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NOCTURNAL BEHAVIOR AND ROOSTING ECOLOGY OF A JUVENILE *LASIURUS CINEREUS* NEAR INDIANAPOLIS, INDIANA

Dale W. Sparks: Department of Ecology and Organismal Biology, Indiana State University, Terre Haute, Indiana 47809 USA

Christopher M. Ritzi: Department of Biology, Sul Ross State University, Alpine, Texas 79832 USA

Brianne L. Everson: Department of Ecology and Organismal Biology, Indiana State University, Terre Haute, Indiana 47809 USA

ABSTRACT. A juvenile male hoary bat (*Lasiurus cinereus*) was radio-tracked to day roosts and foraging areas within an undeveloped area in suburban Indianapolis. The bat roosted with two other bats, likely a mother and sibling, in large eastern cottonwoods (*Populus deltoides*). It used a small foraging area (21.5 ha) and spent much time foraging in oldfields. Observations of this, and several untagged bats, lead us to hypothesize these behaviors are normal for hoary bats in Indiana.

Keywords: Hoary bat, *Lasiurus cinereus*, foraging, Indianapolis International Airport, roosting

A long-term study of the bat community is being conducted near the developing edge of Indianapolis, Indiana (Sparks et al. 1998; Whitaker et al. 2004). The largest bat in this community is the hoary bat (*Lasiurus cinereus*), which is infrequently captured during mist-net surveys. Acoustic data from another regional metroplex (Chicago, Illinois), however, suggest hoary bats are more common than netting would indicate (Gehrt & Chelsvig 2004). In addition to being large, hoary bats occasionally attack other bats (Bishop 1947; Orr 1950; Bell 1980), and defend territories during inclement weather (Barclay 1986, 1989). As such, hoary bats, even at low densities, may be an important component of the local community.

Detailed data about the nocturnal behavior of hoary bats are limited to studies conducted in British Columbia (Barclay 1986, 1989). No information about foraging and roosting behavior of this species is available in Indiana (Mumford & Whitaker 1982), where the species appears to be in decline (Whitaker et al. 2002). In 2003 three hoary bats were radio-tagged, and one of these was successfully tracked to both its foraging and roosting habitat near the Indianapolis International Airport. The behavior of this bat differed substantially from that reported for adult females in more pristine habitats in British Columbia (Barclay 1986, 1989). The primary purpose of this paper is to present a summary of the roosting and foraging behavior of this bat.

METHODS

The focal animal for this study was captured on 13 July 2003 while an annual mist-net survey of the airport's conservation properties was being conducted. This netting survey was targeted at obtaining Indiana myotis (*Myotis sodalis*) for telemetry, with data from this study used to direct local conservation efforts (Sparks et al. 1998, in press; Whitaker et al. 2004). Once detailed telemetry studies have begun, additional individuals or species can be added to the study for the cost of their radio tags (pers. obs.). Upon capture, this bat was examined for age, sex, reproductive status, parasite load, and general condition. A lipped aluminum band was placed on the right wing (Lambourne's Lmt., Birmingham, United Kingdom), a small patch of fur in the midscapular area was shaved, and a 0.49 g radio transmitter (model LB-2, Holohil Systems Ltd., Carp, Ontario, Canada) was attached to the back of the bat using colostomy glue (Skin-bond, Smith and Nephew, Largo,

Florida, USA). The 5% ratio of transmitter-to-body weight recommended by Aldridge & Brigham (1988) was not violated. Similar techniques were used to mark two other hoary bats captured in 2003, but both left the study area within 24 hours. We suspect these bats were migrating because eastern red bats (*Lasiurus borealis*) captured during the same time period were also migrating (B.L. Everson unpubl. data).

The radio-tagged hoary bat was tracked from 14 July until the signal from the transmitter was no longer detected (22 July). Each afternoon the bat was tracked to a day roost. Day roosts were used as starting points for foraging studies conducted from 14–17 July. Beginning with the departure of the bat from the roost, 3–7 tracking crews used three-element yagi antennas and hand-held compasses to simultaneously obtain estimates of the azimuth from the location of each tracking crew to the bat. Azimuths were recorded every 6–9 minutes (depending on the number of other bats being concurrently tracked), and tracking continued until the bat roosted. These telemetry azimuths were then converted to point data using the computer program Locate II (Nams 2000). Point data were loaded into a Geographic Information System (GIS, Arc View, ESRI Corporation 1999), where they were overlaid on a Digital Ortho Quarter Quadrangle photographic map (US Geological Survey 1998); and a habitat map that was digitized from the photomap and ground-checked to include recent habitat changes. A home range (minimum convex polygon) was created surrounding 95% of the foraging points.

Table 1.—Characteristics of roost trees used by a juvenile hoary bat near Indianapolis, Indiana, in July 2003.

Tree species	Height (m)	Diameter (cm)	Dates of use
Populus deltoides	31	94	14–15 July
Populus deltoides	38	84	16–17 July
Populus deltoides	35	94	18–19 July

RESULTS

The bat was tracked to three roost trees in eight days (Table 1). All roosts were large eastern cottonwoods (*Populus deltoides*), where the bat roosted with two other bats (presumably the mother and a sibling). It was not possible to verify the exact location of the day roost on most days. However, on 16–17 July, the group of three roosted in live foliage on a south-facing limb 27 m above the ground. On other days, radio-telemetry indicated that roosting occurred high in trees, although specific roosts could not be observed. During 2003, several untagged hoary bats were observed using similar roosts, suggesting these observations near Indianapolis are typical of this species in Indiana.

During four nights of foraging, 59 triangulations on this bat were obtained, and 57 of

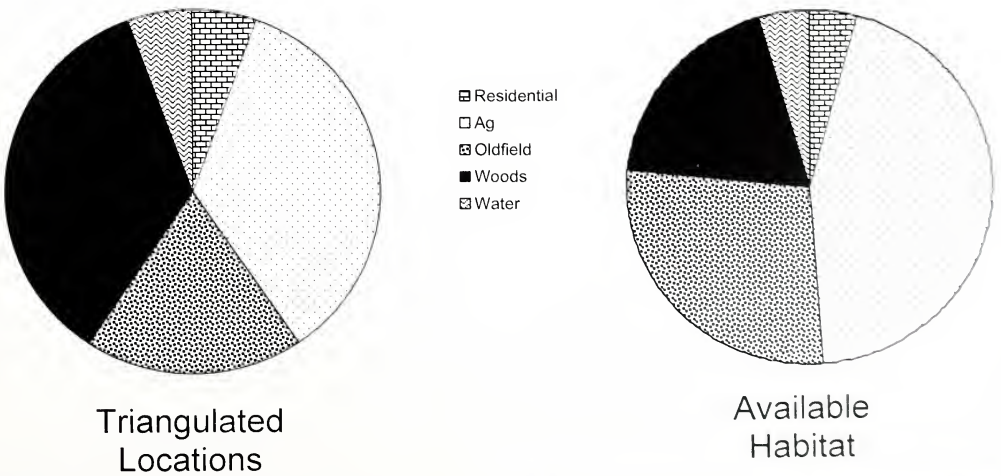

Figure 1.—Comparison of triangulated positions relative to proportions of habitat within the home range of a juvenile male hoary bat (*Lasiurus cinereus*), radio-tracked near Indianapolis, Indiana, in July 2003.

these triangulations were included in the home range. The bat foraged for an average of 107 min per night (range 54–155 min), and returned to the area where it day-roosted following each foraging bout. Although a second foraging bout was detected on 17 July, it lasted only 9 min. The focal bat had a home range containing only 21.5 ha, and flew no further than 1.2 km from any roost. Open habitats including oldfields and agricultural fields were extensively used for foraging, and habitat use was broadly similar to habitat available within the home range (Fig. 1).

DISCUSSION

The small size of the foraging range for this bat was surprising. Given the wing morphology of this species (Farney & Fleharty 1969; Aldridge & Rautenbach 1987) and previously published observations of conspecifics in British Columbia (Barclay 1989), it was anticipated that it would be necessary to follow this bat throughout much of suburban Indianapolis. Barclay (1989) tracked adult females as far as 20 km from their roosts. It is possible our results are spurious or the result of tracking only a single juvenile. We suspect that this is not the case for two reasons. First, we concurrently tracked 11 congeneric red bat (*Lasiurus borealis*), which also have small home ranges (mean = 68 ha, range = 28–143 ha) at the Indianapolis International Airport (B.L. Everson unpubl. data). Second, the hoary bat roosted in riparian vegetation along a stream (East Fork of White Lick Creek) in an area surrounded by fields. Thus, suitable foraging and roosting habitats were located in close proximity.

Hoary bats can be effectively tracked to their foraging ranges using radio-telemetry, but complete analysis of habitat use by animals requires large sample sizes and is labor intensive. Rarely-captured taxa, such as the hoary bat in Indiana, are often ignored by researchers because of the difficulty in obtaining meaningful data, but such species should not be overlooked purely because they are difficult to capture.

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