

## BATS OF ARCHBOLD BIOLOGICAL STATION AND NOTES ON SOME ROOST SITES

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**Abstract.**—Four species of bats were captured at Archbold Biological Station including evening bats (*Nycticeius humeralis*, n = 17), Brazilian free-tailed bats (*Tadarida brasiliensis*, n = 17), northern yellow bats (*Lasiurus intermedius*, n = 13) and Seminole bats (*Lasiurus seminolus*, n = 2). Maternity roosts of northern yellow bats were documented in Spanish moss (*Tillandsia usneoides*), and a solitary adult male was observed nearby roosting under a palm frond in a cabbage palm (*Sabal palmetto*). A mixed colony of 254 Brazilian free-tailed and evening bats was observed using a large slash pine (*Pinus elliotii*) snag, representing one of the few documented records of Brazilian free-tailed bats using such a natural roost.

Layne (1999) reports six species of bats from Archbold Biological Station (ABS) and surrounding area that include: big brown bats (*Eptesicus fuscus*), northern yellow bats (*Lasiurus intermedius*), Seminole bats (*Lasiurus seminolus*), evening bats (*Nycticeius humeralis*), eastern pipistrelles (*Pipistrellus subflavus*), and Brazilian free-tailed bats (*Tadarida brasiliensis*). These species are considered common in Florida (Jennings 1958). With the exception of the Brazilian free-tailed bat, all bat species known from ABS use natural roosts at some period during the year (Barbour and Davis 1969). My objective through this study was to document the presence of bats in natural areas during the summer maternity period in south-central Florida and document their use of roost sites.

### STUDY AREA AND METHODS

This study was conducted at Archbold Biological Station (ABS) from April 2002 to September 2003. ABS is located approximately 120 km south of Orlando at the southern end of the Lake Wales Ridge. The climate of the area is characterized as sub-tropical with hot, wet summers and mild, dry winters with a mean annual temperature of 22°C (Winsberg 1990). Archbold Biological Station covers 2101 ha with approximately 95% comprised of undisturbed natural habitat in which the natural vegetation and hydrology has not been altered. The vegetation of ABS was described by Abrahamson et al. (1984) and consists primarily of xeric habitat, intermixed with seasonal wetlands and bayhead swamps. At ABS, ca. 83% of the land has been burned within the past 20 years with prescribed fire or from wildfires.

Mist-netting was conducted from March-July of 2003 to coincide with the expected maternity period of bats. Mist nets (6.0, 9.0 and 12.0 m) were double stacked and placed across road corridors, trails, canopy gaps, and road rut ponds. In each location, four double-stacked mist-nets were placed perpendicular or parallel to one another. Around snags,

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mist-nets were set in a triangular formation. Nets were raised at sunset and monitored for 1.5-2.5 hours. Captured bats were weighed to the nearest 0.5 g, sexed, and aged.

Roost searches were conducted randomly throughout the Station from April 2002 to October 2003, for about 3-4 hours per month. No systematic searches were conducted for roost sites, but efforts focused on areas with numerous snags, cabbage palms (*Sabal palmetto*), and large concentrations of Spanish moss (*Tillandsia usneoides*). Reports of bat roosts from field workers also were investigated. Bats occupying a roost site were verified by visual observation (Spanish moss and sable palm) or mist-netting (snags). The general characteristics of each roost were measured and include: roost type, host tree species (for Spanish moss roosts), diameter at breast height (for snags), roost height above ground, roost height to understory vegetation, length of roost (for Spanish moss roosts), width of roost (for Spanish moss roosts), distance to water, and distance to edge.

## RESULTS

Four species of bats were captured including evening ( $n = 17$ ), northern yellow ( $n = 13$ ), Brazilian free-tailed ( $n = 17$ ), and Seminole ( $n = 2$ ) bats. Adults and juveniles of each species were captured indicating that all four species rear young in the area. The reproductive period of pregnancy (April-May), birth (late May), lactation (late May-June), and the young taking flight (late June) were synchronized among the four species. An average of 2.19 (SE = 1.79; Range 0 to 20) bats/hour were captured. The highest capture rates were recorded in areas with large trees and canopy cover. No bats were captured in recently burned or open areas with few large trees dominated by an understory of oaks <3 m.

Maternity roost sites ( $n = 5$ ) of northern yellow bats were located in Spanish moss hanging from sand live oaks (*Quercus geminata*) along a sandy fire-line adjacent to a 36.4 ha lake. All roost sites were located in a small buffer strip (8-20 m wide) of sand live oak and saw palmetto (*Serenoa repens*) between a sandy road and the lake. Roost height averaged 2.23 m (SE = 0.06) above the ground and 1.57 m (SE = 0.18) above the nearest vegetation. The average length and width of the roosts were 0.98 m (SE = 0.13) and 0.44 m (SE = 0.08), respectively. The clumps of Spanish moss used for roosting were about 2-3 times larger than other clumps of Spanish moss in the area. All roosts were within 1.06 m (SE = 0.35) of the sandy road and <11.0 m (SE = 2.40) from the lake. Change in roost site was common among the northern yellow bats roosting in Spanish moss. On one occasion, three females with non-volant young were observed in separate roosts but none of the roosts was occupied the next day indicating the females used more than one roost.

A maternity roost containing Brazilian free-tailed and evening bats was located in a slash pine (*Pinus elliottii*) snag created by a lightning strike in an old field. The snag was 12.8 m in height and 51.0 cm in dbh. The upper-third of the main bole contained loose bark, multiple limbs, and woodpecker holes. Roost heights ranged between 6.7-8.8 m with the bats using multiple roost locations in the upper portion of the

snag including loose bark, small fissures, and senescent limbs. Twelve juvenile Brazilian free-tailed and 3 juvenile evening bats were captured in mist nets set around the snag on 28 July 2003. At least 10 more bats escaped from the nets before they could be removed. An emergence count conducted on 2 August 2003 revealed 254 bats (species undetermined) leaving the roost between 2020 and 2045.

A male northern yellow bat roosted on the underside of a partially dead frond of a cabbage palm ca. 12 km northwest of ABS along the edge of Lake August in a residential lawn from 26-28 August 2003. The bat was resting on the brown portion of the frond, which provided excellent cryptic coloration to the bat.

#### DISCUSSION

The four species documented from this survey were reported to be the most common bats in southeast Florida (Hutchinson 2004). In general, the bat fauna of south Florida is low in diversity compared to other regions of the United States, possibly due to the lack of caves (Humphrey 1975). The eastern pipistrelle and big brown bats, both of which occur infrequently in the area (Layne 1992a,b; Hutchinson and Roberts 2001) were not captured at ABS. The capture of Brazilian free-tailed bats from a snag represents one of the few known uses of such a natural roost by this species in the southeastern United States. Lowery (1974) reported of hollow trees being used by Brazilian free-tailed bats as maternity roosts in Louisiana. In the Southeast this species typically roosts in attics and other structures (Barbour and Davis 1969). Numerous snags in various stages of decay are present in the immediate area of the roost and bats have been reported from other nearby snags (Fred Lohrer, ABS, pers. comm.).

Lewis (1995) suggested that foliage- and cavity-roosting bats are more likely to switch roosts more often than are cave- or structure-roosting species, because cave and structure roosts are more permanent. Northern yellow bats using Spanish moss switched roosts often during the maternity season and carried their non-volant young to alternative roosts, possibly to allow for different microclimate conditions. The location of roosts on the southwest side of the lake and the overhanging limbs from the senescent sand live oaks shielded the roost from direct sunlight until late afternoon. All roosts were fully or partially shaded until ca. 1730 before being exposed to direct sunlight, which is about 3.0-3.5 hours before the bats take flight. Spanish moss also appears to protect adults and young during periods of intense rainfall.

The concomitant occurrence of the reproduction period of bats and the beginning of fire season in April may result in some mortality to bats that select roost sites in natural habitat. The least commonly captured bat from the survey, the Seminole bat, is known to roost prima-

rily near the tips of pine needles (Menzel et al. 1999), suggesting that prescribed or natural fire may impact populations or alter roost sites of this species as pine trees often suffer high damage or mortality during fires in the area. Bat mortality is most likely to occur during intense head fires that move rapidly, scorch the canopy, produce intense heat, and create large smoke plumes. The observations of Saugey et al. (1998) in Arkansas indicate that red bats (*Lasiurus borealis*) manage to evade slow moving back-fires. However, it is doubtful if a lactating female bat would have time to move more than one non-volant young during a rapid-moving head fire through scrub, scrubby flatwoods, or flatwoods habitat. Regardless, the use of prescribed fire during the growing season is the primary tool used by land managers in Florida to maintain habitat for listed species of flora and fauna. Further research using radio-telemetry may further reveal the impacts of fire on solitary- and colonial-roosting bats during growing season burns.

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