

Movements of *Myotis lucifugus lucifugus* from a Colony in Boone County, Indiana

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Nine trips have been made since 1958 to a colony of little brown bats (*Myotis lucifugus lucifugus* LeConte) at Thorntown, in Boone County, Indiana, for the purpose of banding and recovering previously banded bats. The dates of banding are as follows: August 9, 1959, August 19, 1959, August 20, 1960, August 3, 1961, July 31, 1962, June 5, 1963, August 14, 1963, September 29, 1963, and October 10, 1963. In these six years, 2410 bats were handled, an average of 400 individuals per year; of the 1710 bats which were banded, 313 were recaptured at Thorntown. This work has been done in conjunction with a banding project throughout Indiana and parts of Kentucky. Acknowledgement is made to many students of Earlham College for their time spent in this study; to National Science Foundation Grant G-5571 which financed in part this study, and particularly to Roy Randel for his generous and continuous cooperation in allowing us to study the colony in one of the buildings on his farm. We are indebted to Gertrude L. Ward for the preparation of the map.

It is well known that *Myotis lucifugus* migrates (2, 4). They go north in the spring and when they arrive at their destinations, the females form a colony and bear one young each. The males do not colonize with the females and young, but are thought to form stag colonies or move erratically within a large area (1). In the fall, the bats migrate south to hibernate in caves.

Of the bats banded at Thorntown in six years, 47 were recaptured at other places. Thirteen recoveries were made in Grotto Cave and eight in Coon's Cave, both in Monroe County about 70 miles south of Thorntown. There was one recovery in each of several other caves in this area, including Ray's Cave, Salamander Cave, and Buckner's Cave. In Lawrence County, three Thorntown bats were recaptured at Donnehue's Cave, 88 miles south of the nursing colony; farther south in Lawrence County, three Thorntown bats were taken at Tunnelton, which is another nursery colony, and two at Donaldson's Cave. Seven bats were recovered in Wyandotte Cave, Crawford County, 132 miles south of Thorntown. Three bats were recovered in Wind Cave, Breckinridge County, Kentucky, 165 miles south of Thorntown. The most distant records are of two bats recaptured in Colossal Cave, Edmonson County, Kentucky, 200 miles from the summer colony.

Thus from Thorntown south, the migrating bats follow a fairly narrow route along the line of caves in which they roost or winter. As one might expect, this route corresponds with the belt of Mississippian limestone in which the caves are formed, Fig. 1. However, there is some evidence that this cave belt migration route is not closely followed. Three bats were captured during the time of fall migration well east of the cave belt, one at Shirley, in Henry County, one at Franklin, Johnson

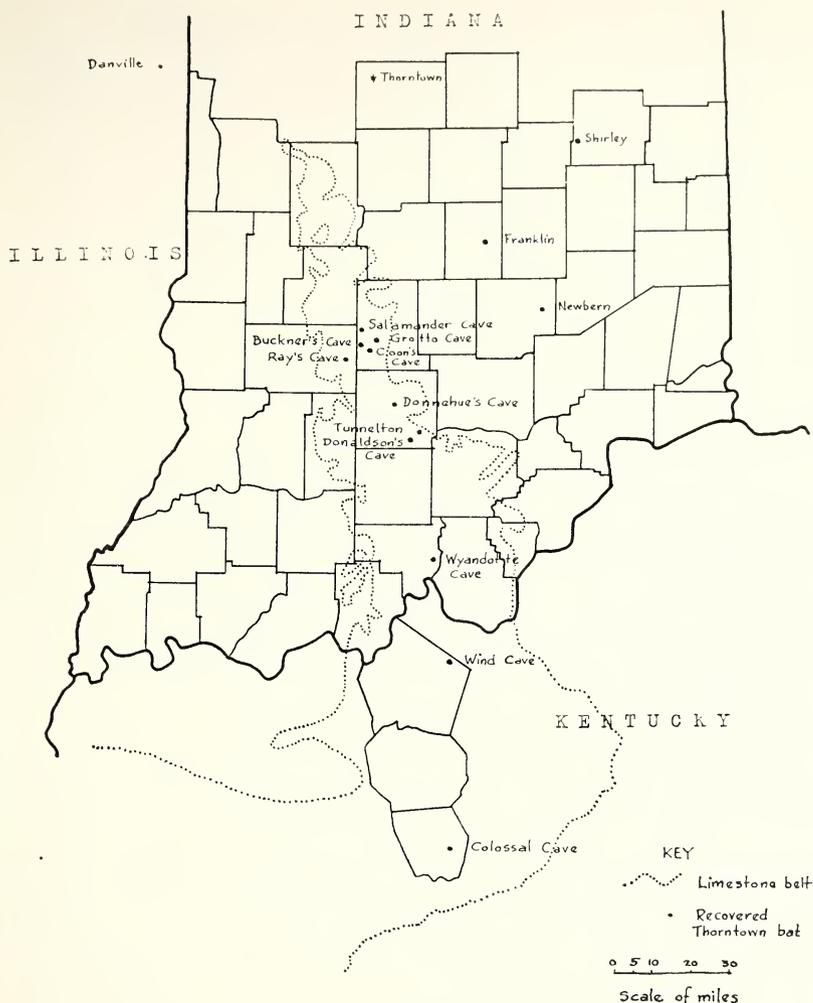


Figure 1

County, and one at Newbern, Bartholomew County. One bat turned up about 70 miles west of Thorntown during fall migration, at Danville, Vermillion County, Illinois. It seems evident that there is some sporadic movement that is not explained by north-south migration.

The data which pinpoint migration routes also help in establishing the dates of migration. As late as August 19, 1959, and August 20, 1960, there were respectively 485 and 450 *M. lucifugus* at the colony, about the same number as on August 3, 1961 and August 9, 1958, earlier in the month. Thus it appears that during the third week of August most of the nursery population is still present. The following data shed light on the dates of southward movement:

Bats banded at Thorntown	Recaptures: place and date	Sex	Number of days to migrate	Distance in miles
1. July 31, 1962	Wyandotte Cave September 5, 1962	F	36	132
2. August 3, 1961	Wyandotte Cave September 6, 1961	M	32	132
3. August 3, 1961	Wyandotte Cave August 23, 1961	M	20	132
4. August 20, 1960	Donnehue's Cave September 2, 1960	M	13	88
5. August 20, 1960	Donnehue's Cave September 1, 1960	M	12	88

From these data, which cover through 1962, it seems that the southward migration takes place during the month of August, probably during the last two weeks of August and the first week of September. On August 14, 1963, there was an estimated total population of 450 bats at Thorntown. On September 29, 1963, there were about 32 bats present, well after our supposed dates of migration; on October 10, 1963, there were still three bats at the colony. This leads us to believe that the peak of southward migration is in late August, but that some bats stay on, resulting in a slowly diminishing population at the end of the season.

Dates of spring migration are not so well defined. Of the bats that were taken at a point south of Thorntown in the spring and again later that year at Thorntown, most were from Coon's Cave, Grotto Cave and Wyandotte. The banding at Coon's Cave was on March 28, 1961, and there was no migratory activity at that time. At Grotto Cave on April 21, 1961, the bats were active; there was one previously banded Thorntown bat there, but it could have been hibernating as well as migrating. A more interesting record is that of a migrating female banded at Wyandotte on April 20, 1963, and recaptured at Thorntown on June 5, 1963. It appears from this that spring migration occurs during the last two weeks of April, during May and probably during the first week of June.

When the colony was visited on June 5, 1963, there was an estimated total population of 135 bats, and no young had been born. Our previous population figures of four and five hundred included offspring. Therefore, if we follow Griffin (3) who found only an occasional male in the nursery colony, and this corroborates our own findings of 98 to 100 percent females rather than those of Cagle and Cockrum (1) who found 38 percent adult males as late as the first week in June, we can assume the population had not built up to its peak. Thus, migration was going on after June 5. On August 14 the estimated total population was the expected 400-450 which seemed to be consistent with the preceding year's population at that time of year.

It is interesting to note whether or not individual bats are consistent in visiting the colony each summer. Of the 1710 bats banded at Thorntown through September 29, 1963, 243 were captured there two different times, 54 were captured there three times, 11 were captured there four times, four were captured five times, and one, six times. Most of these captures were in consecutive years. These recaptures, however, are only 18 percent of the bats banded. There is some inefficiency in banding, but usually about 65 percent of the population is captured. Probably deaths are partly to blame for the low number of returns. Gifford and Griffin (2) noted that bats move to different nursery colonies; while we have no information to substantiate this for the Thorntown colony, it is conceivable that this could be a factor in the low percent of returns.

There is a definite difference in the rate of occurrence of the sexes at the colony. Of the 243 bats that were captured twice, 81 percent were females. Of the 54 bats captured three times, 78 percent were females. Of the bats captured more than three times, 100 percent were females. This substantiates the observation that most males of the species spend their summers apart from the nursery colony. One male was banded at a nursery colony at Tunnelton, Ind., on August 8, 1958, and recaptured at Thorntown on August 9, 1959. This bat was about 90 miles farther north in 1959 than it was at the same date in 1958.

An interesting proportion of sexes was noted on September 29, 1963. Of the 11 bats already banded at the time, nine were females, corresponding with the proportions noted in the nursery population. As we would expect, seven of the nine recaptured females had been at the colony earlier in the summer, and one of the two recaptured males had also been present. Of the 17 bats that had not been banded, 11 were males; this proportion indicates that most of these 17 were ones which had only recently moved in, perhaps during migration.

Although much of our evidence is inconclusive, it shows many trends in the bats' movements. With this as a beginning, we may be able to trace patterns of bat activity in a very significant way. Therefore, while the colony is preserved, we shall have an excellent opportunity for further study.

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