

## BATS OF THE INDIANAPOLIS INTERNATIONAL AIRPORT AREA, 1991–2001

**John O. Whitaker, Jr. and Dale W. Sparks:** Department of Life Sciences, Indiana State University, Terre Haute, Indiana 47809 USA

**Virgil Brack, Jr.:** Environmental Solutions & Innovations, Inc., 781 Neeb Road, Cincinnati, Ohio 45233 USA

**ABSTRACT.** The Indianapolis International Airport (IND) is just west of Indianapolis and just north of Highway I-70 in Marion County. These bats have been studied since 1991 and comprise a diverse community of nine species, listed in approximate decreasing order of abundance: the big brown bat (*Eptesicus fuscus*), the northern myotis (*Myotis septentrionalis*), the eastern red bat (*Lasiurus borealis*), the little brown myotis (*Myotis lucifugus*), the federally-endangered Indiana myotis (*Myotis sodalis*), the state-endangered evening bat (*Nycticeius humeralis*), the eastern pipistrelle (*Pipistrellus subflavus*), the hoary bat (*Lasiurus cinereus*), and the silver-haired bat (*Lasionycteris noctivagans*). Our evidence indicates that all of these species produce young on site except for the silver-haired bat, which is a spring and fall migrant and has its young to the north of Indiana. The northern myotis occupies many of the artificial bat boxes on site.

The Indiana myotis was discovered on the property in 1994; and in 1996 a maternity roost was located in a shagbark hickory tree (*Carya ovata*) in a nearby woodlot, which we now refer to as Sodalís Woods. This tree served as the Indiana myotis primary roost until it fell during the winter of 2001–2002. Several alternate trees were sometimes used as roosts. Evening bats occupied a woodlot north of I-70 but moved into Sodalís Woods when their original lot was developed in the winter of 1997–98.

**Keywords:** Bats, Chiroptera, Indiana, roosts

The Indianapolis International Airport (IND) is managed by the Indianapolis Airport Authority (IAA) and is located in a rapidly developing area on the southwest side of Indianapolis, Indiana. The bats there have been studied since 1991 in a series of mostly unpublished reports. In 1991, the IAA planned to begin construction of a very large new United Airlines Regional Service Hub. For this work the area had to be surveyed for the federally-endangered Indiana myotis (*Myotis sodalis*) between the dates of 15 May–15 August. However, this date had passed, and construction could not be delayed until 1992. Therefore, IND entered into an agreement with the U.S. Fish and Wildlife Service to assume that the Indiana myotis was present on the study site and to mitigate for potential habitat losses that might occur because of construction. Development and implementation of the mitigation plan was contracted to a private consulting firm. The plan included regular mist-net surveys in areas near the new service

hub, planting of new woodlands and wetlands to replace those lost to construction, placement and monitoring of a large number of artificial roost structures for bats (bat-houses, etc.), and radiotelemetry of any Indiana myotis captured during the study. However, a preliminary survey was conducted just after the 15 August deadline, from 20–22 August 1991. A total of 54 bats was captured at five sites as follows: big brown bat (*Eptesicus fuscus*), 38; red bat (*Lasiurus borealis*), 8; northern myotis (*Myotis septentrionalis*), 7; and eastern pipistrelle (*Pipistrellus subflavus*), 1. In 1994, three Indiana myotis were captured, but they roosted on private land and access to the property was denied. However, access was attained in 1996, and radiotelemetry of two Indiana myotis captured that year resulted in the discovery of a roost in a shagbark hickory, *Carya ovata*, in a woodlot just south of the I-70 highway. This woodlot is now termed Sodalís Woods.

Beginning in 1997, responsibility for mon-

itoring the bat community passed to American Consulting Engineers, Inc. (ACE), who subcontracted the bat studies to Indiana State University for the 1997–1999 field seasons. No official monitoring occurred in 2000 or 2001, although university personnel carried on limited work in that period.

Additional construction is now occurring at and near IND, including development of a new interchange at Six Points Road and the re-routing of a section of the East Fork of White Lick Creek. This work necessitated the formulation of a habitat conservation plan (HCP). The HCP was completed by ACE and the bat study was then contracted directly to Indiana State University beginning in 2001. The main purpose of this paper is to summarize information concerning the bat community at the Airport through 2001.

Since the bats at IND will be studied into the foreseeable future, it seemed wise to summarize present data for comparative purposes. Therefore specific objectives of this study were to learn about the roosting and foraging behavior, and habitat of the Indiana myotis and other species of bats in the Indianapolis International Airport study area. Another objective is to determine relative population size of the species within the bat community at the airport. These data are to serve as base data for long-term comparison as further development takes place in and around the airport.

## METHODS

**Study site.**—The airport study site consists of many small, scattered woodlots, up to about 30–40 ha in size, which are surrounded by a mix of agricultural, industrial, and residential areas (Fig. 1). The study area extends from highway US 40 on the north to highway IN 67 on the south, and from IN 267 east to the Indianapolis airport; and I-70 bisects the study area from east to west. However, most of the area north of I-70 has been developed; and, therefore, much of the work is now carried out south of I-70. At times bats are followed to roosts outside of this area.

The East Fork of White Lick Creek, a medium-sized perennial stream, bisects the study area from north to south, from I-70 at Six Points Road to the east side of Mooresville. The wooded banks of White Lick Creek are mostly: box elder (*Acer negundo*); cottonwood (*Populus deltoides*); hackberry (*Celtis*

*occidentalis*); sycamore (*Platanus occidentalis*); green ash (*Fraxinus pennsylvanicus*); black walnut (*Juglans nigra*); and American elm (*Ulmus americana*). In the woodlots on the site, oaks and hickories are generally dominant. Important tree species are: red oak (*Quercus rubra*); white oak (*Quercus alba*); shagbark hickory (*Carya ovata*); shellbark hickory (*Carya laciniosa*); bitternut hickory (*Carya cordiformis*); black walnut (*Juglans nigra*); sugar maple (*Acer saccharum*); American elm (*Ulmus americana*), and honey locust (*Gleditsia triacanthos*). Open areas are mostly cultivated. As part of the mitigation procedures, the airport is purchasing property and planting trees along the East Fork of White Lick Creek.

**Mist-netting.**—The bat community was assessed annually by mist-netting at ten sites along the East Fork of White Lick Creek. Each netting usually included 1–3 nets placed so as to seal the flyway over the stream. Starting at dusk all sites were netted with two or three tier 9 m × 2 m mist-nets suspended by a pole and pulley system. Nets reached a height of 4 or 6 m. A bat detector was used as a measure of the amount of activity present at a site. Nets along the creek were left in place until at least 2400 h, or until 0200 h if sufficient bat activity occurred. Mist-netting was used (1) to obtain information about the overall bat community, especially concerning changes in populations; and (2) to capture Indiana myotis and other species to radio tag and obtain information about roosting and foraging patterns.

In addition, netting near (but at least 20 m from) Indiana myotis roost trees was initiated in 1996 specifically to increase the number of Indiana myotis captured for radio-tagging and telemetry studies. Netting at these sites was conducted from dusk until bat activity decreased; the nets were then bunched and reopened before dawn to capture bats returning to the roost.

**Radio-tracking.**—Radio-telemetry, using transmitters from Holohil Systems, Ltd. (Ontario, Canada) and Titley Electronics (New South Wales, Australia) was used to locate diurnal roosts of the bats. The transmitters had frequencies ranging from 150.0–151.9 kHz, and weighed 0.47 g. Hair in the mid-dorsal portion of the bat's body was removed with surgical scissors, and the transmitters were af-

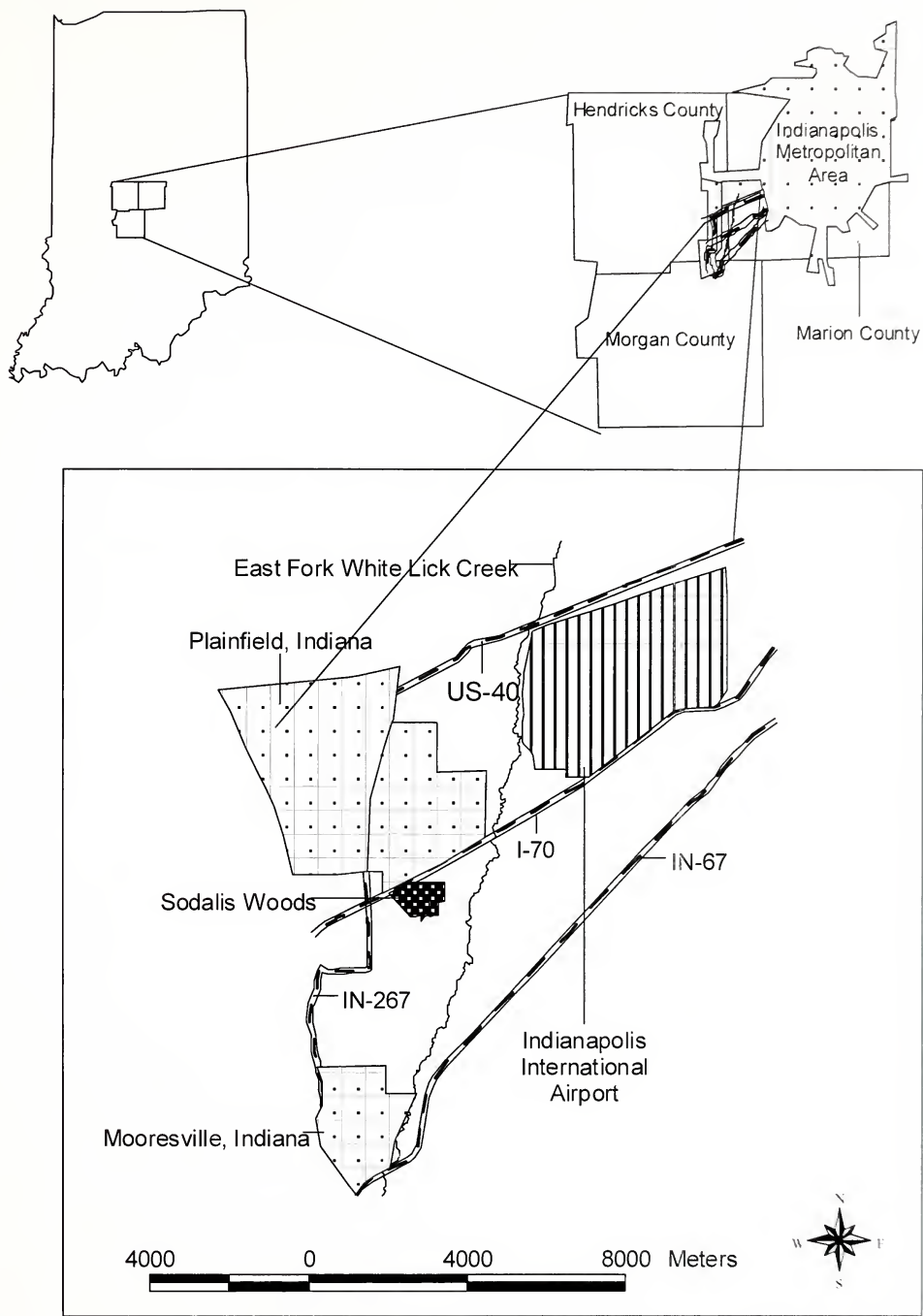


Figure 1.—Major landscape features of the Indianapolis International Airport study site. Stippled areas represent developed (urban, suburban, and commercial) areas. Hashed lines represent major highways and are abbreviated US-40 (US Highway 40), IN-267 (Indiana State Highway 267), IN-67 (Indiana State Highway 67), and I-70 (Interstate Highway 70). Other major features are identified directly on the figure.

Table 1.—Bats taken by mist-netting along the East Fork of White Lick Creek, 1994–1998. No data were collected in 2000 or 2001.

	1994	1995	1996	1997	1998	1999	Total
Species							
<i>Eptesicus fuscus</i>	83	57	20	64	94	74	392
<i>Lasiurus borealis</i>	28	7	1	16	13	23	88
<i>Myotis lucifugus</i>	12	19	3	10	14	13	71
<i>M. septentrionalis</i>	3	15	2	10	3	2	35
<i>Nycticeius humeralis</i>	1	3	1	1	7	15	30
<i>M. sodalis</i>	2	8	2	0	0	10	22
<i>Pipistrellus subflavus</i>	5	4	1	4	2	3	19
<i>L. cinereus</i>	0	1	0	1	0	1	3
<i>Lasionycteris noctivagans</i>	0	0	0	0	0	2	2
Total	134	114	32	106	133	143	662
No. sites netted	10	12	11	10	10	10	—
Avg. no. bats per site	13.4	9.5	2.9	10.6	13.3	14.3	—
No. net nights	30	36	32	30	30	30	—
Avg. no. bats/night	4.5	3.2	1.0	3.5	4.4	4.8	—

fixed with colostomy glue (Skin Bond). TRX-2000s receivers (Wildlife Materials, Inc., Carbondale, Illinois) and R-1000 receivers (Communications Specialists, Inc.) were used to track the bats. Bats were tracked as long as signals were received, or up to six nights.

## RESULTS

**Bat community.**—Numerous artificial roost structures were used at the beginning of these studies, and information collected in 1992 and 1993 consisted mostly of data on bat use of these structures. Systematic collection of biological data by mist-netting commenced in 1994. It supplied information on the bat community and some information on reproduction. Data that year were taken from 2–10 August. Seven species of bats were taken, including the first two Indiana myotis and the first evening bat (Table 1).

**Mist-netting.**—A total of 781 bats, belonging to nine species, was taken in mist-netting at the airport during the six years since regular mist netting was instituted (1994 to 1999). These captures include 662 bats taken along the East Fork of White Lick Creek (Table 1), 104 bats from 1996–1999 in Sodalís Woods, and 15 bats captured near a second primary roost, a cottonwood, in 1998 (Table 2). Listed in approximate order of decreasing abundance, they are: big brown bat (*Eptesicus fuscus*), northern myotis (*M. septentrionalis*), eastern red bat (*Lasiurus borealis*), little brown myotis (*M. lucifugus*), Indiana myotis

(*Myotis sodalis*), evening bat (*Nycticeius humeralis*), eastern pipistrelle (*Pipistrellus subflavus*), hoary bat (*L. cinereus*), and silver-haired bat (*Lasionycteris noctivagans*). This includes all the species of bats at present regularly found in Indiana, except for the gray bat (*Myotis grisescens*), which has one colony in Clark County in southern Indiana.

## THE BATS

**Big brown bat.**—The big brown bat was the bat most commonly taken at the airport, as indicated by 392 (20–94 per year) being netted along White Lick Creek (56.6% of the bats netted there from 1994–1999). Another 47 were netted in Sodalís Woods and 9 near the cottonwood, and it was the most numerous species at both these sites. This is logical since the study area is close to urban areas and this bat inhabits buildings. Relatively few individuals (only 14) were found in the artificial bat structures during regular monitoring. We have located 11 maternity roosts of big brown bats using both radiotelemetry (Duchamp et al. in press) and also visual searches of potential roosts. These roosts have included 1 barn, 2 artificial roosts (bat-houses), 2 bridges, and 6 houses (Fig. 2). In addition, two bridges on the site are commonly used as night roosts by solitary males (Fig. 2). One of these was a maternity roost until the road was resurfaced. Since that time (1999) only males have been found using it as a roost, and big brown bats suddenly began using a series of nearby bat-



Table 2.—Bats netted 1996–1999 in Sodalis Woods near shagbark main tree, and near the cottonwood tree in 1998.

	Sodalis Woods					Cotton-wood tree
	1996	1997	1998	1999	Total	1998
<i>Myotis sodalis</i>	6	3	8	7	24	0
<i>Eptesicus fuscus</i>	0	3	24	20	47	9
<i>M. septentrionalis</i>	0	2	7	0	9	1
<i>Nycticeius humeralis</i>	0	2	4	13	19	1
<i>Lasiurus borealis</i>	0	0	2	0	2	0
<i>M. lucifugus</i>	0	0	1	0	1	3
<i>L. cinereus</i>	0	0	0	0	0	1
<i>Lasionycteris noctivagans</i>	0	0	0	2	2	0
Total	6	10	46	42	104	15

houses. One post-lactating colony of big brown bats was found in a tree (Fig. 2). Pregnant big brown bats ( $n = 8$ ) were captured at the airport from 20 May through 17 June. Lactating big brown bats ( $n = 60$ ) were taken from 14 June through 24 July. Post-lactating big brown bats ( $n = 74$ ) were captured between 9 July and 14 August. Juveniles were captured starting 16 July.

**Northern myotis.**—The northern myotis is common at IND as indicated by 35 being net-

ted along White Lick Creek from 1994 through 1999, and by its common occurrence in the artificial bat-houses there. It is the only species that regularly uses bat-houses at the airport, and it commonly forms maternity colonies at the study site mostly in the bat-houses. Northern myotis often change roost sites, even taking their young with them. They have also been found in a number of sites (Fig. 3) under sloughing bark, in cavities, in cracks in trees, and in a power pole (Sparks et al. in

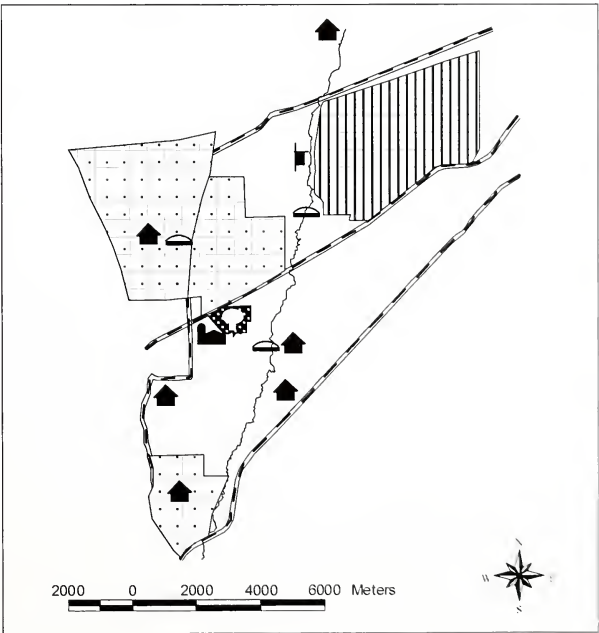


Figure 2.—Roosts used by big brown bats (*Eptesicus fuscus*) near the Indianapolis International Airport. Symbols: homes and barns have triangular roosts, barns include a silo, bat-houses have flat roofs, and bridges have curved tops, and the single tree is a white outline inside Sodalis Woods (see Fig. 1).

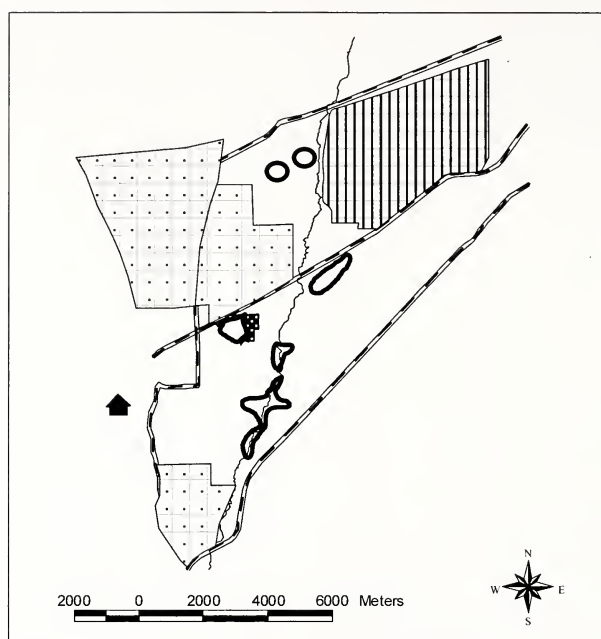


Figure 3.—Roosts used by the northern myotis (*Myotis septentrionalis* the little brown bat (*Myotis lucifugus*) near the Indianapolis International Airport. The symbol with triangular roof represents a house. Northern myotis roosted in a variety of structures. Circular outlines represent the approximate borders between different colonies of *Myotis septentrionalis* determined by radio-tracking. *Myotis lucifugus* was not radio-tracked.

press). Pregnant females were found between 14 May and 26 June ( $n = 146$ ), lactating females were found from 14 June to 19 July ( $n = 63$ ), and post-lactating females ( $n = 26$ ) were found from 2 July through 9 August ( $n = 13$ ). Juveniles were first seen on 16 July.

**Little brown myotis.**—The little brown myotis was captured mostly in mist-nets at IND, although two were found in artificial structures. It was surprising that more were not taken in structures as this species nearly always roosts in buildings. A total of 74 little brown myotis was captured by mist-netting, 71 along White Lick Creek, 1 in Sodalis Woods, and 3 near the large cottonwood tree. In 2002, we radio-tracked a female little brown myotis to a barn south of Plainfield and west of Highway 267 (Fig. 3). We suspect that most or all of the little brown myotis caught during the study originated at this site. The landowner indicated that this colony has been present for many years. Pregnant females ( $n = 7$ ) were observed between 20 May and 15 June, lactating females ( $n = 10$ ) were observed between 25 June and 14 July, and post-

lactating females were captured between 13 July and 11 August. The first juveniles were seen on 24 July.

**Indiana myotis.**—The Indiana myotis was the target species for this study. The Indiana myotis was first captured on site in 1994 when two individuals were netted. Radio-telemetry in 1996 led to the discovery of the primary roost tree, a dead shagbark hickory in Sodalis Woods (Fig. 4). This tree served as the main roost tree for the species in the study area until it fell over in the winter of 2001–2002. Although this was the principal tree used, dusk counts indicated that many alternate roost trees were used. Also, the large cottonwood was regularly used as a second primary tree in 1997 and 1998 until a major storm caused loss of most of its bark on 29 June 1998. Twenty-two individuals have been captured by mist-net along White Lick Creek and 24 in Sodalis Woods. Pregnant individuals ( $n = 5$ ) were captured between 3 and 23 June, and 6 lactating individuals were captured between 27 June and 30 July.

**Red bat.**—Red bats are solitary, having their young among the leaves of trees. They

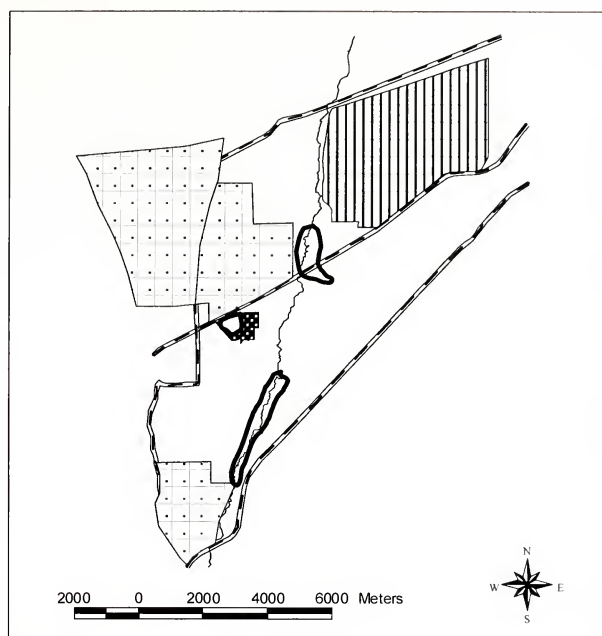


Figure 4.—Roosts used by the federally-endangered Indiana myotis (*Myotis sodalis*) near the Indianapolis International Airport. Three different roosting areas for the one colony present are outlined.

are common in the study area, 88 having been taken in mist-nets along White Lick Creek between 1994 and 1999, and 2 in Sodalís Woods. Lactating individuals ( $n = 3$ ) were found between 14 July and 11 August, and post-lactating individuals ( $n = 29$ ) were found between 25 July and 21 August. Brianne L. Everson (pers. commun.) is currently conducting a study of the roosting and foraging of this bat and has located 3 roosting areas to date (Fig. 5).

**Evening bat.**—Evening bats are listed as state-endangered but not federally-endangered. Evening bats are probably much less common in Indiana than are Indiana myotis (Whitaker et al. 2002). Earlier, all known colonies of evening bats in Indiana were in buildings (Whitaker & Gummer 1993). However, all maternity colonies of this species currently known in Indiana are in tree cavities (Whitaker & Gummer 2003). Most known populations are in the lower Wabash River bottoms from southern Vigo County south, and on the lower White River; but other colonies occur on the upper Muscatatuck River (Jennings County), at Atterbury Reserve Forces Training Center (Bartholomew County) and at IND. We think that evening bats were always in the lower

Wabash River bottoms, and that during particularly favorable times they moved up the larger streams and some took up residence earlier in buildings, now in woodlots there. The big brown bat has been increasing in Indiana over recent decades (Whitaker et al. 2002), and may have outcompeted the evening bat for roosts in buildings.

A total of 30 evening bats was caught during mist-netting of White Lick Creek from 1994 through 1999 (Table 1). Also, 19 individuals were captured in Sodalís Woods.

An evening bat was captured on White Lick Creek in 1997 and was radio-tagged. It was tracked to a roost in an American beech (*Fagus grandifolia*) in a woodlot north of I-70 on 1 August 1997 (Fig. 6). It was in the same tree on 16 and 17 August, and a dusk count on 17 August yielded three animals leaving that tree. In addition, 10 others emerged from a nearby tree. Numerous calls of evening bats were heard in this woodlot. It was clear that the evening bats inhabited this woods in 1997. The woodlot with the evening bats in 1997 was almost due north of the Indiana bat maternity roost. This woodlot was clear-cut in the winter of 1997–98 (Sparks et al. 1998). The evening bats then moved to Sodalís Woods.

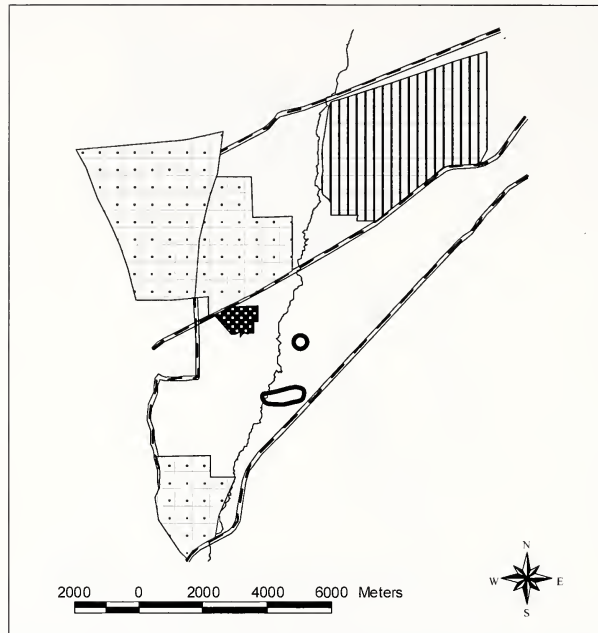


Figure 5.—Roosts used by the eastern red bat (*Lasiurus borealis*) near the Indianapolis International Airport. Two roosting areas are outlined.

No evening bats were taken in 1996, the first year of netting there, whereas 2, 4, and 13 captures occurred in 1997–1999, respectively. Roosts were located in tree cavities in a variety of species of trees.

We have tracked evening bats to 14 trees in Sodalis Woods and to other woodlots south of Interstate 70 (Duchamp et al. in press). Five species of trees were used: shagbark hickory (*Carya ovata*, 5 trees), red oak (*Quercus rubra*, 3), sugar maple (*Acer saccharum*, 2), bitternut hickory (*Carya cordiformis*, 2), white oak (*Quercus alba*, 1), and green ash (*Fraxinus pennsylvanicus*, 1). All evening bats roosted in tree cavities, and numbers counted at emergence ran from 2 to 100.

Five lactating evening bats were captured between 25 June and 8 July; three post-lactating individuals were captured between 12 July and 11 August and the first juveniles were seen on 3 August. No evening bats were ever observed in buildings or artificial structures.

**Silver-haired bat.**—This species does not reproduce in Indiana, but migrates to its summering grounds to the north in spring (Mumford & Whitaker 1982). One silver-haired bat was taken in a bat structure on 18 June 1993.

Two additional silver-haired bats were netted on 17 June 1999. These records are later than is typical for migrating silver-haired bats in Indiana. We radio-tagged one of these bats. On 18 June it day-roosted under the bark of a shagbark hickory in Sodalis Woods and then disappeared immediately after emerging. These data, combined with the absence of subsequent captures, indicate that this bat was simply a late migrant.

**Hoary bat.**—The hoary bat is solitary and relatively uncommon. Like the red bat, this species roosts among the leaves of trees. Four were netted at the study site from 1994 through 1999, three along White Lick Creek, and one near the cottonwood roost. One taken on 28 July 1997 was a juvenile, and a post-lactating female was netted on 12 July 1998. In 2002, a juvenile male was radio-tagged and tracked to roosts along the East Fork of White Lick Creek (Fig. 7).

**Eastern pipistrelle.**—The eastern pipistrelle sometimes forms small maternity colonies in buildings (Whitaker 1998) but more often lives in woods where it roosts singly or in very small numbers in clusters of leaves (Veilleux et al. 2003). Nineteen individuals were netted at IND along White Lick Creek. Four



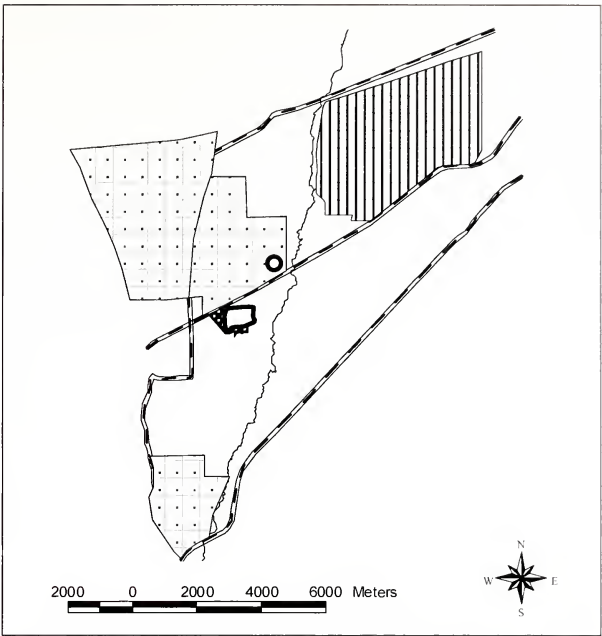


Figure 6.—Roosts used by the state-endangered evening bats (*Nycticeius humeralis*) near the Indianapolis International Airport. In 1997 the colony roosted in an area north of Interstate Highway 70, and then moved into Sodalis Woods when the original roost was cut. Both areas are outlined.

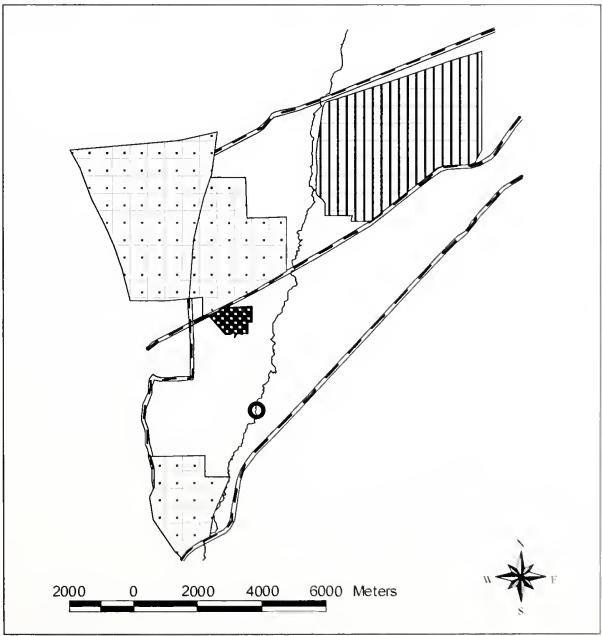


Figure 7.—Roosts used by a hoary bat (*Lasiurus cinereus*) near the Indianapolis International Airport. Three trees used by a single hoary bat are outlined.

lactating individuals were captured between 5–16 July.

### DISCUSSION

It is interesting that this site still hosts all nine species of bats that could reasonably be expected there (Mumford & Whitaker 1982), and eight produce young there. This is especially interesting since there is so little woodland, and since the area is being so drastically developed. It is possible that this is a result of being crowded into the site as the surrounding areas are developed. In the north end of the area, much of what was natural area at the beginning of this study, including some excellent woodland habitat for bats, has now been developed and consists of roads, large warehouses, mowed grass and open ponds. However, the number of bats captured in the mist-nets may seem small. This may be partly because of the relatively small amount of forest near the airport. Another reason may be the limited amount of canopy available along the East Fork of White Lick Creek. Limited cover may reduce numbers of bats captured in mist-nets because the bats can more easily maneuver to avoid capture. These data do give the best baseline data for later comparison to help determine the future status of the bat community at the airport.

Roosting areas of the bats at IND are indicated in Figs. 2–7. Big brown and little brown bats are in human structures, thus do not conflict with the other species for roosts. However, all of the woodland bats are concentrated in the area south of I-70, particularly the Sodalis Woods. Indiana myotis, northern myotis, and evening bats all roost in this area. There are other areas where Indiana myotis roost, particularly along the East Fork of White Lick Creek (Fig. 4), but evening bats currently roost only in that area. Northern myotis, however, are much less restricted and occur in several other areas. Current information on red and hoary bats is more limited (Figs. 5, 7), but those species are the subjects of current study. We suspect that red bats, at least, probably roost throughout much of the study area.

That the bats are able to survive is probably due in part to the variation in the summer roosting habits of the female bats. The silver-haired bat spends the summer north of Indiana, whereas the remainder of the species live

in summer in Indiana. Red and hoary bats occur in Indiana in summer among the foliage of trees. Eastern pipistrelles roost in clusters of leaves (Veilleux et al. 2003). Big brown bats and little brown bats, especially the former which is the most common species on site, use human structures. The evening bat previously often used human structures, but now uses cavities in the trunks or larger limbs of trees, old woodpecker holes and the like, but not necessarily in the sun. The Indiana myotis has the most specialized maternity roost requirements, normally using fairly large trees with areas of sloughing bark open to the sun. The northern myotis is the most variable of these species in maternity roost choice. It is primarily a forest species and will roost in or out of the sun, and roost in cracks of broken-off trees, or in other protected areas besides using sloughing bark or cavities. In addition, this is the only species regularly using the bat-houses.

Another possibility as to why bat diversity at IND is so great is that the bats are so loyal to an area and are so long-lived that they keep coming back each year. However, it is possible that they are actually slowly dying out in this area because of decreasing suitable habitat and/or increased competition with other species. The evening bat is the most likely species at risk. It has already been forced out of one area and it now roosts and forages in a small area between Sodalis Woods and the airport (Duchamp 2002).

The Indiana myotis and evening bat are the two species that seem most in conflict, not so much because of competition for roost sites, since one uses cavities and the other sloughing bark, but because they both currently have their centers of activity in the same woods, and there is much interaction of the two here. We have even seen some evidence of actual roost sharing as bat parasites are very host specific, and we have seen three bats that have had parasites of one of the other species (Ritzi pers. commun.). As indicated above, *M. sodalis* roosts primarily under sloughing bark. However, both *M. septentrionalis* and *Nycticeius* will also sometimes roost under sloughing bark. Therefore, they could be subjected to increasing competition for roosts in this situation where *Nycticeius* has invaded the Sodalis Woods and natural woodland habitat has continued to decrease. Fortunately their food

habits are quite different, with the evening bat feeding primarily on beetles, true bugs and few moths, whereas the Indiana myotis feeds heavily on moths, smaller beetles and dipterans (Mumford & Whitaker 1982; Whitaker 2004).

Although the woods have continued to decrease dramatically near the airport over the last decade, conservation efforts are underway at IND. As much woodland as possible is being preserved, and new woodlands and ponds have been created. IND has already replanted about 160 ha to trees. The woods are still very young, but the ponds are already the best area in the vicinity for reptiles and amphibians (Foster et al. 2004). Overall, IND is creating a suitable natural area southwest of Indianapolis for many kinds of plants. Bats may be currently stressed at IND because of the relatively small amount of woodland for roosting, but it will be very interesting to see over the following decades how well the bat community does—especially the Indiana myotis and evening bat.

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#### LITERATURE CITED

- Callahan, E.V., R.D. Drobney & R.L. Clawson. 1997. Selection of summer roosting sites by Indiana bat (*Myotis sodalis*) in Missouri. *Journal of Mammalogy* 78:818–825.
- Clark, B.K., J.B. Bowles & B.S. Clark. 1987. Summer habitat of the endangered Indiana bat in Iowa. *American Midland Naturalist* 118:32–39.
- Duchamp, J.E., D.W. Sparks & J.O. Whitaker, Jr. In press. Foraging habitat selection by bats at an urban-rural interface: A comparison of a successful with a less successful species. *Canadian Journal of Zoology*.
- Foster, B.J., D.W. Sparks & J.E. Duchamp. 2004. Urban Herpetology II. Amphibians and reptiles at the Indianapolis Airport conservation lands. *Proceedings of the Indiana Academy of Science* 113:53B59.
- Gardner, J.E., J.D. Garner & J.E. Hofmann. 1991. Summer roost selection and roosting behavior of *Myotis sodalis* (Indiana bat) in Illinois. Final Report. Illinois Natural History Survey, Illinois Department of Conservation. 56 pp.
- Humphrey, S.R., A.R. Richter & J.B. Cope. 1977. Summer habitat and ecology of the endangered Indiana bat, *Myotis sodalis*. *Journal of Mammalogy* 58:334–346.
- LaVal, R.K., R.L. Clawson, M.L. LaVal & W. Caire. 1977. Foraging behavior and nocturnal activity patterns of Missouri bats, with emphasis on the endangered species *Myotis grisescens* and *Myotis sodalis*. *Journal of Mammalogy* 58:592–599.
- LaVal, R.K. & M.L. LaVal. 1980. Ecological studies and management of Missouri bats, with emphasis on cave-dwelling species. Missouri Department of Conservation, Terrestrial Series 8:1–52.
- Mumford, R.E. & J.O. Whitaker, Jr. 1982. *Mammals of Indiana*. Indiana University Press. 537 pp.
- Sparks, D.W., J.A. Laborda & J.O. Whitaker, Jr. 1998 (2001). Bats of the Indianapolis International Airport as compared with a more rural community of bats at Prairie Creek. *Proceedings of the Indiana Academy of Science* 107:11–179.
- Sparks, J.K.F., B.J. Foster & D.W. Sparks. In press. Utility pole used as a roost by a northern myotis, *Myotis septentrionalis*. *Bat Research News*.
- Veilleux, J.P., J.O. Whitaker, Jr. & S.L. Veilleux. 2003. Tree roosting ecology of reproductive female eastern pipistrelles, *Pipistrellus subflavus*, in Indiana. *Journal of Mammalogy* 84:1068–1075.
- Whitaker, J.O., Jr. 1998. Life history and roost switching in six colonies of eastern pipistrelles in buildings. *Journal of Mammalogy* 79:651–659.
- Whitaker, J.O., Jr. 2004. Prey selection in a temperate zone insectivorous bat community. *Journal of Mammalogy* 85:460–469.
- Whitaker, J.O., Jr., J.B. Cope & V. Brack, Jr. 2002. Are bats in Indiana declining? *Proceedings of the Indiana Academy of Science* 111:95–106.
- Whitaker, J.O., Jr. & S.L. Gummer. 1993. The status of the evening bat, *Nycticeius humeralis*, in Indiana. *Proceedings of the Indiana Academy of Science* 102:283–291.
- Whitaker, J.O., Jr. & S.L. Gummer. 2003. Current status of the evening bat, *Nycticeius humeralis*, in Indiana. *Proceedings of the Indiana Academy of Science* 112:55–60.
- Whitaker, J.O., Jr. & W.J. Hamilton, Jr. 1998. *Mammals of the Eastern United States*. Comstock Press, Ithaca, New York. 583 pp.
- Whitaker, J.O., Jr., L. Pruitt & S. Pruitt. 2001. The gray bat, *Myotis grisescens*, in Indiana. *Proceedings of the Indiana Academy of Science* 110:114–122.

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