

POPULATION STUDIES ON A MATERNITY COLONY OF LITTLE BROWN BATS IN WEST-CENTRAL INDIANA

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ABSTRACT. Between 1987 and 1992 studies were conducted on a large maternity colony of little brown myotis (*Myotis lucifugus*) in a barn in Clay County near Brazil, Indiana. Evening flight counts were conducted to examine seasonal population fluctuations, and over 1700 bats were banded to determine possible use of alternative roosts and the location of winter hibernacula. In 1988 and 1989, spring buildup occurred from late March through late April. Summer counts in 1987 showed a marked increase from early to mid-July, while counts from 1989 showed a dramatic decline from late May until early July. The 1989 decline was very unusual because it continued well after parturition, and volancy of young, when the population should have been highest. Reasons for the decline are unclear, but banded bats found in a nearby colony indicate some use of alternative summer roosts. Fall counts in 1988, 1989 and 1990 found a similar rate of decline from September through October though many more bats were present in 1988. Most bats were gone by early November. Twenty-six banded bats were found at six locations in central and southern Indiana and Kentucky. Seven bats were found in summer while 19 were hibernating bats. Most relocations were within 60 km of the barn.

Keywords: Bats, little brown myotis, *Myotis lucifugus*, maternity colony, hibernation

The little brown myotis (*Myotis lucifugus*) is widely distributed in North America. It typically hibernates in caves in winter, but commonly utilizes man-made structures as maternity roosts in summer (Fenton & Barclay 1980). In central Indiana, maternity colonies typically begin to form in late March or early April and begin to disperse in late summer and early fall as bats move to fall swarming sites and hibernacula. The timing of fall migration varies with latitude, occurring as early as August in northern parts of their range in Canada and Alaska (Fenton & Barclay 1980).

Humphrey & Cope (1976) conducted flight counts in two colonies of little brown myotis in central Indiana to examine seasonal fluctuations. They noted population increases from late April into May, followed by a decline in early June. The June decline was followed by another peak in early July with the addition of volant young to the population. The fall decline began in August and continued until early October. In fall, this species moves to swarming sites in caves or mine openings. Presumably mating occurs at this time. Some bats hibernate at swarming sites,

though much more information is needed about swarming and swarming sites. Eventually, bats move to winter hibernacula but little is known about the extent to which individuals from one maternity colony use the same hibernacula or disperse.

In Indiana, long-term data indicate that this species is declining, possibly due to competition with big brown bats (*Eptesicus fuscus*) for roosting sites (Whitaker et al. 2002). Cope et al. (1991) noted that little brown myotis colonies had decreased in relation to big brown bat colonies between 1959 and 1989. Presumably, these declines are not exclusive to Indiana, but their extent is unknown. More information is clearly needed on the population dynamics and movement patterns of this species.

This study was conducted on a large maternity colony to examine the pattern of population fluctuation, gather information on the use of alternative summer roosts, and determine the locations of winter hibernacula. These data were intended to provide baseline information for more extensive population studies; however, the barn that housed the col-

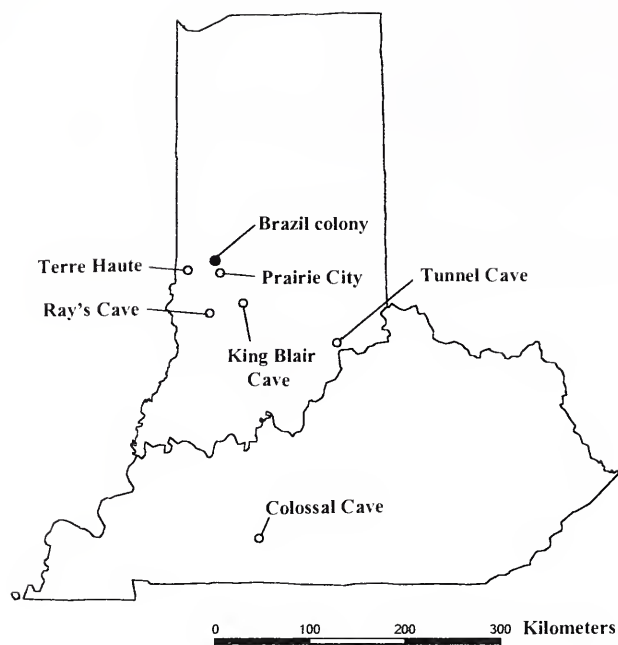


Figure 1.—Location of the barn colony at Brazil, along with the approximate locations of bats banded from the colony. Twenty six banded bats were found at six locations. Most bats were found within 60 km of the barn, although two hibernacula were well over 100 km away.

ony was torn down in 1992 and the potential for future work was lost.

METHODS

The bat colony was located in a barn approximately 8 km south of Brazil, Clay County, in west-central Indiana (Fig. 1). The surrounding landscape is a mixture of agricultural, residential and woodland areas, with a few small ponds near the barn. The colony was the largest known in Indiana with a maximum count of 6500 bats. Although no definitive data exist, indications from local accounts and the amount of guano present suggest that bats had used the barn for at least 30 years prior to 1987. Most data were collected in 1988, 1989 and 1990 and include evening flight counts and banding returns from bats banded in 1988 and 1989.

Flight counts.—Flight counts were conducted in July, October and November of 1987 and in April, September and October of 1988. Weekly flight counts were made from March–November of 1989 and from October–December 1990. A daytime count of roosting bats was made in September 1990 and two evening flight counts were made in April and July 1991.

Bats exited primarily through a large open

window on the west side of the barn, from a smaller window on the east side, and from under the eaves on all sides. Two to four people were stationed at opposite corners of the barn where exits could be most clearly seen. Bats were counted as they exited at dusk. Counts were stopped when at least 10 minutes had passed without bats emerging and when visual inspection showed no, or very few, bats remaining in the barn.

Banding.—In 1988 and 1989, banding was conducted to determine locations of winter roosts and to examine the possible use of alternative roosts in summer. Bats were captured for banding using a framed wire bat trap (Tuttle 1974) or by hand as they roosted and were fitted with orange plastic forearm bands. Bats were banded in August and September 1988 and July 1989, with over 1700 bats banded in total. Information on locations of banded bats was gathered from a biennial winter search (1980 to present) of all known hibernacula in Indiana (Brack & Dunlop 1999), investigation of other known colonies, or other reported sightings. Flight count data are presented by season (spring buildup, summer patterns, and fall decline) so that the overall patterns can be examined, and differences among years discussed. Spring buildup was considered the time from the first counts to the end of buildup (March–May). Summer was the time from the end of buildup to the beginning of fall decline (June–mid August), and fall decline was the time from the beginning of decrease until no bats remained.

RESULTS

Spring buildup.—Spring counts were made in 1988, 1989 and 1991 (Fig. 2). No bats were seen on 15 or 25 March 1988, but 164 bats were counted on 9 April. On 26 April 1050 bats were counted, and an estimated 2000 bats remained in the barn when counts were stopped due to darkness. In 1989, no bats were seen on 22 March while five were counted on 29 March. Numbers increased rapidly through April and peaked at 2283 bats on 26 April 1989. Numbers dropped slightly but remained around 2000 bats throughout May. Fifty-four bats were counted on 6 April 1991.

Summer patterns.—Summer counts were made in 1987, 1989 and 1991 (Fig. 3). In 1987, 2180 bats were counted on 7 July and 6500 on 15 July. The most extensive counts

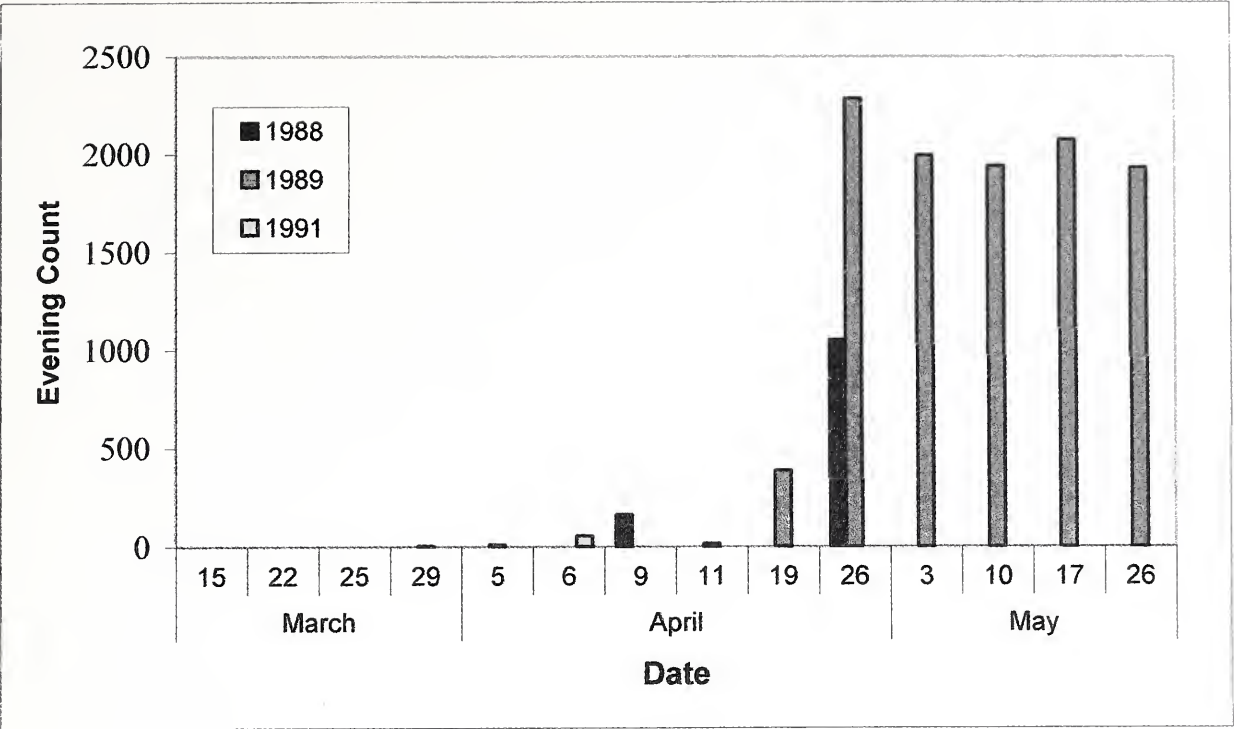


Figure 2.—Spring bat counts in 1988, 1989 and 1991 showing a rapid increase in late April and the buildup complete by May.

were made in 1989 when numbers declined from 2072 in late May to a low of 627 by late June. The first young were seen on 4 June and the first volant young were seen on 15 June 1989. Numbers increased to 1095 bats by 26 July and remained around 1000 bats through

August. There were 1254 bats counted on 30 July 1991.

Fall decline.—Fall counts were made in 1988, 1989 and 1990 (Fig. 4). Numbers fell markedly from September through early October though there were many more bats pres-

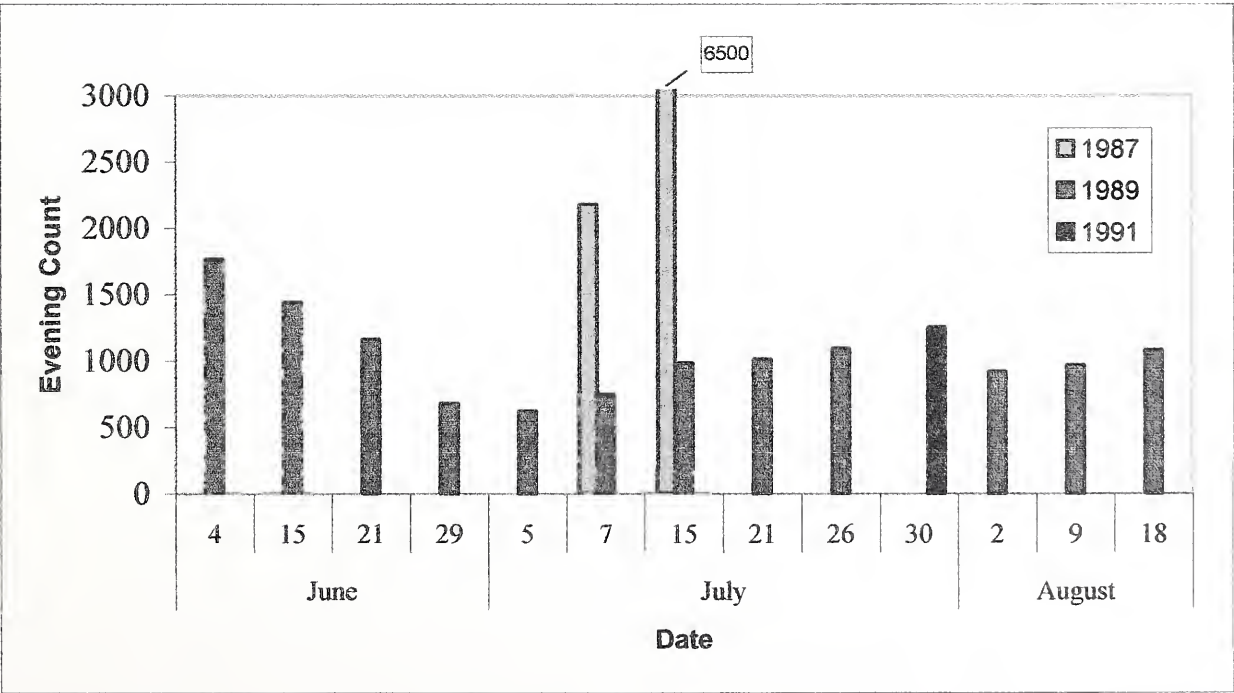


Figure 3.—Summer bat counts in 1987, 1989 and 1991. A large increase was seen in 1987, with a dramatic decline through June 1989. The 1991 count was most similar to numbers in 1989.

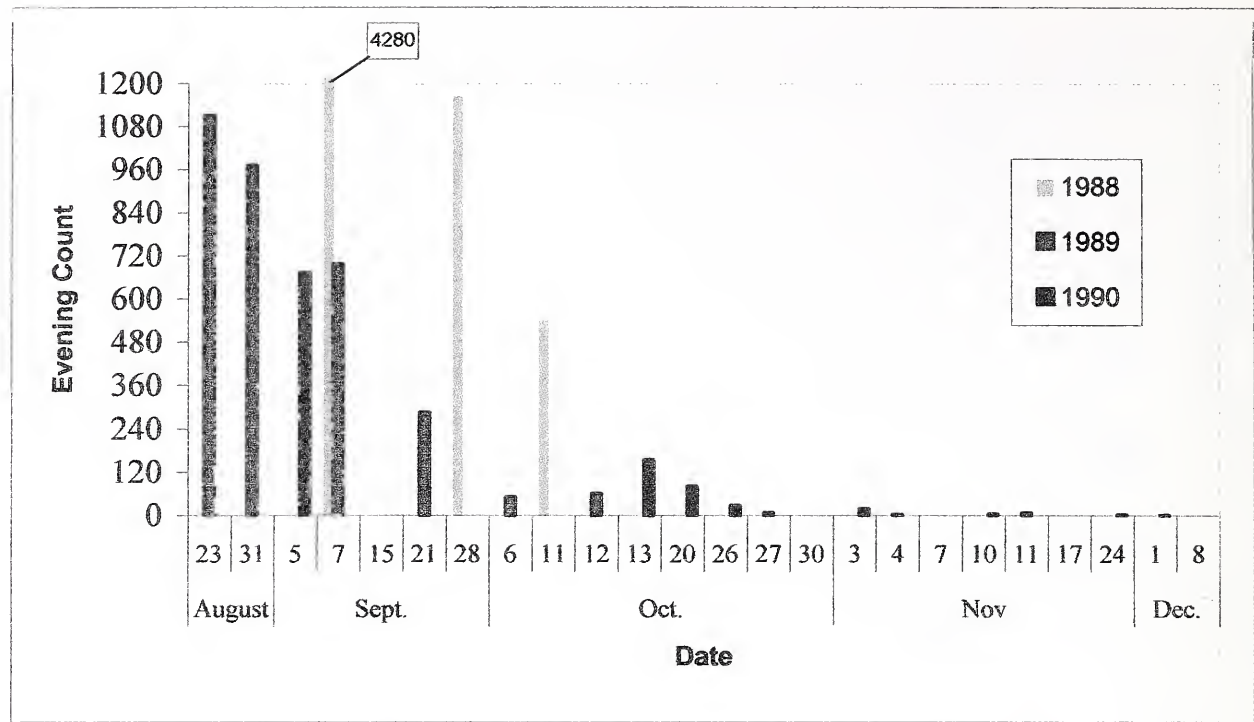


Figure 4.—Fall bat counts in 1988, 1989 and 1990 indicate rapid declines through September and early October but with many more bats present in 1988. Most bats were gone by early November each year.

ent in 1988. In 1988, there were 4381 bats on 7 September and 540 on 11 October. In 1989 and 1990, there were fewer than 700 bats in early September and around 100 remaining in early October. Very few bats remained by early November and only one bat was seen on 1 December 1990. No bats were seen either in the barn or exiting on 8 December 1990.

Banding returns.—Between 1988 and 1992, 26 banded bats were found at six locations in central and southern Indiana and

Kentucky (Fig. 1, Table 1). Seven bats total were found in the summer and the other 19 were found in winter. In 1988, a dead juvenile bat was found in a warehouse in Terre Haute, Indiana approximately 24 km west of the barn. In 1992, six banded bats were counted in a nearby church colony at Prairie City, Indiana on 30 July. Banded bats from the barn had been commonly seen in the church prior to 1992; and while no specific counts were made, an estimated 5–10 bats were seen per visit.

The remaining bats were found hibernating in caves between October and early April. Fifteen were found in Ray’s Cave, approximately 60 km south and one at King Blair Cave, approximately 48 km southeast of the barn. Two bats were found at Tunnel Cave, approximately 160 km southeast of the barn and one bat was found approximately 280 km south at Colossal Cave in Kentucky.

Table 1.—Relocated bats from the Brazil colony. Most were hibernating bats found at Ray’s cave between October and April. Winter locations showed a wide range of distances while summer locations were relatively close to the barn.

Date	Location	Bats	Distance (km)
8 August 1988	Terre Haute	1	24
11 October 1988	Ray’s Cave	1	60
13 January 1989	Colossal Cave	1	280
27 January 1989	Ray’s Cave	11	60
27 January 1989	Tunnel Cave	2	150
12 April 1989	Ray’s Cave	2	60
13 January 1990	Ray’s Cave	1	60
6 March 1990	King Blair Cave	1	48
30 July 1992	Prairie City	6	3

DISCUSSION

Spring buildup.—The trend of rapid spring buildup is similar to that observed in central Indiana by Humphrey & Cope (1976) who observed spring buildup beginning in early April and complete by early May. The pattern is also similar to spring emergence of little brown myotis from an abandoned mine

hibernaculum at Copperhead Cave in Parke County, Indiana (approximately 30 km northwest of the barn) where bats leaving hibernation emerged from March to May (Whitaker & Rissler 1992).

Summer patterns.—The increase in July 1987 was similar to the pattern expected by the addition of volant young; however, no data on the onset of volancy were collected that year. Summer counts in 1989 show a much different pattern than that seen in other studies. Humphrey & Cope (1976) noted a decline following spring buildup and continuing until late June when young become volant and numbers increased. They attributed this decline to the movement of transient individuals into and out of the population during spring buildup. While the 1989 decline at Brazil began after spring buildup, it was unusual because it continued after parturition and volancy of young when the population should have been the largest. Apparently the peak expected from the addition of volant young was masked by the declines. The population did not begin to increase until early July, well after young were flying. It is possible that the young seen during June were born early and that the majority of young were born in July thus accounting for the increase. However, visual inspections in the barn were made after each count in 1989, and non-volant young were only seen in early June. It is also possible that there were fluctuations in the population that weekly counts did not detect. Using daily flight counts, Humphrey & Cope (1976) reported an increase from 570 to 1360 bats in one colony in late July. They noted that the peak of 1360 was brief and would have been missed by using weekly counts alone. Though they attributed some of these peaks to females not joining in early evening flights, the marked daily fluctuation in numbers suggests the use of alternative roosts. The large increase in July 1987 may have been due to the onset of volancy. However, even 100% reproduction could not have accounted for the increase, suggesting the use of alternative roosts by large numbers of individuals.

Other factors that might affect population numbers include high adult mortality, low reproductive success, inclement weather, researcher error, and human disturbance. No evidence was found to suggest high mortality (i.e., large numbers of dead bats in the barn)

and while low reproductive success would have influenced any peak associated with the addition of volant young, it would not explain the severe drop prior to parturition. Syme et al. (2001) noted significant differences in the numbers of little brown bats using some roosts between years at Chautauqua, New York. They attributed this to increased clustering by bats in cooler years. At Brazil, 1989 was not a significantly cooler summer and weather did not appear to be a factor in the decline that year.

Given the large number of bats in the barn and difficulty in making dusk counts, some human error undoubtedly occurred; but we are confident it did not account for the large fluctuations observed. Disturbance from capturing and collecting bats can also influence movement patterns (Humphrey & Cope 1976), but this seems unlikely to have accounted for the patterns seen in 1989, since the steepest declines occurred before any captures were made that year. Some repairs were made on the roof of the barn in late July, and bat numbers dropped slightly in early August. While it is difficult to determine the extent to which these small fluctuations were influenced by the captures or roof repairs, disturbance did not seem to be a factor in the large declines in June.

How the destruction of the barn in 1992 might have influenced bat movements is unknown. Neilson & Fenton (1994) reported a small number of banded bats moving between several buildings used as summer roosts in Chautauqua, New York. They found that most banded bats (91.8%) roosted only in the building where initially caught, and that the majority of movement between roosts that did occur was in June. They further noted that bats roosting in buildings that were torn down did not make use of nearby buildings or bat houses, and that very few bats from razed buildings (0.9%) were recaptured at other buildings that year. Whether the banded bats seen in 1992 at the Prairie City church were there as a result of the destruction of the barn is unknown. However, the regular occurrence of banded bats in the church prior to 1992 indicates regular use and prior knowledge of the church colony. This also provides evidence of the use of alternative roosts by bats in the barn colony. It appears that major fluctuations in this study were due to movements of bats between alternative roosts, most of which were not found. Though little brown

bats are generally considered sedentary (Humphrey & Cope 1976), some use of alternative roosts has been noted; and we suspect that there is much more movement between roosts by this species than previously thought.

Fall declines.—In 1988, 1989 and 1990, numbers declined by approximately 90% from September through early October, with most bats gone by November. However, there were six times as many bats in early September 1988 as in subsequent years. Whether this indicates that the 1988 population was unusually high or that other years were low is difficult to determine. Like the summer decline in 1989, we suspect that the use of alternative roosts was a factor in the marked difference between 1988 and other years. To what extent the differences reflect the larger declines described by Cope et al. (1991) is also unknown since no long-term data were collected on this colony.

Banding returns.—Relocation data, though limited, indicate some use of alternative roosts and that at least some bats travel long distances to hibernate. The difficulty in locating both summer and winter roosts makes extensive data difficult to collect. However, given the long term declines in Indiana, these types of data will be important in understanding movement patterns of this species.

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