Notes on Homing of Two Species of Bats, *Myotis lucifugus* and *Eptesicus fuscus*[1]

James B. Cope, Keith Koontz, and Edward Churchwell,
Earlham College

Homing experiments with bats in the United States began in 1924 when Howell and Little (3) banded and released five *Eptesicus fuscus* 20 miles from their home colonies. Since that time a number of homing experiments have been undertaken. A discussion of those prior to 1955 can be found in the work of Cockrum (1). Some of the outstanding experiments since 1955 have been carried out by Mueller and Emlen (4) who worked with cave hibernating colonies of *Myotis lucifugus*, and Smith and Goodpasture (5) who experimented with a nursery colony of *Eptesicus fuscus*. Most of these experiments have dealt mainly with the distance from which bats have homed. In almost all cases the percentage of returns has been small and only in a few cases has the homing been rapid.

The emphasis in our experiments was placed on distance, time, and percentage of return. Because we were working with nursery colonies in which there were many hiding places and numerous exits, we found it impossible to use conventional methods of tagging, therefore radioactive tagging was the method used in our study.

Method: Regular U. S. Fish and Wildlife Service metal bands were used. To the inside of each band was pipetted 5 lambdas (100 microcuries) of gold-198 Aurcoloid solution. The droplet was dried under an infrared lamp and was covered with a thin coat of clear fingernail polish. Each band was detectable through a two-inch thickness of wood, tin, brick, slate, etc., and enabled us to record high percentages of returns when the bats were completely hidden. Bats were collected in the nursery colonies by hand and with hand nets and were not banded until they had been taken to the point of release. The bats were detected upon return to the colonies with a NMC Model #GS-sL Survey Meter. Estimates of total returns were based on (1) the number of spots in which the radiation was detected, and (2) the intensity of radiation in these areas.

Myotis lucifugus

The colonies of *Myotis lucifugus* used in our experiments are located at Brookville, Indiana, one in the attic of St. Michael's school and the other in the steeple of St. Michael's church. These two colonies are just across the street from each other.

Our experiment with *Myotis* was carried out in the attic of St. Michael's school on the night of July 14. Forty female *M. lucifugus* were collected from 5:30 to 6:00 p.m. They were banded with radioactive bands between 9:00 and 9:34 p. m. and released 20 air miles due west of the nursing colony. The first bat was discovered back in the attic of the

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school at 1:55 a.m. A thorough monitoring of the attic takes a good deal of time, which means that the bat could have arrived any time between 12:30 and 1:55 a.m., because the first check ended at 12:30. Other concentrations of radiation were detected at: 2:20 (3 bats), 2:30 (6-7), 2:35 (4-5), 2:45 (9-10), 2:50 (7-8). Because of the number of places in which we found radiation and the amount of activity at these places, we estimated that 80-90% of the banded bats had returned by 3:00 a.m.

We wanted to find if there were any interchange between the school and the church. At 4:45 a.m. a check was made in the steeple for radiation. Radiation was detected, which indicated that approximately 4 bats or 10% of the total number banded were in the steeple. This illustrated the tendency of bats to return to the general vicinity of their home roost as described by Gifford and Griffin (2) and Twente (5). However, as the data indicates, the percentage of interchange was rather low, but it definitely proves that there is an interchange between these colonies.

We believe that it is significant that 80-90% of the bats returned in a matter of hours. If we had used the conventional method of banding, we would have recorded only a return of 2.5%, because only two of these bats were seen. The rest were hidden between boards of the roof and the tin roofing itself.

We believe that the flying time of these bats is also significant. The first bat we discovered had a maximum flying time of four hours and fifty-five minutes. It is possible that it did not come directly into the attic as soon as it reached Brookville; also it is possible that it could have been in the attic at least an hour before it was discovered. Flights of this type would give little time for random wandering. The bats would almost have to have a knowledge of the territory within a 20-mile radius or a direct homing instinct.

The theory that they have a direct homing instinct can be substantiated by the fact that as soon as they were released, they flew directly toward the nursery colony. This is in contrast to studies made by the senior author (unpublished) in which he liberated *Myotis* in the daytime and watched them with binoculars. He noted that they flew to the nearest cover, rather than to the home roost.

In future experiments in which it is desirable to determine how fast a flight these bats are capable of making over short distances better data could be obtained by collecting the bats late at night after they have returned from feeding, and releasing them shortly before daybreak. In this way we would have a better idea of their actual flight time, because it is probable that they would not feed on the way, and that they would enter the building immediately upon return.

Eptesicus fuscus

The majority of our experiments were done with nursery colonies of *Eptesicus fuscus* because there were more colonies of this species available in our area. One of the first experiments which we did with this species was in the attic of St. Michael's church at Brookville, Indiana. This was a nursery colony of about 75 adults. On the night of July 14 we banded and released 16 females and four males with radioactive bands 20 miles

due west of Brookville. We collected these bats between 6:00 and 6:30 p.m. and released them between 8:45 and 9:00 p.m. The first concentration of radiation back in the attic of the church was detected at 1:05 a.m., behind a brick wall. Because two separate spots of activity were detected through this wall, we feel safe in saying that at least two had returned. Other concentrations of radiation were detected at the following times: 1:30 (1-2), 3:00 (1), 3:44 (1), 4:10 (5-6), and 4:16 (4-6). By 4:30 a.m., we estimated that 70-90% had returned.

The next experiment was conducted with a nursing colony in St. Mary's of the Rock Catholic church near Batesville, Indiana. On the night of July 14, 37 adult females and 10 adult males were collected. These were banded and released on July 15 with radioactive bands, between 1:00 and 2:00 p.m. 40 miles due south of St. Mary's. These bats did not return the first night. However, on the night of July 16, the bats were detected during our first monitoring of the attic at 10:05 p.m. We were able to collect four of these which we kept until 6:00 a.m. At 5:00 a.m., two spots were found in one corner under a tin cornice which runs along the outside edge of the roof. The bats were between this and the 2" x 8" roof rafters to which the cornice was fastened. It was estimated that 4-6 were in one spot, and 7-9 in the other. Because of the amount of activity we feel that there were not more than 31-40% returns.

On July 14, 10 females and 1 male *Eptesicus fuscus* were collected at 8:00 a.m., on the John Longstreth place just north of Richmond, Indiana. These were taken 100 miles due north, banded with radioactive bands, and released between noon and 12:15 p.m. Three days later the bats were detected back at the home roost. They had arrived some time during the third night. In monitoring the barn we found six places of radiation. Some bats were hanging in the crest of the roof along with some unbanded ones. Others were between the new tin roof and the older shingle roof. We estimated from two to three bats in two of these places, another spot had from one to two, and the other spots had only one bat. Although only a small percentage could be seen, the others were readily detected. This was a total return of eight to eleven bats, or 72.7 to 100%.

Another homing experiment was started July 20. In this experiment bats were collected from two different colonies. Thirty-six adult females were collected at Milton, Indiana and 33 adult females at Longstreth's. The bats from Milton, collected between 6:00 and 7:00 a.m., were banded with radioactive bands and released between 10:25 and 10:50 p.m. 250 air miles due south of Milton. The bats from Richmond which were collected between 8:00 and 8:30 a.m., were banded and released between 8:35 and 9:05 p.m. 250 air miles due south of Richmond.

The first monitoring of the nursery colony at Milton was on the evening of July 24. We could not gain access to the building until 9:30 o'clock. The monitoring began at 9:45; at this time we discovered some radiation behind a brick wall. This was probably only one bat because the radiation could not be detected a few minutes later. It is probable that this bat had gone to feed. At least two bats were detected later in the night, at 12:45 a.m. At 7:30 a.m. we detected a total of five, a return of 13.8% by the end of the fifth night. We are confident that the bat which we detected at 9:45 had returned some time during the fourth night,

perhaps along with others which had already left to feed before we could monitor the building. The next day we made another check on the colony and at this time we were certain that almost all the bats were back because there were many hot spots and the background was considerably higher than normal. We estimated that at least 85% must have returned by this time.

A check on the colony at Richmond was not made until the morning of July 25, at which time we collected two of our banded bats. We were unable, however, to make an estimate of the returns because the building was still contaminated from the earlier experiment on July 14.

A duplicate of this experiment was performed with the Wilbur Holzback colony near Andersonville, Indiana. On August 4, 14 females and 5 males were banded with radioactive bands and released between 6:00 and 6:25 p.m. 250 miles due north of Andersonville. A check was made following the third night and checks were made continually during the fourth night, but no bats were discovered until 6:00 a.m. following the fourth night. At this time only one bat was discovered. Although several checks were made on subsequent days, no more bats were discovered on the home roost. See Table 1.

TABLE 1

Results of *Eptesicus fuscus* Homing Experiments

Date	Distance Transported	Number Released	Estimated Returns: No.	%	Elapsed time before return
July 14	20 mi. W	20 Ad. F	14–18	70–90	4 hrs. 20 min. – 8 hrs. 45 min.
July 15	40 mi. S	37 Ad. F 10 Ad. M	15–19	32–40	2 nights
July 14	100 mi. N	10 Ad. F 1 Ad. M	8–11	73–100	3 nights
July 20	250 mi. S	36 Ad. F	31	85	4 nights–6 nights
Aug. 4	250 mi. N	13 Ad. F 5 Ad. M	1	6	4 nights

These experiments with *Eptesicus* show that these bats are capable of long and rapid flights. However, as Gifford and Griffin (2) have suggested, this ability is used to a great extent early in the summer and to a lesser extent as the summer progresses. Evidently the group of bats which were taken 250 miles south possessed a much stronger homing instinct than did those which were taken 250 miles north 15 days later.

We believe that in future experiments of this nature more significant results would be achieved for a comparison if both groups of bats were taken from the same general vicinity and released in the opposite direction at the same time.

Summary

Homing experiments with summer nursery colonies of *Myotis lucifugus* and *Eptesicus fuscus* were conducted. Radioactive gold-198 was

used to tag the bats and a portable survey meter was used to locate individual bats in the nursery colonies. From 75-80% of a group of *Myotis lucifugus* released 20 miles west of their home colony returned between 4 hrs. 55 min. and 6 hrs. later. A total of 10% returned not to the home colony but to a nearby colony at the end of 7 hrs. 45 min. A total of 36 *Eptesicus fuscus* were taken 250 miles south and released, and 85% of these returned by the sixth night. Only one *Eptesicus fuscus* of 18 released 250 miles north returned. This was found on the fourth night. Subsequent checks showed no additional returns. Other experiments with *Eptesicus* yielded returns ranging from 31-40% in two nights from a distance of 40 miles to 72-100% in three nights from a distance of 100 miles. All experiments emphasized the value of radioactive tagging, for in none of the experiments did the number of banded bats collected or seen at the home roost exceed 10%.

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