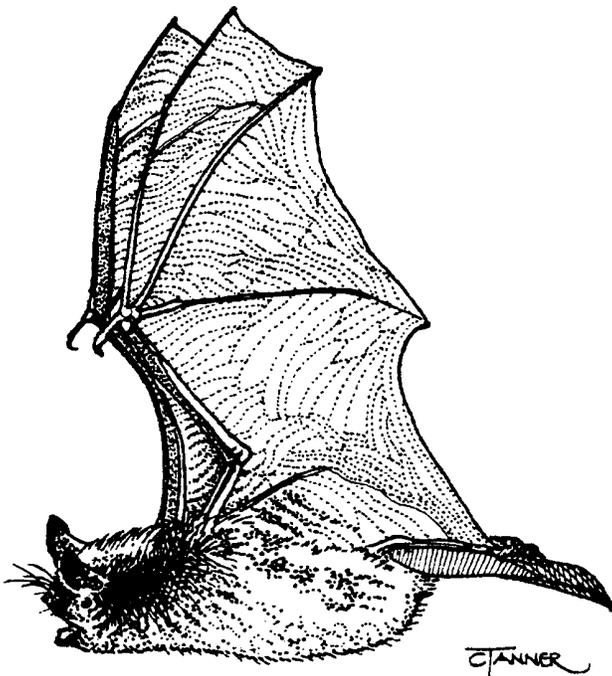


BAT SURVEY OF ROARING SPRINGS CAVE (COCONINO COUNTY, ARIZONA)

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INTRODUCTION

Roaring Springs Cave (RSC) is located within Grand Canyon National Park (GCNP), near the confluence of Roaring Springs and Bright Angel creeks. The elevation at the cave entrance is approximately 1570 m (5160 ft). The cave is a maze of narrow corridors formed by an underground river with perennial surface flow. RSC has six known entrances, with approximately 3.5 km of accessible passages (Fig. 1). The main passage is 1.4 km (4500 ft) long.

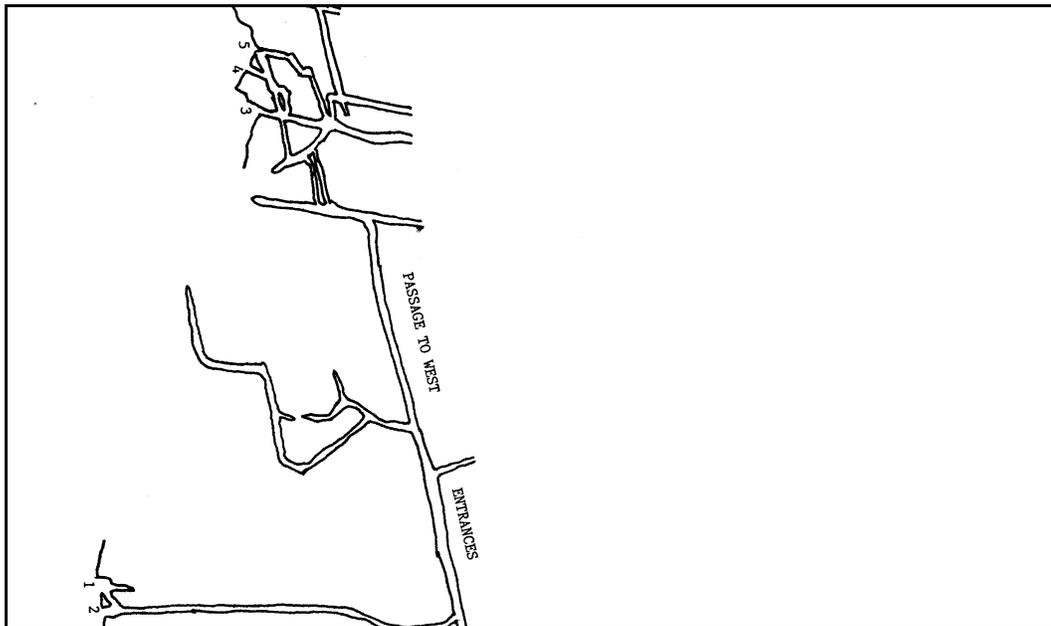


Figure 1. Map of Roaring Springs Cave, Grand Canyon National Park, Arizona, 1994. Based on an unpublished site map produced by the Central Arizona Grotto on file at GCNP. 1 = Gated Entrance; 2 = Flow Portal; 3-6 = West Entrances.

The cave's water supplies all of GCNP. Intake pipes are located at the mouth of the gated entrance, and one water sample intake is at 61 m (200 ft) within the main passage. The Arizona Water Resources Department has classified RSC as a surface water source and not a ground water source. This classification prompted a biological assessment of RSC. In 1977, Peck (1980) found "mouse, (bat?) droppings" during an invertebrate fauna survey in RSC, but reported that bats were "scarce or absent" from RSC during his visit.

In September 1994, the Arizona Game and Fish Department was approached for information and assistance in determining bat use of RSC. This report documents our survey results.

METHODS

The RSC interior survey consisted of exploring passages for evidence of bat use, such as guano deposits, skeletal remains, urine staining on walls or ceilings, prey remains, and bat presence. We recorded: date, observer(s), temperature, relative humidity, species, and number of bats present. We used a sling psychrometer and electronic meter to record temperature and relative humidity. We also observed the gated entry and flow portal through night vision equipment after sunset to document bat use.

Mist nets were set at various stations to capture bats. The nets were composed of 30-50 denier, 2 ply, black nylon with a 3.8 cm mesh. Data collected at each net set included: date, observer(s), site location, legal description, habitat description, weather conditions, number of nets set, starting and ending time, time of capture, species, sex, age, reproductive condition, weight, and length of forearm.

RESULTS

Mist Netting

On September 26, 1994, we used mist nets to verify which bat species were still active in the area. Two nets were placed near the Bruce Aikens residence (UTM E407280, N4004800), which is approximately 0.8 km (0.5 mile) downstream from the cave. One 7x18 ft net was placed across Bright Angel Creek, and a 7x30 ft net was set across the residence lawn. Thirty-three bats (5 species) were captured during mist netting: western pipistrelle (*Pipistrellus hesperus*), California myotis (*Myotis californicus*), silver-haired (*Lasionycteris noctivagans*), big brown (*Eptesicus fuscus*), and Mexican free-tailed (*Tadarida brasiliensis*) bats. Twenty-four of the bats captured were adults, 6 were juveniles, and 3 were age undetermined (Table 1).

Table 1. Age and sex of bats captured by mist netting near Bright Angel Creek, Grand Canyon National Park, Arizona, September 26, 1994.					
Species	Male		Female		Unknown ^a
	Adult	Juvenile	Adult	Juvenile	
<i>Myotis californicus</i> ^b	0	0	1	0	0
<i>Lasionycteris noctivagans</i>	1	0	1	0	0
<i>Pipistrellus hesperus</i> ^b	3	3	2	0	2
<i>Eptesicus fuscus</i> ^b	3	0	7	0	1
<i>Tadarida brasiliensis</i> ^b	4	3	2	0	0

^aIndividuals that escaped prior to sex determination.

^bKnown to hibernate in caves.

Cave Survey

We surveyed the interior of RSC on September 27, 1994, but found no bats during exploration of the cave. We found a single piece of guano, on a rock bridge above the water, approximately 30 m (100 ft) within the main passage. It was small and appeared to be from a *Myotis* sp. or western pipistrelle. We found packrat (*Neotoma* sp.) and mouse (*Peromyscus* sp.) droppings scattered throughout the first 150 m (500 ft) of each entrance. We also observed one packrat midden and one *Peromyscus* sp. Air temperature was 12.8°C (55°F). Relative humidity was 90 percent. Water temperature was 10.6°C (51°F). Air and water temperatures were relatively constant throughout RSC. Five of the marked entrances were located and searched for evidence of bats. The sixth entrance was not found, despite extensive searching.

Exit Count

We performed an exit count of the gated entrance and flow portal on September 27, but found no bats exiting the cave from the five marked entrances. However, we did observe a western pipistrelle flying in the entry way above the stairs to the gate. This bat probably came from nearby cliffs and not from within RSC.

CONCLUSIONS

On the basis of this survey, it appears that RSC is little used by bats. However, consideration must be given to the duration and timing of the survey, water flow rates within the cave, and air temperatures and humidity.

This brief survey was conducted during a transitional period when bats may be moving between summer maternity and winter roost sites. Maternity sites require relatively high and constant temperatures. The temperature and air flow within RSC is not conducive to maintaining a maternity roost. No areas were observed that would indicate warm air traps. Areas near the entrances could trap enough warm air to support a maternity colony, however, no staining or guano accumulations were found.

Because the cave has a perennial surface flow, evidence of bat use could be washed away with the water. High water marks indicated that any evidence of bat use on the walls of the cave may also have been washed away. However, only a single piece of bat guano was seen above these marks, indicating limited bat use of the cave.

RSC's use as a hibernaculum is still unknown. Bat defecation rates are reduced during hibernation, therefore large guano deposits may not be present. Staining may also be absent from areas where single bats hibernate. Little is known about the temperature requirements for hibernating bats. Most species select hibernating areas where temperatures remain between 0° and 5°C (32-41°F) (Hill and Smith 1992; Nagorsen and Brigham 1993; Yalden and Morris 1975). Some cave roosting species hibernate in temperatures as high as 15°C (59°F) (Hill and Smith 1992). The temperature in RSC was 12.8°C (55°F).

RECOMMENDATIONS

This was a single survey of the bat use in RSC. It does not appear that RSC is being used as a maternity site by any bats. Hoffmeister (1986) indicates a mummified California myotis may have been collected here. This specimen is in the U.S. Museum of Natural History collection and was collected by V. Bailey in May 1929 from Roaring Springs. No indication of a roost was given. However, because of this record, we recommend that a maternity season (May-June) visit be conducted to verify the presence or absence of such.

Also, both this and Peck's (1980) visit to RSC were conducted in September. Temperature readings were virtually the same during each visit. We recommend that temperatures be recorded at different times of the year to document any seasonal fluctuations that might occur. These records should confirm whether RSC could maintain a maternity site.

Finally, RSC should be surveyed in January to determine whether it supports hibernating bats. Four of the five species captured during the mist netting efforts hibernate in caves (Table 1). Although temperatures appear to be borderline for extended hibernation, it is conceivable for a hibernating population to use RSC.

Because of the unanswered questions regarding the value of RSC as a bat roost, we recommend that these additional surveys be conducted prior to any entrance closures.

LITERATURE CITED

- Hill, J.E. and J.D. Smith. 1992. Bats: a natural history. The University of Texas Press and Natural History Museum London.
- Hoffmeister, D.F. 1986. Mammals of Arizona. The University of Arizona Press and The Arizona Game and Fish Department.
- Nagorsen, D.W. and R.M. Brigham. 1993. Bats of British Columbia. University of British Columbia Press.
- Peck, S.B. 1980. Climatic change and the evolution of cave invertebrates in the Grand Canyon, Arizona. NSS Bulletin. 42:53-60.
- Yalden, D.W. and P.A. Morris. 1975. The lives of bats. New York Times Book Co. New York.