Bat Species Composition and Roost Use in Pinyon-Juniper Woodlands of New Mexico

ALICE L. CHUNG-MACCOUBREY

ABSTRACT

Bat species composition and structures used for maternity colony roosts were investigated in pinyon-juniper habitats of the Cibola National Forest. I mist netted 10 sites with permanent water on four different nights during the summer of 1995. Number of species and total numbers of bats captured ranged from 0–11 species at a site and 0–134 bats in a night. *Myotis californicus, M. ciliolabrum, M. volans, M. thysanodes, Eptesicus fuscus, Lasionycteris noctivagans, Lasiurus cinereus,* and *Tadarida brasiliensis* were captured at ≥5 sites, although not always in high numbers. Species captured at <5 sites were either locally abundant (e.g., *M. evotis*) or a rarity (e.g., *Euderma maculatum*). Radio-telemetry was used to study maternity-roost use by three federal Category 2 candidate species. Three *M. thysanodes,* one *M. evotis,* and two *M. volans* roosts were located. *M. thysanodes* and *M. volans* roosts with 30 to over 200 bats were found in ponderosa pine snags and live ponderosa pine (*Pinus ponderosa*) with long, vertical cracks. These snag and live-tree roosts were located in ponderosa pine stringers in drainages between pinyon-juniper slopes or at the interface of ponderosa pine and pinyon-juniper habitats. *M. evotis* used live and dead junipers exclusively for colony and solitary roosts.

INTRODUCTION

Insectivorous bats consume large quantities of insects each night to support the high energetic costs of flight and reproduction, and to permit storage of energy as fat for the winter (Kunz 1982; O'Shea and Vaughan 1977). Thus, bats may have a large impact on insect populations, insect activity, and many insect-related ecological processes (such as herbivory, pollination, disease transmission, etc.). These far-reaching influences suggest that bats may play an important role in ecosystem function, balance, and integrity. Despite their diversity, abundance, and importance in the environment, little is known of the biology, life history, and habitat requirements of bats in the American Southwest.

Of the 26 bat species found in New Mexico, two are federally endangered and 13 are federal Category 2 candidates. Future decisions relating

to bats for land management, ecosystem management, and federal/state status determinations may largely depend on information provided by current research on geographic presence/absence, habitat associations, life histories, foraging and roost requirements, and other critical needs and threats.

In the Southwest, surface water, appropriate roosts, and food are essential components of suitable bat habitat. Water is very important to insectivorous bats because of their high protein diet and high rates of evaporative water loss (McNab 1982). However, suitable maternity roosts may be most critical to successful reproduction of bats because they provide a microclimate that facilitates gestation and rapid growth of pups (Humphrey 1975). Knowledge of which structures provide a suitable microclimate for reproduction is essential for effective management of bat habitat and populations. Thus, the objectives of this study were to (1) examine species composition, relative abundance, and reproductive timing of bats that use water resources in pinyon-juniper habitats; and (2) identify types of roosts used by maternity colonies of select Category 2 candidate species.

MATERIALS AND METHODS

To determine species composition, I sampled bats by placing mist nets over relatively permanent bodies of water in pinyon-juniper habitats. Ten netting sites were chosen among the Sandia, Manzano, Magdalena, Gallinas, and San Mateo mountains of the Cibola National Forest (34° 10′N, 107° 26′W). Site selection was based on habitat type (pinyon-juniper), geographic location, and permanency of the water source. Water sources were perennial streams, well- and spring-supplied steel tanks, or dirt stock tanks. Following methods described in Kunz and Kurta (1988), each site was netted four times at approximately 2–3-week intervals beginning in May and ending in August 1995. Nets were opened at sunset and were closed after activity had substantially subsided (typically between 2330 and 0100 h). After species, sex, age, reproductive status, and body measurements were recorded, bats were weighed and released.

From the end of June through early August, radio-telemetry was used to track reproductive females to maternity roosts. The Gallinas mountains northwest of Magdalena were chosen for the telemetry study because pinyon-juniper is the primary habitat type of this range, and numerous permanent water sources are dispersed throughout. I netted over water sources to obtain pregnant or lactating long-legged myotis (*M. volans*), fringed myotis (*M. thysanodes*), or long-eared myotis (*M. evotis*), all of which are federal Category 2 candidate species. Only one female of a species was radio-tagged per site per night to avoid tracking bats from the same roost. After clipping fur from between the shoulder-blades, a 0.50–0.67-g radio-transmitter (Holohil Systems, Ltd.) was secured with surgical glue, and the bat was released after the glue had dried (approximately 30 minutes). The following days were spent attempting to locate the bat and identify its roost. If a roost was located, I counted bats exiting at dusk to determine total occupancy of the roost.

From three to 11 species were captured at each site (Table 1). However, all species caught at a site were not necessarily captured on any one night. Number of captures per night at each site was variable between netting events. Numbers of bats caught at any one site in a night ranged from

TABLE 1 *Sites at which each species was captured. Sites are ordered by mountain range.*

	Sandia		Manzano		Gallina		Madgalena	San Mateo		
Species	1	2	3	4	5	6	7	8	9	10
Myotis californicus and ciliolabrum[a,b] California and small-footed myotis	×	×	×	×	×	×	×	×	×	×
M. volans[b] Long-legged myotis		×	×		×	×	×	×	×	×
Eptesicus fuscus Big brown bat	×	×	×		×	×	×	×	×	
Lasionycteris noctivagans Silver-haired bat	×	×	×	×			×	×	×	×
Lasiurus cinereus Hoary bat	×	×	×	×			×	×	×	
M. thysanodes[b] Fringed bat					×	×	×	×	×	
Tadarida brasiliensis Mexican free-tailed bat				×			×	×	×	×
M. evotis[b] Long-eared myotis					×	×			×	×
M. auriculus Southwestern myotis			×			×	×			×
M. yumanensis[b] Yuma myotis						×	×			×
Antrozous pallidus Pallid bat						×	×			
M. lucifugus occultus[b] Little brown myotis							×			
Pipistrellus hesperus Western pipistrelle										×
Idionycteris phyllotis[b] Allen's lappet-browed bat										×
Euderma maculatum[b] Spotted bat										×

[a] These species could not be distinguished in the field and are thus reported together. *M. ciliolabrum* is a federal Category 2 Candidate.
[b] Federal Category 2 candidate species.

TABLE 2 *Total number of bats caught on each netting occasion by site. Sites are arranged by mountain range.*

Netting occasion	Sandia		Manzano		Gallina		Madgalena	San Mateo		
	1	2	3	4	5	6	7	8	9	10
#1	3	23	10	2	64	19	100	6	11	15
#2	0	23	16	5	13	2	134	58	41	8
#3	1	0	52	6	43	44	42	29	97	4
#4	3	2	41	0	27	23	24	51	30	15

0 to 134 (Table 2). *Myotis californicus*, *M. ciliolabrum*, *M. volans*, *M. thysanodes*, *Eptesicus fuscus*, *Lasionycteris noctivagans*, *Lasiurus cinereus*, and *Tadarida brasiliensis* were captured at many or most netting sites (≥5 sites; Table 1), although not always in high numbers. Species that were caught at <5 sites were either locally abundant at their site of capture (e.g., *M. evotis* or *M. auriculus*) or rare (e.g., *Euderma maculatum* or *Idionycteris phyllotis*).

Capture of females who were obviously pregnant began around the second and third weeks of June. Lactating females were caught beginning the first week of July and were still being captured in early August. Post-lactating females were captured starting the first week of August.

In the Gallinas mountains, two long-legged, one long-eared, and three fringed myotis maternity roosts were identified. Long-legged and fringed myotis roosts were in ponderosa pine snags or live ponderosa pines with long, vertical cracks and loose bark. Vertical cracks were most likely due to lightning strikes. Long-legged myotis roosts contained 67 to over 200 bats, and fringed myotis roosts contained 30 to 40 bats. A single, long-eared myotis roost of five bats was found in a cavity within the dead trunk of a live juniper (*Juniperus* sp.). All maternity roosts were vacant by late August/early September. Of the five ponderosa pine roosts, two were in isolated stands of ponderosa pine (stringers) running the lengths of arroyos in pinyon-juniper (*Pinus edulis—Juniperus* sp.) habitat, and three were located at the interface of pinyon-juniper and ponderosa pine habitats.

Lactating long-legged and long-eared myotis radio-tagged in late July/early August were not found in colony roosts, but changed roosts daily. Long-legged myotis females moved amongst pinyon snags and roosted underneath the sloughing bark. Long-eared myotis females moved amongst live and dead junipers (primarily *Juniperus monosperma*) and roosted within the twisted folds of the trunks.

DISCUSSION

This first season, all or a large portion of the bat species that use water and other resources in pinyon-juniper habitats of central New Mexico were identified. Total captures were generally lower in the Sandia and Manzano mountains, most likely due to the fewer number of suitable watering sites in pinyon-juniper habitats of these mountains (pers. obs.).

Netting success between nights was highly variable in both species composition and total captures. Thus, four nettings were probably the minimum necessary to reflect the entire complement of species using a site throughout the season. Many factors affect the species and number of bats captured, including weather, moon phase, site location, overall availability of water, reproductive status of bats, changes in foraging patterns, previous captures, and ability to avoid nets (Reith 1982; Kunz and Kurta 1988). Although many factors may affect netting results, mist netting still provides information, such as geographic distribution, species composition, relative abundance, and timing of activities. Mist netting data from this study may be used by managers for making future status determinations of federal Category 2 candidate species, managing bat habitat, and evaluating land-management practices, and by researchers for designing roost, foraging, and reproductive studies.

Within pinyon-juniper habitats, hard ponderosa pine snags or live ponderosa pines with cracks or loose bark may be important sites for long-legged and fringed myotis maternity colonies. Site fidelity is correlated with permanency of the roost type (Lewis 1995). Thus, bat species that use permanent structures, such as caves, are more likely to reuse the same roost on a daily and annual basis than species that use foliage roosts. However, site fidelity is inversely correlated with availability of the roost type (Lewis 1995). The ponderosa pine roosts used by bats in this study are persistent for many years, but are not in great abundance in pinyon-juniper habitats. Thus, these bats are likely to occupy the same roosts year after year. Female long-eared myotis that were radio-tagged in this study used junipers exclusively (primarily *Juniperus monosperma*) for both colony and solitary roosts. Because of the high availability of junipers, long-eared myotis may not exhibit site fidelity to the same degree as long-legged and fringed myotis. Nevertheless, inadvertent disturbance or loss of any colony roost may potentially displace hundreds of pregnant females or females and young. Because of the low reproductive rate of bats (approximately one young per year), such an occurrence could have a large impact on the local population (Humphrey 1975). Bats evicted from maternity roosts produce fewer offspring after moving to the new roost (Brigham and Fenton 1986). The abundant use of both live and dead trees by bats in pinyon-juniper habitats has important implications in the regulation of fuelwood harvest and salvage logging in the Southwest. To manage for bats in pinyon-juniper habitats, more steps must be taken to ensure that active colony roosts are not disturbed, that potential roost trees remain available for future use, that a diverse food base is cultivated, and a sufficient number and dispersion of water sources are available for use by local populations.

Brigham, R.M. and M.B. Fenton. 1986. The influence of roost closure on the roosting and foraging behaviour of *Eptesicus fuscus* (Chiroptera: Vespertilionidae). Can. J. Zool. 64:1128–33.

Humphrey, S.R. 1975. Nursery roosts and community diversity of nearctic bats. J. Mammal. 56:321–46.

Kunz, T.H. 1982. Roosting ecology of bats. In Ecology of bats. T.H. Kunz (editor). Plenum Press, New York, N.Y., pp. 1–55.

Kunz, T.H. and A. Kurta. 1988. Capture methods and holding devices. In Ecological and behavioral methods for the study of bats. T.H. Kunz (editor). Smithsonian Institution Press, Washington, D.C., pp. 1–28.

Lewis, S.E. 1995. Roost fidelity of bats: a review. J. Mammal. 76:481–96.

McNab, B.K. 1982. Evolutionary alternatives in the physiological ecology of bats. In Ecology of bats. T.H. Kunz (editor). Plenum Press, New York, N.Y., pp. 151–200.

O'Shea, T.J. and T.A. Vaughan. 1977. Nocturnal and seasonal activities of the pallid bat, *Antrozous pallidus*. J. Mammal. 58:269–84.

Reith, C.C. 1982. Insectivorous bats fly in shadows to avoid moonlight. J. Mammal. 63:685–88.