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Notes On The Cave Bats Of Minnesota

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ificantly greater number of progeny than either homozygous *glossy* or *spectacle* females.

The apparent causes of the infertility of the mutant females were disclosed when examination of the internal genitalia was made. It was found that in all cases the spermathecae and pars ovariae, which compose part of the accessory genitalia, were absent in mutant females. The tubular receptacle, which completes the accessory genitalia, was present in all cases and does not appear to differ from that of the normal female. Since it has been observed that the spermathecae and pars ovariae act to store and maintain the sperm before they fertilize the ova, it follows that their absence would result in the failure of most of the sperm to remain viable in the female tract before fertilization. The tubular receptacle might serve to maintain some sperm cells thereby accounting for the partial fertility of the mutant females.

However this fact alone cannot account for the apparently greater fertility of the *glossy/spectacle* females in comparison to the homozygous *glossy* and *spectacle* females, for no difference between the internal structure of the genitalia of the *glossy/spectacle* and the homozygous *glossy* and *spectacle* females was observed. Very likely other factors are involved in the determination of the infertility of the mutant females. The data presented indicate that these unknown factors act to decrease the fertility more completely in the homozygous *glossy* and *spectacle* females than in the heterozygous *glossy/spectacle* females.

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NOTES ON THE CAVE BATS OF MINNESOTA

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Bats have long figured in the legends and arts of people the world over, usually as omens of evil; although in the Chinese culture they have been regarded as bearers of good fortune. The secretive-ness of these creatures have guarded well their habits, and through the ages comparatively little has been learned of their ways.

Because of the scantiness of our information concerning Minnesota forms, this study was undertaken. Although a few notes had been gathered at an earlier date, the problem was first given serious consideration in the fall of 1940. The study is yet young, but much of interest has been learned; and it seems well to set forth the available information at this time.

In Minnesota there are found seven species of bats which fall into two well defined, though arbitrary, groups—those known as tree bats which roost in trees and on cliff faces; and those termed cave bats which gather in caves, buildings, and hollow trees. The

three species of tree bats, red, hoary, and silver-haired bats, are not considered in this paper. They are summer residents only, leaving our state each fall to migrate far southward. The cave bats, on the other hand, remain in greater or lesser numbers throughout the winter season during which time they resort to caves and buildings for shelter.

My study of this latter group has been more or less general in scope, and an effort has been made to gather data on all phases of their life histories. More than 500 bats, including the four species, have been banded with number 1 standard aluminum bird bands placed around the humerus. This banding has permitted individual identification to determine movements within the caves, and it is hoped it will furnish subsequent data on movements between summer and winter roosts and shiftings between caves.

The caves of Minnesota are of two types — the natural limestone caves found principally in the southeastern portion of the state and the artificial caves excavated in sandstone for purposes of raising mushrooms, aging brewery products, and for quarrying abrasive materials. The natural caves are humid and warm, while the artificial caves, generally speaking, are much drier and cooler.

With the advance of the fall season, the cave bats forsake their summer haunts and migrate to the caves to pass the winter. The pipistrelle bats (*Pipistrellus subflavus obscurus*), the little brown bats (*Myotis l. lucifugus*), and the long-eared little brown bats (*Myotis keeni septentrionalis*) reach the caves at a relatively early date, all being found established in winter quarters by early October. The large brown bats (*Eptesicus f. fuscus*) remain abroad until actually forced to seek shelter by inclement weather sometime in mid-November or even later.

The pipistrelle bat is principally a species of the natural caves, and on but three occasions has it been encountered in artificial sandstone caves. Whether in artificial or natural caves, this diminutive species is always found in the innermost chambers where temperatures close to 50 F. prevail and where the relative humidity seldom falls below 90%. Here in these moist caverns, after several days of inactivity, they become laden with droplets of condensed moisture which gives them a strange silvery-white appearance.

It is a solitary species during the winter season; only once have I found a group of them clustered together. This cluster consisted of five individuals which soon separated to hang singly.

The pipistrelle is a relatively new addition to our state faunal list, the first specimen being found by Dr. Gustav Swanson, Dr. Charles Evans, and Mr. W. J. Breckenridge in a cave near St. Peter, Minnesota in 1934. At a later date, Mr. Richard Daggy and Mr. Harold Peters found this species in a Wabasha County cave. This year's study has added four additional counties, Washington, Scott, Goodhue, and Fillmore.

Dr. Donald Hatfield, in preparing his Minnesota check-list of

mammals, assumed that our form of the pipistrelle was *subflavus*. As a matter of confirmation, all prepared specimens from our state were submitted to Dr. Glover Allen who pronounced them to be, without exception, of the subspecies *obscurus*, the northern form.

Oddly enough, no summer specimens of this bat have ever been taken in our state. They likely roost in attics and deserted buildings during this season, and a search will undoubtedly establish their residence in summer.

Only one experiment designed to determine "homing ability" was attempted. A single individual was transported from St. Peter to Minneapolis, banded, and released October 25, 1940. On February 2, 1941 this bat was retaken at its home cave, having traveled a distance of 70 or 80 miles despite the lateness of the season.

The little brown bat is undoubtedly our most common summer species, yet, during the winter season it is almost totally absent from the caves. It is found wintering in large numbers in the caves of the states to the south of us, and it is highly probable that the majority of our summer population migrates to these caves in the fall of the year. This species, when found in our local caves, shows an inclination to form compact clusters on the ceilings.

The relative abundance of the long-eared little brown bat during the summer is unknown. It is reported by some as common, but collections do not bear out this supposition. Only infrequently is it encountered in our caves, but when present shows a tendency to cluster in small recesses of the walls. Both of the last two mentioned species are less exacting in their environmental requirements than is the pipistrelle bat, although they are ordinarily found in the warm and moist chambers.

The large brown bat is particularly hardy and remains abroad late in the season. Only an occasional individual was to be seen in the caves this fall previous to the great storm of November 11 which forced them to seek refuge. A visit to many caves a short while after the storm showed that a great influx had taken place, and in the caves where an accurate count of individuals was maintained, it was noted that bats of this species continued to enter the caves as late as mid-December. It is likely that these unusually late arrivals were individuals which had sought temporary shelter in the face of the sudden storm and later moved to the caves.

In at least one instance the storm wrought a considerable mortality among the large brown bats. During the course of this unseasonable storm, the entrance to one of the two caves at St. Peter used extensively as hibernating quarters by this species was entirely closed by snow. Immediately following the storm, Mr. Meyers, who operates the caves as a tourist attraction, found over a hundred dead large brown bats at the closed entrance. They had evidently been overcome by the raging storm while endeavoring to gain entrance to the cave. Although several other caves near by remained open as available shelters, it appears as though their habit of win-

tering in this particular cave caused them to continue their search for a means of entry until they succumbed.

It was somewhat of a surprise to find the large brown bat to be the most common wintering species, for it is not frequently encountered in summer. In some of the caves, a thousand or more were to be seen, ordinarily clustered together; although many hung singly. A record was made of the sexes of all bats handled, and it was apparent that a tendency toward sex segregation existed. Of 134 bats taken from clusters, 117 were males and but 17 were females. Nearly all single hanging individuals proved to be females.

This bat has been found inhabiting only the sandstone caves, and here they take up positions in the colder and drier portions, not infrequently roosting near the entrances where the temperatures are subject to severe fluctuation in accordance with external conditions. In one instance the temperature recorded next to a group of this species registered 20 F.

By many it has been assumed that bats remain in a state of profound hibernation during the winter months while in the caves. This is far from the truth; banding of individuals clearly showed that they moved about considerably, especially the large brown bats. During these periods of activity, they search for food and take of the moisture condensed upon the walls and ceiling. On several occasions I have observed them lapping up droplets of moisture, and all that have been taken as specimens have dropped well-formed scats containing particles of chitin.

Although this species is social with those of its own kind, I have never seen any of the other species of cave bats clustered with the large brown bats. Perhaps the greater strength and ferocity of the large brown bats is an important factor.

The first large brown bats to be seen abroad this spring were observed in flight on April 12, although they disappeared from the caves at least a week before this date.

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AMPHIBIANS AND REPTILES OF MINNESOTA

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ABSTRACT

Herpetological work in the state is reviewed.

The present work is based largely on the collections of several University departments, plus collections of numerous individuals, including the writer, now assembled as the collection of the Minnesota Museum of Natural History. Material in several smaller institutions in the state was also examined.