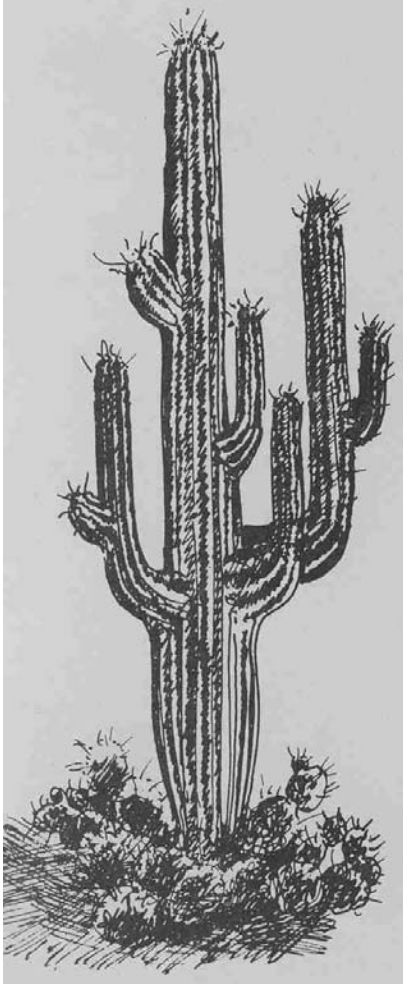

Cooperative National Park Resources Studies Unit

ARIZONA

TECHNICAL REPORT NO. 7
BAT POPULATIONS AND HABITATS
AT THE
ORGAN PIPE CACTUS NATIONAL MONUMENT

University of Arizona
Tucson, Arizona 85721

Western Region
National Park Service
Department of the Interior
San Francisco, Ca. 94102

COOPERATIVE NATIONAL PARK RESOURCES STUDIES UNIT
University of Arizona/Tucson - National Park Service

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TECHNICAL REPORT NO. 7

BAT POPULATIONS AND HABITATS AT THE ORGAN PIPE CACTUS NATIONAL MONUMENT

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August, 1981

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CONTENTS

I Abstract

II Introduction

III Annotated Checklist

IV Provisional List

V Management Considerations

VI Literature Cited

I. ABSTRACT

This study is a modern checklist of the bats known to occur on the Organ Pipe Cactus National Monument, Arizona. It summarizes details of life histories and habitat requirements (seasonal occurrence and activity, types of roosts, food habits and water requirements) thought to be useful in making meaningful management decisions.

II. INTRODUCTION

This study was designed to provide National Park Service personnel with a modern checklist of the bats present on the Organ Pipe Cactus National Monument. Further, details of life histories and habitat requirements necessary for making meaningful decisions concerning such monument management problems as waterhole maintenance and control of human access to abandoned mines was also a stated project objective.

A number of visits were made to the monument between January 1979 and June 30, 1980 to provide additional information about local conditions. Later a literature review plus summaries of personal knowledge and experience were combined with the field data to provide the following overview.

III. ANNOTATED CHECKLIST

To date twelve species have been collected on the monument proper. These are members of three different families and represent a wide spectrum of habitat use and food requirements as will be discussed later. However, based on knowledge of habits of other species taken elsewhere in southern Arizona, it appears probable that a few additional species may eventually be recorded as at least occasional residents on the monument. Common and scientific names used herein are those provided in Jones et al. checklist (1979). The species recorded are:

Family Phyllostomatidae

1. California Leaf-nosed Bat (Macrotus californicus).

This big eared 1eaf-nosed bat is probably a resident on the monument throughout the year. Like the other members of the family, these bats cannot hibernate. Thus they cannot successfully survive extended periods of low ambient temperatures and require food throughout the year.

Day roosts are in caves (and mine tunnels). Elsewhere in southern Arizona a few have been found in cave-like man-made structures (attic of a church and a unique highway bridge support structure). During the cold winter months they roost in deep warm mine tunnels.

Food consists of various insects and some vegetable matter. Ross (1967) found that it feeds mainly on large (40-60 mm length) night-flying insects but also recorded some lepidoptera larvae and some green vegetable matter. Reportedly they feed on ripe saguaro fruits in season.

Free water is required. These bats are able to hover in flight, thus they can drink from small water sources, even from the bottom of a mine shaft.

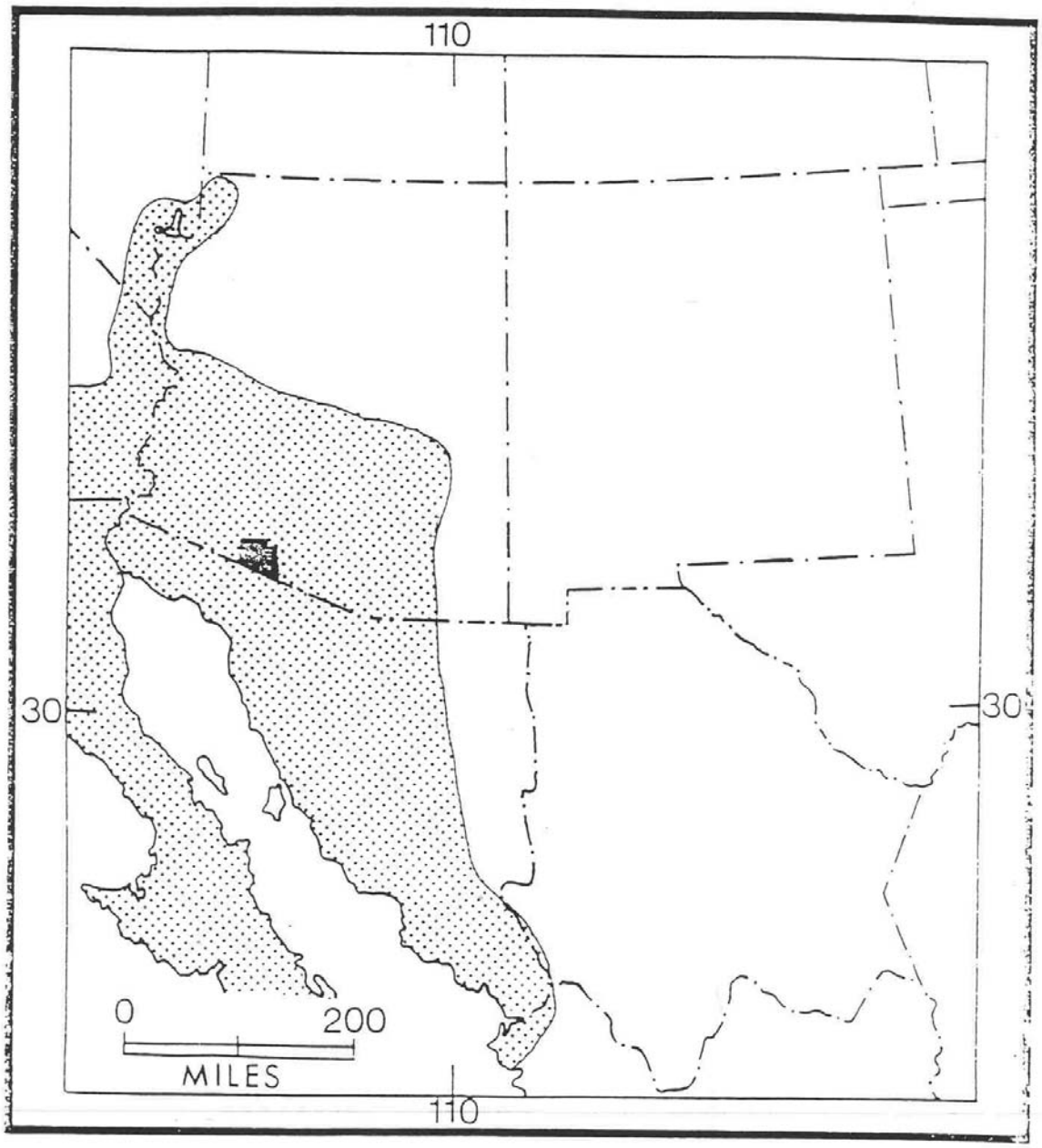
Map l shows the distribution of this species in the general region. Maps 1 through 11 are based on a number of sources including Hall and Kelson (1959), Cockrum (1960) and Findley et al. (1975). Specific records from the monument include: a. Growler Mine (200' horizontal mine tunnel, 1 mi E, 2 mi N Bates Well) 26 Mar. 1961; T.J. Cox and S. Cross banded 5 males and 30 females of estimated 1000 present (UA notes). b. Copper Mountain Mine, 29 April 1977; Henry and Peters took one in mist net and observed others coming from mine shaft at 8 P.M. (monument records). Also 1 June 1977, netted as exiting at 10:33 P.M. (monument records); 2 June 1979, roost observed by Huntly and Inouye; 27 July - 2 August 1979, large day roost observed by Steiger. c. Lost Cabin Mine, 2 June 1979, day roost seen by Huntly and Inouye. d. Mist net at Bates Well, 2 June 1979, 3 recorded by Huntly and Inouye; 27 July and 2 August 1979, 3 recorded by Steiger. e. Mist net at Bonita Well, 21 April 1979, 2 recorded by Wares; 24 February, 2 recorded; 31 March, 6 recorded; all by Wares. f. Mist net over scattered pools in Alamo Canyon; 9-10 July 1979, 8 recorded by Petryszyn. g. Dowling Ranch, 23 August 1950, collected by McCalmont (monument collection).

2. Sanborn's Long-nosed Bat (Leptonycteris sanborni).

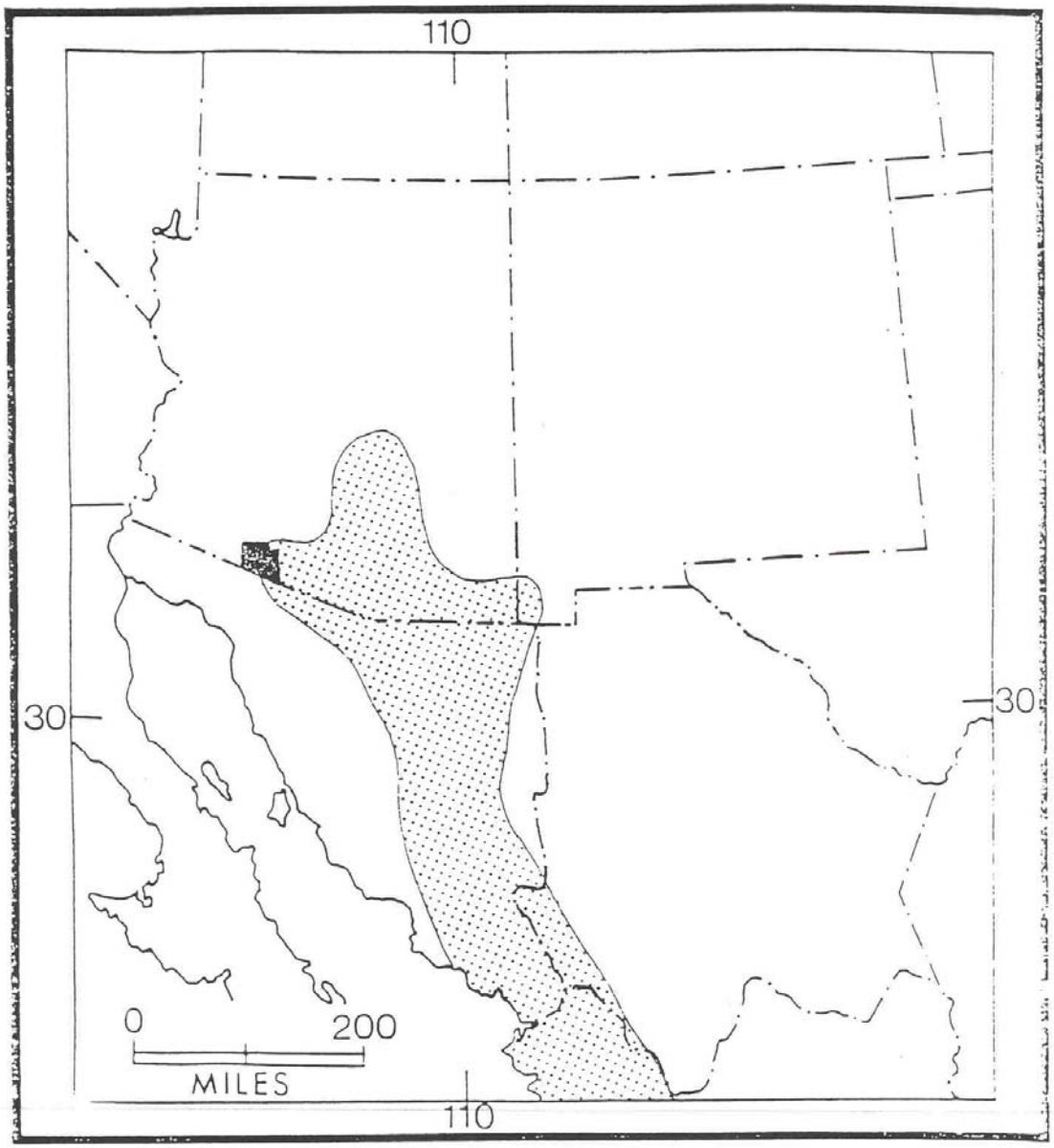
This short-eared leaf-nosed bat is an inhabitant of the monument only from late April through late September. The rest of the year is spent in Mexico. Day roosts are in dark mine tunnels. Food consists of nectar (from the flowers of saguaro, organ-pipe and various agaves) as well as the pulp of ripe saguaro fruit. Droppings stained red by this diet can be seen on the floor of most mine tunnel roosts. Some lay persons have interpreted this as vampire bat droppings. Of course when blood passes through a digestive system the result is a black-tarry material.

Gravid females and some males migrate as far north as southern Arizona. The single young is born between mid-May and early June.

General distribution in the region is shown on map 2. Specific records on the monument include: a. Bluebird Mine (2 mi NW of Growler) 18 September 1970, 250 banded (monument records). b. Copper Mountain Mine, south entrance, 1 June 1977, 10 netted, 10:30 P.M. Monument record); 27 July 1979, roost, Steiger. c. Water trough, Alamo Canyon, 26 June 1977, netted by Henry, Sutherland, Peters (monument records). d. Scattered pools, Alamo Canyon; 29 May 1979, 1 netted by Huntly and Inouye; 9-10 July 1979, 16 (males, females, juveniles) netted by Petryszyn and Steiger. e. Dripping Springs; 27 July - 2 August 1979, 2 netted by Steiger. f. Cement tank, 27 July - 2 August 1979; 3 netted by Steiger. g. Pozo Nuevo trough, 27 July - 2 August 1979, 1 netted by Steiger. h. Bates Well, 27 July - 2 August 1979, 11 netted by Steiger.



Map 1. California Leaf-nosed Bat



Map 2. Sanborn's Long-nosed Bat

Family Vespertilionidae

1. Cave Myotis (Myotis velifer).

This bat is a member of the widely distributed genus of mouse-eared bats. All are insectivorous and all hibernate. In Arizona the Cave Myotis spends the summer months in colonial day roosts. These roosts are often situated in dark parts of relatively short mine tunnels or caves. Winter roosts are unknown but are probably in cool crevices, caves or mine tunnels in the higher parts of the Sierra Madre Mountains (Hayward 1961). The population in the monument appear to represent a southwestern edge of the summer range.

Food consists of a variety of small (4 to 13 mm) flying insects, especially moths. Also taken are some mayflies, leafhoppers, and beetles (Ross 1967). Most, if not all are taken in flight.

Free water is required. Small pools and water troughs are acceptable sources.

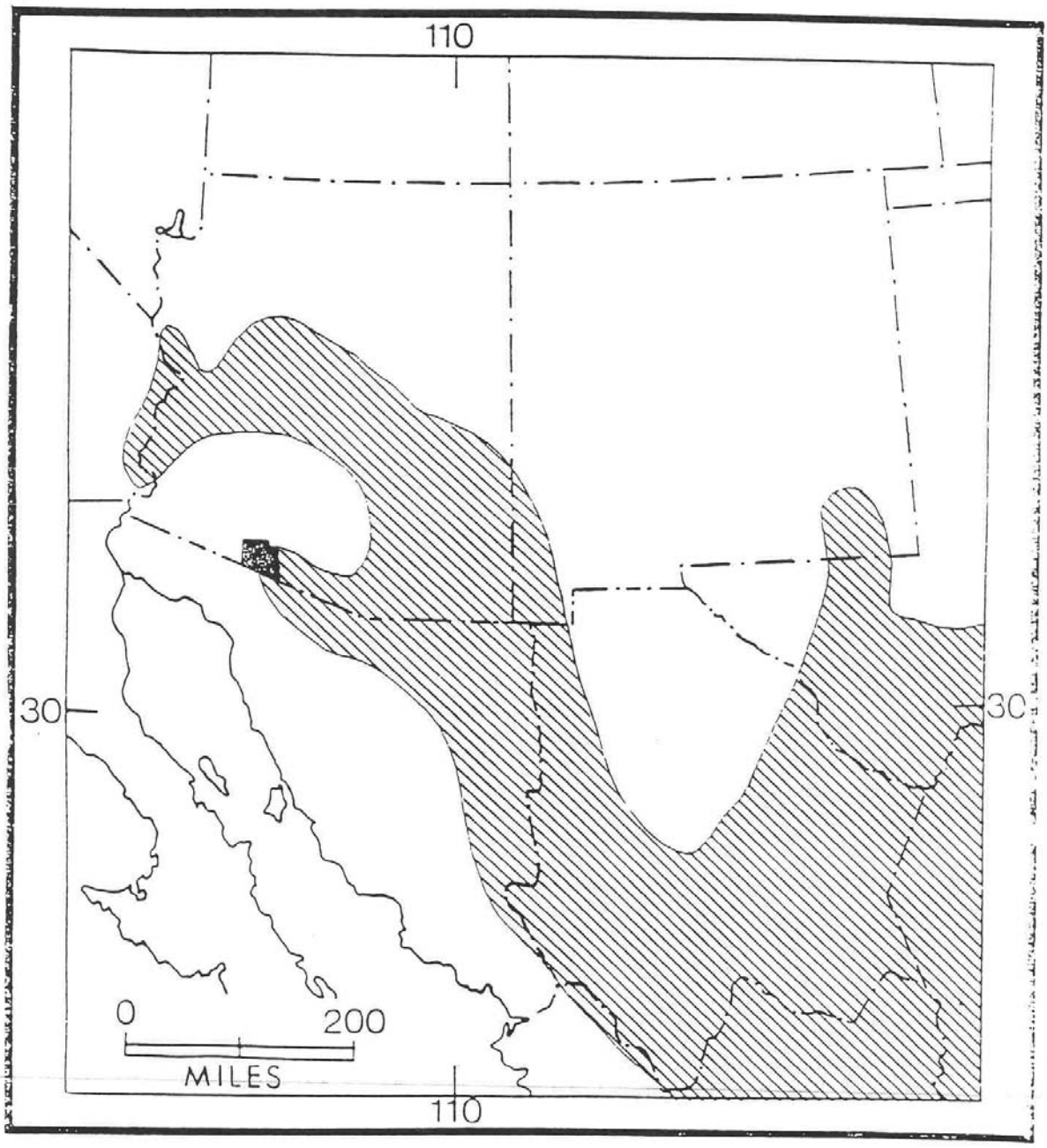
Distribution in the general. region is shown on map 3. Specific records include: a. Alamo Canyon, Ajo Mountains. 3 females taken June 26-30, 1945, in University Florida Museum (Hayward 1961); 4 July 1945, Constantine (monument records); 9 females taken over scattered waterholes 9-10 July 1979 (Petryszyn). b. Dripping Springs, 3 netted 2 August 1979 (Steiger).

3. California Myotis (Myotis californicus).

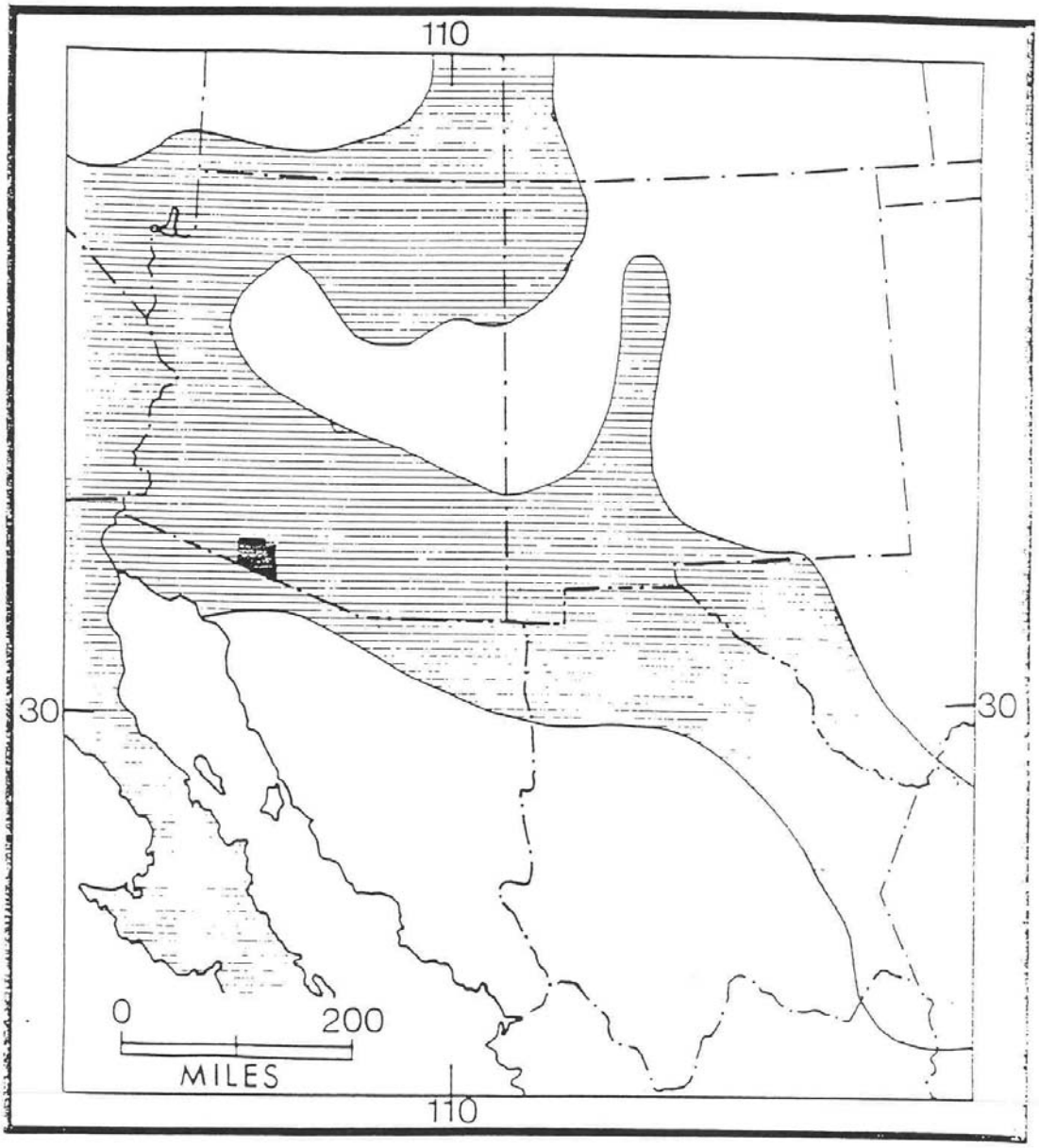
This mouse-eared bat is one of the most common species on the monument. It typically roosts in rock crevices and is rarely found in any large colonies in any part of its range. Occasionally a few are found roosting in crevices of man-made structures. Winter roosts are poorly understood. Probably most remain on the monument, hibernating in cool, shallow crevices. Certainly in other low-desert areas of the state some California Myotis are active pursuing flying insects and drinking during the early evenings of warm winter days.

Food consists of various small insects, mainly moths. Open water is required.

General distribution in the region is shown on map 4. Specific records on the monument include: a. Under water tank, Growler Mine, 2 March 1939, 1 taken (Huey 1942). b. Cleft in rocky bank near Quitobaquito, 5 March 1939; 1 male, 1 female (Huey 1942) (also Cockrum 1960). c. P.N.E. building, 28 February 1977, one hanging on north side to stucco in shade (monument record). d. Adobe house at Blankship Well, 20 seen 9 July 1979 (Petryszyn). e. Alamo Canyon, Ajo Mountains, 10, 4 July 1945, by Constantine (monument records) (Cockrum 1960); water trough, 26 June 1977, 10 netted by Peters, Henry, Southerland (monument records). Mist nets over scattered pools, l, 29 May 1979 (Huntly, Inouye); 41 netted 9 July 1979 (Petryszyn). f. Bates Well, 2 June 1979, 33 netted (Huntly); 27 July 1979, 13 netted (Steiger). g. Pozo Nuevo, 1 netted, 28 July 1979 (Steiger).



Map 3. Cave Myotis



Map 4. California Myotis

3. Western Pipistrelle (Pipistrellus hesperus).

This tiny bat is certainly the most evident and probably the most numerous bat on the monument. During the day these bats roost in small crevices (rocks, buildings) and occasionally even under flat rocks on the ground. They have been taken from holes in saguaros. The evening flight is early, usually shortly after sunset and well before dark. Thus these bats are commonly seen in the winter months, feeding flights have been seen in late afternoon, well before sunset. During the winter, hibernation occurs during cold periods but feeding routinely occurs during all months of the year. Huey (1942) suggested that these bats migrate, leaving the area during the winter. However, we now think that most remain on the monument.

Food consists of small (4 to 10 mm length) flying insects. During most of the year small moths provide most of the food. During the late spring leaf hoppers become important and during the summer rains, flying ants are dominant.

Open water is required. Because of their small size and adept flight even tiny water sources such as small pools, troughs and even cisterns can be used as water sources.

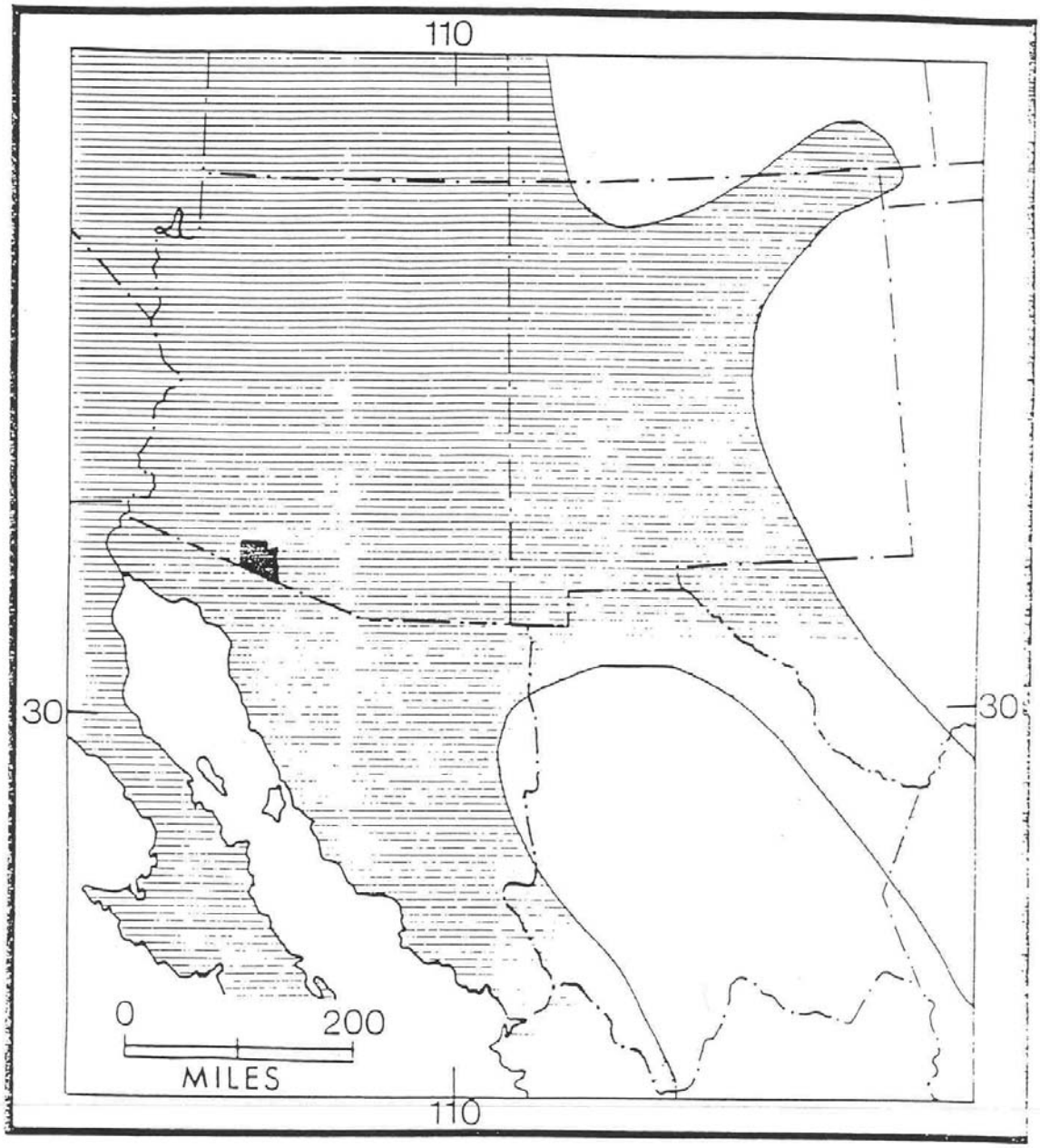
Map 5 shows the distribution in the general region. Specific records on the monument include: a. Quitobaquito, 25 January 1394, male (Mearns and Holzner); 29 April 1939, female with 2 emb, SDSNH (Huey 1942) (Cockrum 1960); one netted, May 1979 (Wares); 2 netted, 15 September 1979 (Petryszyn). b. Bates Well, 1385 feet, 1 male MVZ, 2 February 1934 (Cockrum 1960), 1 male, 22 February 1939 (Huey 1942 and Cockrum, 1960); 2 June 1979, 11 netted (Huntly and Inouye); 27 July - 2 August, 63 netted (Steiger). 18 March 1935; 1 male, 1 female, University of Michigan (Cockrum 1960). d. Growler Mine, 1, (Huey 1942 and Cockrum 1960). e. Alamo Tank, water trough, 26 June 1977, 20 netted by Henry, Sutherland and Peters (monument records); scattered pools (tank dry), 29-30 May 1979, 1 netted (Huntly); 9-10 July 1979, 107 netted (Petryszyn). f. Dripping Springs, 27 July - 2 August 1979, 24 netted (Steiger). l. Sonita Well, 27 July - 2 August 1979, 3 netted (Steiger). h. Cement Tank, 27 July - 2 August 1979, 19 netted (Steiger). i. Pozo Nuevo, 27 July - 2 August 1979, 21 netted (Steiger).

4. Big Brown Bat (Eptesicus fuscus).

This large plain-nosed bat has one of the widest distributions of North American species. It occurs in a wide variety of habitats from sea level to high mountains. Day roosts on the monument include rock crevices, mine tunnels, and even holes in saguaros. Like the Cave Myotis this species hibernates during the winter months in cool rock crevices at higher elevations. Probably most migrate from the monument to higher mountains to the east.

Food consists mainly of medium sized (to 12 mm) night flying insects. Termites, ants, leaf hoppers and beetles are taken. Beetles appear to be taken most commonly and moths only rarely (Ross, 1967).

Free water is required. Medium sized pools can be utilized.



Map 5. Western Pipistrelle

Map 6 shows that this species is widely distributed in the area. Specific records on the monument include: a. Bates Well, 20 mi S Ajo, 4, 1-3 July 1918 (Cockrum 1960); 27 July 1979, 5 netted (Steiger). b. Bonita Well, 2 females netted 21 April 1979 (Wares). c. Alamo Canyon, scattered pools, 29-30 May 1979, 2 netted (Huntly); 9-10 July 1979, 9 netted (Petryszyn). d. Quitobaquito, 15 September 1979, 2 netted (Petryszyn). e. Bonita Well, 31 March 1979, 3 netted (Wares); 27 July 1979, 4 netted (Steiger). f. Dripping Springs, 27 July 1979, 3 netted (Steiger). g. Pozo Nuevo, 27 July 197.9, 3 netted (Steiger).

5. Hoary Bat (Lasiurus cinereus).

The capture of this tree bat on the monument was unexpected. The species has a wide distribution from northern Canada southward to southern South America. However, since the day roost is in the foliage of trees, few records are known from grasslands or deserts. In the latter habitats the known records are associated with trees in riparian habitats. This species migrates from the northern United States and southern Canada southward to southern United States and Mexico to spend the cold seasons. There it remains lethargic during cool periods but actively feeds and drinks during warm evenings.

Food consists of various night-flying insects with a heavy emphasis on moths that fall into the 6 to 30 mm length size range (Ross 1961) .

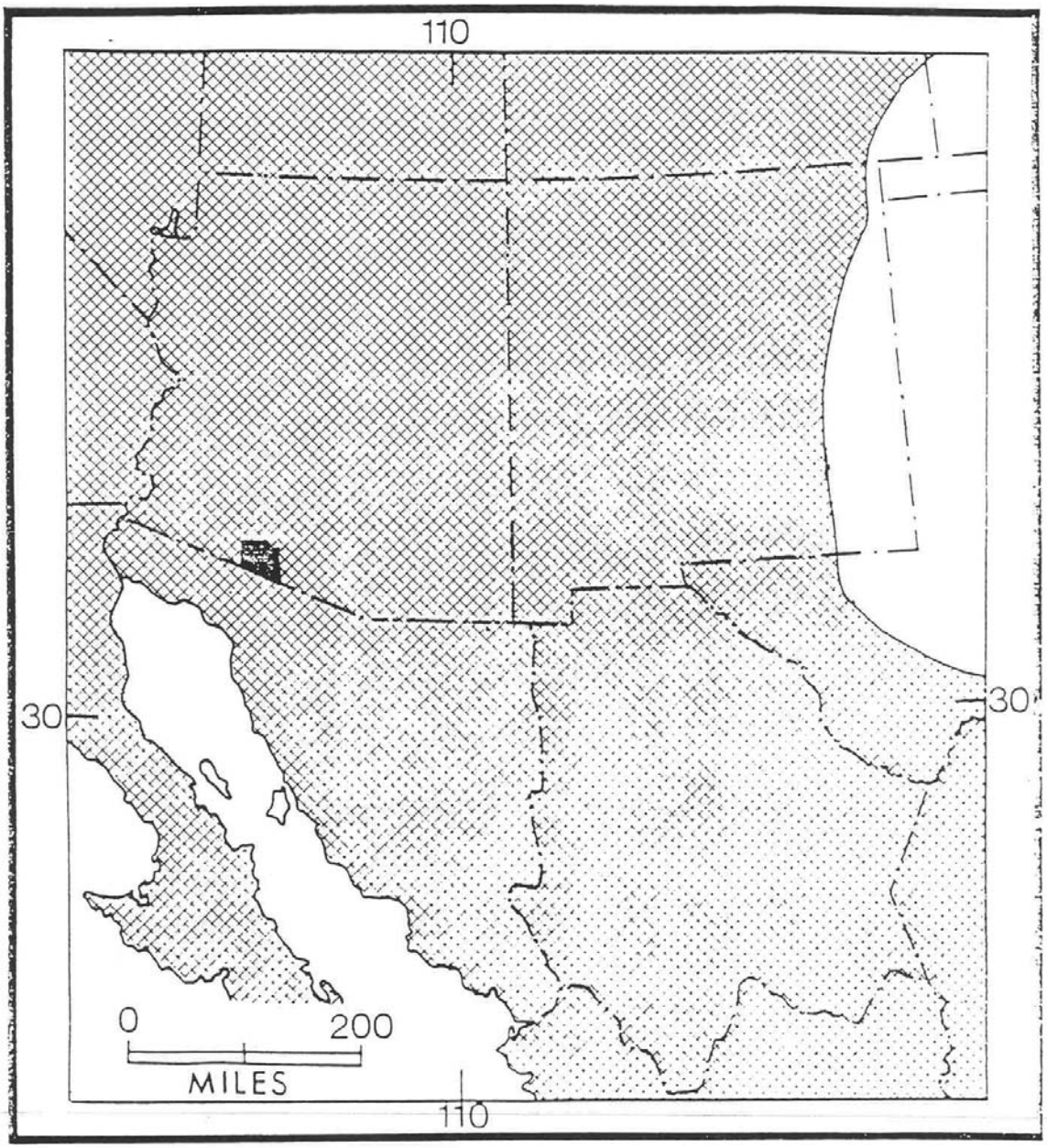
Open water is necessary and the large size indicates that a rather large surface is necessary for the bat to successfully drink.

Distribution in the area is shown on map 7. The single record for the monument is a male taken in a mist net at Quitobaquito on 16 September 1979 by Petryszyn.

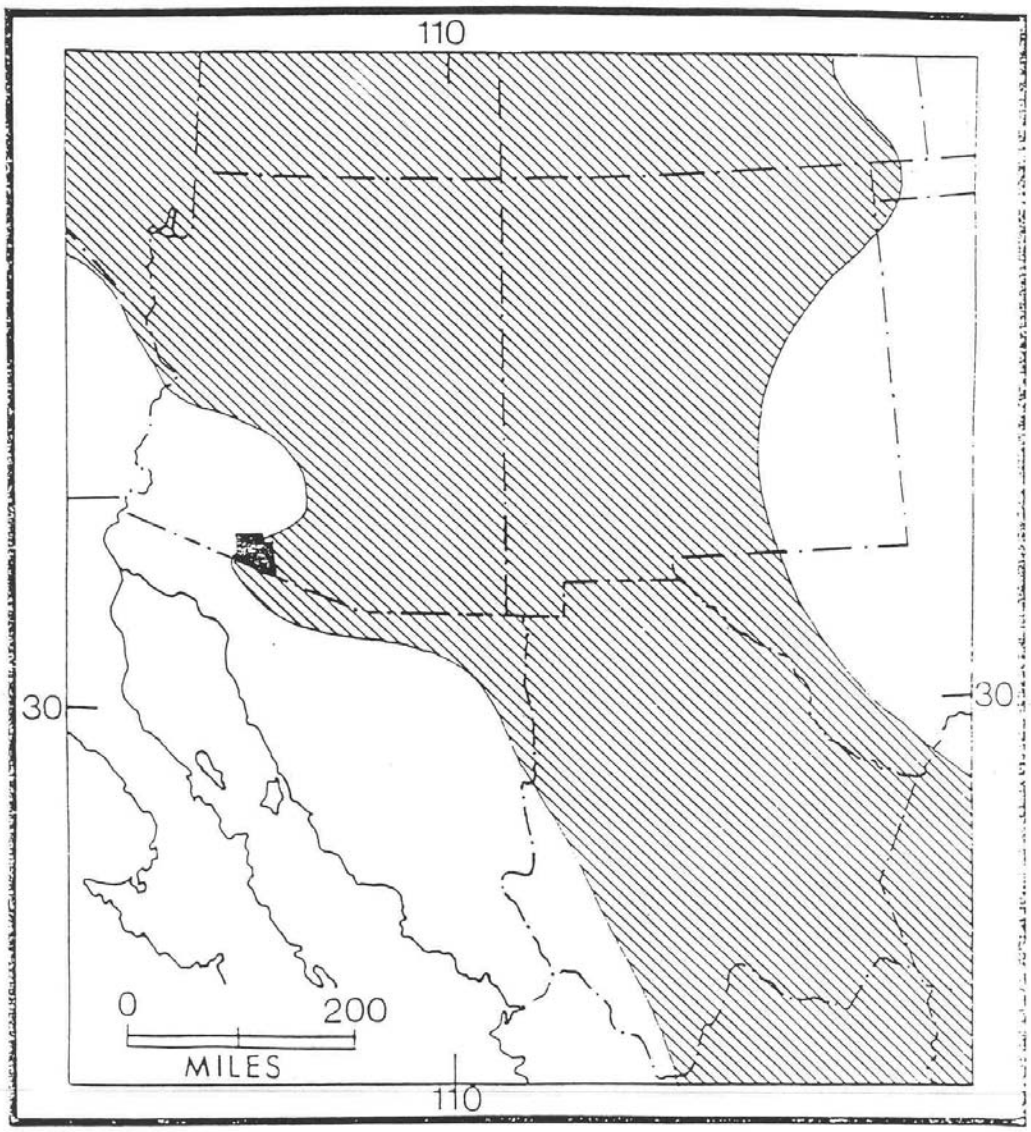
6. Townsend's Big-eared Bat (Plecotus townsendi)

This species is included on the basis of a specimen currently in the collection of the monument. It was taken in July 1945 in Alamo Canyon by Denny Constantine. This species is only rarely recorded from low desert situations and then generally in the spring or fall--not in July! More needs to be learned about this species on the monument. In Arizona this species is generally an inhabitant of higher elevations, generally above 4000 feet. Some records of feeding activity have been noted during warm periods in the winter months near the base of higher mountains. Winters are spent in hibernation in cold damp caves and mine tunnels. Summer day roosts are often found in the attics of buildings and in shallow warm caves and tunnels.

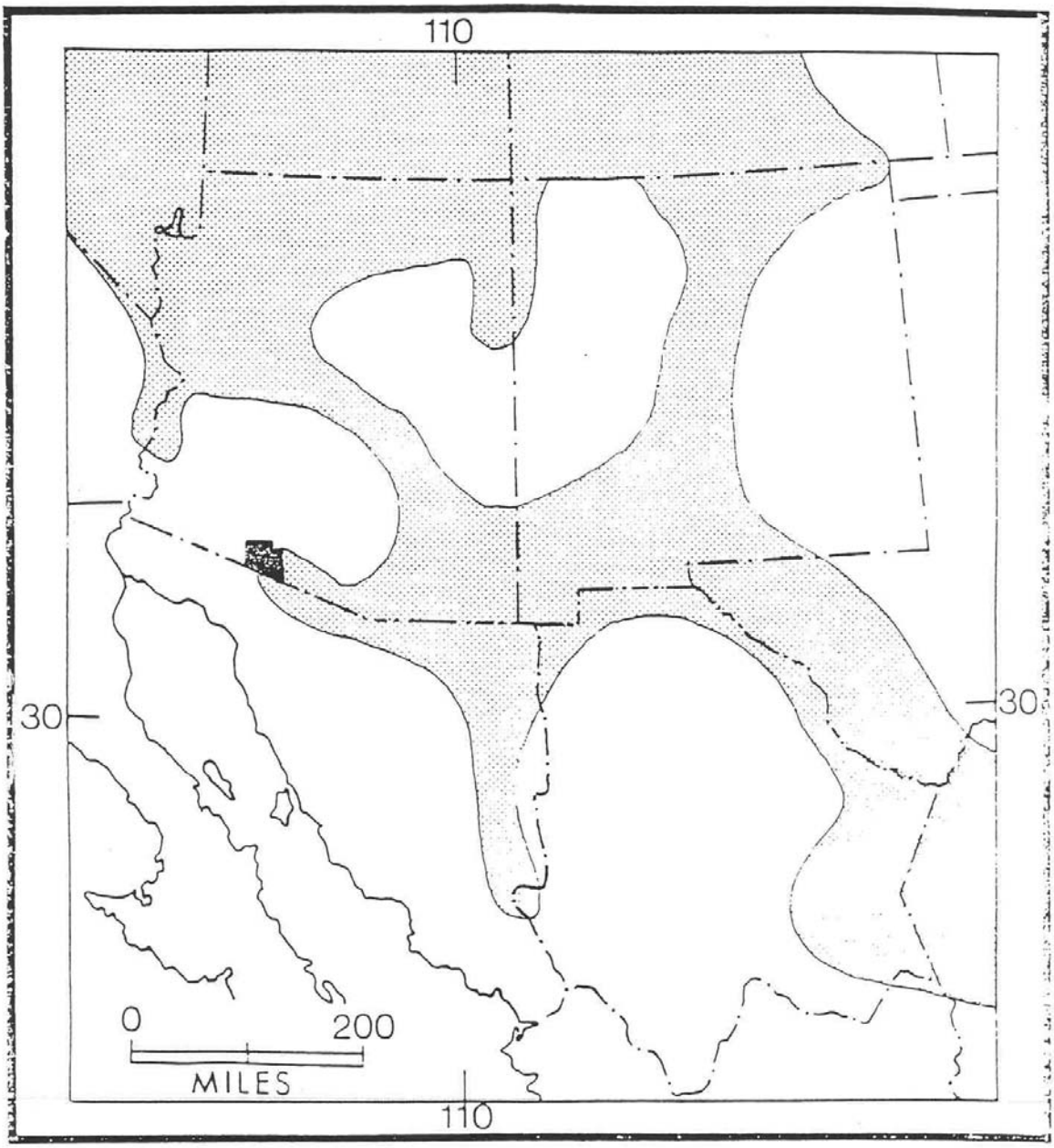
Food seems to consist of small moths (Ross 1961). Distribution in the general region is shown on map 8. None were observed on
the monument during this study.



Map 6. Big Brown



Map 7. Hoary Bat



Map 8. Townsend's Big-eared Bat

7. Pallid Bat (Antrozous pallidus).

The pallid bat is a common inhabitant of the grasslands and deserts of the southwest. Day roosts have been found in a large variety of crevices, not only in rocks, caves and mines, but also in man-made structures including buildings and bridges. Colonies generally consist of a few to fifty or even more individuals. Night roosts are generally in a different place and are often the most evident indication of the presence of pallid bats. Might roosts are usually under some rock overhang or some similar man-made situation such as a shallow mine tunnel, the porch of a house or a carport. Here they bring back food and eat, letting hard parts fall to the ground together with droppings. An accumulation of guano and insect parts is a good indication of their presence. Winter is spent in hibernation in cool rock crevices.

Food consists of a variety of large (up to 30 mm) flying and flightless arthropods including sphinx moths, short horned grasshoppers, katydids, ground crickets, scarab beetles and even scorpions (Ross 1967).

Open water is also a requirement. Relatively small pools can be utilized, especially if they are surrounded by open area (and not dense vegetation or rock walls).

Distribution in the general region is shown in map 9. Specific records on the monument include: a. Bonita Well, 31 March 1979, 3 netted (Wares); 21-22 April 1979, 1 female netted (Wares); 27 July - 2 August 1979, 1 netted (Steiger). b. Bates Well, 2 June 1979, 6 netted (Huntly); 27 - 2 August 1979, 2 netted (Steiger). c. Alamo Canyon, scattered pools, 29 May 1979, 1 netted (Huntly); 9-10 July 1979, 1 female netted (Petryszyn). c. Pozo Nuevo, 27 July - 2 August 1979, 1 netted (Steiger).

Family Molossidae

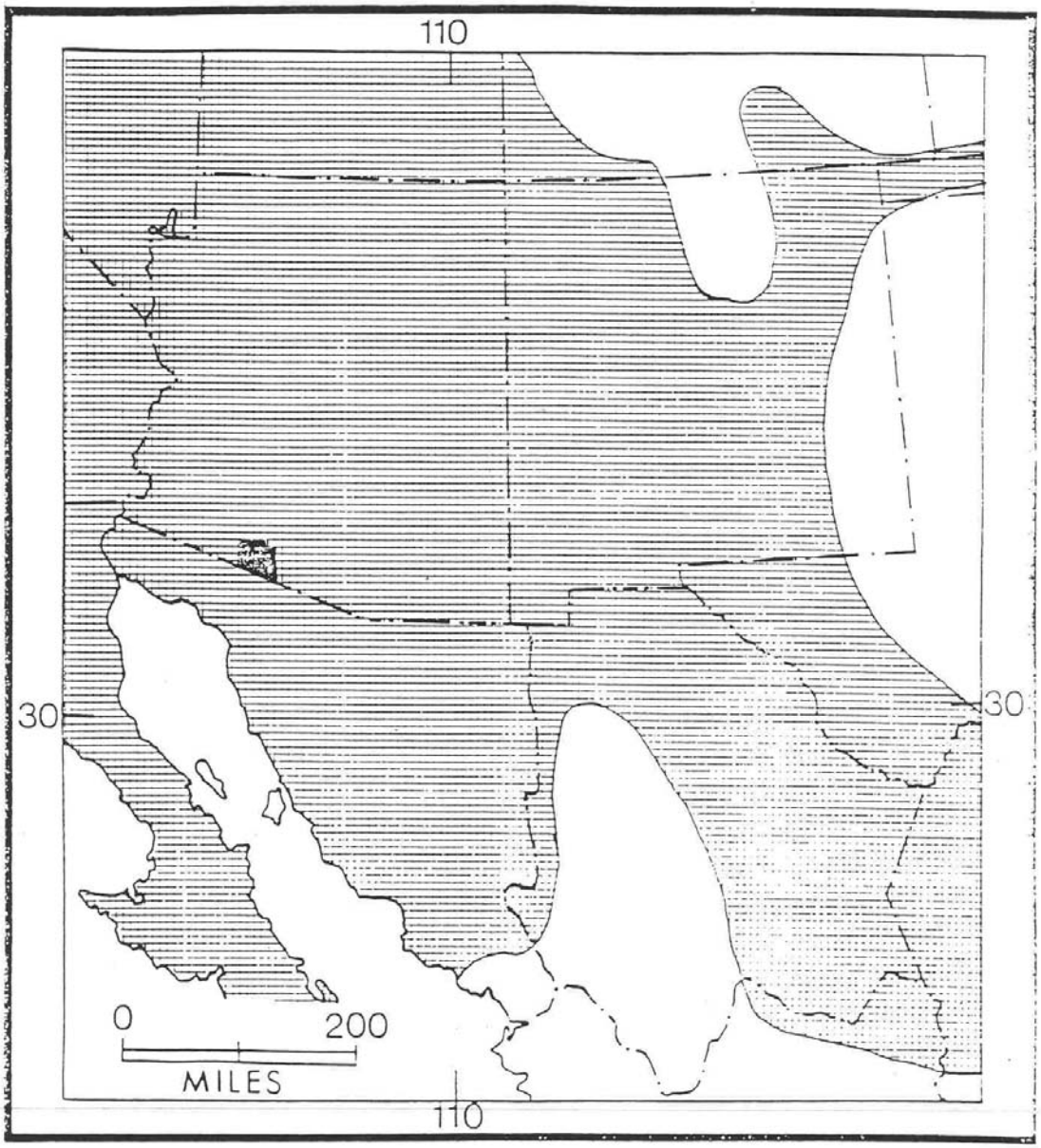
'-----' ----

1. Brazilian Free-tailed Bat (Tadarida brasiliensis).

This free-tailed bat is the common species present at the Carlsbad Caverns. It is migratory, with most individuals spending the winter months in Mexico (Cockrum 1969). During late April and May various flights move northward, occupying a series of transient roosts. During the summer females congregate in large maternity colonies. In the fall (September-October) a southward movement occurs. Apparently few individuals move northward through the desert proper and none appear to inhabit the monument during the summer. Cockrum (1960) mapped some collection sites along the Colorado River and on locality in southern Yuma County at Tinajas Altas. The latter is based on a male taken on 2 May 1931. Probably this bat occurs only as a spring transient on the monument. Day roosts are a wide variety of rock crevices, caves, mine tunnels, and buildings. All are characterized by being readily accessible by direct flight since these narrow-winged bats have limited maneuverability.

Food consists of flying insects (mainly moths, beetles and flying ants) (Ross 1967).

Free water is required. A relatively large tank, with a vegetation-free glide approach and exit is necessary. Again the limited agility in flight is the controlling factor.



Map 9. Pallid Bat

Scattered records are known throughout the general region. Therefore no map is included. The only specific record for the monument is: a. Bates Well, 25 April 1959, 1 (Huey 1942 and Cockrum 1960).

1. Pocketed Free-tailed Bat (Tadarida femerosacca).

This species occupies day roosts that are in crevices of high steep cliffs. Occasionally roosts have been found under roof tiles of two or three story buildings. These bats can hardly take off from a level surface, such as a table top, but must climb up some object and launch into flight by dropping. Gravid females require even higher drops to launch into flight. This trait influences roost sites--as well as watering places.

Food consists of flying insects, including moths and beetles (Ross 1967).

Large surfaced open water is necessary for these bats to successfully drink. Perhaps the water at Quitobaquito is the only suitable source on the monument.

The distribution in the general region is shown on map 10. Specific records on :he monument are: a. Quitobaquito, May 1 netted (Wares); 15-16 September 1979, 11 females netted (Petryszyn),

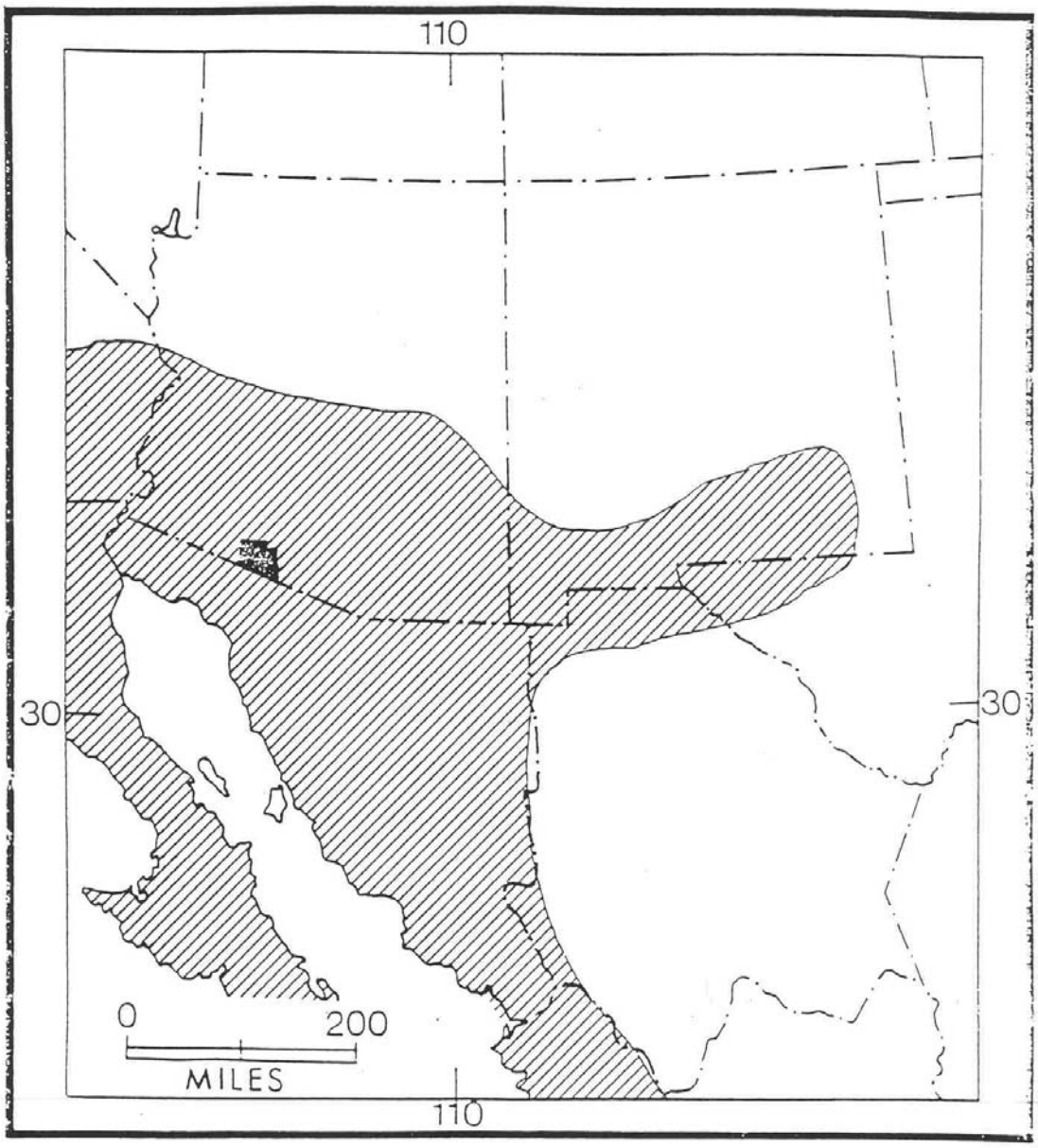
3. Underwood's Mastiff Bat (Eumops underwoodi).

Almost nothing has been recorded concerning the life history of this species. To date no day roosts have been found in Arizona. The only records involve taking bats in mist nets over water. Based on the known requirements of the related Western Mastiff Bat (Eumops perotis) day roosts are probably in high (30-40 feet or more above ground level) rock crevices on steep cliffs. These bats are even less maneuverable than the Pocketed Free-tail discussed above.

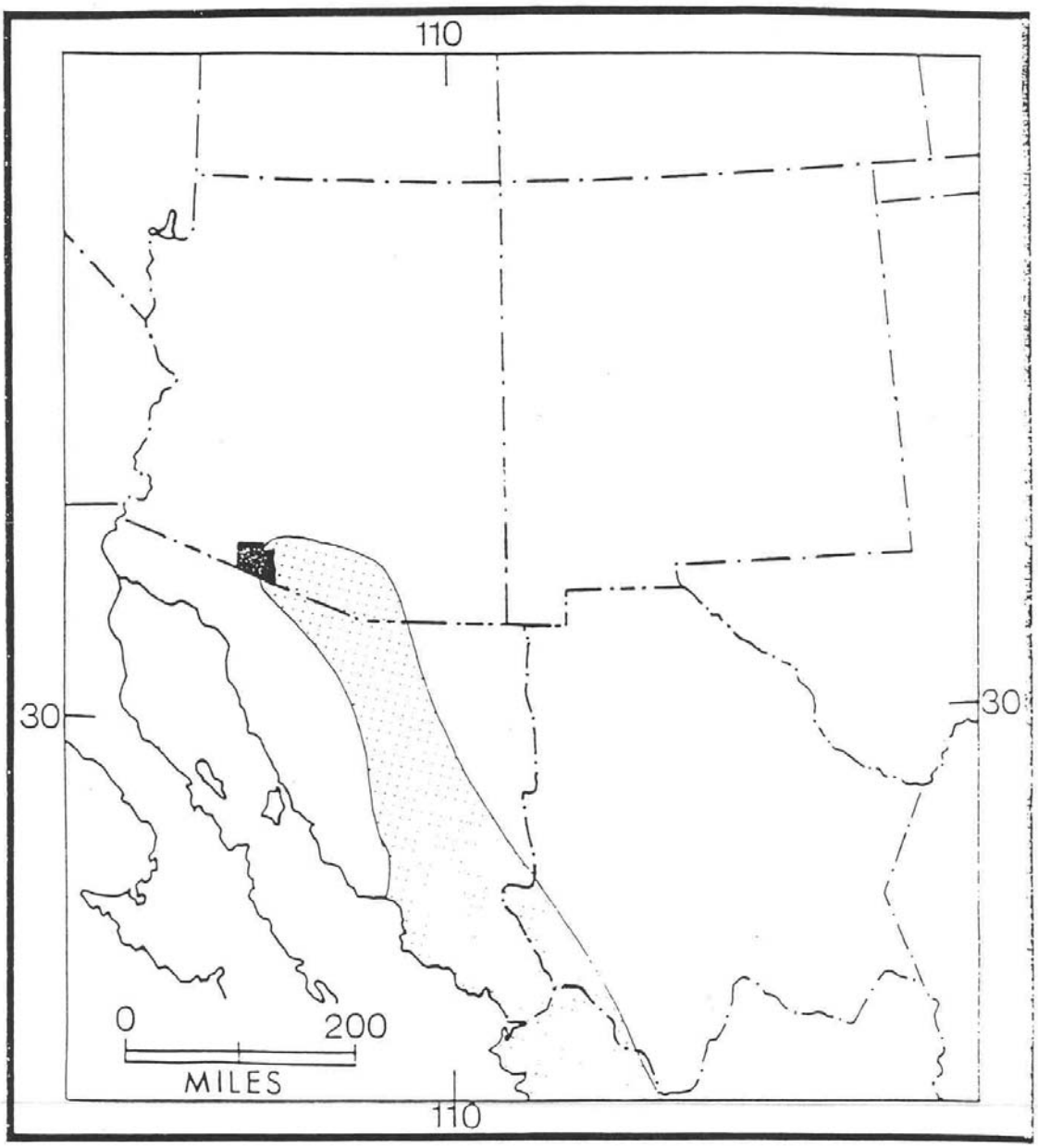
Food consists of large (6 to 60 mm) night flying insects including short-horned grasshoppers (130) and scarab beetles (47w) (Ross 1967).

As indicated, large surfaces of open water are required.

Distribution in the general area is shown on map 11. The monument represents the most northwestern known point of occurrence. The monument record consists of one female netted at Quitobaquito on 15 September 1979 by Petryszyn.



Map 10. Pocketed Free-tailed Bat



Map 11. Underwood's Mastiff Bat

IV. PROVISIONAL LIST

The following species have not yet been recorded on the monument. For the various reasons indicated, I think that some of these may eventually be recorded as part of the local bat fauna.

1. Long-tongued Bat (Choeronycteris mexicana).

This nectar-feeding Phyllostomatid occurs in southeastern Arizona in the summer months. Huntly reported netting an individual over a pool in Alamo Canyon on 29 May 1979. Huntly's experience is such that I feel confident that she identified this bat properly. However, until a voucher specimen is available, I do not include the species on the checklist.

2. Yuma Myotis (Myotis yumanensis).

This mouse-eared bat feeds mainly over water surfaces. Thus most records from the lower desert are associated with permanent streams. In Arizona, desert collecting sites have been restricted to the Colorado and Gila rivers. This species probably will not be recorded from the monument.

3. Red Bat (Lasiurus borealis) and Southern Yellow Bat (Lasiurus ega).

These bats have habits similar to those of the Hoary Bat (summarized above). Both are relatively strong fliers and both are possible "accidental" inhabitants on the monument, especially during the winter months.

4. Big Free-tailed Bat (Tadarida molossa).

The free-tailed bat is known from localities on all sides of the monument. Like the mastiff bat it is a crevice dweller that is a strong flyer but with poor maneuverability. It probably occurs on the monument at times and will probably be recorded eventually at Quitobaquito.

5. Western Mastiff Bat (Eumops perotis).

Whether this species and Underwood's Mastiff Bat occur in the same area is not yet known. However, as mapped in Hall (1981) these species have widely overlapping distributions. They do have similar habits. Probably both do occur on the m 4nument.

V. MANAGEMENT CONSIDERATIONS

It appears that seasonal occurrence, types of day roosts, types of night roosts, food habits, and water requirements are the major factors that park personnel must consider in making meaningful decisions about the management of bat populations on the monument. Therefore each of these factors is discussed separately in the following material.

a. Seasonal Occurrence and Activity. Figure 1 summarizes the monthly distribution of the actual records of bats taken on the monument. Table 1 summarizes the type of activities of each species that influences the patterns seen in Figure 1. Two major types are evident: Resident throughout the year (California Leaf-nosed Bat, California Myotis, Western Pipistrelle and perhaps Pocketed Free-tailed Bat and Underwood's Mastiff Bat) and Seasonally Absent (the remaining seven species).

In the resident group, only the California Leaf-nosed Bat is active throughout the year. It does not have the ability to hibernate. The Western Pipistrelle is active during the warmer parts of even the winter months as well as all summer. It hibernates, generally solitarily, in shallow rock- crevices during cold spells. The other four (California Myotis, Pallid Bat, Pocketed Free-tailed Bat and Underwood's Mastiff Bat) probably hibernate on the monument in high cool rock crevices and are only rarely active in the winter.

The seasonally absent group are diverse in habits. Sanborn's Long-tongued Bat cannot hibernate and feeds primarily on nectar. It migrates southward into Mexico for the October-April period. The Brazilian Free-tailed Bat can hibernate for short periods. It feeds on insects. However most individuals leave Arizona and move southward into Mexico to warm areas where insects are more readily available. The Cave Myotis, Big Brown Bat and Townsend's Big-eared Bat migrate to some mountain where high elevation results in caves and crevices where uniform temperatures of 35 to 45° F are available. In such places these species hibernate during the winter. Rarely are these species found active during the winter. The Hoary Bat migrates from low elevations to spend the summer months at northern latitudes (northern United. States or Canada) or at high elevations in mountains.

b. Types of Day Roosts. As shown in Table 2 three major types of roosts are used: tree roosting (Hoary Bat), caves including deeper mine tunnels, abandoned buildings, attics and similar "caves" (California Leaf-nosed Bat, Sanborn's Long-nosed Bat, Cave Myotis, Townsend's Big-eared Bat and the Brazilian Free-tailed Bat), and crevices including cracks in buildings and even under loose rocks on the ground (California Myotis, Western Pipistrelle, Pallid Bat, Pocketed Free-tailed Bat and Underwood's Mastiff Bat). The Big Brown Bat occurs in "caves" as well as "crevices".

From this analysis, it is evident that the sealing of various mine entrances will affect the availability of day roosts for some species. Day roosts have been observed in the following mines.

1. Copper Mountain Mine. April-August. Leptonycteris, Macrotus.

2. Growler Mine (i.e., the shallow tunnel just N of Growler Pass). March-September. Macrotus, Leptonycteris.

3. Lost Cabin Mines. June-November. Macrotus.

4. Blue Bird Mine. September. Leptonycteris.

Figure 1. Time of year in which bats have been recorded on the Monument. X is actual record given in text. P indicates probably present. A indicates probably absent. - means status unknown.

Species	J	F	M	A	M	J	J	A	S	O	N	D
California Leaf-nosed	P	X	X	X	X	X	X	X	P	P	P	P
Sanborn's Long-nosed	A	A	A	A	X	X	X	X	X	A	A	A
Cave Myotis	A	A	A	A	?	X	X	X	?	A	A	A
California Myotis	P	X	X	P	X	X	X	X	P	P	P	P
Western Pipistrelle	X	X	X	X	X	X	X	X	X	P	X	P
Big Brown Bat	A	A	X	X	X	P	X	X	X	A	A	A
Hoary Bat	P	P	A	A	A	A	A	A	X	P	P	P
Townsend's Big-eared	-	-	-	-	-	-	X	-	-	-	-	-
Pallid Bat	A	A	P	P	P	P	P	P	P	P	P	P
Brazilian Free-tailed	-	-	-	X	-	-	-	-	-	-	-	-
Pocketed Free-tailed	-	-	-	P	X	P	P	P	X	-	-	-
Underwood's Mastiff	-	-	-	P	P	P	P	P	X	-	-	-

Table 1. Summary of activity patterns of bats known to occur on the monument.

Species	Season of Activity
1. California Leaf-nosed Bat	Year-round, no hibernation. Cold winter spells in warm mine tunnels.
2. Sanborn's Long-tongued Bat	Migrate south for winter. No hibernation.
3. Cave Myotis	Migrates to higher elevations to hibernate in winter.
4. California Myotis	Hibernates November-January in rock crevices on monument (?)
5. Western Pipistrelle	Hibernates in local rock crevices in coldest weather. Active all months.
6. Big Brown Bat	Migrates to higher elevations to hibernate October-February.
7. Hoary Bat	Occasionally present September-February.
8. Townsend's Big-eared Bat	Occasional summer visitor?
9. Pallid Bat	Active March-October. Hibernates winter.
10. Brazilian Free-tailed Bat	Transient in spring migration.
11. Pocketed Free-tailed Bat	Active in warm months; hibernates in winter.
12. Underwood' s Mastiff Bat	Active in warm months; hibernates in winter.

Table 2. Summary of types of day roosts of bats known to occur on the Organ Pipe Cactus National Monument

Species	Day Roost
1. California Leaf-nosed Bat	Dark parts of deep mine tunnels.
2. Sanborn's Long-nosed Bat	Dark parts of deep mine tunnels.
3. Cave Myotis	Dark part of shorter mine tunnels (or near the entrance).
4. California Myotis	Rock crevices in small colonies (similar places in buildings).
5. Western Pipistrelle	Usually solitarily in rock crevices (cracks in buildings, behind shutters).
6. Big Brown Bat	Colonial shallow warm crevices or small caves (buildings, hollow saguaros)
7. Hoary Bat	Solitary among leaves of trees.
8. Townsend's Big-eared Bat	Colonial cooler caves (attics of buildings).
9. Pallid Bat	Colonial in warm crevices, small caves, buildings.
10. Brazilian Free-tailed Bat	Colonial, warm caves, mine tunnels, buildings.
11. Pocketed Free-tailed Bat	Colonial, rock crevices in vertical cliffs.
12. Underwood's Mastiff Bat	Colonial, rock crevices in high vertical cliffs.

c. Types of Night Roosts. Some variations in the types of night roosts used by these species is evident. A night roost is a place where a bat hangs while it is not actually flying during the night. Most bats quickly drink their water and fill their stomachs after leaving the day roost. Sometimes this occurs within 30 minutes, usually within an hour. Some species then return to the day roost to rest and digest the food. Later a second (and even a third) feeding and drinking flight may be made. In other species, after satiating the food and water needs the bat simply hangs up, often solitarily, in some place other than the day roost. Often the site appears to be anything that is conveniently nearby--a tree limb, a crevice, a wall of a building. The Pallid Bats appear to be exceptional in that they utilize colonially, specific night roosts, season after season, for many years. My impressions as to the general types are summarized in Table 3. Obviously this is an area of bat behavior about which much more needs to be learned.

d. Food Habits. The manager can do little to manipulate food supplies for bats. Table 4 is provided to help in understanding interactions among the various species of bats in the area. One species feeds on nectar (Sanborn's Long-tongued Bat). Two are primarily insectivorous but may feed on some green vegetation (California Leaf-nosed Bat and the Pallid Bat). The others appear to be strictly insectivorous.

e. Water Requirements. Another of the many areas of ignorance in bat biology is that of water requirements. Some bats do successfully survive on islands surrounded by salt water where no known fresh water exists. Reputedly these survive by utilizing salt water. Nectar feeding bats presumably can get most of their water requirement from their feed. In fact one problem that these bats have is the elimination of excess water. A few reports are that bats can survive for periods of several days on the water in their insect diets. Certainly hibernating bats survive for weeks (months?) without eating or drinking.

However, at the monument in the hot, dry summer months water appears to be routinely taken by all except the nectar feeder. Certainly when a female bat is lactating the need for water in the diet is even greater. The basic management tool needed is an understanding of how free water must be available to the bats.

Bats routinely drink by flying low over a water surface and immersing the mouth (or lower jaw) into the water. Only rarely does a bat alight and drink from a small surface. Therefore the water surface must be large enough for the bat to successfully drink while in flight. The Western Pipistrelle and Townsend's Big-eared Bat can drink from very small water sources (such as a large tub) and can fly down into vertical mine shafts or cisterns and drink. The molossids, with their narrow wings, require large surfaces (15 to 30 feet or more) of free water for long gliding approaches and departures from the water. Table 5 summarizes these variations. Table 6 lists the species found at the water sources examined.

Table 3. Summary of Night Roosts

1.	California Leaf-nosed Bat	Same as day roost.
2.	Sanborn's Long-tongued Bat	Usually same as day roost, sometimes in open building.
3.	Cave Myotis	In bushes, crevices and day roosts
4.	California Myotis	In bushes, crevices and buildings.
5.	Western Pipistrelle	Same as California Myotis.
6.	Big Brown Bat	In shallow caves.
7.	Hoary Bat	In trees.
8.	Townsend's Big-eared Bat	In trees and in shallow caves.
9.	Pallid Bat	In shallow caves (patios, etc.).
10.	Brazilian Free-tailed Bat	In shallow caves.
11.	Pocketed Free-tailed Bat	In day roost.
12.	Underwood's Free-tailed Bat	In day roost.

Table 4. Summary of Food Habits

1. California Leaf-nosed Bat	Large Insects (40-60 mm) and perhaps some ripe saguaro fruit, through out the year.
2. Sanborn's Long-tongued Bat	Nectar (agaves, saguaros, organ pipe, and ripe fruit of saguaro.
3. Cave Myotis	Mainly small (4-13 mm) moths.
4. California Myotis	Similar to Cave Myotis?
5. Western Pipistrelle	Mainly small (4 to 10 mm) moths.
6. Big Brown Bat	Mainly medium sized beetles. Few moths.
7. Hoary Bat	Mainly large (to 30 mm) moths.
8. Townsend's Big-eared Sat	Mainly small moths.
9. Pallid Bat	Large (to 70 mm) often flightless insects.
10. Brazilian Free-tailed Bat	Mainly small moths and beetles.
11 . Pocketed Free-tailed Bat	Medium flying beetles and grasshoppers.
12. Underwood's Mastiff Bat	Large (to 60 mm) flying beetles and grasshoppers.

Table 5. Summary of Water Requirements

1.	California Leaf-nosed Bat	Open water, small surface.
2.	Sanborn's Long-tongued Bat	Some; much furnished by nectar.
3.	Cave Myotis	Open water, small surface
4.	California Myotis	open water, small surface
5.	Western Pipistrelle	Open water, tiny surface.
6.	Big Brown Bat	Open water, medium surface
7.	Hoary Bat	Open water, medium surface
8.	Townsend's Big-eared Bat	Open water, small surface.
9.	Pallid Bat	Open water, medium surface
10	Brazilian Free-tailed Bat	Open water, large surface
11	Pocketed Free-tailed Bat	Open water, large surface
12	Underwood's Mastiff Bat	Open water, large surface

Table 6. Bat Species Found at Water Sources

Alamo Well (includes wash and potholes in area)
California Leaf-nosed Bat
Sanborn's Long-nosed Bat
Cave Myotis
California Myotis
Western Pipistrelle
Big Brown Bat
Townsend's Big-eared Bat
Pallid Bat

Bates Well

California Leaf-nosed Bat
Sanborn's Long-nosed Bat
California Myotis
Western Pipistrelle
Big Brown Bat
Pallid Bat
Brazilian Free-tailed Bat

Bonita Well

California Leaf-nosed Bat
Western Pipistrelle
Big Brown Bat
Pallid Bat

Cement Tank

Sanborn's Long-nosed Bat
Western Pipistrelle

Dripping Springs

Sanborn's Long-nosed Bat
Cave Myotis
Western Pipistrelle
Big Brown Bat
Pallid Bat

Pozo Nuevo

Sanborn's Long-nosed Bat
California Myotis
Western Pipistrelle
Big Brown Eat
Pallid Bat

Quitobacuito
California Myotis
Western Pipistrelle
Big Brown Bat
Hoary Bat
Brazilian Free-tailed Bat
Pocketed Free-tailed Bat
Underwood's Mastiff Bat

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