Roost descriptions for male pallid bats (*Antrozous pallidus*) along the Purgatoire River, Las Animas County, Colorado

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Introduction

The life history of many North American bat species is poorly understood. Because bats use flight as their predominant mode of movement, many bats are nocturnal, and most bats roost in locations that are difficult for humans to access, there are large gaps in the knowledge of bat habitat use. These knowledge gaps are problematic because a host of threats, such as energy development, pesticide use, emerging diseases, and closure of mine roost locations likely are altering bat habitat selection. For cavernicolous (cave, mine and crevice roosting) bats, better descriptions of the types of roost and range-wide comparisons of these roost characters may elucidate roosting requirements for some species.

The pallid bat (*Antrozous pallidus*) is a large (up to 19 g) bat found throughout much of western North America from British Columbia to Texas (Hermanson and O'Shea 1983). It roosts in caves, mines, crevices, trees, and abandoned buildings in large groups of a hundred or more, but usually in small groups or alone. Like most North American bats the pallid bat feeds on invertebrates, but pallid bats are one of the few species that takes a considerable proportion of their meals off the ground or vegetation. Pallid bats can sometimes be found landing on the ground to capture and eat terrestrial arthropods, like scorpions, centipedes, spiders and grasshoppers.

In Colorado, most of the roosting records for pallid bats have come from incidental encounters in buildings or during surveys at caves and mines. It is likely pallid bats are utilizing other roost structures, but there has been little effort to document other roost use.

Questions of interest

The goal of this project was to describe the characteristics of pallid bat roosts in southeastern Colorado. Pallid bats are found in western Colorado and in the southeastern section of the state from El Paso County to the southeastern corner. I hypothesized that pallid bats would utilize crevices in the river canyons along the Purgatoire River of northern Las Animas County (Figure 1).

Figure 1. Overlooking the Purgatoire River Valley, Las Animas County, CO.

When this study was initiated it was an attempt to locate roosts of the Townsend's big-eared bat (*Corynorhinus townsendii*) in southeastern Colorado. The Townsend's big-eared bat is the bat of greatest conservation concern in Colorado (Ellison et al. 2003) and several big-eared bats were captured near the Purgatoire River in northern Las Animas County in 2008. This study was originally intended to locate temporary and maternity roosts of Townsend's big-eared bats. Unfortunately, no big-eared bats were captured during the fieldwork.

Methods/Results

During June and July of 2009, 12 pallid bats, 13 small-footed myotis (*Myotis ciliolabrum*), 11 little brown bats (*Myotis lucifugus*), 2 big brown bats (*Eptesicus fuscus*), and 1 fringed myotis (*Myotis thysanodes*) were captured east of the Purgatoire River south of the Comanche National Grasslands, Las Animas County. Bats were captured in mistnets set over cattle troughs in juniper woodlands and grasslands. Nets were set up before dusk and monitored continuously until midnight.

Once bats were captured they were sexed, weighed, and either released or kept for telemeter attachment. Telemeters were attached to the dorsal surface of the bat using biomedical glue (Skin-Bond, Smith and Nephew Inc., London) (Figure 2). Prior to gluing, hair was trimmed from between the shoulder blades to create a "nest" where the telemeter would sit. I used small (<1.1 g) radiotelemeters (Holohil Systems, Ltd., Ontario, Canada) and attachment was completed within 10 minutes after capture.

Figure 2. Pallid bat with telemeter attached. Antenna is the thin silver line extending behind the bat. Telemeter is near the researcher's thumb.

Bats were tracked during daylight hours to locate diurnal roosts. Once a bat's general location was identified researchers would hike as close as possible to describe the roost structure and characteristics. Table 1 lists the characteristics recorded at roost sites.

Twelve male pallid bats were telemetered and 53 roosts were located. During most attempts to locate telemetered bats the individuals were either well-hidden behind rock structures or inaccessible. However, telemetered bats were seen on 6 occasions.

Table 1. Data taken at pallid bat roosts

Data	Units	Data values
Roost structure	NA	tree, clilff wall, rock
Aspect of roost opening	degrees	various
Aspect of cliff wall	degrees	various
Distance to nearest tree	meters	various
Bearing to nearest tree	degrees	various
Species of nearest tree	NA	juniper, pinon pine
Bearing to nearest water source	degrees	various
Distance to nearest water source	meters	various
Type of water source	NA	river, trough
Canopy cover within 2 m of roost	percent	NA
Canopy cover within 10 m of roost	percent	NA
Presence of guano	NA	yes/no
Presence of bats	NA	yes/no
Roost temperature	degrees Celsius	various
Ambient temperature	degrees Celsius	various
Height of emergence opening	centimeters	various
Width of emergence opening	centimeters	various
Depth of crevice	centimeters	various
Distance to flat ground above entrance	meters	various
Distance to ground below entrance	meters	various
Distance from roost to valley floor	meters	various
Distance from roost to top of mesa	meters	various

Nearly all roosts were on cliff walls and facing south to southwest (mean: 178º), but with much variability (range: 30 - 334º) and in the same general direction as the aspect of the cliff wall (mean: 165º, range: 2 - 268º). Roosts were not surrounded by trees and on no occasions were trees providing canopy cover above roosts. Roost temperatures (26.0 ± 4.9ºC) were comparable to ambient temperatures (24.3 ± 6.9ºC). Crevices were typically narrow (7.8 ± 5.5 cm), but more variable in length (198 ± 346 cm) and nearly equally distributed (55% vertical:45% horizontal) in orientation (Figure 3). Most crevices were high on cliff walls (86.5 ± 46.9 m) and near the top of mesas (within 17.8 ± 22.2 m of mesa top). Six roosts were in standing rocks at the base of cliff walls (Figure 4).

Summary

Pallid bat roosts were high on rock cliff walls and had relatively warm roosts. In British Columbia, pallid bats are known to roost in crevices with high, constant temperatures (30ºC; Rambaldini and Brigham 2008). It was difficult to ensure that the infrared thermometers used in this study adequately depict the true roosting temperatures for pallid bats. Because some roosts were inaccessible, internal roost temperatures were difficult to collect. Also, when crevices were accessible, the telemetered bat was not visible and microclimates for bat roost locations may have had different temperatures than those depicted by thermometers. On several occasions it was unsafe to hike to cliffs where bats were roosting, so researchers were forced to make their best guess for where telemetered bats were located on cliff walls. I expected most roosts to be oriented vertically believing that these roost would have the greatest variability in internal temperature and would allow bats to find optimal temperatures throughout the day, but I found equal numbers of horizontally-oriented roosts. Also, I expected to find some bats utilizing juniper trees, but never tracked telemetered bats to any trees.

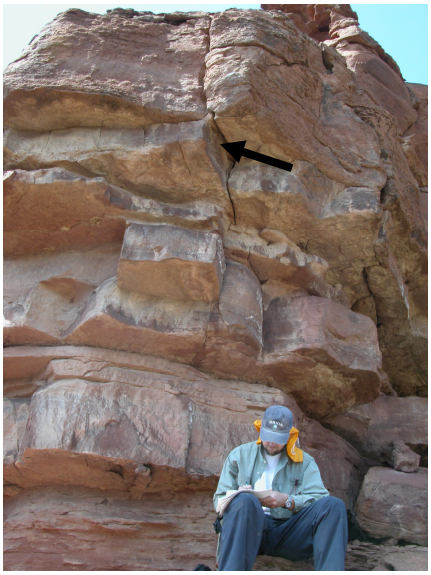

Figure 3. Rob Schorr sitting below crevice roost where two separate bats were found roosting. Arrow shows bat location.

Anecdotally, as researchers hiked the cliffs and valley floor looking for roost locations we found an abundance of grasshoppers (Order Orthoptera) and other terrestrial arthropods, including walking sticks (Order Phasmida), windscorpions (Order Solifugae), and spiders (Class Arachnida) that would be valuable food resources for pallid bats.

This study was able to document regular use of crevices by pallid bats and was able to describe general characteristics of those roosts. One of the areas of conservation concern for cavernicolous bats is the lack of understanding on the amount of crevice use by some species. Although pallid bats may utilize larger caves and mines as maternity roosts it is likely that solitary roosting structures like crevices are valuable resting and thermoregulatory refuge for males.

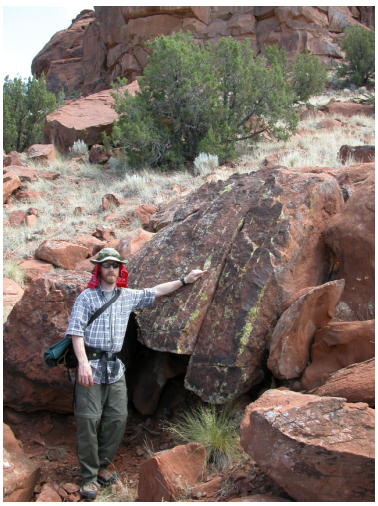

Figure 4. Jeremy Siemers pointing to crack in rock where pallid bat was roosting.

Literature Cited

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Hermanson, J.W., and T. J. O'Shea. 1983. *Antrozous pallidus*. Mammalian Species 213:1-8.

Rambaldini, D. A., and R. M. Brigham. 2008. Torpor use by free-ranging pallid bats (*Antrozous pallidus*) at the northern extent of their range. Journal of Mammalogy 89:933-941.

Pallid bat and close-up and pallid bat with telemeter attached