

**BAT SPECIES RICHNESS AND ABUNDANCE AT THE CHIRICAHUA  
NATIONAL MONUMENT AND FORT BOWIE NATIONAL HISTORIC SITE  
(6<sup>th</sup> year for the 10-year project)**

**Final Report for the 2005 Fieldwork**

Prepared by:

Karen Krebbs (Principal Investigator)  
Conservation Biologist  
Center for Sonoran Desert Studies  
Arizona-Sonora Desert Museum  
Tucson, Arizona

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Townsend's Big-eared Bat

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## EXECUTIVE SUMMARY

We carried out fieldwork in May, June, and August 2005, at the Chiricahua National Monument (CNM) and Fort Bowie National Historic Site (FBNHS) in southeastern Arizona. Year 2005 was the sixth year of an on-going ten-year project to monitor and inventory bats for the National Park Service (NPS). A total of eleven evenings of netting were spent in the two monuments at five different water sources. One hundred ninety-five bats of 15 species at CNM and three bats of three species at FBNHS were captured in 2005. One netting session in May at the CNM was rained out and we repeated the netting in June. The netting sessions in May (and June) at the CNM were more productive for number of bats and species captured than the August netting. Bats appear to be more difficult to net at the CNM once the summer monsoon rains arrive in the Chiricahua Mountains. The summer monsoons produce standing water enabling the bats to disperse to other areas to drink and forage. During dry periods, bats tend to congregate at the few available water sources. The water source at the FBNHS (Apache Springs) is a permanent spring and the NPS had cleared a wider opening around the water for fire prevention. At the FBNHS in August, we netted two new species for that park and this may have resulted from the previous clearing in this area. In 2005, the total number of bats netted at the CNM exceeded that for the years 2000, 2001, and 2002 but not for 2003 or 2004. In 2003, we captured more bats (293) and species (15) than for each of the other five years.

In 2005, Eugenio (Keno) Larios worked with us (Photo 1 & 2) on this project. Keno is a Biologist at the El Pinacate Biosphere Reserve in Sonora, Mexico. The sixth year of fieldwork was completed by September 2005, and the results are presented in this final report.

## ACKNOWLEDGEMENTS

I want to thank the National Park Service, Desert Southwest Cooperative Ecosystem Studies Unit (Desert Southwest CESU), and IMRICO for their support and financial contributions to this project. Alan Whalon, Ruth Olsen, Carrie Dennett, and Jeff Helmer have provided guidance, help, support, and made arrangements for camping and overnight accommodations after the evening netting. Volunteers Bob and Anne Graf, Antje Adams, and Keno Larios helped with the bat netting and fieldwork. Mark Jensen joined us for several evenings of netting to record bat vocalizations and acoustics.

I appreciate Dr. Yar Petryszyn's input and expertise. Janet Tyburec provided records for the BCI Bat Workshops (1992-2005) on the east side of the Chiricahuas for comparison to my data. Tani Hubbard and Dr. Christine Conte helped edit the report. The Arizona-Sonora Desert Museum (ASDM) financial department staff (Kathryn Riser and Penny Poynter) oversaw all grant financial requirements and paper work. I also appreciate conversations with Dr. Virginia Dalton, Dr. Mark Dimmitt, Ruth Olsen, Tim Snow, and Janet Tyburec. Laurence Fahrney (Network Administrator) made the report available on-line for agency personnel to view or download, made helpful suggestions,

and helped with computer problems. Dale Young scanned many slides from the fieldwork and these were utilized in the report. All the above people helped make this project successful and I thank them all.

## INTRODUCTION

More than 950 different species of bats are known worldwide, making up about one-quarter of all living mammals. Bats are among the most diverse and geographically dispersed group of living mammals (Kunz 1988). Bats provide essential ecosystem services including flower pollination and seed dispersal. They are also the major predators of night flying insects. Given the large volumes of insects consumed (up to 100% of body weight per night) and the long distances traveled, these bats are thought to play a major role in regulating nocturnal insect populations and in transporting nutrients across the landscape, particularly from stream corridors to tree roosts (Rainey et al. 1992). Despite the great diversity of bat species around the world and in the United States, bats are poorly studied compared to other mammals. Since bats are secretive and often elusive, the most basic natural history and ecological information have not been studied or documented for many species. Increasingly bats are threatened by habitat destruction, fragmentation, pollution, pesticides, and human ignorance. Drastic reductions in bat populations have occurred during the recent years in the United States and worldwide (Harvey et al. 1999). As human population increases, more pressure is placed on natural resources and more bat habitat has been lost.

The Chiricahua Mountains lie at a meeting place of four ecosystems: the Sierra Madre to the south; the vast Chihuahuan Desert; the warmer Sonoran Desert; and the Rocky Mountains (Parent and Scott 1994). The Chiricahuas are the most massive mountain range in southeastern Arizona and harbor the largest forested area (Parent and Scott 1994). The Chiricahua Mountains encompass sizable acreages of oak and oak-pine woodland and lesser amounts of coniferous forests in Arizona and Sonora (Gehlbach 1993). The large size of the Chiricahua Mountains and its nearness to the Sierra Madre range in Mexico mean that a wide variety of bird, animal, and plant life found nowhere else in the United States can be seen here (Davis and Russell 1995). Many plants and animals of the Sierra Madre Occidental reach the northern limit of their range in the Chiricahuas (Parent and Scott 1994). The Chiricahua National Monument encompasses 12,000 acres and hosts a large variety of bird, animal, and plant life unique to this area. Twenty-three of the 44 species of bats that occur in the United States and Canada have been documented in the Chiricahuas. There are an additional 20 species of bats that occur in Mexico that are not common in the United States. Some of these Mexican species may be present in this mountain range. The high diversity of bat species in the Chiricahua Mountains is probably the result of a diversity of habitats and plants that make up this area. The Fort Bowie National Historic Site in the Dos Cabezas Mountains also boasts a great diversity of mammals (Roth and Cockrum 1970).

A ten-year inventory and monitoring program for bats was initiated in 2000 at the CNM and in 2001 for the FBNHS. Most of the bat studies in the past have taken place on the east side of the Chiricahua Mountains and have not included the CNM on the western

side of this mountain range. Bat Conservation International (BCI) carries out its yearly bat workshops at the American Museum of Natural History Southwestern Research Station on the east side of the Chiricahua Mountains. The 1970 mammal survey by Roth and Cockrum at the FBNHS was the last study carried out for bats in the Dos Cabezas Mountains. Long-term studies can illustrate trends and indicate how bats respond to weather extremes like drought or wet periods in these mountain ranges. Results from bat species inventory and monitoring projects can help resource managers better manage their natural resources and the animals that depend upon these resources for their survival. It is also essential for managers to know what bat species occur in these areas. In 2005, we completed the sixth year (CNM) and the fifth year (FBNHS) for this ten-year bat study. We surveyed five different sites for bat species diversity at selected water sources within the two parks.

### **OBJECTIVES**

- 1) Carry out a total of eleven nights of netting for the CNM and the FBNHS in May, June, and August 2005.
- 2) Compare the previous years' netting at the CNM (2000-2004) and the FBNHS (2001-2004) to that of 2005.
- 3) Provide a final report to the NPS, Desert Southwest CESU, and IMRICO by September 30, 2005.



**Photo 1: Anne, Bob, Keno, and Karen in field netting bats.**



**Photo 2: Karen, Keno, and Mark working on bat acoustics.**

## **METHODS**

Eleven evenings of netting were carried out at the CNM and the FBNHS in southeastern Arizona during May, June, and August 2005. Standard mist nets were utilized at five different water sources to capture bats in both parks. Bats normally use streams and washes as travel corridors and for drinking. Three separate 2.6 m nets were setup at each site and monitored from dusk until midnight. We collected data for weight, species, sex, reproductive condition, external parasites, and noted other physical traits for all bats captured (Tables 1-11). All data collected was recorded on data sheets and later entered into a table for the final report. Bats were released at the site of capture after the data collection. Each of the five water sources was inventoried for one evening in May and June for the CNM and FBNHS (June) and the netting repeated in August for each site at both parks. We had to reschedule one evening of netting in May at the CNM because of a severe thunderstorm. One to two trained volunteers assisted in the nightly netting at each site. Keno Larios (Pinacate Biosphere Preserve Biologist) assisted us at the CNM and FBNHS to add to his knowledge of bat natural history in southeastern Arizona.

### **Chiricahua National Monument**

Bats were mist netted at four sites in May, June, and August 2005 (Tables 1-10). These sites were also monitored for the same months in 2000, 2001, 2002, 2003, and 2004. The only reliable water site was "Silver Spur Creek" ("SSC") since the other three sites were below normal for water levels. During the May netting at "SSC", we were rained out by a thunderstorm and had to reschedule the netting for June. Since "SSC" is the best netting site at the CNM, I felt it was important to reschedule for a later time. In the past we have never observed such low water levels as we did in 2005. The four netting sites were: 1) "Small Pool" in the drainage parallel to the road, 225 m (250 yards) north of Bonita Canyon Campground (BCC), 2) "Old Pump" 2.4 km (1.5 mi) north of BCC, 3) "Big Rock" near Superintendent's House and south of BCC, and 4) "Silver Spur Creek" below the meadow and south of BCC.

One site was netted per evening, and the netting sessions were carried out over two consecutive nights. Three to four separate nets were set up at each site. The ends of the net were placed on 3 m (10 ft) poles (two-5 ft. poles on top of each other), hung over the water, and attached to another 3 m pole on the opposite side of the water. The nets were opened as early as 1900 hours and closed as late as 0040 hours. Each location had at least three people processing the bat capture and count. Each bat caught in the net was processed immediately and released.

### **Fort Bowie National Historic Site**

Bats were mist netted at Apache Springs in the FBNHS (Tables 5 & 11). Apache Springs is located between the Visitor Center and the Cemetery at FBNHS. This site was monitored for bats in 2001, 2002, 2003, and 2004. Apache Springs is a reliable source of

water each year. Three separate nets were set up at this site for one evening in June and August 2004. The nets were opened as early as 1900 hours and closed as late as 2335 hours. This site had two people processing bats and all bats were released after the data collection. In the past years (2001, 2002, 2003) we have only inventoried bats in June at the FBNHS. In 2004, we began to inventory bats in both June and August so that the data would be consistent with that for the CNM where we net bats before and after (or during) the summer monsoon rains.

**Photo 3: Pallid bat and Townsend's big-eared bat.**



## RESULTS

Tables 1-11 present the raw data from the eleven evenings of bat mist netting at the CNM and the FBNHS for 2005. Included in each table are the data that was taken on each bat captured in the nets. Tables 12-14 summarize the rainfall data for the CNM, CNM Bat Summary data for 2000-2005, and the FBNHS Bat Summary data for 2001-2005 for each year. Table 15 explains the abbreviations

for bat species used in Figures 1-9 for both the CNM and the FBNHS. Over the past six years, a total of 1044 bats of 17 species (Tables 13 and 14) have been captured at the CNM and the FBNHS.

### Chiricahua National Monument

A total of 195 bats of 15 species (Table 13) were captured at the CNM in 2005. During the past six years, we have captured a total of 16 species (Figure 4) and 1010 bats at the four netting sites in the CNM (Table 13, Figure 1, 2, 6).

### Fort Bowie National Historic Site

At the FBNHS, a total of three bats of three species (Table 14) were captured over two evenings in 2005. Over the past five years, we have captured nine species (Figure 3 and 5) and 34 bats at the FBNHS (Table 14, Figure 3, 5, 7). One species (*Myotis occultus*) captured at Apache Springs in the FBNHS, has never been captured at the CNM during the past five years for this inventory project. In 2005, we captured two new species (*Leptonycteris curasoae* and *Corynorhinus townsendii*) to this area (Table 14).

## DISCUSSION

We accomplished all of our objectives for the 2005 bat inventory and monitoring program at the CNM and the FBNHS. Year 2005 was another exciting year for the ten-year bat monitoring and inventory project at the two parks. We carried out eleven evenings of netting at five different water sources in the CNM and the FBNHS in southeastern Arizona. The months of May and June were hot and dry in these areas with the exception of an unusual thunderstorm on May 27, 2005. The amount of water at the netting sites appeared lower than for the previous years, with the exception of Apache Springs (FBNHS) and Silver Spur Creek (CNM), which are permanent springs. Our 2005 capture data indicated that this year was the third highest in number of bats captured for the past six years (Table 13) at the CNM. Only in 2003, did we exceed the capture numbers for 2004. I think that the number of bats captured in 2005 at the CNM might have exceeded that of 2004 if we had not been rained out for several nettings in August.

We continue to experience a drought in Arizona (Dimmitt pers. com.) but the 2005 spring rains and unusual rainfall prior to the summer months in Arizona have helped improve the drought situation in Arizona. It appears that as water sources have shrunk in these areas, the number of bats captured increases (Figure 8). Bats utilize water sources for drinking, to catch insects, and as travel corridors. Bats appear to congregate at water sources during drier periods and when water is not as abundant. Insects also seek out areas of standing water during periods of drought and when water is scarce. Bats have been harder to capture (results from this study) when there is more water available (Table 12-13 and Figure 8). Bats have more options for water sources in wet years. The bat netting attempts at the CNM (Tables 3, 8, 9, 10) were interrupted by rain, weather extremes, and lower levels of water and bats were harder to capture on these evenings.

Apache Springs (AS) at the FBNHS is a reliable, year-round spring, and we have not noticed a large difference in the number of bats or species captured over the four years. The vegetation is thick and dense around AS and prior to 2005 we have never captured species other than myotis. Larger bats may not be able to maneuver in this crowded space and may explain why larger species have not been captured at this site before 2005. In the spring of 2005, the NPS cleared out much of the vegetation around the spring at FBNHS. Opening this area probably allowed larger species like *Leptonycteris curasoae* and *Corynorhinus townsendii* (Table 11) enough space to drink water at this spring. We did not capture any bats during the June netting at "AS" even though the area had been cleared of vegetation clutter before the June netting. Our netting in June may have been too soon after the vegetation clearing change for the larger bats to discover that they could maneuver and drink at this water source.

We captured more than 200 bats at the CNM in each of 2003 and 2004. This is more than twice as many bats captured for each of the previous three years. The extended drought may have contributed to the high number of bats captured in 2003 and 2004. In 2005, we captured a total of 195 bats at the CNM and probably would have

netted a higher number of bats if rain had not spoiled several of the netting sessions. Water sources have appeared to shrink each year in the CNM (personal observation) even though all four netting sites retained some water until August 2005. During the past few years, we have not used the larger nets over the water because the smaller net (2.6 m) has been adequate for the shrinking water sites. I had expected all the established netting

Photo 4: Whiskered screech-owl.



Photo 5: Spotted owl.



sites to have water in August but was surprised to find several of the sites dry or with very low water levels. Even though the spring rains have been generous over most of Arizona and the Chiricahua Mountains experienced rain in May, some of the netting sites were dry. At the CNM we placed nets over the dry streams since bats will use these areas as highways but did not capture any bats (Table 10).

The number of species captured at the CNM in 2005 (15) was the same as for 2003 (Table 13). In 2003, we captured an additional two species of bat for a total of 15 species for the year. One of the additional species in 2003 was *Lasiurus blossevillii*, a very exciting capture. While this bat (red bat) has been captured in the Chiricahuas on the east side by BCI (Tyburec 2004) and in early inventories (Cockrum and Ordway 1959), captures of this species are unusual. We captured three *L. blossevillii* (2 males and 1 female) in May 2003. Not a lot is known about red bats in Arizona but in California the sexes segregate during spring and summer (Monday 1993). In California, females remain in lowland areas, whereas males apparently move to higher elevations (Cryan 2003). In Arizona, the red bat is thought to be a summer resident only (Monday 1993). We did not capture any *L. blossevillii* in 2004 or 2005.

We captured two *Leptonycteris curasoae* (lesser long-nosed bat) in both parks (Table 7 & 11) and this endangered bat is not captured each year. Netting a lesser long-nosed bat at the FBNHS was a new species for that area for this study. At the FBNHS there are agave plants for the endangered bat to forage on and we felt that this species

was definitely in this area. In the past we have netted young male lesser long-nosed bats at the CNM but both bats this year were adult females. One of these females was post lactating and the other did not have noticeable nipples. We captured two female *Choeronycteris mexicana* (Mexican long-tongued bat) at the CNM (Table 7, 8, 13) at the beginning of August and both were lactating. Both of the nectar bat species (*L. curasoae* and *C. mexicana*) have only been netted in the August months for this project. It is interesting that we captured *Idionycteris phyllotis* (Allen's lappet-browed bat) in 2000, 2001, 2002, and 2005 but not in 2003 or 2004. This is an exciting species to capture because it has not been netted often in the Chiricahua Mountains for this study.

Large numbers of the tree bat, *Lasionycteris noctivagans*, were netted at the CNM in 2003 and 2004, compared to the prior three years but captures dropped drastically in 2005 (Table 13). In 2003, we captured 46 *L. noctivagans* (silver-haired bat) and in 2004 we captured 37 at the CNM. In 2005, only 15 silver-haired bats were netted. All the *L. noctivagans* were captured in May and not in the August netting sessions. We netted one silver-haired bat in the June (make-up session) at the CNM. *Lasionycteris noctivagans* is considered to be a highly migratory (Barbour and Davis 1969) bat and perhaps explaining why this species was captured in May. Previous studies or reports for this species in the Chiricahua Mountains (Allen 1895, Cockrum and Ordway 1959, Cahalane 1939, Hoffmeister 1986, Schmidt and Dalton 1994) indicate that it is primarily netted in May and June in the summer and during the winter months in this area.

Schmidt and Dalton (1994) state there have never been any gravid females captured in Arizona. We netted two gravid females in May 2003 (2003 report, Table 2), which may be the first evidence that pregnant females do occur in the Chiricahuas. These are the only females of this species that we have ever captured in the Chiricahuas for this study but there are probably more females present in this mountain range during this time. These two females may have been migrating through this area to more northern altitudes. Absence of female *L. noctivagans* from mountainous regions of western North American during summer might reflect their inability to raise young under the climatic conditions and relatively low productivity experienced in these regions (Cryan 2003). We have never captured this species in August and their presence in other areas of the Chiricahua Mountains in the middle of June, suggests that this species of bat shows seasonal altitudinal migration (Cockrum and Ordway 1959). Our data (2003 and 2004 Yearly Reports) at this time supports the seasonal altitudinal migration of *L. noctivagans*. I think that timing (and luck) is important to the success of capturing numerous silver-haired bats in the Chiricahua Mountains during the summer.

For the past six years, with the exception of 2002, we have captured *Lasiurus cinereus* (hoary bat) at the CNM. Hoary bats roost in the foliage of trees and are considered one of Arizona's tree bats (Monday 1993). All five hoary bats captured in May 2005 were males but five pregnant females were netted in May 2004 at the CNM. It would be difficult to say if these females were resident or migrating through our area for more northern latitudes. It is not known if young are born in Arizona and we have not captured any lactating females during this project. Females have been taken in Arizona in April, May, July, August, October, and December (Hoffmeister 1986). Hoffmeister

thinks that females are present longer in Arizona than just migrating through the state in April and May. In southeastern Arizona hoary bats may be present year-round (Hoffmeister 1986). We rarely net hoary bats in August but it is difficult to capture most of the species of bats during this month when water is more plentiful.

In 2005, we captured almost as many *Corynorhinus townsendii* (Townsend's big-eared bat) as in 2004 (Table 13 and Photo 3). Many of these bats were pregnant females and may indicate that a maternity colony of *C. townsendii* exists in this mountain range. Females congregate in maternity colonies of 12 to several hundred individuals in the spring and summer, whereas the males tend to be more solitary (Monday 1993). Previous studies or mine checks from 1939 to 1955 of the Virtue Mine and Crystal Cave in the Chiricahua Mountains by Cahalene, Cockrum, and Bogert found clusters of pregnant *C. townsendii* (Cockrum and Ordway 1959). *Eptesicus fuscus* (big brown bat) is a species we commonly capture in the nets and over the past three years (2003-2005) we have netted more than twice the number we usually capture (Table 13). Big brown bats are commonly associated with buildings in eastern North America but appear to depend more on tree cavities in western North America (Kunz and Fenton 2003). *Myotis thysanodes* (fringed myotis) is the species of bat we have consistently captured large numbers of more of than any other species at the CNM (Table 13 & Figure 2, 4). Records from the BCI workshops at Portal indicate that the *Myotis californicus* (California myotis) is the bat species that is captured more often on the east side of the Chiricahua Mountains. *Myotis californicus* and *Myotis auriculus* (Southwestern myotis) are the second most common species of Myotis (Figure 4) that we capture at the CNM.

Rainfall differences or changes in the Chiricahua Mountains over the past few years have probably affected the number of bats captured (Figure 8). It appears that the lack of rainfall in this area results in an increase in bat numbers around water sources (personal observation). As the amount of rainfall decreases, the number of bats captured in our nets increases (Figure 8). Bats utilize water sites for capturing insects and as a source of drinking water. The scarcity of water in the Chiricahua Mountains during the drier months could be a limiting factor for bats in this area. Bats are mobile (flight) and have the advantage of being able to move to other areas in a short time if a resource such as water is unavailable to them. Bats are the only mammals that have sustained flight (Nowak 1994). Unfortunately, bats that are forced to move to more favorable areas in search of water may have negative effects on resident populations of bats. Bird populations "erupt" (departure of birds from their normal range) when food sources change or are unavailable for the birds (Weidensaul 1999). This results in increased competition for food sources for the resident populations of birds. The same may be true for bat populations that have to share a shrinking water source or move to other areas in search of additional water.

During the netting sessions in May 2005 at the CNM we captured an *Otus trichopsis* (whiskered screech-owl) at the same time and in the same pocket of the net as a *Myotis ciliolabrum* (western small-footed myotis bat). We even found the owl trying to grab the bat with a talon while entangled in the net. I think it is safe to conclude that the owl was chasing the bat when both were captured in the net. We have captured

whiskered screech-owls (Photo 4) in our nets in previous years. In August 2005, we observed a large owl sitting close to one of our nets at the pump site in the CNM. We identified the owl as *Strix occidentalis* (spotted owl) and 45 minutes after we first observed the owl we captured it in our nets. We documented the spotted owl (Photo 5) by taking pictures and released it. Despite the fact that owls and other raptors prey upon flying bats, and that some snake species prey on individuals as they leave the roost site, when bats are foraging they are typically too aware, evasive, and fast to be at risk (Adams 2003). It was obvious from observing the two species of owls during our netting this year that they were hunting bats at the CNM. The presence of the spotted owl at the pump site was within one of the designated owl PACS but the NPS has not observed or carried out surveys for this species in that area for several years (Olsen pers. comm.).

During the make-up session (June 11, 2005) at the CNM, an *Ursus americanus* (black bear) approached us while we were waiting for bats to fly into our nets. The black bear was half grown and appeared unafraid of our group. This bear approached within 9 m (30 ft.) of our group and we were forced to throw rocks and tree limbs and shout loudly at this animal to discourage his advances. It took the bear several minutes to leave our area but it did not return that evening. Later I talked to Ruth Olsen and found out the bear had been observed begging for food at the public camping area. Bears that associate humans with food can become dangerous animals in our National Parks.

For the beginning of 2005, we had a “wetter than normal” start for the year. The rainfall this spring (2005) has been above normal but it appears that this above normal rainfall did not affect the numbers of bats captured or increase the water levels at the netting sites. Several of the water sources at the CNM were dry or lower than for the past five years. The drought period over the past several years for Arizona may be having a negative effect upon water sources despite the current rainfall increases. Long-term inventory and monitoring projects allow us to examine temporal and spatial population shifts in relation to environmental and climatic change. Finding rare species, such as the red bat, or detecting population response to drought would not be possible in a short-term study. Shifting trends in seasonal migration patterns are also more likely captured in long-term studies like the large numbers of male silver-haired bats found in May 2003 and 2004 during this study. Capturing numerous pregnant Townsend’s big-eared bats in 2004 and 2005 at the CNM emphasizes the importance of protecting maternity roosts. Our data provides a tool that resource managers and biologists can utilize to help fill in gaps of knowledge for bat species in the Chiricahua Mountains. We will continue our study at the CNM and FBNHS in 2006.

This grant provided equipment and supplies for Keno Larios and the Pinacate Biosphere Reserve in Mexico. Keno now has the equipment to monitor and inventory bat species at the Pinacate and does not have to borrow equipment from other biologists. Equipment and supplies provided to Keno included poles, nets, cloth bags, stakes, rope, headlamp, boots, gloves, and bat identification guides for fieldwork in Mexico. Keno also gained important handling and identification experience with species of bats that he had not handled in the past. We also worked closely with Mark Jensen (Photo 2) and

were able to record the vocalizations of 11 species of bats at the CNM. Mark is developing a new bat detection system that biologists can utilize in the future.

### LITERATURE CITED

- Adams, R.A. 2003. *BATS of the Rocky Mountain West: Natural History, Ecology, and Conservation*. University Press of Colorado.
- Allen, J.A. 1895. On a collection of mammals from Arizona and Mexico, made by Mr. W.W. Price, with field notes by the collector. Bull. Amer. Mus. Nat. Hist., vol. 7, pp. 193-258.
- Barbour, R.W. and W.H. Davis. 1969. *Bats of America*. University Press of Kentucky, Lexington.
- Cahalane, V.H. 1939. Mammals of the Chiricahua Mountains, Cochise County, Arizona. Journal of Mammalogy 20:418-440.
- Cockrum, E.L. and E. Ordway. 1959. Bats of the Chiricahua Mountains, Cochise County, Arizona. Am. Mus. Novitates 1938, 35 pp.
- Cryan, P.M. 2003. Seasonal Distribution of Migratory Tree Bats (*Lasiurus* AND *Lasionycteris*) in North America. Journal of Mammalogy 84(2):579-593.
- Davis, W.A. and S.M. Russell. 1995. *Finding Birds in Southeastern Arizona*. Tucson Audubon Society, Tucson, AZ.
- Gehlbach, F.R. 1993. *Mountain Islands and Desert Seas*. Texas A & M University Press.
- Harvey, M.J., J.S. Altenbach, and T.L. Best. 1999. Bats of the United States. Arkansas Game & Fish Commission.
- Hoffmeister, D.F. 1986. *Mammals of Arizona*. Univ. of Ariz. Press, Tucson. 602 pp.
- Kunz, T.H. (ed.). 1988. Behavioral and Ecological Methods for the Study of Bats. Smithsonian Institution Press, Washington, D.C.
- Kunz, T.H. and M.B. Fenton (eds.). 2003. *Bat Ecology*. The University of Chicago Press, Chicago and London.
- Monday, D.C. (ed.). 1993. *Bats of Arizona in Arizona Wildlife Views*. Special Heritage Edition, Publication of Arizona Game and Fish Department, Vol. 36, # 8.

- Nowak, R.M. 1994. *Walker's Bats of the World*. The John Hopkins University Press, Baltimore and London.
- Parent, L. and S. Scott (ed.). 1994. *Chiricahua National Monument*. Southwest Parks and Monuments Association, Tucson, Arizona.
- Rainey, W.E., E.D. Pierson, M. Colberg, and J.H. Barclay. 1992. Bats in hollow redwoods: Seasonal use and role in nutrient transfer into old growth communities. *Bat. Res. News* 33(4):71.
- Roth, E.L. and E.L. Cockrum. 1970. A Survey of the Mammals of the Fort Bowie National Historic Site. Technical Report for the National Park Service, AZ.
- Schmidt, S.L. and D.C. Dalton. 1994. "Biodiversity and Management of the Madrean Archipelago: The Sky Islands of Southwestern United States and Northern Mexico," USDA Forest Service, General Technical Report RM-GTR-264.
- Tyburec, J. 2004. Portal Arizona Bat Capture Summary for 1992 to 2004. Bat Conservation International Bat Workshops in Southeastern Arizona.
- Weidensaul, S. 1999. *Living on the Wind Across the Hemisphere with Migratory Birds*. North Point Press, New York.
- Weldon, H. 1993. *The Chiricahua Sky Island*. Marguerite Bantlin Publishing.

**APPENDIX (BAT FIELD DATA TABLES & FIGURES FOR THE CNM and FBNHS 2005)**

**TABLE 1:** Bat netting data from the small pool in the drainage parallel to road 250 yards north of Bonita Canyon Campground in the CNM on May 20, 2005. Three 2.6 m (8') nets were opened at 1920 hours and closed at 2400 hours. Site coordinates are: (Net #1 s.) N Lat 32° 00.458, W Long 109° 21.156, 1645 m (5428') elev.; (Net #2 b/t #1 & 3) N Lat 32° 00.467, W Long 109° 21.148, 1642 m (5419') elev.; (Net #3 n.) N Lat 32° 46.7, W Long 109° 21.141, 1635 m (5395') elev.; ¾ moon, clear; Temp., wind, humidity from 1900 to 2400 hours: (81.3° F to 70.0°F), (0 mph), (20 % to 27%); N= North, Lat = Latitude, W = West, Long = Longitude, Temp. = temperature, elev. = elevation, FA = Forearm, (g) = grams, M = male, F = female, s. = south, n. = north, WT. = WEIGHT.

| TIME          | SPECIES                          | SEX                | WT. (g) | NOTES                                                               |
|---------------|----------------------------------|--------------------|---------|---------------------------------------------------------------------|
| 1942          | <i>Pipistrellus hesperus</i>     | M                  | 4       |                                                                     |
| 2007          | <i>Myotis thysanodes</i>         | F                  | 8       | Pregnant; left ear mites                                            |
| 2008          | <i>Myotis auriculus</i>          | F                  | 7       | Pregnant                                                            |
| 2008          | <i>Lasionycteris noctivagans</i> | M                  | 9       |                                                                     |
| 2010          | <i>Corynorhinus townsendii</i>   | M                  | 7.5     |                                                                     |
| 2035          | <i>Myotis auriculus</i>          | F                  | 7       | Pregnant                                                            |
| 2036          | <i>Corynorhinus townsendii</i>   | M                  | 7       |                                                                     |
| 2135          | <i>Myotis californicus</i>       | F                  | 4.5     | Pregnant                                                            |
| 2235          | <i>Myotis ciliolabrum</i>        | M                  | 4.5     |                                                                     |
| 2305          | <i>Myotis ciliolabrum</i>        | M                  | 4       | Chased into net by whiskered screech owl who was netted @ same time |
| 2347          | <i>Myotis californicus</i>       | M                  | 4.5     |                                                                     |
| <b>TOTALS</b> | <b>11 BATS<br/>7 SPECIES</b>     | <b>7 M<br/>4 F</b> |         |                                                                     |

**TABLE 2:** Bat netting data from the "Old Pump" 1.5 miles north of Bonita Canyon Campground in the CNM on May 21, 2005. Four 2.6 m (8') nets were opened at 1915 hours and closed at 2440 hours. Site coordinates are: (Net #1 @ pump) N Lat 32° 01.298, W Long 109° 20.341, 1706 m (5594') elev.; (Net #2 b/t #1 & 3) N Lat 32° 01.294, W Long 109° 20.344, 1706 m (5593') elev.; (Net #3) N Lat 32° 01.294, W Long 109° 20.342, 1706 m (5592') elev.; (Net #4) N Lat 32° 01.299, W Long 109° 20.353, 1704 m (5587') elev.; ¾ moon, clear; Temp., wind, humidity from 1900 to 2300 hours: (85.6°F to 73.8°F), (0 mph to 1 mph), (16% to 22%); N= North, Lat = Latitude, W = West, Long = Longitude, Temp. = temperature, elev. = elevation, FA = Forearm, (g) = grams, M = male, F = female, WT. = WEIGHT, R = right.

| TIME | SPECIES                    | SEX | WT. (g) | NOTES                     |
|------|----------------------------|-----|---------|---------------------------|
| 1935 | <i>Myotis californicus</i> | M   | 4       |                           |
| 1940 | <i>Myotis ciliolabrum</i>  | M   | 4       |                           |
| 1941 | <i>Myotis californicus</i> | M   | 4.5     | Tear on R wing (5 X 2 mm) |
| 1942 | <i>Myotis californicus</i> | M   | 4       |                           |
| 1943 | <i>Myotis californicus</i> | M   | 4       |                           |

| Table 2 continued |                                  |   |      |                                |
|-------------------|----------------------------------|---|------|--------------------------------|
| 1944              | <i>Myotis thysanodes</i>         | M | 6.5  |                                |
| 1955              | <i>Myotis californicus</i>       | M | 3.5  |                                |
| 2000              | <i>Myotis californicus</i>       | F | 4.5  | Pregnant; not lactating        |
| 2002              | <i>Myotis auriculus</i>          | F | 6    | Pregnant; not lactating        |
| 2005              | <i>Myotis ciliolabrum</i>        | M | 4    |                                |
| 2007              | <i>Myotis thysanodes</i>         | F | 7    | Pregnant                       |
| 2010              | <i>Myotis thysanodes</i>         | M | 8    |                                |
| 2012              | <i>Idionycteris phyllotis</i>    | M | 10   |                                |
| 2015              | <i>Myotis thysanodes</i>         | F | 8    | Pregnant                       |
| 2015              | <i>Myotis thysanodes</i>         | M | 6    | Descended testes               |
| 2024              | <i>Myotis ciliolabrum</i>        | M | 4.5  |                                |
| 2025              | <i>Myotis thysanodes</i>         | M | 9    |                                |
| 2030              | <i>Myotis californicus</i>       | M | 5    |                                |
| 2030              | <i>Corynorhinus townsendii</i>   | M | 8    |                                |
| 2030              | <i>Eptesicus fuscus</i>          | M | 14   |                                |
| 2035              | <i>Eptesicus fuscus</i>          | M | 16   |                                |
| 2037              | <i>Pipistrellus hesperus</i>     | M | 3.5  |                                |
| 2054              | <i>Myotis ciliolabrum</i>        | M | 4    |                                |
| 2055              | <i>Lasionycteris noctivagans</i> | M | 9.5  |                                |
| 2110              | <i>Pipistrellus hesperus</i>     | M | 3.5  |                                |
| 2113              | <i>Myotis auriculus</i>          | M | 7.5  |                                |
| 2140              | <i>Myotis ciliolabrum</i>        | M | 4    |                                |
| 2142              | <i>Myotis auriculus</i>          | F | 7    | Lactating                      |
| 2144              | <i>Myotis ciliolabrum</i>        | M | 5    |                                |
| 2145              | <i>Eptesicus fuscus</i>          | M | 14.5 |                                |
| 2148              | <i>Myotis auriculus</i>          | F | 8    | Lactating                      |
| 2151              | <i>Eptesicus fuscus</i>          | M | 15   |                                |
| 2152              | <i>Lasionycteris noctivagans</i> | M | 10.5 |                                |
| 2210              | <i>Myotis auriculus</i>          | F | 8    | Lactating                      |
| 2215              | <i>Myotis auriculus</i>          | F | 7.5  | Lactating                      |
| 2220              | <i>Myotis thysanodes</i>         | F | 9    | Pregnant; mites                |
| 2225              | <i>Pipistrellus hesperus</i>     | M | 4    |                                |
| 2230              | <i>Myotis auriculus</i>          | F | 7    | Pregnant                       |
| 2250              | <i>Myotis ciliolabrum</i>        | M | 4    |                                |
| 2252              | <i>Corynorhinus townsendii</i>   | M | 9    | Hole in 5 <sup>th</sup> finger |
| 2315              | <i>Eptesicus fuscus</i>          | M | 15.5 |                                |
| 2316              | <i>Myotis ciliolabrum</i>        | M | 4    |                                |
| 2318              | <i>Pipistrellus hesperus</i>     | M | 4    |                                |
| 2320              | <i>Myotis californicus</i>       | M | 4    |                                |
| 2322              | <i>Myotis thysanodes</i>         | F | 9    | Pregnant; mites                |
| 2339              | <i>Myotis californicus</i>       | F | 5    |                                |
| 2345              | <i>Pipistrellus hesperus</i>     | M | 3    |                                |
| 2347              | <i>Lasiurus cinereus</i>         | M | 24   |                                |
| 2351              | <i>Myotis thysanodes</i>         | M | 13   |                                |

| Table 2 continued |                               |                      |     |                                |
|-------------------|-------------------------------|----------------------|-----|--------------------------------|
| 2352              | <i>Eptesicus fuscus</i>       | M                    | 12  | Scar about right elbow         |
| 2355              | <i>Antrozous pallidus</i>     | M                    | 16  | Healed scars left wing         |
| 2417              | <i>Pipistrellus hesperus</i>  | M                    | 3   |                                |
| 2418              | <i>Pipistrellus hesperus</i>  | M                    | 4   |                                |
| 2420              | <i>Myotis thysanodes</i>      | F                    | 8   | Lactating; bedbug left forearm |
| 2422              | <i>Myotis thysanodes</i>      | F                    | 8.5 | Pregnant                       |
| 2425              | <i>Myotis thysanodes</i>      | F                    | 6.5 |                                |
| 2429              | <i>Myotis californicus</i>    | M                    | 5   |                                |
| 2440              | <i>Myotis ciliolabrum</i>     | M                    | 4   |                                |
| <b>TOTALS</b>     | <b>58 BATS<br/>11 SPECIES</b> | <b>43 M<br/>15 F</b> |     |                                |

**TABLE 3:** Bat netting data from Silver Spur Creek in the CNM on May 27, 2005. Hard rain throughout the evening.

#### RAINED OUT: RESCHEDULED FOR JUNE 11, 2005

**TABLE 4:** Bat netting data from the “Big Rock and Small Stream” near the Superintendent’s House in the CNM on May 28, 2005. Four 2.6 m (8’) nets were opened at 1915 hours and closed at 2440 hours. Site coordinates are: (Net #1 @ Big Rock) N Lat 32° 00.534, W Long 109° 21.970, 1607 m (5268’) elev.; (Net #2 b/t #1 & 3) N Lat 32° 00.532, W Long 109° 21.965, 1608 m (5272’) elev.; (Net #3 n.) N Lat 32° 00.538, W Long 109° 21.968, 1607 m (5268’) elev.; (Net #4) N Lat 32° 00.535, W Long 109° 21.968, 1607 m (5268’); Overcast; Temp., wind, humidity from 1900 to 2325 hours: (67.0°F to 63.5°F), (0 mph), (62% to 79%); N= North, Lat = Latitude, W = West, Long = Longitude, Temp. = temperature, elev. = elevation, FA = Forearm, (g) = grams, M = male, F = female, s. = south, n. = north, WT. = WEIGHT, > = greater than, < = less than.

| TIME | SPECIES                          | SEX | WT. (g) | NOTES               |
|------|----------------------------------|-----|---------|---------------------|
| 1950 | <i>Myotis ciliolabrum</i>        | M   | 3.5     | Thumb > 4           |
| 1952 | <i>Eptesicus fuscus</i>          | M   | 14      |                     |
| 1953 | <i>Lasionycteris noctivagans</i> | M   | 9       |                     |
| 1955 | <i>Eptesicus fuscus</i>          | M   | 14      |                     |
| 1959 | <i>Eptesicus fuscus</i>          | M   | 14      | Pregnant            |
| 2001 | <i>Myotis thysanodes</i>         | F   | 8       | Pregnant            |
| 2004 | <i>Myotis ciliolabrum</i>        | F   | 4.5     | Lactating; Thumb >4 |
| 2006 | <i>Lasionycteris noctivagans</i> | M   | 10      |                     |
| 2008 | <i>Myotis thysanodes</i>         | F   | 10      | Pregnant            |
| 2009 | <i>Eptesicus fuscus</i>          | M   | 13      |                     |
| 2010 | <i>Lasionycteris noctivagans</i> | M   | 9       |                     |
| 2011 | <i>Eptesicus fuscus</i>          | M   | 15      |                     |
| 2012 | <i>Lasionycteris noctivagans</i> | M   | 14      |                     |

| Table 4 continued |                                  |             |     |                                                        |
|-------------------|----------------------------------|-------------|-----|--------------------------------------------------------|
| 2013              | <i>Myotis thysanodes</i>         | F           | 9   | Pregnant                                               |
| 2016              | <i>Eptesicus fuscus</i>          | F           | 20  | Pregnant                                               |
| 2017              | <i>Myotis thysanodes</i>         | F           | 7   |                                                        |
| 2020              | <i>Lasionycteris noctivagans</i> | M           | 9   | Left wing extreme damage: ½ wing missing thumb to foot |
| 2021              | <i>Myotis thysanodes</i>         | M           | 10  |                                                        |
| 2022              | <i>Lasionycteris noctivagans</i> | M           | 9   |                                                        |
| 2023              | <i>Eptesicus fuscus</i>          | F           | 16  | Pregnant                                               |
| 2025              | <i>Eptesicus fuscus</i>          | M           | 14  |                                                        |
| 2027              | <i>Myotis volans</i>             | M           | 6.5 | Fur to elbow; FA=37mm                                  |
| 2030              | <i>Lasionycteris noctivagans</i> | M           | 9   |                                                        |
| 2034              | <i>Eptesicus fuscus</i>          | M           | 11  |                                                        |
| 2035              | <i>Lasionycteris noctivagans</i> | M           | 10  |                                                        |
| 2036              | <i>Eptesicus fuscus</i>          | M           | 13  |                                                        |
| 2037              | <i>Eptesicus fuscus</i>          | M           | 13  |                                                        |
| 2040              | <i>Lasionycteris noctivagans</i> | M           | 9   |                                                        |
| 2042              | <i>Lasiurus cinereus</i>         | M           | 28  |                                                        |
| 2050              | <i>Lasionycteris noctivagans</i> | M           | 10  |                                                        |
| 2100              | <i>Eptesicus fuscus</i>          | F           | 19  | Pregnant                                               |
| 2102              | <i>Myotis volans</i>             | F           | 9   | Pregnant; FA=39mm                                      |
| 2104              | <i>Eptesicus fuscus</i>          | M           | 13  |                                                        |
| 2105              | <i>Lasionycteris noctivagans</i> | M           | 9   |                                                        |
| 2115              | <i>Eptesicus fuscus</i>          | F           | 15  | Pregnant                                               |
| 2123              | <i>Eptesicus fuscus</i>          | F           | 19  | Pregnant                                               |
| 2125              | <i>Lasiurus cinereus</i>         | M           | 24  |                                                        |
| 2135              | <i>Lasiurus cinereus</i>         | M           | 25  |                                                        |
| 2146              | <i>Eptesicus fuscus</i>          | F           | 15  | Lactating                                              |
| 2142              | <i>Eptesicus fuscus</i>          | F           | 17  | Pregnant                                               |
| 2204              | <i>Myotis volans</i>             | F           | 8   | Pregnant; FA=38mm                                      |
| 2315              | <i>Eptesicus fuscus</i>          | F           | 16  | Pregnant                                               |
| 2330              | <i>Lasiurus cinereus</i>         | M           | 27  |                                                        |
| <b>TOTALS</b>     | <b>43 BATS</b>                   | <b>28 M</b> |     |                                                        |
|                   | <b>6 SPECIES</b>                 | <b>15 F</b> |     |                                                        |

**TABLE 5:** Bat netting data from “Apache Springs” (AS) at the FBNHS on June 10, 2005. Three 2.6 m (8’) nets were opened at 19130 hours and closed at 2335 hours. Site coordinates are: (Net #1 @ Spring, n.) N Lat 32° 08.445, W Long 109° 26.261, 1514 m (4963’) elev.; (Net #2 b/t #1 & 3) N Lat 32° 08.443, W Long 109° 26.26, 1504m (4932’) elev.; (Net #3 s.) N Lat 32° 08.443, W Long 109° 26.266, 1502m (4924’) elev.; clear; Temp., wind, humidity from 1800 to 2335 hours: (78.6°F to 59.3°F), (0.9 mph to 1.2 mph), (21% to 38%); N= North, Lat = Latitude, W = West, Long = Longitude, Temp. = temperature, elev. = elevation, FA = Forearm, (g) = grams, M = male, F = female, s. = south, n. = north.

**No bats were captured!**

**TABLE 6:** Bat netting data from “Silver Spur Creek” in the CNM on June 11, 2005. Four 2.6 m (8’) nets were opened at 1916 hours and closed at 2400 hours. Site coordinates are: (Net #1 s.) N Lat 32° 00.316, W Long 109° 21.376, 1629 m (5342’) elev.; (Net #2 b/t #1 & 3) N Lat 32° 00.318, W Long 109° 21.376, 1629 m (5342’).; (Net #3 n.) N Lat 32° 00.321, W Long 109° 21.389, 1629 m (5341’) elev.; ¼ waxing moon, clear; Temp., wind, humidity from 1916 to 2300 hours: (77.1°F to 68.7°F), (0.9 mph to 1.0 mph), (17% to 32%); N= North, Lat = Latitude, W = West, Long = Longitude, Temp. = temperature, elev. = elevation, FA = Forearm, (g) = grams, M = male, F = female, s. = south, n. = north, WT. = WEIGHT.

| TIME | SPECIES                        | SEX | WT. (g) | NOTES                            |
|------|--------------------------------|-----|---------|----------------------------------|
| 2015 | <i>Myotis ciliolabrum</i>      | M   | 3.5     |                                  |
| 2016 | <i>Myotis ciliolabrum</i>      | M   | 4       |                                  |
| 2017 | <i>Myotis auriculus</i>        | F   | 6       | Lactating                        |
| 2018 | <i>Myotis auriculus</i>        | F   | 6       | Lactating                        |
| 2019 | <i>Myotis auriculus</i>        | M   | 7       |                                  |
| 2020 | <i>Myotis thysanodes</i>       | F   | 6.5     | Pregnant                         |
| 2021 | <i>Myotis thysanodes</i>       | M   | 6       |                                  |
| 2022 | <i>Eptesicus fuscus</i>        | M   | 13      |                                  |
| 2023 | <i>Myotis thysanodes</i>       | F   | 7       | Lactating; damaged tail membrane |
| 2025 | <i>Myotis volans</i>           | M   | 7       |                                  |
| 2026 | <i>Myotis thysanodes</i>       | F   | 9       | Pregnant                         |
| 2027 | <i>Myotis ciliolabrum</i>      | F   | 3.5     |                                  |
| 2027 | <i>Myotis californicus</i>     | M   | 3       |                                  |
| 2034 | <i>Corynorhinus townsendii</i> | F   | 9       |                                  |
| 2040 | <i>Myotis thysanodes</i>       | F   | 7       | Lactating                        |
| 2042 | <i>Myotis californicus</i>     | M   | 4       |                                  |
| 2044 | <i>Corynorhinus townsendii</i> | M   | 7.5     |                                  |
| 2045 | <i>Antrozous pallidus</i>      | F   | 16      | Pregnant                         |
| 2048 | <i>Myotis thysanodes</i>       | F   | 7       | Pregnant; ticks                  |
| 2050 | <i>Antrozous pallidus</i>      | F   | 16      | Pregnant                         |
| 2051 | <i>Myotis volans</i>           | M   | 3.5     |                                  |
| 2052 | <i>Myotis thysanodes</i>       | F   | 6       | Pregnant                         |
| 2053 | <i>Myotis thysanodes</i>       | F   | 7       | Lactating                        |
| 2056 | <i>Myotis californicus</i>     | M   | 3.5     |                                  |
| 2059 | <i>Myotis auriculus</i>        | F   | 9       | Pregnant                         |
| 2100 | <i>Corynorhinus townsendii</i> | F   | 10      | Lactating                        |
| 2102 | <i>Corynorhinus townsendii</i> | F   | 9       | Lactating                        |
| 2107 | <i>Antrozous pallidus</i>      | F   | 17      | Pregnant                         |
| 2108 | <i>Corynorhinus townsendii</i> | F   | 9       | Lactating                        |
| 2110 | <i>Myotis auriculus</i>        | M   | 6       |                                  |
| 2111 | <i>Antrozous pallidus</i>      | F   | 17      | Pregnant                         |
| 2113 | <i>Eptesicus fuscus</i>        | M   | 15      |                                  |
| 2115 | <i>Myotis thysanodes</i>       | F   | 8       | Lactating                        |
| 2117 | <i>Myotis thysanodes</i>       | F   | 9       | Pregnant                         |

| Table 6 continued |                                     |                            |      |                                               |
|-------------------|-------------------------------------|----------------------------|------|-----------------------------------------------|
| 2118              | <i>Corynorhinus townsendii</i>      | M                          | 7    |                                               |
| 2119              | <i>Eptesicus fuscus</i>             | M                          | 14   |                                               |
| 2120              | <i>Myotis thysanodes</i>            | M                          | 8    |                                               |
| 2120              | <i>Antrozous pallidus</i>           | M                          | 15   |                                               |
| 2121              | <i>Eptesicus fuscus</i>             | M                          | 17   |                                               |
| 2130              | <i>Eptesicus fuscus</i>             | M                          | 15   |                                               |
| 2131              | <i>Lasionycteris noctivagans</i>    | M                          | 11   |                                               |
| 2132              | <i>Myotis thysanodes</i>            | F                          | 8    | Pregnant, ticks                               |
| 2145              | <i>Myotis volans</i>                | M                          | 7    |                                               |
| 2151              | <i>Eptesicus fuscus</i>             | M                          | 15   | Hair missing on left shoulder and right chest |
| 2156              | <i>Corynorhinus townsendii</i>      | M                          | 10.5 |                                               |
| 2158              | <i>Myotis ciliolabrum</i>           | M                          | 4    |                                               |
| 2200              | <i>Myotis ciliolabrum</i>           | M                          | 3.5  |                                               |
| 2202              | <i>Eptesicus fuscus</i>             | M                          | 14   | Hole in left hand membrane                    |
| 2205              | <i>Eptesicus fuscus</i>             | M                          | 14   |                                               |
| 2212              | <i>Corynorhinus townsendii</i>      | F                          | 11   | Lactating                                     |
| 2225              | <i>Eptesicus fuscus</i>             | M                          | 15   |                                               |
| 2227              | <i>Eptesicus fuscus</i>             | M                          | 14   |                                               |
| 2228              | <i>Eptesicus fuscus</i>             | M                          | 15   |                                               |
| 2240              | <i>Eptesicus fuscus</i>             | M                          | 14   |                                               |
| 2241              | <i>Eptesicus fuscus</i>             | M                          | 16.5 |                                               |
| 2243              | <i>Eptesicus fuscus</i>             | F                          | 20   | Pregnant                                      |
| 2300              | <i>Myotis californicus</i>          | M                          | 4    |                                               |
| 2302              | <i>Myotis velifer</i>               | F                          | 11   | Pregnant                                      |
| 2320              | <i>Myotis auriculus</i>             | F                          | 9    |                                               |
| 2340              | <i>Eptesicus fuscus</i>             | M                          | 16   | Bed bugs                                      |
| <b>TOTALS</b>     | <b>60 BATS</b><br><b>10 SPECIES</b> | <b>34 M</b><br><b>26 F</b> |      |                                               |

**TABLE 7:** Bat netting data from the small pool in the drainage parallel to road 250 yards north of Bonita Canyon Campground in the CNM on August 5, 2005. Three 2.6 m (8') nets were opened at 1930 hours and closed at 2300 hours. Site coordinates are: (Net #1 s.) N Lat 32° 00.901, W Long 109° 21.215, 1591 m (5217') elev.; (Net #2 b/t #1 & 3) N Lat 32° 00.904, W Long 109° 21.204 1644 m (5392'); (Net #3 n.) N Lat 32° 00.915, W Long 109° 21.202 1663 m (5452''); clear; slight breeze; Temp., wind, humidity from 1900 to 2250 hours: (77.5°F to 73.5°F), (1.6 mph to 0.9 mph), (50% to 57%); N= North, Lat = Latitude, W = West, Long = Longitude, Temp. = temperature, elev. = elevation, FA = Forearm, (g) = grams, M = male, F = female, s. = south, n. = north, WT. = WEIGHT.

| TIME          | SPECIES                           | SEX                      | WT. (g) | NOTES                         |
|---------------|-----------------------------------|--------------------------|---------|-------------------------------|
| 2005          | <i>Choeronycteris mexicana</i>    | F                        | 16      | Adult; mites; post lactating; |
| 2144          | <i>Leptonycteris curasoae</i>     | F                        | 27      | Adult; mites; post lactating; |
| <b>TOTALS</b> | <b>2 BATS</b><br><b>2 SPECIES</b> | <b>2 F</b><br><b>0 M</b> |         |                               |

**TABLE 8:** Bat netting data from the “Old Pump” 1.5 miles north of Bonita Canyon Campground in the CNM on August 6, 2005. Four 2.6 m (8’) nets were opened at 1925 hours and closed at 2345 hours. Site coordinates are: (Net #1 @ pump n.) N Lat 32° 01.297, W Long 109° 20.343 1718 m (5633’) elev.; (Net #2 b/t #1 & 3) N Lat 32° 01.295, W Long 109° 20.349, 1717 m (5630’); (Net #3 s.) N Lat 32° 01.292, W Long 109° 20.359, 1718 m (5633’) elev.; (Net # 4 s.) N Lat 32° 01.293, W Long 109° 20.365 1719 m (5636’) elev.; cloudy, few sprinkles; Temp., wind, humidity from 2000 to 2330 hours: (77.9°F to 74.0°F), (0.5mph to 0mph), (47% to 63%); N= North, Lat = Latitude, W = West, Long = Longitude, Temp. = temperature, elev. = elevation, FA = Forearm, (g) = grams, M = male, F = female, s. = south, n. = north, WT. = WEIGHT, L = left, > = greater than, < = less than.

| TIME          | SPECIES                        | SEX                 | WT.<br>(g) | NOTES                  |
|---------------|--------------------------------|---------------------|------------|------------------------|
| 1940          | <i>Pipistrellus hesperus</i>   | F                   | 3.5        |                        |
| 1943          | <i>Myotis thysanodes</i>       | F                   | 7          | Post lactating         |
| 1943          | <i>Myotis volans</i>           | M                   | 5          |                        |
| 1943          | <i>Myotis volans</i>           | M                   | 6          |                        |
| 1959          | <i>Myotis ciliolabrum</i>      | M                   | 4          | Thumb > 4              |
| 1959          | <i>Myotis auriculus</i>        | M                   | 6          |                        |
| 1959          | <i>Myotis thysanodes</i>       | M                   | 7.5        |                        |
| 2007          | <i>Myotis auriculus</i>        | F                   | 7          | Young of the year      |
| 2020          | <i>Corynorhinus townsendii</i> | M                   | 7.5        |                        |
| 2020          | <i>Myotis thysanodes</i>       | M                   | 7.5        |                        |
| 2028          | <i>Myotis californicus</i>     | M                   | 4.5        | Thumb < 4              |
| 2049          | <i>Myotis ciliolabrum</i>      | M                   | 4.5        | Mites; scar on L wing; |
| 2049          | <i>Corynorhinus townsendii</i> | M                   | 7          |                        |
| 2129          | <i>Myotis ciliolabrum</i>      | M                   | 4          | Thumb > 4              |
| 2159          | <i>Myotis volans</i>           | M                   | 5          |                        |
| 2159          | <i>Eptesicus fuscus</i>        | M                   | 19         |                        |
| 2202          | <i>Choeronycteris mexicana</i> | F                   | 18         | Post lactating         |
| 2202          | <i>Corynorhinus townsendii</i> | M                   | 8          |                        |
| <b>TOTALS</b> | <b>18 BATS<br/>9 SPECIES</b>   | <b>14 M<br/>4 F</b> |            |                        |

**TABLE 9:** Bat netting data from “Silver Spur Creek” in the CNM on August 12, 2005. Three 2.6 m (8’) nets were opened at 2015 hours and closed at 2215 hours. Site coordinates are: (Net #1 s.) N Lat 32° 00.316, W Long 109° 21.376, 1629 m (5342’) elev.; (Net #2 b/t #1 & 3) N Lat 32° 00.318, W Long 109° 21.376, 1629 m (5342’); (Net #3 n.) N Lat 32° 00.321, W Long 109° 21.389, 1629 m (5341’) elev.; Overcast and rainy; Temp., wind, humidity from 2000 to 2200 hours: (65.1°F to 60.0°F), (2.2mph to 1.0mph), (86% to 90%); N= North, Lat = Latitude, W = West, Long = Longitude, Temp. = temperature, elev. = elevation, FA = Forearm, (g) = grams, M = male, F = female, s. = south, n. = north, WT. = WEIGHT.

| <b>Table 9</b> |                                   |                          |                |                       |
|----------------|-----------------------------------|--------------------------|----------------|-----------------------|
| <b>TIME</b>    | <b>SPECIES</b>                    | <b>SEX</b>               | <b>WT. (g)</b> | <b>NOTES</b>          |
| 2042           | <i>Myotis thysanodes</i>          | F                        | 8              | Post lactating;       |
| 2100           | <i>Myotis thysanodes</i>          | F                        | 8              | Post lactating;       |
| 2107           | <i>Myotis thysanodes</i>          | F                        | 9              | Young of year; mites; |
| <b>TOTALS</b>  | <b>3 BATS</b><br><b>1 SPECIES</b> | <b>0 M</b><br><b>3 F</b> |                |                       |

**TABLE 10:** Bat netting data from the “Big Rock and Small Stream” near the Superintendent’s House in the CNM on August 13, 2005. Four 2.6 m (8’) nets were opened at 1920 hours and closed at 2315 hours. Site coordinates are: (Net #1 @ Big Rock) N Lat 32° 00.527, W Long 109° 21.979, 1606 m (5267’) elev.; (Net #2 s.) N Lat 32° 00.533, W Long 109° 21.959, 1607 m (5268’) elev.; (Net #3 b/t #2 & 4) N Lat 32° 00.533, W Long 109° 21.964, 1606 m (5267’) elev.; (Net #4 n.) N Lat 32° 00.534, W Long 109° 21.972, 1606 m (5265’); ½ moon, clear; Temp., wind, humidity from 1900 to 2200 hours: (69.8°F to 66.7°F), (0 mph), (76% to 88%); N= North, Lat = Latitude, W = West, Long = Longitude, Temp. = temperature, elev. = elevation, FA = Forearm, (g) = grams, M = male, F = female, s. = south, n. = north, WT. = WEIGHT.

**Bats heard and seen throughout the evening as they foraged in the area. The stream was dry and the “Big Rock” had the least amount of water observed for the entire study (6 years).**

**0 BATS WERE NETTED!**

**TABLE 11:** Bat netting data from “Apache Springs” (AS) at the FBNHS on August 26, 2005. Three 2.6 m (8’) nets were opened at 1900 hours and closed at 2300 hours. Site coordinates are: (Net #1 @ Spring, n.) N Lat 32° 08.445, W Long 109° 26.261, 1514 m (4963’) elev.; (Net #2 b/t #1 & 3) N Lat 32° 08.443, W Long 109° 26.26, 1504m (4932’) elev.; (Net #3 s.) N Lat 32° 08.443, W Long 109° 26.266, 1502m (4924’) elev.; clear; Temp., wind, humidity for 1900 to 2100 hours: (82.6°F to 79.2°F), (0.9mph to 0mph), (38% to 40%); N= North, Lat = Latitude, W = West, Long = Longitude, Temp. = temperature, elev. = elevation, FA = Forearm, (g) = grams, M = male, F = female, s. = south, n. = north, > = greater than, L = left.

| <b>TIME</b>   | <b>SPECIES</b>                    | <b>SEX</b>               | <b>WT. (g)</b> | <b>NOTES</b>                                                                             |
|---------------|-----------------------------------|--------------------------|----------------|------------------------------------------------------------------------------------------|
| 1915          | <i>Myotis ciliolabrum</i>         | M                        | 4              | Thumb > 4                                                                                |
| 2055          | <i>Corynorhinus townsendii</i>    | M                        | 9              |                                                                                          |
| 2125          | <i>Leptonycteris curasoae</i>     | F                        | 26             | Mites; Small growth on L hand b/t # 3 & # 4 finger; Adult coloring & no nipples obvious; |
| <b>TOTALS</b> | <b>3 BATS</b><br><b>3 SPECIES</b> | <b>2 M</b><br><b>1 F</b> |                |                                                                                          |

**TABLE 12:** Rainfall data (inches) totals for the CNM for April – August 2000 to 2005.

| <b>YEAR/<br/>MONTH</b> | <b>APRIL</b> | <b>MAY</b> | <b>JUNE</b> | <b>JULY</b> | <b>AUGUST</b> | <b>TOTALS<br/>(April to August)</b> |
|------------------------|--------------|------------|-------------|-------------|---------------|-------------------------------------|
| <b>2000</b>            | 0.00         | 0.00       | 4.70        | 2.52        | 4.59          | <b>11.81 (30.0 cm)</b>              |
| <b>2001</b>            | 1.01         | 0.39       | 0.36        | 4.87        | 5.56          | <b>12.19 (31.0 cm)</b>              |
| <b>2002</b>            | 0.08         | 0.00       | 0.00        | 2.97        | 7.32          | <b>10.37 (26.3 cm)</b>              |
| <b>2003</b>            | 0.00         | 0.00       | 0.22        | 1.31        | 1.36          | <b>2.89 (7.3 cm)</b>                |
| <b>2004</b>            | 1.21         | 0.14       | 1.18        | 3.39        | 3.61          | <b>9.53 (24.2 cm)</b>               |
| <b>2005</b>            | 0.51         | 0.49       | 0.09        | 0.36        | 3.47          | <b>4.92 (12.5 cm)</b>               |

**TABLE 13:** CNM Bat Summary Data for Years 2000 – 2005. ID = Identification, SP = Species.

| <b>BAT SPECIES/YEAR</b>            | <b>2000</b>               | <b>2001</b>              | <b>2002</b>               | <b>2003</b>               | <b>2004</b>               | <b>2005</b>               |
|------------------------------------|---------------------------|--------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| <i>Antrozous pallidus</i>          | 5                         | 0                        | 5                         | 8                         | 4                         | 6                         |
| <i>Choeronycteris mexicana</i>     | 0                         | 1                        | 1                         | 1                         | 1                         | 2                         |
| <i>Corynorhinus townsendii</i>     | 5                         | 3                        | 2                         | 6                         | 17                        | 15                        |
| <i>Eptesicus fuscus</i>            | 18                        | 14                       | 19                        | 46                        | 41                        | 40                        |
| <i>Idionycteris phyllotis</i>      | 1                         | 1                        | 1                         | 0                         | 0                         | 1                         |
| <i>Lasionycteris noctivagans</i>   | 0                         | 6                        | 4                         | 46                        | 37                        | 15                        |
| <i>Lasiurus blossevillii</i>       | 0                         | 0                        | 0                         | 3                         | 0                         | 0                         |
| <i>Lasiurus cinereus</i>           | 1                         | 3                        | 0                         | 3                         | 5                         | 5                         |
| <i>Leptonycteris curasoae</i>      | 2                         | 0                        | 0                         | 1                         | 0                         | 1                         |
| <i>Myotis auriculus</i>            | 18                        | 5                        | 13                        | 46                        | 16                        | 17                        |
| <i>Myotis californicus</i>         | 6                         | 12                       | 14                        | 46                        | 21                        | 17                        |
| <i>Myotis ciliolabrum</i>          | 4                         | 3                        | 0                         | 9                         | 16                        | 21                        |
| <i>Myotis occultus (lucifugus)</i> | 0                         | 0                        | 0                         | 0                         | 0                         | 0                         |
| <i>Myotis thysanodes</i>           | 36                        | 31                       | 45                        | 60                        | 34                        | 36                        |
| <i>Myotis velifer</i>              | 1                         | 5                        | 5                         | 8                         | 3                         | 1                         |
| <i>Myotis volans</i>               | 6                         | 0                        | 3                         | 5                         | 11                        | 9                         |
| <i>Myotis species (no ID)</i>      | 2                         | 0                        | 1                         | 0                         | 0                         | 0                         |
| <i>Pipistrellus hesperus</i>       | 2                         | 1                        | 3                         | 5                         | 8                         | 9                         |
| <b>TOTALS</b>                      | <b>107 BATS<br/>13 SP</b> | <b>85 BATS<br/>12 SP</b> | <b>116 BATS<br/>12 SP</b> | <b>293 BATS<br/>15 SP</b> | <b>214 BATS<br/>13 SP</b> | <b>195 BATS<br/>15 SP</b> |

**TABLE 14:** FBNHS Bat Summary Data for Years 2001 – 2005. ID = Identification, SP = Species.

| <b>BAT SPECIES/YEAR</b>            | <b>2001</b>             | <b>2002</b>            | <b>2003</b>            | <b>2004</b>            | <b>2005</b>            |
|------------------------------------|-------------------------|------------------------|------------------------|------------------------|------------------------|
| <i>Corynorhinus townsendii</i>     | 0                       | 0                      | 0                      | 0                      | 1                      |
| <i>Leptonycteris curasoae</i>      | 0                       | 0                      | 0                      | 0                      | 1                      |
| <i>Myotis auriculus</i>            | 1                       | 0                      | 0                      | 0                      | 0                      |
| <i>Myotis californicus</i>         | 4                       | 3                      | 3                      | 3                      | 0                      |
| <i>Myotis ciliolabrum (leibii)</i> | 1                       | 0                      | 1                      | 1                      | 1                      |
| <i>Myotis occultus (lucifugus)</i> | 1                       | 0                      | 0                      | 0                      | 0                      |
| <i>Myotis thysanodes</i>           | 1                       | 2                      | 1                      | 3                      | 0                      |
| <i>Myotis velifer</i>              | 2                       | 0                      | 0                      | 1                      | 0                      |
| <i>Myotis volans</i>               | 0                       | 0                      | 0                      | 1                      | 0                      |
| <i>Myotis species (no ID)</i>      | 2                       | 0                      | 0                      | 0                      | 0                      |
| <b>TOTALS</b>                      | <b>12 BATS<br/>6 SP</b> | <b>5 BATS<br/>2 SP</b> | <b>5 BATS<br/>3 SP</b> | <b>9 BATS<br/>5 SP</b> | <b>3 BATS<br/>3 SP</b> |

**TABLE 15:** Species Names for Tables and Figures for the CNM and FBNHS Data.

| SPECIES - SCIENTIFIC NAME          | SPECIES – COMMON NAME           | SPECIES ABBREVIATION |
|------------------------------------|---------------------------------|----------------------|
| <i>Antrozous pallidus</i>          | Pallid bat                      | Apal                 |
| <i>Choeronycteris mexicana</i>     | Mexican long-tongued bat        | Cmex                 |
| <i>Corynorhinus townsendii</i>     | Townsend's big-eared bat        | Ctow                 |
| <i>Eptesicus fuscus</i>            | Big brown bat                   | Efus                 |
| <i>Idionycteris phyllotis</i>      | Allen's lappet-browed bat       | Iphy                 |
| <i>Lasionycteris noctivagans</i>   | Silver-haired bat               | Lnoc                 |
| <i>Lasiurus blossevillii</i>       | Western red bat                 | Lblo                 |
| <i>Lasiurus cinereus</i>           | Hoary bat                       | Lcin                 |
| <i>Leptonycteris curasoae</i>      | Lesser long-nosed bat           | Lcur                 |
| <i>Myotis auriculus</i>            | Southwestern Myotis bat         | Maur                 |
| <i>Myotis californicus</i>         | California Myotis bat           | Myca                 |
| <i>Myotis ciliolabrum (leibii)</i> | Western small-footed Myotis bat | Meil                 |
| <i>Myotis occultus (lucifugus)</i> | Occult little brown bat         | Mocc                 |
| <i>Myotis thysanodes</i>           | Fringed Myotis bat              | Mthy                 |
| <i>Myotis velifer</i>              | Cave Myotis bat                 | Mvel                 |
| <i>Myotis volans</i>               | Long-legged Myotis bat          | Mvol                 |
| <i>Pipistrellus hesperus</i>       | Western pipistrelle bat         | Phes                 |

**Figure 1 - CNM Bat Totals by Species & Year**

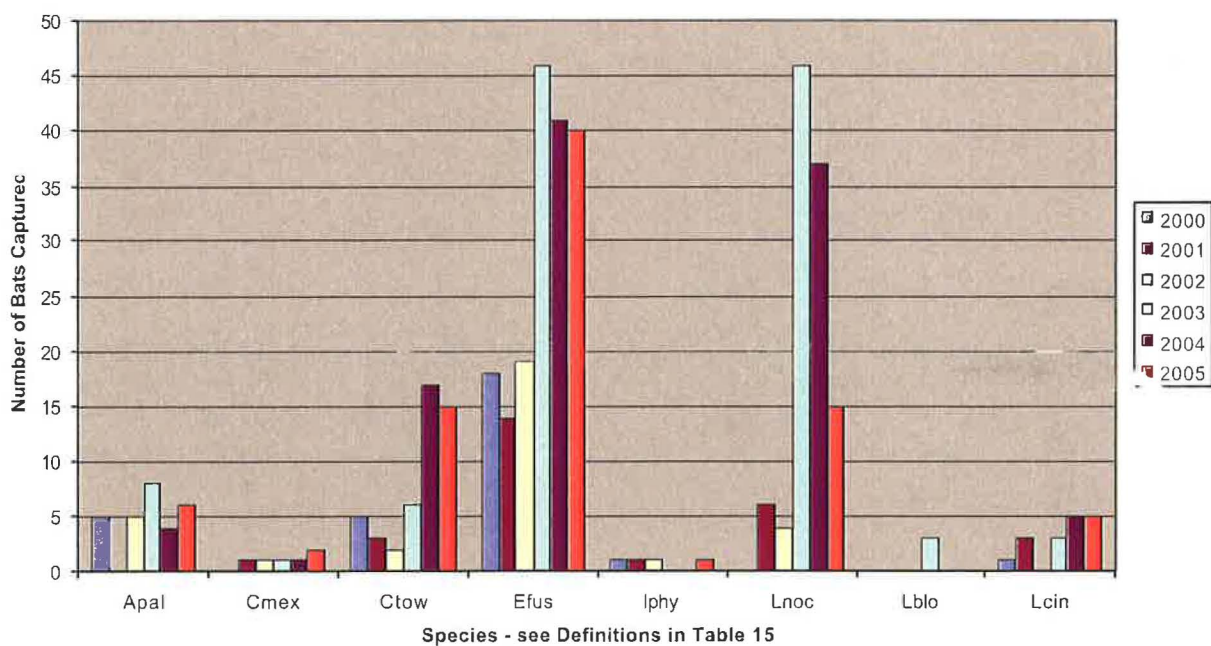


Figure 2 - CNM Bat Totals by Species & Year

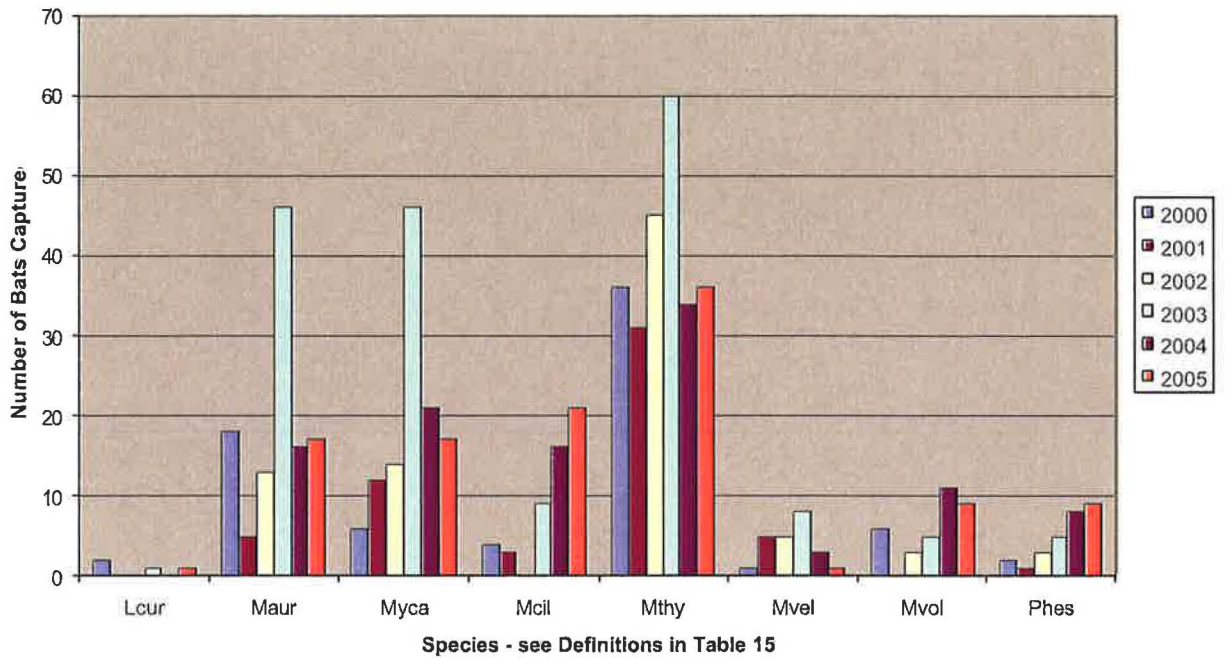


Figure 3 - FBNHS Bat Totals by Species & Year

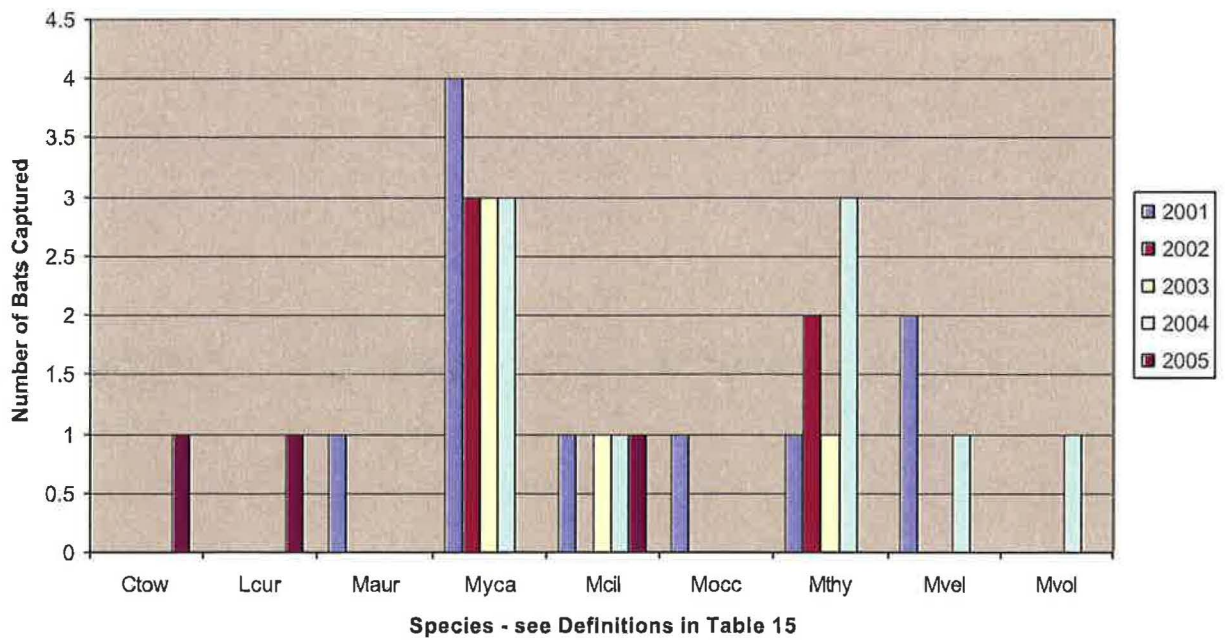


Figure 4 - CNM Bat Species Totals for 2000-2005 - See Definitions in Table 15

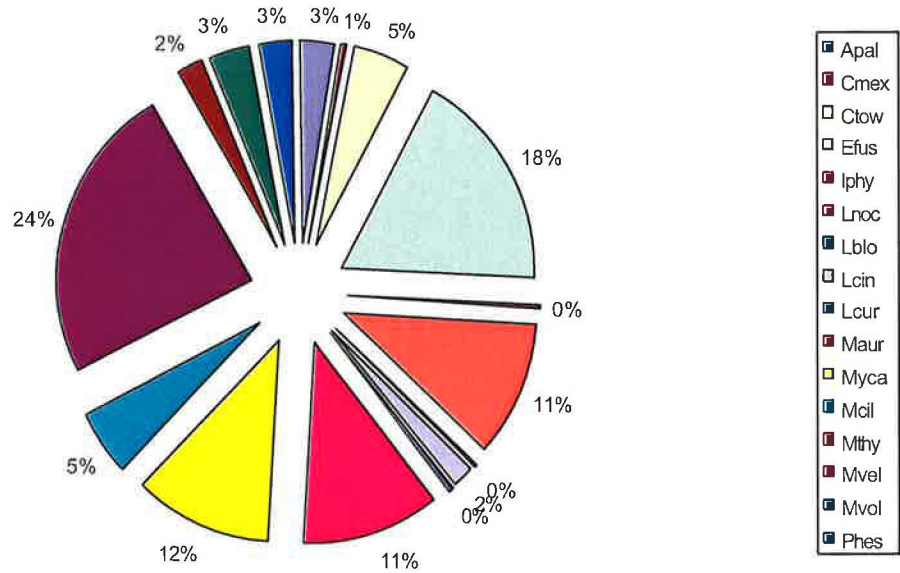


Figure 5 - FBNHS Bat Species Totals for 2001-2005 - See Species Definitions in Table 15

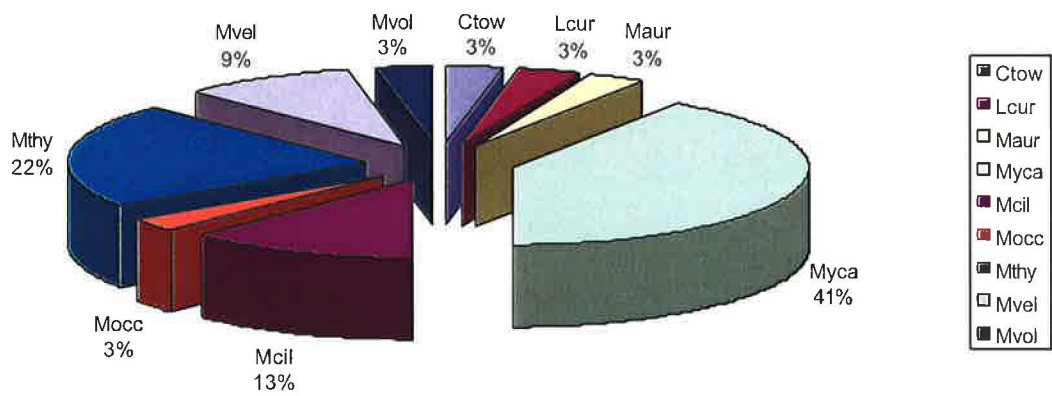


Figure 6 - CNM Totals for Bat Numbers and Species by Year

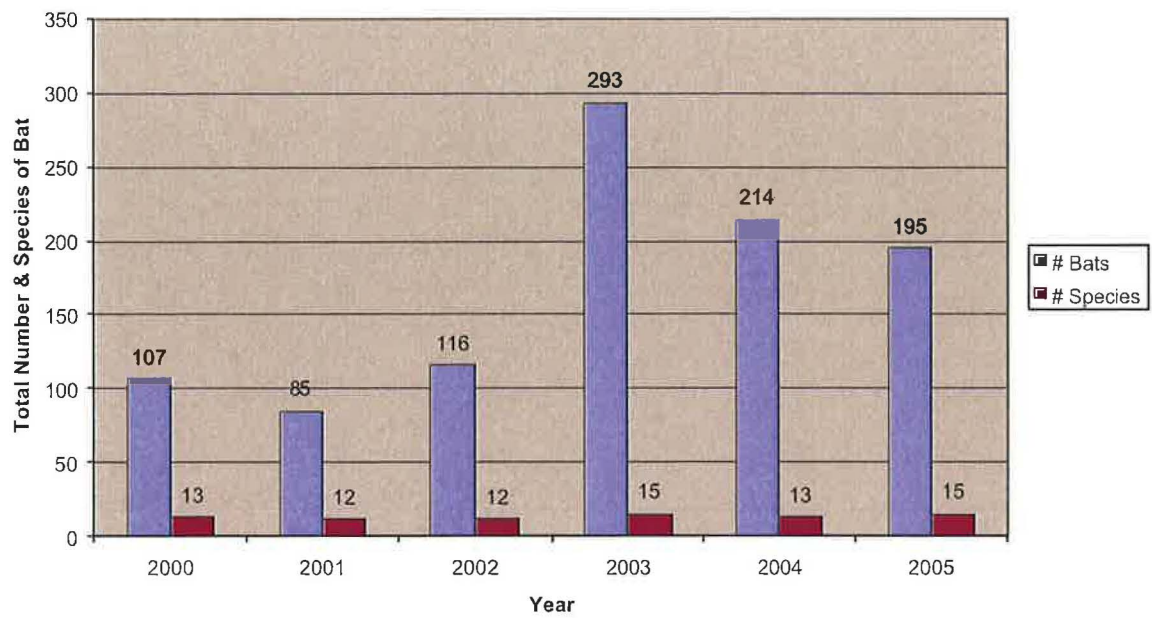


Figure 7 - FBNHS Totals for Bat Numbers and Species by Year

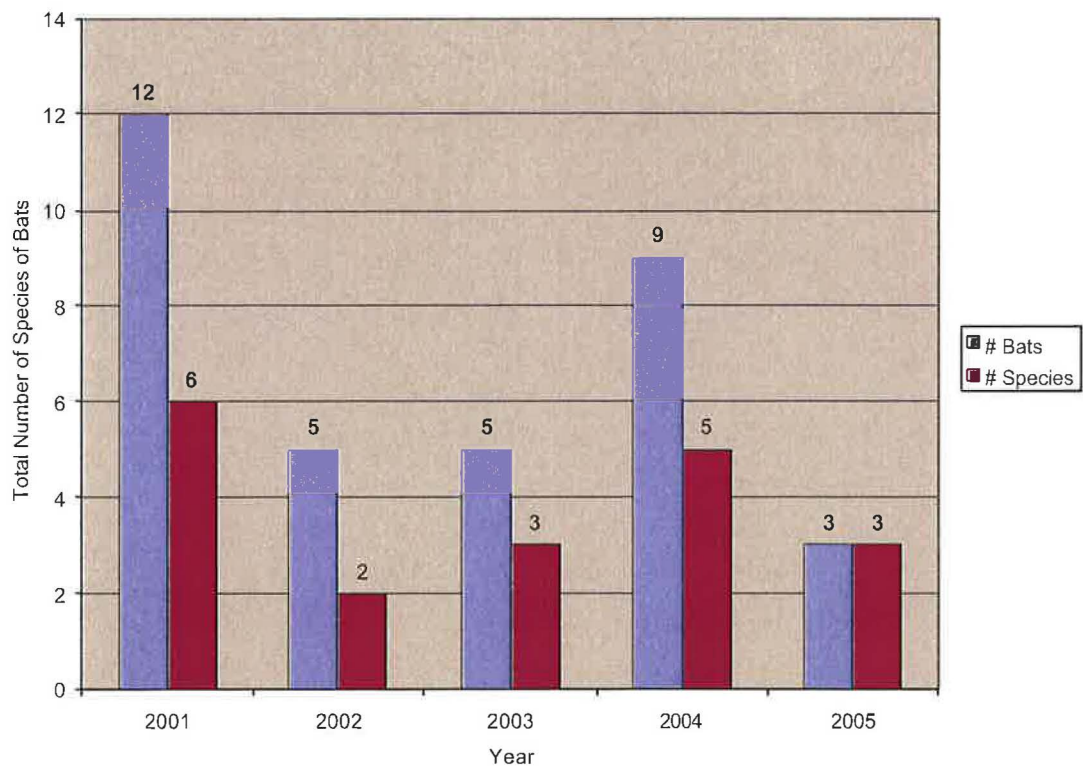


Figure 8 - CNM Totals for Bat Numbers and Rainfall (April-August) by Year

