*	Yes
46. Merriam's Kangaroo Rat	*Dipodomys merriami*	Yes
47. Ord's Kangaroo Rat	*Dipodomys ordii*	Yes
48. Banner-tailed Kangaroo Rat	*Dipodomys spectabilis*	Yes
49. Silky Pocket Mouse	*Perognathus flavus*	Yes
50. Rock Squirrel	*Otospermophilus variegatus*	Yes
51. Arizona Gray Squirrel	*Sciurus arizonensis*	Yes
52. Spotted Ground Squirrel	*Xerospermophilus spilosoma*	Yes

[1]Observed from April-July 2016.

Table 5. List of mammalian species observed on the New Mexico Department of Game and Fish Double E Property in Grant County, New Mexico. I only netted bats a couple of times on this property as access was limited to one area on the north side of the property, restricting access most habitats across the property. I made the decision to focus efforts on the NMDGF River Ranch due to the diversity of roads, access, and habitats on that property. To fully survey the Double E Property, ATVs or horseback would be required. Some mammals documented below represent observations by trail cameras that I had placed out as well as some provided by those with prior access to the property.

Common Name	Scientific Name	Double E Ranch
1. Black-tailed Jackrabbit	*Lepus californicus*	Yes
2. Brazilian Free-tailed Bat	*Tadarida brasiliensis*	Yes
3. Pallid Bat	*Antrozous pallidus*	Yes
4. Big Brown Bat	*Eptesicus fuscus*	Yes
5. Hoary Bat	*Lasiurus cinereus*	Yes
6. Southwestern Myotis	*Myotis auriculus*	Yes
7. California Myotis	*Myotis californicus*	Yes
8. Southwestern Little Brown Myotis	*Myotis occultus*	Yes
9. Yuma Myotis	*Myotis yumanensis*	Yes
10. Coyote	*Canis latrans*	Yes
11. Common Gray Fox	*Urocyon cinereoargenteus*	Yes
12. Striped Skunk	*Mephitis mephitis*	Yes
13. Northern Raccoon	*Procyon lotor*	Yes
14. American Black Bear	*Ursus americanus*	Yes
15. Bighorn Sheep	*Ovis canadensis*	Yes
16. Mule Deer	*Odocoileus hemionus*	Yes
17. White-tailed Deer	*Odocoileus virginianus*	Yes
18. Collared Peccary	*Pecari tajacu*	Yes
19. Rock Squirrel	*Otospermophilus variegatus*	Yes

Table 6. List of mammalian species observed on The Nature Conservency properties along the Gila and Mimbres rivers. The objective of the main survey was to document species of mammals throughout the two regions, not to document as many species as possible on each property. Thus, many more species occur on each property than listed below. Species listed below represent those I observed from June 2014 to March 2016, unless otherwise noted.

Common Name	TNC-4NM	TNC-5SJ	TNC-1GB	TNC-3LC	TNC-2IB
1. Black-tailed Jackrabbit			Yes		
2. Desert Cottontail	Yes		Yes	Yes	
3. Big Free-tailed Bat		Yes			
4. Brazilian Free-tailed Bat	Yes	Yes		Yes	Yes
5. Townsend's Big-eared Bat	Yes				
6. Big Brown Bat	Yes				
7. Spotted Bat				Yes[1]	
8. Silver-haired Bat	Yes			Yes	
9. Western Red Bat	Yes				
10. Hoary Bat	Yes	Yes		Yes	Yes
11. California Myotis	Yes				
12.Western Small-footed Myotis	Yes				
13. Southwestern Little Brown Myotis	Yes	Yes		Yes	Yes
14. Fringed Myotis	Yes				
15. Cave Myotis					Yes
16. Long-legged Myotis	Yes				
17. Yuma Myotis	Yes			Yes	Yes
18. Evening Bat	Yes				
19. American Parastrelle		Yes		Yes	
20. Coyote	Yes			Yes	
21. Common Gray Fox	Yes		Yes	Yes	
22. Bobcat			Yes	Yes	
23. Mountain Lion	Yes		Yes		
24. White-backed Hog-nosed Skunk			Yes	Yes	
25. Hooded Skunk			Yes[2]	Yes	
26. Striped Skunk	Yes	Yes	Yes	Yes	
27. Western Spotted Skunk	Yes		Yes		
28. Ringtail	Yes		Yes	Yes	
29. White-nosed Coati			Yes		
30. Northern Raccoon		Yes	Yes	Yes	
31. American Black Bear	Yes		Yes		
32. Wapiti	Yes			Yes	
33. Mule Deer	Yes		Yes	Yes	
34. White-tailed Deer			Yes	Yes	
35. Collared Peccary	Yes		Yes	Yes	
36. American Beaver		Yes	Yes	Yes	Yes
37. Northern Pygmy Mouse			Yes	Yes	
38. Mogollon Vole	Yes				

39. Western White-throated Woodrat	Yes		Yes	Yes	Yes
40. Mexican Woodrat	Yes				
41. Common Muskrat				Yes[3]	
42. Southern Grasshopper Mouse			Yes		
43. Brush Deermouse	Yes		Yes		Yes
44. Cactus Deermouse			Yes	Yes	Yes
45. White-footed Deermouse	Yes		Yes	Yes	Yes
46. North American Deermouse			Yes	Yes	
47. Western Harvest Mouse	Yes		Yes	Yes	Yes
48. Tawny-bellied Cotton Rat	Yes			Yes	
49. Hispid Cotton Rat	Yes			Yes	
50. Yellow-nosed Cotton Rat			Yes		
51. Botta's Pocket Gopher	Yes	Yes	Yes	Yes	Yes
52. Hispid Pocket Mouse				Yes	
53. Rock Pocket Mouse			Yes		Yes
54. Ord's Kangaroo Rat			Yes	Yes	
55. Silky Pocket Mouse	Yes		Yes		
56. Rock Squirrel	Yes		Yes	Yes	
57. Arizona Gray Squirrel	Yes	Yes	Yes	Yes	
58. Cliff Chipmunk	Yes		Yes		

[1]Audible call only
[2]Documented April-July 2016
[3]Prior trip to locality species was observed

Table 7. List of mammalian species observed on private ranch along the Gila River, Grant County. Many more species occur on this property than listed below. Species listed below represent those I observed from May 2015 to July 2016. I netted for bats for the first time on this ranch on May and June 2016, so this Table will not match up with species accounts above for where species were observed.

Common Name	Scientific Name	Private Ranch
1. Black-tailed Jackrabbit	*Lepus californicus*	Yes
2. Desert Cottontail	*Sylvilagus audubonii*	Yes
3. Big Free-tailed Bat	*Nyctinomops macrotis*	Yes[1]
5. Brazilian Free-tailed Bat	*Tadarida brasiliensis*	Yes
6. Long-nosed Bat	*Leptonycteris spp.*	Yes[2]
7. Pallid Bat	*Antrozous pallidus*	Yes
8. Big Brown Bat	*Eptesicus fuscus*	Yes
9. Spotted Bat	*Euderma maculatum*	Yes[1]
10. Silver-haired Bat	*Lasionycteris noctivagans*	Yes
11. Hoary Bat	*Lasiurus cinereus*	Yes
12. Southwestern Little Brown Myotis	*Myotis occultus*	Yes
13. Long-legged Myotis	*Myotis volans*	Yes
14. Yuma Myotis	*Myotis yumanensis*	Yes
16. Coyote	*Canis latrans*	Yes
17. Common Gray Fox	*Urocyon cinereoargenteus*	Yes
18. Striped Skunk	*Mephitis mephitis*	Yes
19. Ringtail	*Bassariscus astutus*	Yes
20. Northern Raccoon	*Procyon lotor*	Yes
21. Mule Deer	*Odocoileus hemionus*	Yes
22. White-tailed Deer	*Odocoileus virginianus*	Yes
23. Collared Peccary	*Pecari tajacu*	Yes
24. American Beaver	*Castor canadensis*	Yes
25. Western White-throated Woodrat	*Neotoma albigula*	Yes
26. Brush Deermouse	*Peromyscus boylii*	Yes
27. Cactus Deermouse	*Peromyscus eremicus*	Yes
28. White-footed Deermouse	*Peromyscus leucopus*	Yes
29. North American Deermouse	*Peromyscus maniculatus*	Yes
30. Western Harvest Mouse	*Reithrodontomys megalotis*	Yes
31. Tawny-bellied Cotton Rat	*Sigmodon fulviventer*	Yes
32. Hispid Cotton Rat	*Sigmodon hispidus*	Yes
33. Botta's Pocket Gopher	*Thomomys bottae*	Yes
34. Rock Pocket Mouse	*Chaetodipus intermedius*	Yes
35. Merriam's Kangaroo Rat	*Dipodomys merriami*	Yes
36. Ord's Kangaroo Rat	*Dipodomys ordii*	Yes
37. House Mouse	*Mus musculus*	Yes
38. Rock Squirrel	*Otospermophilus variegatus*	Yes
39. Arizona Gray Squirrel	*Sciurus arizonensis*	Yes

[1]Detected via audible calls heard at night.

[2]Reported that hummingbird feeders were drained at night in late summer/early autumn by bats by ranch owners.

Chapter 2

Westward Expansion of the Evening Bat (*Nycticeius humeralis*) in the United States with Notes on the First Record from New Mexico

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Abstract

The Great Plains once served as a buffer creating a division between many eastern and western woodland species. However, expansion of riparian corridors along prairie waterways has facilitated an assortment of eastern deciduous mammals in expanding their distributional range westward. Following the first capture of an evening bat (*Nycticeius humeralis*) in New Mexico in May 2015, we inquired about an expanding range for this eastern bat species in the United States. We searched for publications and museum vouchers for this species west of its entire western distributional range since it was last published in 1981. We observed a westward expansion of the evening bats along most of its western distributional limits in the United States, expanding to western parts of the central Great Plains. Our findings should encourage researchers to factor in the possible occurrence of this and other eastern bat species beyond published western limits during mist netting and acoustic surveys to reduce the likelihood of misidentification. Movement of eastern bat species along riparian corridors in the Great Plains might become an avenue for transmission of the fungus, *Pseudogymnoascus destructans*, associated with white-nose syndrome into western cave systems that would result in unprecedented impacts to western bat communities.

Introduction

Many mammals inhabiting eastern deciduous forests have expanded their distributional ranges in response to changes throughout central parts of North America (Benedict et al. 1996). The Great Plains once served as a buffer dividing eastern and western woodland species, but anthropogenic influences in prairies have led to a widespread increase in trees. For example, Johnson (1994) demonstrated dramatic increases and expansion in riparian forests along prairie waterways in the last century due in part to implementation of dams for flood control, fewer ice jams, and fire suppression. Moreover, European settlement of the plains led to the intentional planting of trees, shelter belts, and woodlands in towns and farmsteads (Hunt 1965, Johnson 1994, Benedict et al. 1996). Such changes have allowed some eastern woodland mammals to expand westward into previously undocumented areas across the Great Plains (e.g., Choate and Reed 1986, Wilson and Choate 1996, Benedict et al. 2000, Geluso 2004).

Bats can respond rapidly to habitat changes driven by various environmental factors due to their volant capabilities (Scheel et al. 1996, Kurta et al. 2007). Climate change and increasing temperatures, for example, have permitted latitudinal range shifts into previously uninhabitable locations for species, and projections indicate that these shifts should continue as the climate warms (Humphries et al. 2002, LaVal 2004, Rebelo et al. 2010). Availability of suitable habitat is another necessary requirement for the presence of a species. Because bats require suitable

roosts to protect against environmental conditions and predation as well as to provide females a place to nurture their young (Altringham 2011), lack of appropriate habitat can be a limiting factor for many species. For tree-roosting bats, presence of forested habitat typically correlates with their existence in an area (Fenton 1990). As riparian corridors across the Great Plains become increasingly forested, these tree roosting species are afforded the opportunity to expand into novel localities. Understanding historic and current geographic ranges of species is important as distributions are not static and continue to shift due to human alterations to ecosystems (Parris et al. 2005, Kurta et al. 2007).

Some eastern deciduous bat species appear to have expanded their geographic distribution into and across the Great Plains now that requisite habitat exists (Benedict et al. 1996, Geluso et al. 2005, Phelps et al. 2008). One such species, the American perimyotis (*Perimyotis subflavus*, formerly *Pipistrellus subflavus*) previously had a distribution limited only to eastern portions of North America (Hall 1981). However, Geluso et al. (2005) updated the range of the species which now occurs throughout the central and southern plains states. There are records now occurring from western South Dakota, eastern Wyoming, eastern Colorado, eastern New Mexico, and western Texas, constituting a substantial range expansion for the species. Additional records of *P. subflavus* have been published since 2005, which supplement the Geluso et al. (2005) records in the newly expanded area (White et al. 2006, Armstrong et al. 2006, Valdez et al. 2009, Riedle and Matlack 2013). The Seminole bat (*Lasiurus seminolus*), another eastern forest-dwelling species, also has been documented farther west than previously known in the southeastern United States (Brant and Dowler 2000). These examples indicate that given proper habitat, bat species will continue to expand ranges outside of previously known limits.

The evening bat (*Nycticeius humeralis*) inhabits deciduous woodlands and ranges across most of the eastern United States, extending north into Michigan, south into Mexico, and previously, as far west as central Kansas (Jones 1964, Watkins 1972, Hall 1981, Watkins and Shump 1981). Females migrate north in summer to give birth to and raise young, while limited captures of males indicate they remain in southern reaches of their range year round (Jones 1967, Watkins 1969). This species commonly roosts in buildings and trees (Watkins 1972, Boyles and Robbins 2006), and based on the historical western extent of its range, a lack of trees across the Great Plains likely limited its colonization of the region (Altringham 2011).

In this study, we amassed recent distributional records of *N. humeralis* across the Great Plains since Hall (1981) to update the western distributional limits for the evening bat. Furthermore, we report on the first capture of this species in New Mexico, which further expands its distribution westward beyond the Great Plains. We also discuss potential routes for the individual to reach southwestern New Mexico and implications associated with westward expansion of this and other eastern deciduous bat species across the Great Plains.

Methods

Our literature review consisted of seeking out publications and museum records of *N. humeralis* representing localities outside of the historic range described in Hall (1981). We last accessed VertNet (vertnet.org) on 2 March 2016 and examined the electronic database for records from areas west of the species' historic range from 92 reporting museums. In addition, we contacted curators and collection managers from museums near the edge of or beyond the historic range of *N. humeralis* (e.g., from western or central Oklahoma and Texas as well as eastern New Mexico) that were not linked with VertNet and lacked accessible online databases.

Those museums included Central Oklahoma University (COU), Midwestern State University (MWSU), and Eastern New Mexico University (ENMU). Distributional records only were included if the entire county was located outside of the historic distribution described in Hall (1981).

Impetus for this project began with a field component of our research and capture of an evening bat in southwestern New Mexico. The field site was located on the Mimbres River, Grant County, New Mexico, approximately 1.2 km north of Bear Canyon Reservoir. We surveyed bats at three different areas along a 0.7 km stretch of the river at this site. Upland habitats surrounding the riparian area consisted of piñon-juniper woodlands, but dominant trees adjacent to this small endorheic river consisted of cottonwood (*Populus sp.*), Goodding's willow (*Salix goodingii*), Arizona black walnut (*Juglans major*), box elder (*Acer negundo*) and juniper (*Juniperus sp.*).

We deployed mist nets (Avinet Inc., Dryden, New York) on seven nights in 2014 and 2015 (8 and 9 June 2014; 18 and 29 May, 3 June, and 17 and 19 July 2015). We stretched from one to three nets ranging in size from 6 to 18 m across the river in areas of calm water or sections where tree canopy forced bats into tight corridors above the river. Each net was set just above the water, and nets were not stacked atop one another. We monitored nets continually during the evenings. Nets were opened on average for 3.7 h per night and typically closed subjectively as bat activity declined. The one night that nets were left open for more than 4 h, only four bats were captured in the extra 2 h that these nets remained open. All individuals captured were identified to species, and we recorded the gender, age, reproductive status, forearm length, and weight of all individuals. Ossification of phalanges was used to determine age (Anthony 1988), but due to the location and time of year, all bats captured in this study were adults. Female reproductive status was determined by examining for the presence or absence of fetuses by gentle palpation. Lactation was noted if milk could be expressed. Most individuals were released at the site of capture, but a few were taken as voucher specimens and deposited in the mammalian collection at the Museum of Southwestern Biology (MSB), University of New Mexico, Albuquerque, New Mexico.

Results

Literature Review.—Our review of the literature and museums yielded a total of 24 county records west of the historic distributional range of *N. humeralis* (Hall 1981) from the following states: South Dakota (1), Nebraska (5), Kansas (1), Oklahoma (2), Texas (15) (Fig. 1, Table 1). These records included one state record (South Dakota: Lane et al. 2003) and one record in western Kansas which was located only 2 km from Colorado (Phelps et al. 2008). Following an extensive literature review and compilation of specimens from the Texas Department of State Health Services, Ammerman et al. (2012) was able to accumulate a large number of records of *N. humeralis* in the state both inside and outside of its historic range. Since that publication, only one new county record has been identified in western parts of the state (Randall Co.: Riedle and Matlack 2013). Two new counties in Texas (Bailey and Yoakum Co.) with records of *N. humeralis* were adjacent to New Mexico (Ammerman et al. 2012).

Field Work.—On 18 May 2015, we captured an adult male, non-reproductive evening bat at 2045 Mountain Daylight Standard Time, representing a state record for New Mexico. The individual had a weight of 8.5 g and its external measurements were as follows: total length, 101 mm; length of tail, 40 mm; length of hind foot, 7 mm; length of ear, 14 mm; length of forearm, 38 mm; testes, 4 X 2 mm. Skull measurements were as follows: greatest length of skull, 14.2

mm; breadth across canines, 4.9 mm; interorbital breadth, 4.0 mm; zygomatic breadth, 9.9 mm; cranial breadth, 7.2 mm; length of maxillary toothrow, 5.4 mm; width across molars, 6.6 mm. The dental formula for the bat was I 1/3, C 1/1, Pm 1/2, M 3/3 × 2=30. Davis (1944) described the pelage coloration of the Mexican subspecies, *N. h. mexicanus*, as lighter than the eastern subspecies, *N. h. humeralis*. Coloration of the individual was indistinguishable from museum specimens from Nebraska suggesting that this individual is from an eastern subspecies population. The individual was kept as a voucher specimen and deposited in the Museum of Southwestern Biology (MSB #291773 and tissues were also preserved NK #257417). In the three nets deployed that night, we captured 26 individuals representing 7 species, including the evening bat (Table 2). Nets were open from 2000 h to midnight.

Along the 0.7 km stretch of the Mimbres River in 2014 and 2015, we captured a total of 101 bats representing 12 species in 2014 and 2015 (Table 2). Foliage roosting bats comprised 70% of captures (n = 71), including the silver-haired bat (*Lasionycteris noctivagans*), western red bat (*Lasiurus blossevillii*), and hoary bat (*Lasiurus cinereus*). Five species of *Myotis* represented another 23% of captures (n = 23). While males represented the majority of individuals captured (63%), the only significantly skewed sex ratio was observed with silver-haired bats.

Discussion

Our capture of an evening bat in New Mexico represents the first individual reported in the state, as well as the farthest western occurrence of the species in North America (475 km west of Presidio County, Texas; Dowler et al. 1999). The route the individual used to reach southwestern New Mexico is unclear. The capture of a male matches previous data that males typically remain in southern reaches in summer (Jones 1967, Watkins 1969). Schmidly and Jones (2001) speculated that the Rio Grande has been a route for *N. humeralis* to travel westward into Mexico, as individuals are known from Coahuila, Mexico. The riparian corridor of the Rio Grande, with its many deciduous trees, leads into southern New Mexico and was possibly part of the route for this male to reach the Mimbres River. Records of the evening bat from western Texas could mean that the individual traversed eastern New Mexico to reach the Mimbres River. Other individuals might be residing in deciduous habitats along the Rio Grande in southern New Mexico. Additional research is warranted to determine the status of this species in New Mexico.

The capture of a single individual in southwestern New Mexico is best referred to as an extra-limital record at this time until more individuals are captured in the area. Documentation of many *N. humeralis* beyond the former western and northern edges of their range in the Great Plains states, however, indicates not all captures are extra-limital, and there is evidence for a westward expansion across the Great Plains (Fig. 1). A number of sites within the newly expanded distribution yielded multiple captures, flying young, and reproducing females (Dowler et al. 1999, Sparks and Choate 2000, Lane et al. 2003, Geluso et al. 2008, Serbousek and Geluso 2009, Johnson and Geluso in preparation). While there is the possibility that the species has always occurred in these recently documented localities and limited sampling efforts permitted the species to exist unnoticed in the area (Phelps et al. 2008), these individuals were all captured along waterways containing deciduous trees. Since the establishment of forested habitat along waterways and in residential areas continues throughout the Great Plains, we suspect that this species will continue to expand its distribution and increase in abundance throughout the region in appropriate habitats. We find the need for bat surveys in eastern Colorado and eastern New

Mexico to further corroborate our predictions and better define the current distributional limits of the evening bats in North America.

In light of recent distributional changes for some eastern bat species, it is important for researchers to be aware of the possibility of encountering such eastern species in western parts of North America, even though they are along the edge or beyond distributional limits. Ruling out species based purely on historical distribution may lead to improper identification in hand and via acoustic software. We cannot contradict the possibility that *N. humeralis* actually has been captured or detected in New Mexico previously, but been misidentified. To properly identify *N. humeralis*, it is important to note that it has a smaller forearm (<40 mm) than the big brown bat, *Eptesicus fuscus*, and a short, blunt tragus that differentiates it from all myotis species that have a long, pointed tragus. We encourage that researchers know the characteristics of this and other eastern bat species and retain voucher materials to positively confirm and publish on species occurrences beyond distributional limits. Yates (1985) states that voucher specimens represent vital, non-renewable resources which serve to physically and permanently document the occurrence and identity of a species. Thus, voucher specimens make historical comparison possible (Yates 1985). In addition, we recommend that individuals with questionable identifications should be kept as voucher specimens for later identification via genetic confirmation or examination of skull characteristics.

Technological advancements in recent years have led to surveys of bats via recording and discrimination of acoustical echolocation calls (e.g., Lemen et al. 2015, Russo and Voigt 2016). Some acoustics programs base their identification software on regional libraries. While reducing the possible number of species aids in proper identification of calls based on the species likely to be observed in an area, recent studies on range expansions indicate that ruling out some species based on distribution alone will likely lead to misidentification of echolocation call sequences. Allowing users of automated software programs to select particular species, rather than a broad region, would alleviate such issues as long as researchers are aware of which species should be included for their region.

Perhaps the most significant impact associated with the western expansion of eastern species is the potential for continued westward spread of white-nose syndrome (WNS) caused by the fungus *Pseudogymnoascus destructans*. Following significant declines of some bat populations in the eastern United States from WNS, the possibility exists that the fungus would be stopped by the natural barrier created by the Great Plains. Now that eastern species have bridged the gap connecting the east to the west, especially those species known to roost in WNS-positive caves, such as *N. humeralis* and American perimyotis, infected bats might carry the fungus with them into unaffected areas. This new threat poses serious risk to western populations of hibernating bat species in North America. Further investigations will be needed to not only monitor this novel route for WNS transmission, but to understand the impact that WNS may have on western bat species.

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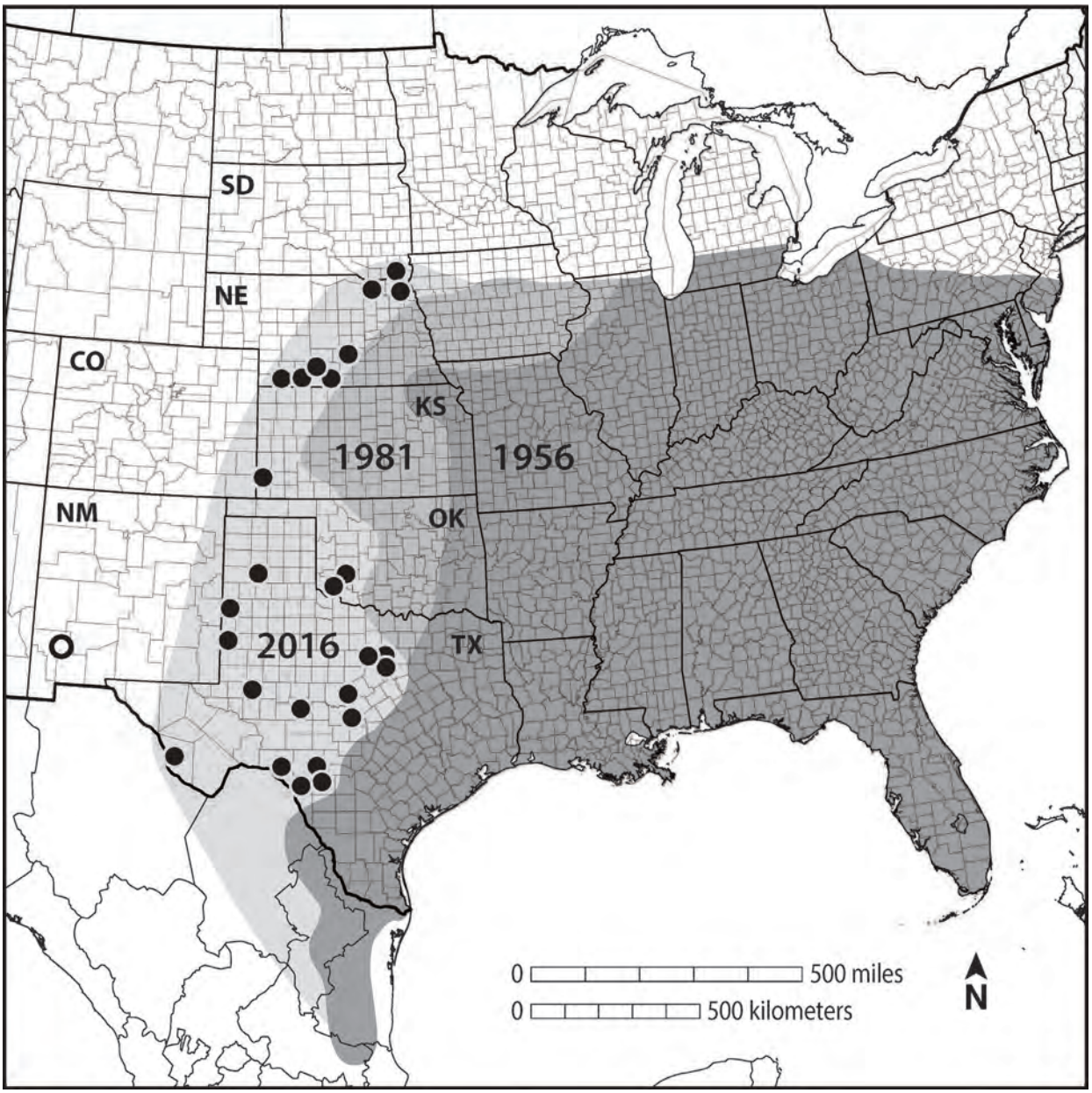

Figure 1. Distributional map of the evening bat (*N. humeralis*) representing the historical ranges plotted by Hall and Kelson (1956) and Hall (1981) as well as the updated range including all county records identified since Hall (1981: black dots, this study). The open circle in New Mexico represents the first record of *N. humeralis* in the state captured in May 2015. Due to the substantial distance from the New Mexico record to other localities of occurrence, we did not included it in the proposed distributional expansion as of 2016. Thus, at this time, we consider the New Mexico record to be an extra-limital record until more individuals are captured in the area.

Table 1. Records for evening bats (*Nycticeius humeralis*) outside of the previously published distributional limits in Hall (1981). Year represents the first year the species was documented in the county.

State	County	Year	Museum	Reference
Kansas	Stanton	2007	FHSM	Phelps et al. 2008
Nebraska	Buffalo	2013	UNSM	Johnson and Geluso in prep
Nebraska	Furnas	2004	UNSM	Johnson and Geluso in prep
Nebraska	Harlan	2006	MSB	Geluso et al. 2008
Nebraska	Hitchcock	2007	UNSM	Serbousek and Geluso 2009
Nebraska	Kearney	2013	UNSM	Johnson and Geluso in prep
Nebraska	Red Willow	2007	UNSM	Serbousek and Geluso 2009
New Mexico	Grant	2015	MSB	This Study
Oklahoma	Jackson	1978	UCO	N/A
Oklahoma	Kiowa	2007	OU	N/A
South Dakota	Clay	2000	None**	Lane et al. 2003
Texas	Bailey*	N/A	None	Ammerman et al. 2012
Texas	Brown	2002	ASNHC	Ammerman et al. 2012
Texas	Hood	2009	TTU	Demere et al. 2012
Texas	Kinney	1986	TTU	Manning et al. 1987
Texas	Midland*	N/A	None	Ammerman et al. 2012
Texas	Palo Pinto	1971	MWSU	N/A
Texas	Parker	2005	ASNHC	Ammerman et al. 2012
Texas	Presidio	1996	ASNHC	Dowler et al. 1999
Texas	Randall	2006	TTU	Riedle and Matlack 2013
Texas	Real	1986	TTU	Davis and Schmidly 1994
Texas	San Saba	1976	TCWC	Wilkins et al. 1979
Texas	Tom Green	1992	ASNHC	Dowler et al. 1992
Texas	Uvalde	1972	TCWC	Ammerman et al. 2012
Texas	Val Verde	1998	ASNHC	Dowler et al. 1999
Texas	Yoakum*	N/A	None	Ammerman et al. 2012

*Specimens collected by the Texas Department of State Health Services reported by Ammerman et al. (2012) but not confirmed specimens.
**No voucher was kept according to Swier 2006.

Table 2. Total bats captured along the Mimbres River in Grant County, New Mexico, in 2014 and 2015. We attempted to capture bats on seven nights about 4 km north of the town of Mimbres along a 0.7-km stretch of river

Scientific Name	Common Name	Male	Female	Unknown	Total
Lasionycteris noctivagans*	Silver-haired bat	35	1	0	36
Lasiurus cinereus*	Hoary bat	16	16	2	34
Myotis occultus*	Southwestern myotis	7	1	0	8
Myotis californicus*	California myotis	2	6	0	8
Eptesicus fuscus*	Big brown bat	0	4	0	4
Myotis thysanodes	Fringed myotis	0	3	1	4
Tadarida brasiliensis	Brazilian free-tailed bat	1	1	0	2
Myotis volans	Long-legged myotis	0	2	0	2
Lasiurus blossevillii	Western red bat	1	0	0	1
Myotis yumanensis*	Yuma myotis	1	0	0	1
Nycticeius humeralis*	Evening bat	1	0	0	1
Totals		64	34	3	101

*Indicates species captured on the night that the state record *N. humeralis* was captured in May 2015.

Fig. Netting site of the evening bat. This was how the site was in June 2014.

Chapter 3

Roost Site Selection of Western Red Bats (*Lasiurus blossevillii*) in Southern New Mexico

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Abstract

Bats select roosts that afford the greatest protection for them and their offspring. Availability of such suitable roosts can often times be a limiting factor for a bat species. In New Mexico, roosting habits of western red bats (*Lasiurus blossevillii*), a species of greatest conservation need in the state, are poorly understood. In 2015, we radio-tracked five individuals and identified multiple roosts used by western red bats along the Mimbres River. We observed individuals roosting in three different deciduous tree species, including cottonwood (*Populus sp.*), velvet ash (*Fraxinus velutina*), and box elder (*Acer negundo*). All trees were alive. Four of the five bats radio-tracked were observed roosting in clusters with at least one other western red bat, a rarely observed behavior for this species. By understanding roosting habits of western red bats, resources managers and biologists can properly prescribe the best habitat management plans required for the long-term success of the species in the state.

Introduction

Day roosts serve a variety of important functions necessary for the survival of bats, such as protection from predators and environmental factors as well as bearing and raising offspring. While food and water are necessities for survival, roost site availability also is suspected to be influential in limiting the size of bat populations (Humphrey 1975). For bats classified as tree roosting, species can be subdivided into groups occupying bark, tree cavities, and foliage (Lacki et al. 2007, Altringham 2011). Due to their exposure, foliage roosting bats have evolved different cryptic colorations to hide among leaves of trees. While extensive information is available about bats roosting in caves, mines, and tree cavities, little is known about the ecology of foliage-roosting bats (Lacki et al. 2007, Altringham 2011).

Lasiurine bats predominately roost in foliage and will often roost in specific tree species to reduce interspecies competition. This affiliation between lasiurine bats and tree species allow for assumptions to be made regarding species presence or absence based on tree composition in a forest. It is important to identify the roosting habits of tree roosting species as it is valuable in informing the protection and management of these species (Lacki et al. 2007).

Red bats were once grouped as a single species, *Lasiurus borealis*, comprised of an eastern and western subspecies. Molecular phylogenetic examination determined that these two subspecies represent two distinct species, *L. borealis*, the eastern red bat and *L. blossevillii*, the western red bat (Baker et al. 1988, Morales and Bickham 1995). Natural history data for *L. borealis* is extensive, but it is surprisingly lacking for *L. blossevillii*. Relatively little is understood about the roosting ecology of the western red bat throughout western North America (Shump and Shump 1982, Adams 2003). Western red bats appear to be closely correlated to cottonwood, oak, and sycamore trees along rivers and streams and appear to have an affinity

towards cottonwood trees (Findley et al. 1975, Adams 2003, Pierson et al. 2006, Diamond et al. 2012).

New Mexico represents the eastern edge of the distributional limits for western red bats in the United States, as relatively few have been captured in the state (Constantine 1961, Jones 1961, 1966, Mumford and Zimmerman 1964, Jones and Suttkus 1972, Findley et al. 1975, Cook 1986, Valdez et al. 1999). To date, there is no information on their roosting ecology from the state (Findley et al. 1975, Cook 1986) and western red bats are considered a "Species of Greatest Conservation Need" due to limited information on the species and threats to the habitats that they require ((New Mexico Department of Game and Fish 2006). The objective of this study was to capture western red bats along the Mimbres River and identify roost sites selected by individuals tagged with radio transmitters via radio-telemetry.

Methods

From 12 May to 10 June 2015, we conducted our study on the River Ranch property owned by the New Mexico Department of Game and Fish (NMDGF) located on the Mimbres River, Luna County, in southwestern New Mexico. We set mist nets (Avinet Inc., Dryden, New York) over the Mimbres River to capture western red bats. Once captured, gender, age and reproductive status were recorded for each bat. Measurements of weight and forearm length were also recorded. Hair was clipped between the scapulae of five western red bats and a radio-transmitter (Holohil Systems Ltd., Ontario, Canada; Model: LB-2N, weight 0.31 g) was fixed between the shoulder blades using Perma-type surgical cement (Perma-type Company, Plainville, CT). Once the glue set, each bat was released and direction of departure was observed using a 3-element Yagi antennae and an R-1000 Telemetry Receiver (Communications Specialists, Inc., Orange, CA).

On days following the release of radio-tagged bats, we tracked each bat to a roost tree and attempted to locate each individual. We visually located most bats in the foliage of trees by standing underneath the roost and pinpointing the general location of the bat in the tree using the Yagi antennae. At each roost tree, we recorded a GPS point under the location of each roost. The species of roost tree was determined, the diameter at breast height (dbh) and height of tree were calculated, and approximate canopy cover was estimated, as well as the orientation of the bat in the roost with north representing 0°. At each roost that the bat subsequently moved to, the above information was recorded until the radio signal was lost or the radio-tag was recovered on the ground. These procedures were approved by the IACUC at the University of Nebraska-Kearney (#020614, K. Geluso).

Results

In 2015, we captured a total of 228 bats representing 12 species (Table 1) on the NMDGF River Ranch, including 10 *L. blossevillii*. Five of these bats, all female, were fixed with radio-transmitters and released. We located a total of 11 roosts, at least two roosts from each individual, prior to the battery dying or the transmitter being shed (Table 2). While not all bats were observed in every roost, the tagged bat was visually confirmed at eight of 11 roosts.

All roosts identified were live trees comprised of one of three different species, cottonwood (*Populus sp.*), velvet ash (*Fraxinus velutina*), or box elder (*Acer negundo*). None of the bats was observed roosting on the north side of the tree. Bats did not seem to have a preference for roost tree location. Roost trees were observed in all possible habitat types, including single trees surrounded by grasslands, forest interior, and river corridor. Four of five

bats were observed roosting in clusters with at least one other western red bat (Fig. 1) at different distances from the river and in trees of different habitat types. Two of the tagged bats were tracked to the same tree, but those individuals were not observed in the same cluster.

Conservation Note

While this was a small sample size, a fair amount of information was collected on western red bat roost selection. While roost fidelity, or number of days occupying a single roost, was highly variable and the bats selected the most common tree species on the property, the use of a single roost tree by multiple bats is noteworthy. Only one report of clustering has been documented in western red bats (Ammerman et al. 2012), but based on our sample, this behavior might be more common in the species than previously recorded. Additional research will be needed to determine whether these observations were an anomaly or a more common behavior exhibited by the species. The five individuals tracked showed high fidelity to the River Ranch property. Thus, investigating the relatedness of the individuals on the property may reveal that this location is important for the western red bat population in the area. We plan to continue this research in May and June 2016 again on the NMDGF River Ranch. This chapter of the report represents our first attempts to summarize our data from 2015, but further analyses of these and additional data will be written up in the future and will subsequently be submitted to the NMDGF upon completion of this facet of our research.

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Table 1. Total numbers of bats captured at the NMDGF River Ranch property on the Mimbres River, Luna County, New Mexico. Unknown individuals were those identified to species in the net but escaped prior to handling to determine gender.

Scientific Name	Common Name	Male	Female	Unknown	Total
Myotis occultus	Southwestern Little Brown Myotis	39	53	2	94
Myotis thysanodes	Fringed Myotis	3	30	0	33
Myotis yumanensis	Yuma Myotis	15	12	0	27
Lasiurus cinereus	Hoary Bat	5	16	0	21
Tadarida brasiliensis	Brazilian Free-tailed Bat	8	5	0	13
Myotis auriculus	Southwestern Myotis	1	9	1	11
Lasiurus blossevillii	Western Red Bat	1	9	0	10

Myotis californicus	California Myotis	2	7	1	10
Parastrellus hesperus	American Parastrelle	1	2	0	3
Antrozous pallidus	Pallid Bat	0	3	0	3
Myotis ciliolabrum	Western Small-footed Myotis	0	2	0	2
Eptesicus fuscus	Big Brown Bat	0	1	0	1
Grand Totals		75	149	4	228

Table 2. Roost trees identified for western red bats (*Lasiurus blossevillii*) on the NMDGF River Ranch property on the Mimbres River, Grant and Luna counties, New Mexico.

Radiotag	Roost Species	Days	Tree Health	Orientation*	Cluster Size
173.178	*Fraxinus velutina*	1	Live	NA	NA
173.178	*Acer negundo*	4	Live	West	3
173.238	*Populus sp.*	1	Live	NA	NA
173.298	*Populus sp.*	4	Live	Southeast	2
173.298	*Populus sp.*	1	Live	South	1
173.352	*Populus sp.*	1	Live	NA	NA
173.352	*Populus sp.*	1	Live	South	3
173.367	*Fraxinus velutina*	1	Live	South	1
173.367	*Populus sp.*	1	Live	Southwest	1
173.367	*Populus sp.*	3	Live	Southeast	1
173.367	*Populus sp.*	1	Live	Southwest	1

*NA indicates that the roost tree was located, but the bat could not be observed in the tree.

Fig. A western red bat with an attached radio-tag on the NMDGF River Ranch property, Luna County, New Mexico.

Fig. A western red bat ready to be released after affixing a radio-tag.

Fig. Brett Andersen following the released western red bat at night.

Fig. One of our first western red bats observed in a roost.

Fig. One of our first roost trees of a western red bat on the NMDGF River Ranch Property, Luna County, New Mexico. The person in the red shirt is standing directly below the roost. This tree was located in the interior of a forest patch on the ranch.

Fig. A pair of western red bats in a cottonwood tree on the NMDGF River Ranch property, Grant County, New Mexico.

Fig. Open roost tree of a pair of western red bats on the River Ranch, Grant County, New Mexico. Bats were roosting above the person standing on right about half way up the first large clump of branches and leaves. See the Fig. above for the bats roosting in the tree.

Fig. A solitary western red bat in a cottonwood tree. This tree was located on the edge of the Mimbres River, Luna County, New Mexico.

Fig. Roost tree of the solitary western red bat in the above Fig. along the Mimbres River, Luna County, New Mexico. The bat was in the big closest cottonwood tree on the grassland side of the tree.

Fig. We suspect this is the same pair of western red bats shown on a previous Fig. but on a subsequent day in the same cottonwood tree, close to the previous roost but not exactly in the same spot.

Fig. One of our netting sites along the Mimbres River just above the irrigation diversion.

Fig. Cluster of three western red bats in a box elder tree on the NMDGF River Ranch property.

Fig. Roost tree of the cluster of three western red bats in the box elder. This demonstrates another interior tree roost for the species.