

Capture Heights and Times of *Lasiurus borealis* (Chiroptera: Vespertilionidae) in Southeastern Oklahoma

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The capture heights and times of 251 red bats mist netted in southeastern Oklahoma were examined. Average capture heights varied from 3.4 m in May to 2.2 m in August. Most red bats were captured within the first four hours after sunset. Reproductively active male bats were most active from 2 to 4 h after sunset which increased their chances of finding a mate. Southeastern Oklahoma may be a nursery region with males migrating into the area in late summer.

INTRODUCTION

The red bat, *Lasiurus borealis*, is a solitary, nomadic, migratory, tree dweller (1), which makes it difficult to study. Since the literature reveals that much of what is known about this bat is anecdotal (2), any contribution to our knowledge of its ecology will be of great value. The purpose of this research was to examine the capture heights and times of red bats in southeastern Oklahoma.

MATERIALS AND METHODS

The study was conducted in Choctaw, LeFlore, McCurtain, and Pushmataha counties of southeastern Oklahoma from May through August of 1985. There were 35 different collecting sites (see Caire (3) for habitat descriptions). Mist nests were set across tree-lined streams. A combination of standard-size mist nests (3.8-cm mesh, 9.1 - 21.3 m long by 2.1 m high) and "high" mist nests (three, 9.1-m by 2.1-m nets hoisted one above another to a height of 6.4 m) were used at each site. The bottom of the nets were within 15 cm of the substrate and no bats were observed flying under the net. During the study, 121 standard and 53 high mist nets were tended from sunset until dawn (usually 10 h). A total of 251 red bats were captured. A cage containing bats was occasionally placed near the nets so that the bat sounds would attract other bats. These captures were not included in capture heights and times analyses, but were included in the total number taken each month.

The following data were recorded for each bat: capture time; height above ground; sex; reproductive state (i.e.-pregnant, lactating, postlactating, epididymides descended, or nonreproductive); and age (i.e., juvenile, subadult, or adult). Bats with no external signs of breeding activity were considered nonreproductive. Age was based on degree of phalangeal ossification, overall body size, appearance of pelage, relative wear on the canines, and reproductive state. Capture times were recorded to the nearest minute, then tallied into 2-h intervals, beginning at sunset. The time of sunset was adjusted for daily shifts using information furnished by the Oklahoma Climatological Survey in Norman, Oklahoma.

RESULTS AND DISCUSSION

The numbers of bats netted each month (Table 1) were significantly different ($X^2 = 191.7$, $P < 0.05$). Fewer numbers were taken in May and June. A similar scarcity of red bats in midsummer has been reported for other states (4 - 6, 8). The increase in bats in August was in part due to reproductive accrument. However, the large increase in adult males may reflect sexual differences in seasonal movements (6, 8). Southeastern Oklahoma may be a nursery region similar to that of eastern Kansas (9). The regional separation of the sexes in early summer would reduce intraspecific competition for similar food resources. If male and female red bat

TABLE 1. Numbers of male and female *Lasiurus borealis* captured each month in southeastern Oklahoma in 1985.

Age Group	Sex	Month			
		May	June	July	August
Adults	Males	12	4	6	54
	Females	7	9	10	15
Juveniles	Males		1	23	2
	Females			31	
Subadults	Males				39
	Females				38
Totals		19	14	70	148

females were also uncommon in late spring and early summer. Females were perhaps restricting their activities to parturition sites. Layne (5) noted that female red bats were uncommon in Illinois in mid-May. He suggested that during late pregnancy and nursing, female red bats curtail their activity, and are difficult to capture.

Capture heights over time were significantly different (Kruskal-Wallis test, $H = 11.5$, $P < 0.05$). Heights averaged 3.4 m in May ($n = 15$, $SD = 2.0$), 2.6 m in June ($n = 8$, $SD = 1.5$), 3.0 m in July ($n = 56$, $SD = 1.8$), and 2.2 m in August ($n = 74$, $SD = 1.6$). The small May and June samples consisted of adult bats except for one juvenile captured in June, while in the other months, especially July and August, samples were larger, but contained subadult as well as adult bats. A comparison of capture heights of adult male and female bats among months revealed no significant differences (Kruskal-Wallis test, $H = 7.0$, $P > 0.05$). Capture heights among male or female bats in differing reproductive states were not significantly different (Mann-Whitney test, $P > 0.05$). Why the differences exist in some of the capture heights is not readily apparent. There was no indication of the behavior of the bats prior to capture; e.g., prey pursuit, cruising from one area to another, predator avoidance, and competitor interactions. These different behaviors could have influenced the heights at which the bats flew and were subsequently captured. Prey items might also have occurred at varying heights during the summer.

In Arkansas, Texas, and elsewhere (1,11, 12), red bats were most active soon after sunset. A similar pattern was noted for southeastern Oklahoma red bats (Table 2). The number of bats captured per each 2-h post-sunset interval was significantly different ($X^2 = 90.6$, $P < 0.05$). Within 4 h after sunset, 75% of all bats was captured. Eighty-one percent of all males and 71% of all females were captured within 4 h of sunset. A large percentage of each age class was also

diets were similar (7, 10), the seasonal geographic separation would allow females to forage more efficiently during the nursery period. A pronounced increase occurred in the number of adult males caught in August, soon after the young were flying (Table 1). A timely migration of males into southeastern Oklahoma near the end of the summer would facilitate mating in late summer and early fall (1).

Another explanation for the paucity of adult males in early summer was that mist nets were not set in microhabitats frequented. A seasonal shift in habitat use might account for the late summer increase in males. However, 35 different sites were sampled, most on several occasions, and, seemingly, some of the early summer habitats used by males would have been sampled. Adult

TABLE 2. Numbers of *Lasiurus borealis* captured in each two-hour post-sunset interval.

Sex	Age group	Post-sunset intervals				
		0-2	2-4	4-6	6-8	8-10
Males	Adults	7	16	6	1	1
	Subadults	13	9	1	1	
	Juveniles	13	4	4		
	Potential breeders	10	22	2	1	
	Nonreproductive	23	10	6	1	1
Females	Adults	14	10	4	2	2
	Subadults	7	8	3	2	
	Juveniles	11	4	5	2	3
	Pregnant and lactating	6	2	1	1	
	Potential breeders	10	15	3	3	1

captured within 4 h after sunset. The percentage of males and females for each age class was: adults, 75% and 75%, subadults, 92% and 75%, and juveniles 75% and 60%.

In the same time span, 80% of the pregnant and lactating females were captured as well as 69% of all other females. Of the potential breeding (postlactating and showing no signs of reproductive activity) females, 78% captured in August were netted within 4 h after sunset.

Ninety-one percent of the potentially reproductively active males and 80% of the nonreproductive males (from all months combined) were netted within 4 h after sunset. However, the percent captured in each of the 2-h intervals differed. During the study, 56% of the nonreproductive males captured was netted within the first 2 h after sunset while 65% of the reproductively active males was captured between 2 and 4 h after sunset. Perhaps this behavior minimized energy expenditure and enhanced reproductive success. Copulation, which may be initiated while the bats are in flight (13), is energy demanding and requires optimal use of flight time. During the first 6 h after sunset, 85% of all potentially breeding females was active (Table 2). By intensifying flight activity in the 2- to 4-h post-sunset interval, reproductively active males improved their chances of finding a mate by being available for early- and late-flying females.

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