

# BAT USAGE AND CAVE MANAGEMENT OF TORGAC CAVE, NEW MEXICO

DAVID H. JAGNOW

1300 Iris St. #103, Los Alamos, NM 87544 USA

*Torgac Cave, New Mexico, is a dolomite and gypsum cave that provides a stable winter hibernaculum for several species of bats, primarily Myotis velifer, the cave myotis; Corynorhinus (formerly Plecotus) townsendii, Townsend's big-eared bat; and Myotis ciliolabrum, the western small-footed myotis. Occasional bat count studies between 1966 and 1996 indicate a total hibernating population ranging from 649 to 3951 individuals. Temperature and relative humidity studies have established the preferred habitat of each species. Through wise management by the Bureau of Land Management (BLM) and volunteers of the Southwestern Region, NSS, the population has remained stable over the past 30 years, even though the cave has been gated and off-season visitation has increased substantially. The construction of bat-friendly gates and the seasonal closure of Torgac Cave from November 1 to April 15 have helped maintain a stable bat population. It is recommended that the BLM continue the winter bat counts on an annual basis, and that studies be initiated of the summer bat flights.*

Torgac Cave (aka: Torgoc Cave, Torgoc's Cave) is located in central New Mexico, about 100 km northeast of the town of Capitan. The cave is located on public land administered by the Bureau of Land Management (BLM). It is gated, and access is controlled by the BLM. The purpose of this review is to determine the size, variety, stability and trends of the winter bat population using Torgac Cave as a hibernaculum. This information will be used by the BLM to better manage the cave and bat population.

According to tradition, Torgac Cave was discovered and named after a hunter who found it in the 1950s. Reports of bats using Torgac Cave date back to about 1965 when cavers began to visit this gypsum-dolomite cave. Large, knee-deep piles of dried bat guano in the Bat Rooms, in the northwest end of the cave (Fig. 1), attest to the fact that bats have used that portion of the cave much more extensively in the past than at present. The Bat Rooms are presently accessed by tight crawls through a large breakdown collapse area. It appears that the extensive dried deposits of bat guano predate the breakdown collapse. Within recent years, only a few individual bats have been observed in that portion of the cave, and only very minor amounts of fresh guano are found there.

There were also large mounds of bat guano present in the Bat Nursery Room, the western extension off the Circle Room. This room remains easily accessible to the main cave, and was reportedly occupied by small maternity colonies, perhaps 300-400 individuals, during the summer months in the late 1960s. However, within recent years, only a handful of bats have occupied this once-popular roost (Corcoran III, personal communications, 1996).

The earliest study of the bats in Torgac Cave was done by D. J. Howell from September, 1966 to April, 1967, as an unpublished report to the BLM. Approximately every two weeks, Howell measured the fluctuations in temperature, humidity, and ammonia concentrations, and tracked bat move-

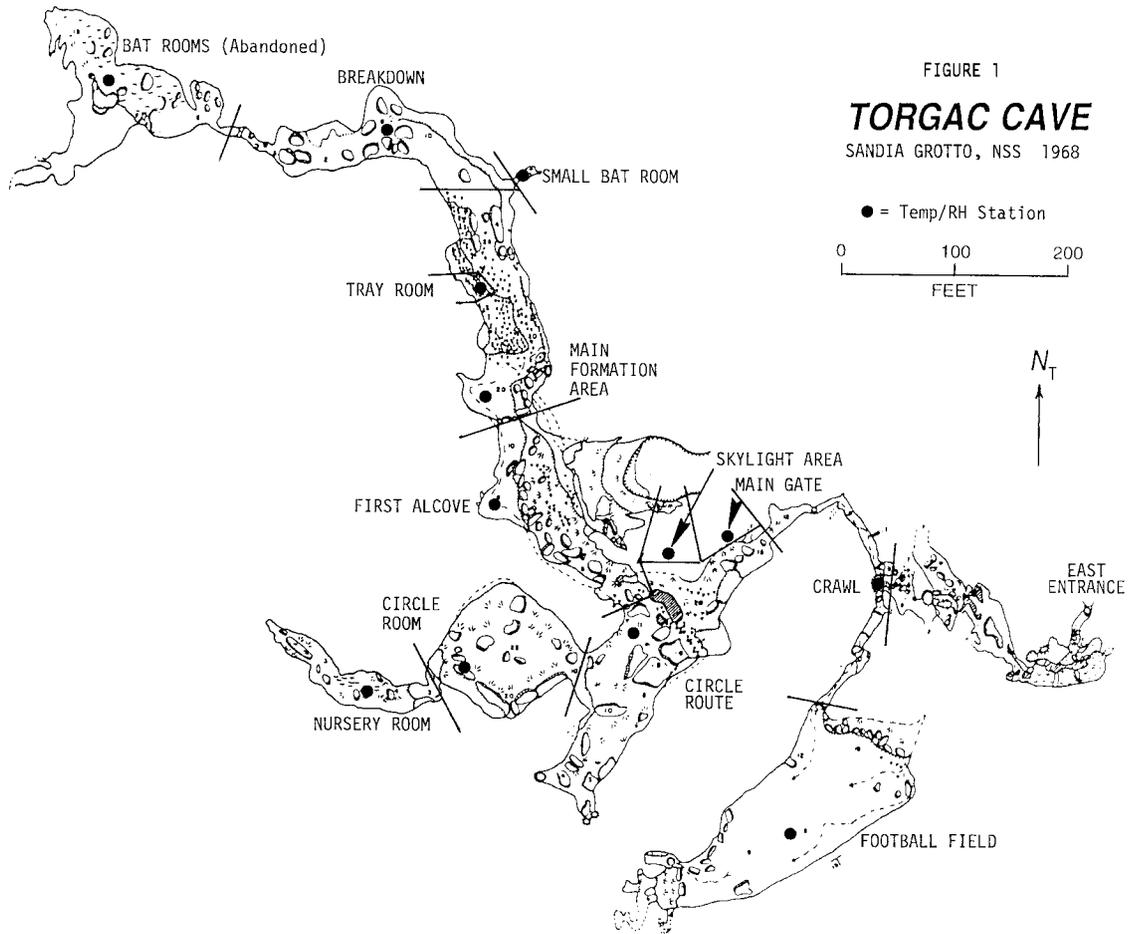
ments as a result of changing microclimates. This baseline study indicated about 560 cave myotis and about 100 Townsend's big-eared bats at the peak of the winter hibernation.

The author attended the Southwestern Regional held at Torgac Cave the weekend of October 26, 1968. The approximately 40 cavers were shocked by recent vandalism to the unique gypsum speleothems. Members of the Sandia Grotto, NSS, met on October 29, 1968, to discuss how to protect the cave. Even at that time, one of the main concerns was the protection of the bats. "Gating the cave was another suggestion; however, a sufficient opening will have to be created in order for the bats to enter and leave the cave freely. Horizontal bars across the main entrance will fulfill this purpose." (Rohwer, 1968: 3)

The following weekend, members of the Sandia Grotto again visited Torgac Cave. Jim Hardy, John Corcoran, Jennifer and Robbie Babb showed the vandalism to BLM Cave Specialist Don Sawyer, and they made plans to gate the entrance. "Sunday we did a little more caving; then the main entrances were sealed off, officially, as well as practically, ending the trip." (Mauser, 1968: 2) At this time, the bats were forced to use many small openings around the perimeter of the large entrance sink. I'm sure this move did not help the bat population, but it did serve to protect the beautiful gypsum speleothems.

Torgac Cave was subsequently gated at two entrances in late 1970. Both gates were designed to be bat-friendly, and were later rebuilt. In 1992, Jim Cox rebuilt the main gate to be even more vandal-resistant and more bat-friendly. Now the bats not only exit through both gates during the summer months, but also through small openings too tight for human entrance.

There is no record of any bat counts between 1967 and 1987. The hibernating bat colony study at Torgac Cave was



**Figure 1.**  
Map of Torgac Cave showing temperature and relative humidity collecting stations.

initiated by BLM cave specialist Matt Safford in the winter of 1987/88, and two counts were made (Safford, 1988). Safford continued these studies annually until January 6, 1990, at which time he was transferred to a different district. Since then, the bat counts have been conducted by volunteers. Rebecca Jagnow led a bat count on February 2, 1991. David Jagnow led the most recent bat counts from January 7, 1995 to February 11, 1996 (Table 1). Plans are to continue an annual census by members of the Pajarito Grotto, NSS. The results of these bat surveys are summarized in Table 2 and Figure 2.

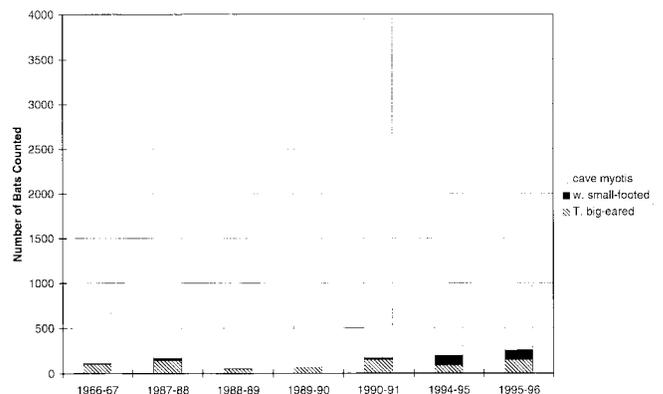
Because Torgac Cave is recognized as a bat hibernaculum, the BLM decided in 1993 to seasonally close the cave from November 1 to April 15 to protect hibernating bat populations and to maintain the natural microclimate (Bilbo, 1993). Within the Roswell Resource Area, the BLM has enforced the seasonal closure of Torgac and nine other caves to protect these critical bat hibernacula (BLM, 1993).

DESCRIPTION OF ENVIRONMENT

GEOLOGY

Torgac Cave is located in eastern Lincoln County, New Mexico, at an elevation of 1550 m (5075 ft). The large sink-hole entrance is located in the extensive gypsum karst area cre-

ated by the Fourmile Draw Member of the San Andres Formation of Permian age. The interbedded gypsum and dolomite dip approximately 10m/km (50ft/mile) to the east. Bedding is disturbed locally by numerous subsurface collapses caused by karst drainage to the Pecos River in the east. The surface topography consists of sparsely vegetated rolling gypsum hills with about 20 m of local relief. Within Torgac Cave, the roughly-weathered dolomite beds provide a good purchase



**Figure 2.** Torgac Cave bat census.

**Table 1.**  
**Torgac Cave Bat Count Statistics, February 11, 1996.**

Area	Temp	RH	MV	CT	MC	PH
Bat Rooms	9.8	54%	-	3	-	-
Breakdown	(no readings)		-	-	-	-
Small Bat Room	C 9.5 F 7.6	73% 59%	658	-	2	-
Tray Room	C 5.7 F 9.9	62% 52%	-	-	51	-
Main Formation Area	C 5.7 F 3.8	62% 46%	6	70	51	-
First Alcove	F 3.9	46%	6	67	1	-
Skylight Area	6.1	32%	1	2	-	-
Main Gate	7.4	26%	-	-	-	1
Circle Route	5.1	37%	-	3	1	-
Circle Room	7.7	38%	-	2	-	-
Nursery Room	9.4	42%	-	1	-	-
Crawl	7.2	54%	39	-	-	-
Football Field	7.7	61%	1	-	2	-
Total			711	148	108	1

MV = *Myotis velifer* (cave myotis)  
 CT = *Corynorhinus townsendii* (Townsend's big-eared)  
 MC = *Myotis ciliolabrum* (western small-footed myotis)  
 PH = *Pipistrellus hesperus* (western pipistrelle)  
 C = Ceiling Temperature (°C)/Relative Humidity  
 F = Floor Temperature (°C)/Relative Humidity

for the bat clusters. Mineralogy of Torgac Cave is discussed in Doran and Hill (1998).

**SPELEOGENESIS**

Torgac Cave is an inactive vadose cave with the main passage located about 30 m below the surface. From the main entrance, the dry vadose passage extends approximately 300 m to the northwest, through the Northwest Passage, to some abandoned Bat Rooms where the passage is terminated by collapse. Also from the main entrance, the vadose passage extends approximately 300 m to the south through two main branches, the Circle Room, and the Football Field, both of which are also terminated by collapses. The current water table is well below the main vadose level of Torgac Cave, and the flat dirt floors of the main passage are now only occasionally flooded by water entering from the main entrance sink.

**TEMPERATURE**

The entrance sink is approximately 25 m in diameter and lies on the side of a much larger surface depression that opens to the southwest. This topography forms a cold-air trap that

funnels cold air into the center of Torgac Cave. This forms a stable bat hibernaculum during the winter months, with temperatures ranging from a low of 4°C near the main entrance sink, and warming to about 10°C near the extremities of the cave. The annual temperature high for Torgac Cave is 14°C, recorded in August (Rolfe, 1967). Average summer temperature is about 11°C. Most of the passages are 15-18 m in width, with a ceiling height of two to six meters. The bats typically cling to resistant dolomite beds or gypsum-encrusted dolomite beds that form the ceilings of these passages.

**BATS OF TORGAC CAVE**

**CAVE MYOTIS**

By far the most populous bat in the study is *Myotis velifer*, the cave myotis. These bats vary in color from dark gray to a light buff with a dark gray face and short gray ears. They typically form large clusters during hibernation. In Torgac Cave the typical cluster size is from 25 to 40 individuals. They tend to hibernate in relatively warm, high humidity areas of the cave and often appear quite alert when encountered.

**TOWNSEND'S BIG-EARED BAT**

The second most common bat in Torgac Cave is *Corynorhinus townsendii*, the Townsend's big-eared bat. Until recently, this bat species was identified as *Plecotus townsendii*. Townsend's big-eared bats vary in color from dark to light gray to dingy yellow, but are most readily identified by their large ears, approximately three centimeters in length. However, the ears may be folded back against the body and largely covered by their wings, with only the tragus visible. If their ears are folded back, they can sometimes be distinguished from the cave myotis by their slightly larger size. These big-eared bats typically hibernate in small clusters or singly. They are usually found hibernating in the coldest areas of the cave and at lower relative humidities than the cave myotis prefer.

**WESTERN SMALL-FOOTED MYOTIS**

Torgac Cave also hosts a small population of *Myotis ciliolabrum*, the western small-footed myotis. These bats can be identified by their dark gold (brassy) fur in striking contrast to their dark short ears and dark mask around their eyes. Small-footed myotis tend to hibernate individually or in small clusters up to 25 individuals on open, moist ceilings. They also love to cram themselves into moist ceiling cracks. They prefer cold to moderate temperatures, and congregate in areas of high humidity.

**OTHERS**

Other bats occasionally found in Torgac Cave include the big brown bat (*Eptesicus fuscus*), which can be identified by its large size (almost twice as large as the other species); its small, dark ears with a large, rounded tragus; and its beautiful brown fur. The western pipistrelle (*Pipistrellus hesperus*) is occasionally found hibernating as individuals. They can be identi-

	Bats	66/67	87/88	88/89	89/90	90/91	94/95	95/96
<b>Table 2.</b> <b>Annual Bat</b> <b>Census: Torgac</b> <b>Cave.</b>	Cave myotis	560	2821	655	2039	3778	450	711
	Townsend's big-eared	100	141	46	68	147	87	148
	Western small-footed myotis	10	30	7	0	26	111	108
	Big Brown	-	1	-	-	-	-	-
	Pallid	-	-	-	-	-	?(8)	-
	Western Pipistrelle	-	-	-	-	-	1	1
	Total	670	2993	708	2107	3951	649	968

fied by their very small size, light gray to yellowish fur and their black leathery mask. There have also been possible sightings of pallid bats (*Antrozous pallidus*). They can be identified by their pale-colored fur, light yellow above and cream to white below, and their long naked ears and pale pink face. These bats were recorded only occasionally as solitary individuals and, thus, are probably transient inhabitants.

CENSUS METHODS

Population numbers were obtained by direct count of the bats during hibernation. Care was taken not to create undue disturbance and the animals were not handled, except by Howell (1967). Torgac Cave was divided into sections to facilitate counting and to determine if the bats were changing locations during the winter months. Temperature and relative humidity readings were taken either by sling psychrometer or by electronic instruments at established data stations. When possible, floor and ceiling readings are taken.

During the bat counts, the volunteer cavers followed the bat survey guidelines developed by Mike Ballistreri (1995), bat biologist at the University of New Mexico. We avoided nylon clothing or coveralls that would make noise while walking. We used electric lights, and covered the lenses with red automotive tail-light repair tape in those areas where bats were present. Unnecessary packs and clothing were left outside the cave, and all dangling metal objects such as zipper pulls or metal shoulder-strap connectors were silenced by taping over with duct tape. Talking was held to a minimum and at a low volume, and the volunteers moved as smoothly and quietly through the cave as possible.

RESULTS

NUMBER OF BATS

The annual bat census data for Torgac Cave are summarized in Table 2 and Figure 2. Note that there are gaps in the collected data between 1967 and 1987, and again between 1991 and 1994. The total number of bats varied from a high in the winter of 1990/91 of 3951 to a low of 649 in the winter of 1994/95. The data can be divided into three high-count years (87/88, 89/90, & 90/91) and four baseline years (66/67, 88/89, 94/95, & 95/96).

The cave myotis have consistently accounted for the high-

est percentage of the total population. The greatest variation from year to year is in the number of cave myotis, from a low of 450 in 94/95, to a high of 3778 in 90/91. The high cave myotis count the winter of 1990-91 may be questionable. During that count, the Small Bat Room (Velifer Room) was so loaded with bats that they estimated the size of each cluster and totaled the number of square feet of bats. At that time, the BLM used the packing ratio of 166 velifer/square foot to determine the number of bats. There is some error associated with this calculation, as the packing ratios probably vary with temperature and relative humidity during the hibernation period. Over the years, the cave myotis population has averaged 1573 during the peak of hibernation.

The Townsend's big-eared bat population has remained very stable over the past 30 years. The low count was 46 individuals in 88/89, with the highest count of 148 individuals in 95/96. These counts of the Townsend's big-eared bats are probably accurate, because they tend to hibernate in pairs or small clusters that are well-exposed and easy to count. The big-eared count has averaged 105 over the seven years of data.

The western small-footed bat population has always remained relatively small, varying from 0 in 89/90 to 111 in 94/95. The count has averaged 42 over the seven years of data. These counts are probably the least accurate because the western small-footed bats tend to hibernate out of sight, in small cracks and pockets.

Other bats include one big brown bat, counted by Matt Safford on January 16, 1988. The big browns are rare in Torgac Cave, but are commonly found in small numbers in other caves in the Roswell Resource Area.

The author found eight possible pallid bats on January 7, 1995. One, just beyond the Main Gate, was a positive identification. The other small cluster of seven possible pallids was located in the First Alcove/Breakdown area. Their fur was extremely light colored, but their faces were light gray and ears were shorter than the other pallid. Bill Ellis also spotted a possible pallid bat on November 12, 1995. This large, very pale bat with large ears was sighted at the very end of the Nursery Room, but flew before it could be examined closely.

One western pipistrelle has consistently visited Torgac Cave from 94/95 to 95/96. He moves about the cave during hibernation, from about 30 m past the Small Bat Room, to just outside the entrance to the Small Bat Room, and most recently was located on a breakdown block about six meters above

the Main Gate.

#### TEMPERATURE AND RELATIVE HUMIDITY

Torgac Cave provides an ideal bat hibernaculum because of the very stable cave environment and wide variety of temperatures. Detailed temperature and relative humidity studies are discussed by Forbes (1998). Torgac Cave does not have multiple entrances, other than around the perimeter of the main collapse, so there is very little air movement through the cave other than atmospheric pumping. Even though surface winds average 17 kph out of the south during the winter months (Howell, 1967), Torgac Cave is colder and more independent of the external environment than other caves in the vicinity.

The Main Entrance sink provides a cold air trap, with the coldest temperatures measured at the base of the breakdown collapse pile. The First Alcove and Main Formation Area have reached a low temperature of 4°C (95/96), and over the years have averaged 4.9°C during the bat counts. The Townsend's big-eared bats prefer roosting on the dry dolomite ceilings of these coldest portions of the cave. The relative humidity (RH) of these portions varied from 46% (95/96) to 79% (66/67 & 94/95), averaging 62% over the years that data is available. Within these areas, the cold dry air is at floor level, with warmer humid air along the ceiling, as is typical of many portions of Torgac Cave. The most recent measurements in the Main Formation Area revealed 3.8°C and 46% RH near the floor, and 5.7°C and 62% RH near the ceiling where the bats roost.

The western small-footed bats prefer slightly warmer and more humid conditions. They pack into a five-centimeter-wide dripping crack in the ceiling of the Main Formation Area, and also like to cluster on the dripping ceiling of the Tray Room—an isolated portion of the Main Formation Area. The relative humidity of the Tray Room has varied from 52% near the floor to 96% near the ceiling (Forbes, 1998).

The cave myotis obviously prefer the warmer and more humid conditions of the Small Bat Room (Velifer Room) off the east side of the Northwest Passage. This small room, approximately one to two meters in height and about 10 m in diameter, contains an average of 1375 cave myotis. Temperature and relative humidity have varied from 2°C and 99% RH (Howell, 1967) to 13.5°C (11/30/88 & 1/6/90) and 73% RH (2/11/96). Some years, the ceiling in this room is dripping, and many of the velifer are soaking wet. On average, this room measures 8.5°C and probably over 86% RH.

The second-largest concentration of cave myotis occurs where the East Entrance passage joins with the Crawlfway between the Main Entrance and the Football Field. In this area, approximately 40-100 cave myotis can be found in small clusters up a steeply-dipping gypsum-encrusted wall for about 30 m. Temperature and relative humidity probably vary greatly over the expanse of this wall, well out of reach of our instruments.

The warmest areas of Torgac Cave are also the most isolated from the central collapse cone. The (abandoned) Bat Room,

at the northwest end of the Northwest Passage, is typically 10°C and 55% RH during the winter months. Although it contains knee-deep piles of dried guano, the room has only been occupied by a small number of bats in recent years. The Nursery Room, off the west end of the Circle Room, averages 11°C and 50% RH during the winter months. This room may contain one or two active bats during the winter months, and occasionally contains small clusters of cave myotis during the summer months. A very large mound of guano indicates this room was probably a favored summer roost prior to the cave's discovery by cavers in the mid-1960s. The Nursery Room is flagged as "off limits" due to the strong smell and dusty conditions of the bat guano.

Temperatures throughout the cave are relatively stable from year to year. However, relative humidity varies widely, depending on recent rains. In 94/95 the cave was about 20% more humid on average than the corresponding areas in 95/96. The streambed had recently flooded in 1994, and the ceiling of the Velifer Room and other areas were very actively dripping. However, 1995 was a dry year, the stream bed sediments were dry, and areas like the Velifer Room were not dripping as much. The humidity within the cave is probably highly dependent on the local path of the late summer thunderstorms, which can dump tremendous amounts of water within a very narrow storm track.

#### DISCUSSION

The author has no good explanation for why the cave myotis are so numerous in certain years. The population variation does not appear to track well with climatic conditions. Safford (1989) had enough data from nearby Fort Stanton Cave to see a five year cycle of highs and lows in population numbers. The data for Torgac Cave is too sparse and contains too many gaps to do a similar comparison.

Relatively low-count baseline years are essentially identical to the earliest studies done by Howell (1967). Howell's studies were comprehensive and were performed before Torgac Cave experienced much visitation, prior to closing many small entrances and installing the two gates. It appears that the subsequent installation of the gates has protected the unique gypsum speleothems of Torgac Cave, while not noticeably impacting the hibernating bat populations. It is possible that the caver traffic and/or gates have affected the summer nursery usage.

#### RECOMMENDATIONS

It is recommended that the BLM continue to close Torgac Cave to visitation from November 1 to April 15. The current policy of limiting visitation to one trip (six person maximum) per month during the summer months is also recommended.

It is further recommended that members of the Pajarito Grotto on an annual basis continue the winter bat count program. Howell recorded an unusual year in 1966 when Torgac

Cave reached its coldest temperature immediately following a cold snap in November. During most years, however, the greatest number of bats and the deepest state of hibernation occurs early in February. This is approximately midway through the hibernation cycle, and it is recommended that bat counts be performed at this time each year. To minimize disturbance, it is further recommended that only one bat count be performed each year.

At present, the United States Fish and Wildlife Service lists the three main species of bats found in Torgac Cave as C2: "Species of special concern. Listing as endangered or threatened may be appropriate, but conclusive data are not currently available." For each of these species, human disturbance of the maternity and/or hibernating roosts was cited as the primary cause of decline. It is well known that the Townsend's big-eared bat is highly susceptible to disturbance (Barbour & Davies, 1969; Mohr, 1972). It is therefore extremely important that both summer and winter roosting sites be protected through thoughtful management if this species is to survive. The author is especially appreciative that the BLM Roswell Resource Area has recognized this concern, and has enforced seasonal closure of their bat caves. It is hoped that other federal and state agencies across the United States will take similar actions to protect sensitive bat habitats.

Much more research could be conducted on the bats of Torgac Cave. Summer studies of the bats have not been done. It would be good to have each group of summer visitors report the location and numbers of bats observed, and be aware of their presence so as to cause minimal disturbance. Evening bat counts of exiting bats could be performed at both gates and other various small exits. On May 6, 1994, Bill Ellis and Paul Reynolds (Ellis, 1994) counted 64 bats exiting Torgac Cave through a small hole about 12m east of the Main Gate between 8:30 and 9:30pm. Similar data would help expand our knowledge of the bats year round.

It would be interesting to core an undisturbed portion of the bat guano piles in the Bat Room and in the Nursery Room for radiocarbon dating and species identification. It is believed that bat skulls present in the cores could provide species identification.

#### ACKNOWLEDGMENTS

Special thanks for all the caver volunteers who have assisted with the bat counts over the years. The Bureau of Land Management, Roswell District, New Mexico, provided research permits and allowed access to Torgac Cave. Mike Bilbo, cave specialist for the Roswell District, provided access to the BLM data as well as professional and personal support for this project. Dr. Mike Balistreri, University of New Mexico, trained many of the volunteers in bat identification, and provided very useful guidelines for performing the bat counts with minimal disturbance.

#### REFERENCES

- Balistreri, M. (1995). *Bat Survey Guidelines (Crystal, Torgac, Crockett's Caves), & Bat Species of New Mexico*. unpublished report: 4p.
- Barbour, R.W. & Davis, W.H. (1969). *Bats of America*. The University Press of Kentucky: 286 pp.
- Bilbo, M. J., et. al. (1993). *Seasonal Closure of Bat Hibernaculum Caves: BLM (Roswell) Amendment to Ft. Stanton Cave, Torgac's Cave, Crockett's Cave, Cave Management Plans and Interim Cave Visitation Policy*: 6p.
- Bureau of Land Management. (1993). Closure and restriction order: Roswell resource area bat hibernaculum. *Federal Register*, 9/17/93, 58(179): 48668-48669.
- Doran, L.M. & Hill, C.A. (1998). Gypsum trays in Torgac Cave, New Mexico. *Journal of Cave and Karst Studies* 60(1): 39-43.
- Ellis, B. (1994). *Torgac's Cave Trip Synopsis*. unpublished report in BLM Roswell Resource Area files: 3 p.
- Forbes, J. (1998). Air temperature and relative humidity study: Torgac Cave, New Mexico. *Journal of Cave and Karst Studies* 60(1): 27-32.
- Howell, D.J. (1967). *Bats of Fort Stanton Cave and Torgac's Cave*. unpublished report, BLM Roswell Resource Area: 57 pp.
- Mausser, M. (1968). Trip report, Torgac's. *Underground Experience: Sandia Grotto Newsletter* 1(3) (November 6): 2.
- Mohr, C. (1972). The status of threatened species of cave-dwelling bats. *National Speleological Society Bulletin* 34: 33-47.
- Rohwer, R. (1968). Vandalism of Torgac's. *Underground Experience: Sandia Grotto Newsletter* 1(2) (October 30): 3.
- Rolfe, E. (1967). Personal communication to D.J. Howell.
- Safford, M. (1988). Hibernating bat population studies. *Southwestern Cavers* (Nov-Dec): 65-67.
- Safford, M. (1989). Bat population study Fort Stanton Cave. *National Speleological Society Bulletin* 51: 42-46.