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Summer Records and a Maternity Roost of the Southeastern Myotis (*Myotis austroriparius*) in Illinois

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ABSTRACT

Information was collected on the summer distribution of the state-endangered southeastern myotis (*Myotis austroriparius*) from 1985 through 1991. Mist netting was conducted at 53 sites in the 11 southernmost Illinois counties; in addition, four caves, 17 abandoned mines, and a quarry in southern Illinois were surveyed for bats during the summer. Netting resulted in 68 captures of southeastern myotis at three locations: in Alexander and Pope counties and along the Johnson/Pulaski county line. Captures of reproductively active females demonstrated that maternity colonies occur in Illinois. Members of a maternity colony were radio-tracked to their diurnal roost in a hollow-based tupelo gum (*Nyssa aquatica*) tree in Little Black Slough, Johnson County. This was the northernmost maternity roost found for this species and the first documented use of a roost site other than a cave or building by a southeastern myotis maternity colony.

INTRODUCTION

The southeastern myotis (*Myotis austroriparius*) is a species of the southeastern United States whose range extends from southern North Carolina down the Atlantic seaboard to the northern half of peninsular Florida, through the Gulf States to eastern Texas and southeastern Oklahoma, and up the Mississippi and lower Ohio River valleys to southern Illinois and Indiana (Jones and Manning 1989). This species is listed as endangered in Illinois (Illinois Endangered Species Protection Board 1994), Indiana (Indiana Department of Natural Resources 1993), and Kentucky (Kentucky State Nature Preserves Commission 1996), threatened in South Carolina (South Carolina Department of Natural

Resources 1997), a species of special concern in North Carolina (North Carolina Wildlife Resources Commission 1994), and a protected species in Alabama (Alabama Department of Conservation and Natural Resources 1997). The southeastern myotis also was formerly a Category 2 candidate for federal listing as a threatened or endangered species (U.S. Fish and Wildlife Service 1989).

The natural history of the southeastern myotis has been studied most intensively in Florida (e.g. Rice 1957, Foster et al. 1978, Zinn and Humphrey 1981, Hermanson and Wilkins 1986). Maternity colonies in Florida primarily use caves (Rice 1957, Humphrey and Gore 1992), but small colonies also have been found in buildings (Sherman 1930, Foster et al. 1978, Hermanson and Wilkins 1986). Southeastern myotis maternity roosts are almost unknown outside Florida; caves used by maternity colonies are located in southern Alabama (Best et al. 1992), western Kentucky (J.R. MacGregor, pers. comm., 1992), and southwestern Georgia (J.A. Gore, pers. comm., 1992). Maternity colonies are thought to roost in hollow trees or buildings in Louisiana (Lowery 1974), eastern Texas (Schmidly 1983), and caveless portions of Arkansas (Sealander and Heidt 1990). During summer most adult males roost apart from the maternity colonies in caves, buildings, culverts, and bridges (Humphrey and Gore 1992). In peninsular Florida and Louisiana southeastern myotis are active year-round and some individuals use culverts, bridges, storm sewers, buildings, and hollow trees as well as caves as winter roosts (Fargo 1929, Rice 1957, Lowery 1974, Humphrey and Gore 1992). Individuals roosting in a box culvert in Texas during the winter were not dormant (Walker et al. 1996) and bats have been observed emerging from caves in western Florida throughout the winter (Humphrey and Gore 1992). In northern parts of their range southeastern myotis hibernate for several months in caves or abandoned mines (Whitaker and Gammon 1988, Hoffmeister 1989, Sealander and Heidt 1990, Harvey et al. 1991).

Historical records for the southeastern myotis in Illinois are limited and, prior to the results reported here, the species had been documented at only eight (to ten) localities in four counties: Alexander, Hardin, Johnson, and Union (Hoffmeister 1989; Appendix). Smith and Parmalee (1954) reported the first Illinois specimens obtained from a cave and fluorspar mine in Hardin County during 1953, although the University of Illinois Museum of Natural History Mammal Collection [UIMNH] contains specimens collected in a Hardin County cave during 1950 (specimens originally identified as *M. grisescens*). Southeastern myotis in Illinois also have been found in abandoned silica mines (Illinois Natural History Survey Mammal Collection [INHS], Whitaker and Winter 1977). Prior to this study, the most recent confirmed records for this species in the state were from a 1974 bat survey of caves and mines on the Shawnee National Forest (Whitaker 1975, Whitaker and Winter 1977). Most of the records are of individuals collected or observed during late autumn and winter (October through March) and only males had been caught in the state during summer (Whitaker 1975, Hoffmeister 1989).

The Illinois Natural History Survey and Illinois Department of Conservation (now Department of Natural Resources), with support from the Illinois Department of Transportation, Shawnee National Forest (U.S. Forest Service), and U.S. Fish and Wildlife Service (Region 3), undertook a cooperative effort from 1985 through 1991 to determine the summer distribution and status of this species in southern Illinois. The capture of a lactating female southeastern myotis along the Cache River during July 1987 was the first

indication that a maternity colony occurred in the state. Accordingly, radio-tracking was conducted during the summers of 1989 and 1991 to find the roost site(s) of this colony and determine its foraging range.

METHODS

Mist Netting

The primary method used to determine the summer distribution of the southeastern bat was mist netting at surface sites in the 11 southernmost counties of Illinois: Alexander, Gallatin, Hardin, Jackson, Johnson, Massac, Pope, Pulaski, Saline, Union, and Williamson. Most of the netting sites were along perennial or intermittent streams or small rivers. Mist nets were placed at locations where overhanging branches of riparian trees formed a canopy above the stream or river channel; such a situation creates a tunnel through which bats fly to drink or feed on aquatic insects.

Bats were captured in black, 38-mm mesh, monofilament mist nets that ranged from 5.5 to 18.5 m in length and could be spread to a height of 2.2 m. A pair of metal poles either 6.1 or 9.2 m high was positioned under overhanging tree branches on opposite sides of the channel. Nets of equal length were stacked vertically and suspended above the stream or river between rope and pulley systems attached to the two poles (Gardner et al. 1989). Using these ropes it was possible to raise the top of the uppermost net to the canopy and block most of the flyway above the stream. An additional mist net frequently was spread across the channel just above water level to catch low-flying bats.

Mist netting was conducted from May through August on nights when environmental conditions were considered favorable (i.e. no precipitation or strong winds, limited moonlight, and temperatures above 9°C). Nets were raised at dusk and checked at 10- to 15-min intervals until 2400 h or later. Bats were removed from the net and examined to determine species, sex, age (juvenile or adult), and reproductive condition. Age class was determined by the degree of closure of the phalangeal epiphyses; juveniles (i.e. young of the year) are recognizable by the incomplete ossification of the epiphyses (Barbour and Davis 1969). The reproductive condition of males was assessed by the size of the epididymides; sexually mature males have enlarged or distended epididymides which can be seen through the interfemoral membrane (Racey 1988). Pregnant females were recognized by gently palpating the fetus through the abdomen, and lactating and post-lactating females by examination of the teats. Body weights were determined to the nearest 0.1 g with a Pesola spring scale. Southeastern myotis were color-banded for individual identification with a red or white sequentially-numbered, size XCL, celluloid split-ring band (A.C. Hughes, Hampton Hill, Middlesex, U.K.) on one forearm (right forearm for males, left for females).

Cave/mine Survey

Caves and abandoned silica and fluorspar mines in four southern Illinois counties (Alexander, Hardin, Johnson, and Union) with historical records for the southeastern myotis were visited during summer (May through August) to determine if they were used by this species. Bats also were captured at a Hardin County cave during 1985 and 1986 using a portable harp trap similar to one described by Tidemann and Woodside (1978). After the trap had been positioned in the cave's entrance, coarse nylon netting was used to cover

the remainder of the entrance and direct emerging bats into the trap. The trap was checked periodically from dusk until bats were no longer emerging from the cave.

Radiotelemetry

Radiotelemetry studies were conducted near the Cache River in Johnson and Pulaski counties. Radio transmitters were attached to selected southeastern myotis captured at the river as soon as the bat had been removed from the net and examined. Series BD-2A transmitters emitting unique frequencies between 172.0 and 173.0 Mhz (Holohil Systems Ltd., Woodlawn, Ontario, Canada) were used. These transmitters measure 12 x 8 x 4 mm, are equipped with a 11-cm long whip antenna, and weigh 0.68 to 0.80 g. Non-toxic medical cement (Smith+Nephew United Inc., Largo, Florida) was used to attach a transmitter to a bat's mid-sagittal dorsal surface just posterior to the scapulae after the hair in that area had been clipped. The bat was released as soon as the transmitter was attached firmly and the signal from the transmitter had been tested.

Bats were tracked using model TRX-1000S receivers (Wildlife Materials Inc., Carbondale, IL) and collapsible, three-element Yagi antennas (AF Antronics Inc., White Heath, IL). Attempts to track the bats to their diurnal roost site(s) involved covering an area within approximately 8 km of the capture site by vehicle, on foot, or by boat during the daytime. In 1989 an attempt to delineate the bats' foraging range by taking a series of simultaneous readings from three fixed radio-tracking stations established on hilltops in the study area was unsuccessful because only sporadic signals were received. Limited information on foraging locations was obtained by monitoring signals at night from various locations in the study area.

RESULTS AND DISCUSSION

Mist netting was conducted for 86 nights at 53 sites in 11 southern Illinois counties during the summers of 1985 through 1991 (Figure 1). There were 598 captures of bats during this period, representing all 12 species that occur in Illinois. Sixty-eight captures (11.4%) were of southeastern myotis; this species was caught at three surface locations (Figure 2, Table 1). Four caves, 17 abandoned mines, and a quarry (containing a remnant of a natural cave) were surveyed for bats during summer (Figure 1); seven other mine entrances were located, but the shafts were collapsed or flooded. No southeastern myotis were found roosting in any underground sites.

The results of this survey suggest that three maternity colonies of southeastern myotis are present in southern Illinois. Three adult males and a lactating female were netted along Big Grand Pierre Creek (near IL Route 146) in Pope County in July 1988 and a lactating female was caught at Black Creek (near Horseshoe Lake) in Alexander County in July 1991 (Table 1). These may represent relatively small or relict colonies. The remaining 63 captures (39 adult females, ten adult males, and 14 juveniles) occurred at two net sites on the Cache River along the Johnson/Pulaski county line; southeastern myotis were netted in this area during the summers of 1987, 1988, 1989, and 1991 (Table 1). These captures, however, actually may not represent 63 individual bats. Three bats caught during 1987 were not banded and could have been captured during a subsequent summer and three bats that were not banded during 1989 could have been caught later that summer or

during 1991. It is also possible that an individual could have lost its band and been recaptured during a subsequent year. Nonetheless, it is apparent that a maternity colony composed of numerous southeastern myotis females roosted in the vicinity of the Cache River capture sites. Eleven adult females were caught there on two consecutive nights during May 1988 and 16 reproductively active females were caught during the summer of 1989.

These were the first female southeastern myotis known to have been captured in Illinois during summer. Of the few males that had been recorded during spring and summer, all but one were from a single location, Cave Spring Cave in Hardin County. Three males were collected there in late May 1959, six were collected in early August 1950, and seven were mist-netted in late August 1974 (UIMNH, Whitaker 1975). During this study, however, no southeastern myotis were trapped at Cave Spring Cave in 1985 or 1986. The remaining male was collected in an abandoned silica mine in Alexander County in April 1954 (INHS). Two additional southeastern myotis were observed or captured during late August 1974 at Rich's Cave in Union County and an active fluorspar mine in Hardin County, but the sex of these individuals was not reported (Whitaker 1975).

Bats in the Illinois maternity colonies spend the summer close to known and potential hibernation sites. Similarly, southeastern myotis in Florida did not appear to travel long distances between winter and summer roost sites (Rice 1957). The Black Creek location is within 20 km of abandoned silica mines in Alexander and southern Union counties. Neither Layne (1958) nor Pearson (1962) found southeastern myotis in silica mines, but a male collected in an Alexander County mine in early April 1954 (INHS) may have hibernated there and a hibernating individual was found in a Union County mine (Whitaker and Winter 1977). Two southeastern myotis also have been found hibernating in Rich's Cave (Layne 1958, Whitaker and Winter 1977), 45 km north of Black Creek. The Cache River sites are only 4.7 km from Whitehill Quarry where 23 specimens were collected in February 1960 (UIMNH, Southern Illinois University at Carbondale Mammal Collection [SIC]). During the winters of 1988 through 1991 between two and 220 southeastern myotis were censused in a remnant of a natural cave in an abandoned portion of the quarry (Gardner et al. 1992). The Big Grand Pierre Creek site is near several caves in Pope and Hardin counties as well as fluorspar mines in Hardin County. There are historical winter records for Cave Spring Cave, Layoff Cave, and fluorspar mines (Smith and Parmalee 1954; Layne 1958; W.H. Davis, cited in Whitaker and Winter 1977; UIMNH; SIC) and recent sightings in one cave each in Pope (1993) and Hardin (1998) counties (Illinois Natural Heritage Database, Illinois Department of Natural Resources, Division of Natural Heritage).

The captures of reproductively active females and juveniles (Table 1) supplement the limited reproductive data available for this species, most of which is from Florida. Parturition in Florida appears to occur from the end of April until late May, with a peak during the second week of May (Rice 1957, Sherman 1930, Foster et al. 1978) and Caire et al. (1989) speculated that parturition in Oklahoma occurs during mid-May. Rice (1957) thought that because of the latitudinal difference southeastern myotis females in Illinois and Indiana would give birth during late June. All 11 females captured at the Cache River on 4 and 5 May 1988 were pregnant; this suggests that parturition could have occurred as early as mid-May. In 1989 three females were lactating on 30 May, probably

having given birth during May, whereas two others were lactating on 14 and 15 July and may not have given birth until June. A female was lactating on 15 May 1991, an indication that parturition had begun by mid-May that year. All seven females caught on 15 and 16 July 1991 were post-lactating and 13 juveniles also were captured on those dates. Southeastern myotis become volant five to six weeks after birth (Rice 1957); thus it appears that these young were born in early June at the latest. Females from Alexander and Pope counties were lactating in early July; the adult female caught at the Cache River in 1987 was lactating in mid-July, but a juvenile also was captured at that time. These limited data suggest that parturition in southern Illinois typically occurs from mid-May through early June.

Radio transmitters were attached to 21 southeastern myotis caught at the Cache River. Transmitters were placed on a lactating female in July 1987, eight lactating females and two adult males during 1989, and one lactating female, four post-lactating females, and five juveniles (four females, one male) during 1991. In addition, the lactating female southeastern myotis netted in Alexander County was fitted with a transmitter in July 1991. In all cases the transmitter weighed < 12% of the bat's body mass and the mean holding time for 20 bats was 55 min (range: 28-103 min). Only three individuals displayed any difficulty flying away when released, but any added weight decreases a bat's maneuverability during flight (Aldridge and Brigham 1988).

On 1 June 1989 a diurnal roost used by two radio-tagged lactating females was discovered. The roost was a live tupelo gum (*Nyssa aquatica*) tree (Figure 3) in Little Black Slough, a bald cypress (*Taxodium distichum*) and tupelo gum swamp in Johnson County. The tree was surrounded by water, was located approximately 85 m from the edge of the slough, and had a diameter at breast height of 105 cm. A triangular opening 60 cm high and 25 cm wide (measured at water level) on the south side of its base led into a cavity that was 1.6 m in diameter at water level and extended upward for at least 6 m. A smaller, more circular opening (16 cm high x 30 cm wide) occurred on the west side of the trunk near water level. Canopy cover in the vicinity of the roost tree was visually estimated at 35% and the understory was sparse. This tree was the northernmost maternity roost documented for the southeastern myotis and the first roost site other than a cave or building known to be used by a maternity colony of this species. Rice (1957) had predicted that caves in Illinois and Indiana, which are 5° to 11°C cooler than Florida caves, might not be suitable roosts for southeastern myotis maternity colonies.

One hundred one southeastern myotis were counted as they exited this roost tree through the triangular opening at dusk on 15 June 1989. Subsequently, the water level in Little Black Slough rose and the tree had been abandoned by 18 July 1989. Because the openings are at the base of the tree, alternate roost sites must be available for the maternity colony to use during periods of high water. Members of the colony may have moved to another of the many hollow trees in Little Black Slough. When the roost tree was examined on 25 July 1990, at least 75 southeastern myotis were observed. The bats became agitated and a post-lactating female was captured as she tried to exit. This was an indication of roost fidelity on the part of the maternity colony. No bats occupied the tree on 16 May 1991 when high water again covered most of the openings.

Despite extensive efforts (driving and walking through the study area with receivers for several days following the attachment of transmitters) no other radio-tagged members of the Cache River population were tracked to a diurnal roost. Likewise no roost was found for the radio-tagged female caught near Horseshoe Lake although that area was thoroughly covered by car and boat. Signals were never received from some transmitters during the daytime and only occasional signals from others were detected. Possible reasons for this lack of success include bats roosting at great distances from their foraging areas, bats roosting underground or in man-made structures that blocked signal transmission, loss or malfunctioning of the transmitters (two were known to have become detached), decreased survival of bats fitted with transmitters, and hilly terrain interfering with signal transmission.

The straight-line distance between the roost tree in Little Black Slough and the site on the Cache River where the two radio-tagged females had been captured was 5.7 km. After these lactating females were fitted with transmitters they foraged along the Cache River both downstream and upstream of the capture site and along the Post Creek Cutoff (a large, channelized drainage ditch upstream of the capture site). They were detected at a location along the Cutoff that was 3.2 km from the capture site and 8.7 km from the roost tree. The movements of these individuals suggest that southeastern myotis cover large distances while foraging, especially as the added weight of the transmitters may have restricted their foraging range.

In summary, this study demonstrated that maternity colonies of southeastern myotis occur in Illinois, located the northernmost maternity roost for this species, and revealed the first documented use of a roost site other than a cave or building by a southeastern myotis maternity colony.

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Table 1. Capture data for southeastern myotis (*Myotis austroriparius*) in southern Illinois, 1985-1991. PG = pregnant female, L = lactating female, PL = post-lactating female, NR = non-reproductive adult female, AM = adult male, JM = juvenile male, JF = juvenile female.

Location	Year	PG	L	PL	NR	AM	JM	JF
Pope Co.								
Big Grand Pierre Creek	1988		1			3		
Alexander Co.								
Black Creek	1991		1					
Johnson/Pulaski Cos.								
Cache River	1987		1		2			1
	1988	11				4		
	1989		14	2	1	6		
	1991		1	7			6	7

Figure 1. Location of mist netting sites and summer cave/mine surveys, 1985 – 1991.

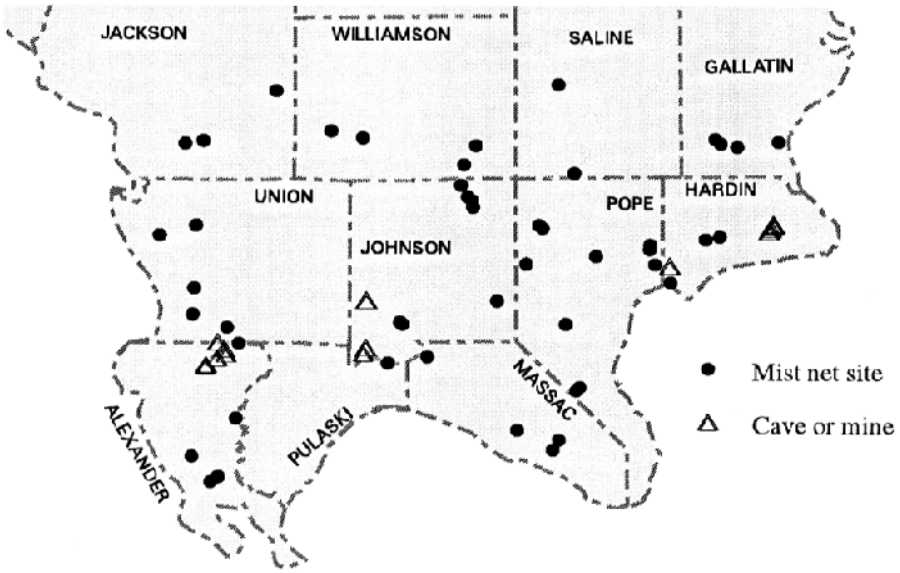

Figure 2. Summer records for southeastern myotis (*Myotis austroriparius*), 1985 – 1991, and location of roost tree used by maternity colony.

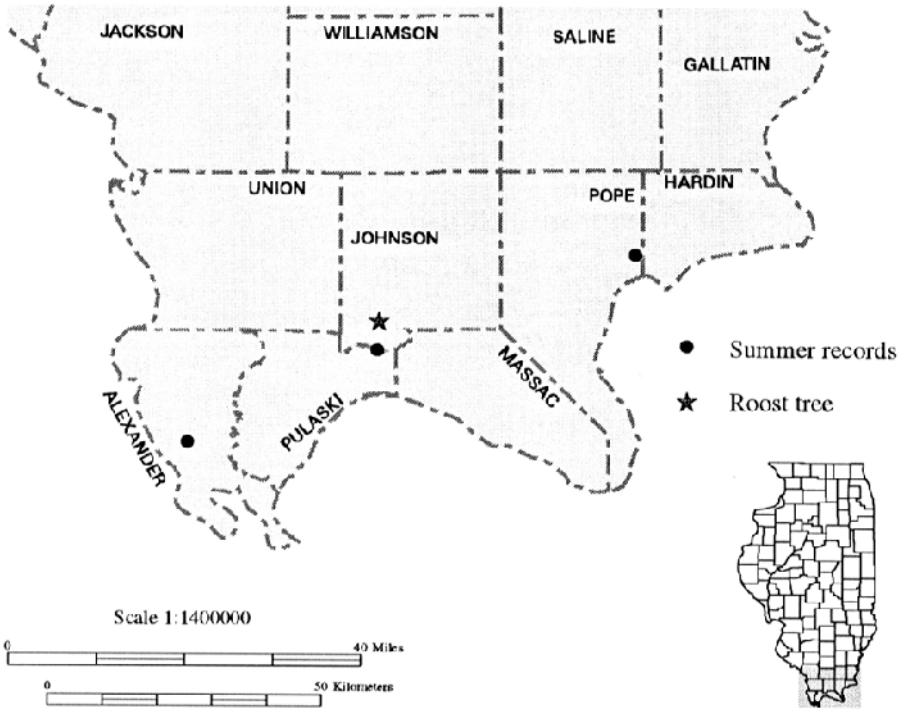

Figure 3. Tupelo gum (*Nyssa aquatica*) in Little Black Slough, Johnson County, Illinois used as a roost by a maternity colony of southeastern myotis (*Myotis austroriparius*)

APPENDIX

Historical records of southeastern myotis (*Myotis austroriparius*) in Illinois

County	Location	Date	Source(s)
Alexander	silica mine, 0.5 mi N Olive Branch	1954	INHS
Hardin	Cave Spring Cave	1950	UIMNH
	Cave Spring Cave	1953	cited in 5
	Cave Spring Cave	1954	3, FL
	Cave Spring Cave	1959	UIMNH
	Cave Spring Cave	1974	5
Hardin	Layoff Cave	1953	1, INHS, ISM, UIMNH, FM
	Layoff Cave	1954	3, SIC, FL
	Layoff Cave	1955	3, FL
	Layoff Cave	1956	SIC
Hardin	Griffith Cave	?	2
Hardin	fluorspar mine, 2.5 mi NW Cave in Rock	1953	1, INHS
	Crystal Mine #66	1974	4
	Mine 8 (exact location unknown)	1960	SIC
Johnson	Whitehill Quarry	1960	UIMNH, SIC
Union	Rich's Cave	1955	3, FL
	Rich's Cave	1974	4, 5
Union	silica mine #40	1974	5

Sources: 1 = Smith and Parmalee (1954); 2 = Rice (1955); 3 = Layne (1958); 4 = Whitaker (1975); 5 = Whitaker and Winter (1977); UIMNH = University of Illinois Museum of Natural History Mammal Collection; INHS = Illinois Natural History Survey Mammal Collection; SIC = Southern Illinois University at Carbondale Mammal Collection; ISM = Illinois State Museum Mammal Collection; FM = Field Museum of Natural History Mammal Collection; FL = Florida Museum of Natural History Mammal Collection