

SPECIES OF THE GENUS Myotis IN OKLAHOMA

By

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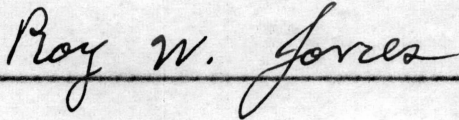
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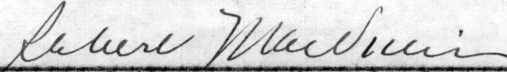
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## PREFACE

At the beginning of this study little was known concerning which species of bats occur in the state. This was especially true of the genus Myotis. Only four species had been recorded, and only two of these had been reported from more than one locality. The caves that harbor bats had not, with a few exceptions, been mentioned by other mammalogists.

Work on the biology and public health importance of bats in Oklahoma of which this study is a part, began on July 1, 1954, and is to continue through August 31, 1956. Because of time limitations this paper covers collections made through March 30, 1956, and covers only the taxonomy and distribution of the genus Myotis. Other material collected has been utilized by several workers on the same project under the general direction of Dr. Bryan P. Glass and will be reported on separately.

The genus Myotis was represented by 96 of the 318 bats preserved during the course of this study. Eight species were included, and new locality records were established for each.

This paper discusses the methods of collection and the identification of these bats. Data are presented to establish the taxonomic position of the forms collected, and maps of their distribution records are included.

Appreciation is due first of all to the project leader, Dr. Bryan P. Glass, for his part in directing this work. Suggestions from him have been invaluable in developing collecting techniques and resolving taxonomic problems. The Oklahoma Department of Health contributed funds that initiated the project in the summer of 1954, and provided a one-half-ton truck for use on the project. The U. S. Public Health Service made continuation of the project possible by a grant, U.S.P.H. Grant E-819, on The Biology and Public Health Importance of Bats in Oklahoma, that became effective in September, 1954. Appreciation is due Dr. Walter W. Dalquest of Midwestern University for information on measuring methods and for verification of certain identifications. Dr. E. Raymond Hall and J. Knox Jones of the University of Kansas are recognized for their help in identifying some specimens. In addition, gratitude is expressed to all the students who took part in collecting, and to the landowners and others who rendered assistance in the field.

Appreciation is extended to Drs. R. W. Jones, W. H. Irwin, G. A. Moore, and D. E. Howell and other members of the faculty for helpful suggestions or other assistance.

The writer wishes to extend appreciation to Charles O. Handley, Jr., United States National Museum; George H. Lowery, Jr., Louisiana State University; William H. Burt, University of Michigan; and H. B. Sherman of DeLand, Florida for the loan of valuable specimens used in making comparisons with specimens from Oklahoma.

For convenience the following abbreviations are used in the text: United States National Museum, USNM; University of Michigan Museum of Zoology, UMMZ; Louisiana State University Museum, LSU; Oklahoma

Agricultural and Mechanical College Museum of Zoology, ; Harvard  
University Museum of Comparative Zoology, MCZ; and rican Museum of  
Natural History, IH.

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## INTRODUCTION

Bats of the genus Nyctis were first reported as occurring in Oklahoma by Howard Cross (1917) who listed N. subulatus [sic] and N. lucifugus in a semi-popular bulletin prepared for the Oklahoma Geological Survey. The species were listed without reference either to existing specimens or to localities. He called N. subulatus the big-eared bat, which may have reference to the species keeni, as it was commonly designated as subulatus at that time. Miller and Allen (1928) listed three specimens of N. velifer incautus from Fort Reno. Blair (1939) gave locality records for three species, two (N. subulatus melanorhinus and N. griseosens) of which were new records for the state. Glass (1951) reported collecting N. subulatus melanorhinus from the Black Mesa Region. His specimens are herein designated as N. yumanensis. N. sodalis was reported (Glass, 1955) from Adair Bat Cave. Doubtless, other workers have collected Nyctis in Oklahoma, but there are no additional published records.

Dr. Bryan Glass, Okla. A. & M. College, of the Dept. of Zoology, began studying the bats of Oklahoma in 1947, and has collected bats from many localities in the state. Most of these are deposited in the Oklahoma A. & M. College Museum of Zoology. The collection, with additions made during the present study has supplied the material for this report.

On September 1, 1951, the U. S. Public Health Department provided funds for a study of the bats of Oklahoma for the purpose of determining their relation to public health with particular emphasis on rabies and other pathogenic conditions that might be transmitted to man or domestic animals.

An understanding of the taxonomic status and distribution of a group of animals in an area is basic to further studies concerning movements, habitat requirements, behavior, etc. The study of Myotis was made in correlation with the general study of the importance of bats to public health. Bats were collected throughout the state and records kept on the collections.

Because of the lack of knowledge of the bats of the state, and the large amount of material collected, many new problems of taxonomy and distribution have become apparent. This report deals only with the genus, Myotis; other forms require further investigation. An effort was made to consolidate the records of distribution already reported and all new records into a single report. These records were plotted on state maps. (Figures 1-8).

## METHODS

### Collection

The collecting of any animal raises specific problems related to the habits of the species. This is particularly true for bats which not only are capable of flying, but also are nocturnal or crepuscular. Different species of bats fly in various patterns and at different altitudes. They also vary in their choice of roosting places, some prefer caves, whereas others dwell in forests, or are found about buildings. In some species, as in Nyctis lucifugus, the choice of resting sites varies with the season.

Different species appear in a certain area at different times. For example, Nyctis yanamensis has been reported to be found on the feeding grounds only after dark (Howell 1919).

Four principal methods of collection were used; (1) Exploration of caves; (2) Shooting; (3) Netting; (4) Examination of buildings. Exploration of caves. The term cave is applied to all underground chambers accessible to bats. The difference between caverns and caves as described by Twente (1955) is considered unimportant for the purpose of this paper. Some caves listed are scarcely more than a single room formed by crevices in the rocks.

The geographical location, topography, soil types, and climate of Oklahoma result in a wide variation of biotic districts being found within its borders. These have been described by Blair (1938) and are

used in this paper for describing certain areas.

The main regions of Oklahoma where caves are to be found are the Ozark district of the northeast where the caves are formed in limestone and chert, the gypsum hills area of the west where caves are formed by erosion of gypsum rock and clay, and in the Panhandle where there are numerous small caves formed by the erosion of sandstone. Many of the caves have streams running through them or contain pools of standing water. Relatively few are without either.

The walls and roofs of the caves vary from comparatively smooth surfaces, where formed by the dissolution of solid rock, to rough and irregular ones, where formed by stratum faults and breaks in the rock or gypsum. Some are composed almost entirely of great boulders with the walls, roof, and floor shaped by their outlines.

Caves were located by gathering information from interested persons, going to the vicinity and inquiring of local residents, and often by a considerable amount of searching. The locations as listed in this paper were determined by checking mileage along the roads with the speedometer. The distances from the parking point to the cave were either paced or estimated, depending upon convenience. Positions were then plotted on county maps with a scale of one-half inch to the mile. Since this method is subject to errors, locations of caves near section lines may not be exact. However, this listing should greatly facilitate locating of the caves by other workers.

Equipment for collecting in caves included flashlights or electric head lamps, paper bags, and a bat net. The term 'bat net' is used to indicate a net resembling an insect net but with a longer handle.

Ordinary paper bags were found to be convenient in keeping the species separate because they were easily labeled, and could be used once and discarded. Two bags, one inside the other, were sometimes used to reduce the chance of escape. Polyethylene bags were used when bats were to be examined for ectoparasites.

Practically every cave of any size that could be located was examined for bats or for signs that bats had previously inhabited it. Thirty-eight caves in widely scattered parts of the state were inspected. In addition, several smaller holes that could scarcely be called caves were investigated. Caves were visited as often as convenience permitted or conditions demanded.

Bats were found hanging from the walls or roofs of the caves or hidden in cracks or crevices. Those located were taken by hand or with a longhandled net.

Wherever possible the names used for caves are those established and in local use. In cases where no known names were available, short names were selected, based either on the location of the cave or the name of the landowner.

#### Bat cave localities.

Adair Bat Cave: Sec. 7, T1N, R24E of I.M., four miles south of Kansas, Adair County.

Alabaster Caverns: Sec. 33, T26N, R18W of I.M., five miles south, two miles west of Freedom, Woodward County.

Anderson Creek Caves: Sec. 17, T27N, R17W of I.M., three miles east of Camp Houston, Woods County.

Black Hollow Cave: Sec. 20, T22N, R22E of I.M., one mile east of Spavinaw Hills Park, Delaware County.

Bower's Trail Cave: Sec. 17, T1N, R22E of I.M., four and one-half miles northwest of Honobia, Pushmataha County.

Boy Scout Cave: Sec. 33, T26N, R24E of I.M., three miles east, six and one-half miles north of Grove, Ottawa County.

Cave Springs Cave: Sec. 34, T15N, R24E of I.M., one mile east, three and one-half miles north of Bunch, Adair County.

Cochran's Trout Cave: Sec. 3, T22N, R25E of I.M., five miles east of Sycamore, Delaware County.

Comer's Cave: Sec. 30, T22N, R15W of I.M., five miles south, two miles east of junction of U. S. Highway 281 and Oklahoma Highway 15, Major County.

Corn Caves: Sec. 5, T11N, R15W of I.M., five and one-half miles north, two miles west of Corn, Washita County.

Crystal Cave: Sec. 31, T14N, R24E of I.M., three miles south, two miles west of Bunch, Adair County.

Dunaway Cave: Sec. 13, T23N, R22E of I.M., five miles west, three and one-half miles north of Jay, Delaware County.

Duncan Cave: Sec. 8, T20N, R25E of I.M., two miles south, one and one-half miles east of Colcord, Delaware County.

Griever Creek Cave: Sec. 30, T22N, R15W of I.M., three miles east, four miles south of junction of U. S. Highway 281 and Oklahoma Highway 15, Major County.

Half-Moon Cave: Sec. 27, T18N, R21E of I.M., one-half mile north of Gideon on Fourteen-Mile Creek, Cherokee County.

Icebox Cave: Sec. 33, T26N, R19W of I.M., six miles south, seven and one-half miles west of Freedom, Woodward County.

Iron Door Cave: Sec. 19, T22N, R22E of I.M., one-half mile east of Spavinaw Hills Park, Delaware County.

Jester Cave: Sec. 35, T19N, R24W of I.M., three miles north of Jester, Greer County.

Kiamichi Mountain Cave: Sec. 27, T2N, R24E of I.M., three and one-half miles south of Muse, LeFlore County.

Longhorn Mountain Cave: Sec. 2, T5N, R15W of I.M., three miles south, one-half mile east of Sedan, Kiowa County.

Marehew Cave: Sec. 17, T29N, R17W of I.M., 13 miles north, three miles east of Camp Houston, Woods County.

Mystic Cave: Sec. 18, T25N, R4E of I.M., 10 miles south, one and one-half miles east of Sulphur, Murray County.

Pigeon Cave: Sec. 11, T5N, R1E of C.M., three miles east, one mile north of Kenton, Cimarron County.

Radzinski Mountain Cave: Sec. 22, T3N, R17W of I.M., one-half mile north, one and one-half miles west of Mountain Park, Kiowa County.

Reed Caves: Sec. 28, T15N, R24W of I.M., three miles west, one and one-half miles south of Reed, Harmon County.

Selman's Cave: Sec. 33, T26N, R19W of I.M., four miles south, seven miles west of Freedom on Trader's Creek Woodward County.

Sutherland Caves: Sec. 10, T22N, R25E of I.M., five and one-half miles east of Sycamore, Delaware County.

Spavinaw Creek Cave: Sec. 15, T22N, R22E of I.M., three miles west, one-half mile south of New Eucha, Delaware County.

Stansbury's Cave: Sec. 11, T21N, R24E of I.M., seven miles south, four and one-half miles east of Jay, Delaware County.



Tesse Equite Cave: Sec. 35, T5N, R1E of C.M., two miles east, three miles south of Kenton, Cimarron County.

Vickery Caves: Sec. 5, T22N, R16W of I.M., two and one-half miles west of junction of U. S. Highway 281 and Oklahoma Highway 15, Major County.

Weatherford Caves = Corn Caves

Windmill Cave: Sec. 25, T5N, R11W of I.M., 15 $\frac{1}{2}$  miles south, one and one-half miles west of Carnegie, Kiowa County.

Wooden Door Cave: Sec. 21, T22N, R22E of I.M., two and one-half miles north of Topsy, Delaware County.

Shooting. Shooting was attempted at about 40 points in the state. Shotguns of .410 gauge were used with shot sizes #9 or #12.

At least a few nights were spent in each of the major biotic districts in an attempt to obtain a representative sample. Usually a site was selected on a stream or lake. Bats concentrate over the water and are also more easily seen, particularly when flying low. Shooting is also easier as there is a more open firing field.

Most shooting took place at dusk while there was still enough natural light to illuminate the targets. Some shooting was done after dark using the truck lights for flooding the area with light and a plug-in spotlight for better illumination of the bat. Relatively few bats were taken by this method, and the expenditure of shells was high. However, some species were rarely taken by any other means.

Netting. Netting was done with Japanese mist nets. Dalquest (1954) described the use of the nets in collecting bats in Mexico. He reported good returns from their use when the nets were set under proper conditions.

When the present study of Oklahoma bats began in July of 1954, the equipment included three mist nets. Two of these were each 10 meters long, the other, 15 meters. All were of 3/4-inch mesh measured along the strand from corner to corner.

At first the nets were set among trees, but no bats were taken. Later the nets were hung in various places in the open, among the trees, or over water where bats had been seen flying. Only a single capture was made, and after setting the nets in different situations this method of collecting was abandoned for some time.

Martin and Martin (1954) reported success in capturing tropical bats by closing the mouths of caves with min. nowseines. They stated that only bats attempting to enter were taken; that although approximately 100 bats were seen flying about inside the cave, they could not be driven into the seine even by gunfire.

On June 30, 1955, a mist net was placed across the mouth of Cave Springs Cave. This cave has a vertical opening about 24 feet wide by eight feet high. The net was hung after dark, so that it covered as much of the opening as possible, and was left unattended for about two hours. When first examined it contained about 10 bats. An additional hour was spent attending the net, and in the course of the evening a total of 29 bats of four species were taken.

Several other caves were closed with nets during the year, usually resulting in good catches (Glass, 1956). Better catches were made at caves with large vertical mouths but catches were made at caves with various types of openings. In caves with horizontal openings the net was hung loosely over the opening and was set as low as possible.

At Radziminski Mountain Cave the net was set vertically inside the chamber. Several bats were taken among which were two Myotis subulatus. On two occasions nets were productive when hung horizontally in the open hallway of a building where bats were roosting on the rafters.

As indicated by Dalquest the effectiveness of these nets depends on the position and locality where they are set. The present study illustrates the productivity of a net set across the mouth of a cave. Bats were usually taken as they attempted to enter, but often also as they attempted to leave. It was noted that the net should be hung slightly slack, as otherwise the bats frequently rebound from the mesh and fall clear. A stiff breeze causing the net to balloon caused a marked decrease in effectiveness.

Examination of buildings. Many buildings are known to harbor bats. Usually these are abandoned or little-used buildings, but sometimes dwellings or commercial buildings are infested.

Examination of buildings required considerable time in that it was necessary to obtain the owner's permission before entering. In addition, the bats were often in crevices under boards or roofing and were quite inaccessible. It was with considerable difficulty that such bats were taken from their roosts without causing damage to the building. A pair of long forceps was found to be useful for this purpose, although it was not always possible to reach the bats with any device. Flashlights and ladders are necessary for this type of collecting.

### Preservation

A representative sample of each species was retained from every locality where it was taken. All specimens were preserved as dried skins and skulls, prepared in the manner described by Hall (1955). The skulls were labeled, dried, and cleaned by the use of dermestid beetles. After being cleaned of flesh they were degreased in ammonia water, rinsed, and dried. Skins and skulls were catalogued and deposited in the O.A.M.C. Museum of Zoology.

### Identification

Keys by Krutzsch (1954), Glass (unpubl.), and Davis (unpubl.) were used for tentative identification to species. Identity of subspecies was based on published descriptions, specimen comparisons, and known ranges of the different forms.

For color comparisons and nomenclature, Ridgway's color standards (1912) were used. Capitalized color terms are from Ridgway.

Specimens were measured and measurements checked against those of specimens examined by Miller and Allen (1928). For comparison of sizes of Myotis austroriparius gatesi, a form recently described (Lowery, 1943) four specimens were obtained and measured. Because of doubt concerning the identity of the Oklahoma subspecies of yumanensis, a series of these bats from Texas was obtained and compared with the Oklahoma specimens.

A few identified skins and skulls of every form under consideration were obtained for comparison of skull characters, hair texture, and coloration.

Finally, specimens of species new to the state were taken to Drs. W. W. Dalquest, Midwestern University, and E. R. Hall, Kansas University, for verification of identity.

Catalogue numbers of specimens examined are listed in Appendix B.

Measurements. Some variation in methods of measuring bats seems to exist among mammalogists. The variation exists because of the failure of some workers to give an adequate description of their methods. Standardized methods would be desirable because measurements made by a reliable worker could be utilized and remeasuring made unnecessary.

All measurements included herein (Tables I-XVI), unless otherwise specified, were taken with a dial caliper graduated to tenths of a millimeter. Measurements smaller than tenths of a millimeter were estimated. Skull measurements were taken under a binocular microscope.

The following is a description of the measurements taken by the writer. A graphic comparison of skull measurements is contained in Appendix A.

#### Skull

Total length: shortest distance along the longest axis of the skull, excluding incisors.

Condylbasal length: the distance from the anterior edge of the incisive alveolus to the posteriormost margin of the occipital condyle.

Zygomatic breadth: the greatest distance between the outside margins of the zygomatic arches, taken perpendicular to the long axis of the skull.

Interorbital constriction: the width of the interorbital constriction at its narrowest point.

Breadth of brain case: the greatest width of the brain case, usually directly behind the zygomatic arches.

Occipital depth: vertical distance from the notch formed by the basioccipital to the top of the cranium, excluding the sagittal crest.

Mandible: greatest length of the mandible, not including the lower incisors.

Maxillary tooth row: distance from the front face of the canine, excluding cingulum, to the posteriormost point on the last molar.

Maxillary breadth at  $M^3$ : greatest distance between the outside surfaces of the third molars.

Mandibular tooth row: distance from the front surface of the canine, excluding cingulum, to the posteriormost point on the last molar.

Five measurements were taken before the animal was skinned.

These are well standardized as described by Cockrum (1955) and need no further explanation. In many instances the writer had to rely on these measurements as taken by students. The skeletal parts that are left in the dried skin and utilized for comparison were measured as described below:

## Skin

**Forearm:** the length of the bone and covering skin, from the end of the elbow to a shallow but distinct notch on the inside of the wrist which marks the end of the bone.

**Third metacarpal:** the length of the bone itself. The insertion of the bone can usually be determined through the dried skin.

**Fifth metacarpal:** length of the bone itself.

**Tibia:** self explanatory. The bone should be disarticulated with the femur at the joint when preparing the skin.

**Thumb:** length of the thumb from the insertion at the wrist to the tip of the claw.

## DISCUSSION

### The genus Myotis

Most bats belonging to the genus Myotis have no specialized external structures or morphological features that set them off from other members of the family Vespertilionidae. The group is characterized by the lack of specialized structures.

The primitive condition of the genus is exhibited by the dentition. Myotis has the maximum number of teeth found among the Chiroptera, and the teeth have a full complement of primary and secondary cusps, a condition which would be expected in a primitive member of the order.

The dental formula is  $i \frac{2}{3}, c \frac{1}{1}, p \frac{3}{3}, m \frac{3}{3} = 38$ .

The number of teeth (38) and the long slender tragus are the most easily recognized characters that set off Myotis from other Vespertilionidae. The tail, as in all members of the family, extends to or only slightly beyond the margin of the interfemoral membrane.

The vespertilionid bats of the United States are all insectivorous, feeding mainly on flying insects. Food habits are difficult to study because the food is thoroughly masticated and only the smaller scales or tough chitinous parts are left intact. Some beetles, moths, Diptera, and other insects have been identified from stomach contents.



Bats of the genus Myotis are found in caves, abandoned buildings, hollow trees, and cellars. Dalquest (1947) reported that the species M. yumanensis had so adapted itself to man-made structures that he found no instance of its being found in natural sites. This was not found by the writer to be true in Oklahoma. Further discussion on habitat preference is presented under the accounts of species.

Breeding occurs in late fall and winter. At other times of the year, the adult males are usually found separated from the females. This condition was noticed in lucifugus, griseus, velifer, and yumanensis in this study. Dalquest (1947) reported yumanensis males occurring separately from the females. Stegeman (1954) found only young males with female lucifugus.

Delayed fertilization has been reported in some species of Myotis. Copulation does occur in the fall as early as September, and during the winter (Guthrie, 1933). She concluded that copulation takes place again in the spring, the spermatozoa from previous inseminations having been destroyed or voided.

In this study one specimen of velifer was found active on December 10 in one of the Wickery Caves where the other bats were dormant. The bat was heard emitting continuous squeaks while the others were quiet. Investigation disclosed that this was a male in full erection. It was fully active and its body was warm to the touch. The other four in the cluster, one male and three females, were quiescent.

The young of Myotis are born in late spring and early summer. The exact dates vary slightly with the species. M. velifer in Oklahoma bear young in late June and early July. Observations have disclosed

that some of the young of grisescons are born in early June and are all able to fly by July 24. Well-developed embryos were found in yumanensis from Cimarron County on June 10. Gockrum (1956) reported lucifugus born as late as July 12 in Illinois. M. austroriparius bear young in May in Florida (Hamilton, 1943), keeni in July in New York (Hamilton, 1943), and subulatus in the latter part of May in California (Koford & Koford, 1948).

Wimsatt (1945) estimated the gestation period of lucifugus to be from 50 to 60 days duration.

Most species of Myotis bear only one young per year. This was found in this study to be the condition in velifer, grisescons, and yumanensis. M. lucifugus, keeni (Hamilton, 1943) and subulatus (Koford and Koford, 1948) have been reported to bear only one young. H. B. Sherman (1930) found that out of 29 austroriparius females examined, 21 had either two young or two embryos, while only eight had a single young.

There are no records to indicate that whole populations of Myotis make extensive periodic migrations; rather they hibernate during the winter in temperate climates. Some movements do occur from cave to cave. Griffin (1945) reported banded lucifugus to have moved as far as 153 miles and sodalis, keeni, and subulatus more than 10 miles from the banding locality. M. velifer has also been found to move from cave to cave (Glass, pers. comm.).

Several enemies of bats have been recognized. Horned owls were often found in bat caves in the western part of Oklahoma. Examination of the pellets showed that they fed regularly on bats (Tadarida).

Beer (1953) reported observing a screech owl feeding on bats in a cave entrance. In Kansas sparrow hawks and some buteos were found to prey on bats (Twente, 1954). Raccoon tracks are very common in bat caves. Twente (1955) found by experiment that raccoons do eat bats. He also reported finding bat remains in raccoon feces. Another predator reported by Twente (Ibid.) was the rat snake, Elaphe guttata emoryi. He reported that this snake was frequently found in caves.

One interesting habit of Myotis is their tendency to form clusters, which may contain a few or a great many individuals. M. velifer and grisescens are the only species in the state found in clusters of a thousand or more. Other species are found in large clusters nearer the center of their range. Clustering occurs both in the nursing period and during hibernation.

Records on longevity show that some Myotis may live for at least 12 years. Banding (Cockrum, 1956) has resulted in the establishment of the following age records: lucifugus, 12 years, keeni, five years; sodalis, 10 years; and subulatus, nine years.

Key to the Species of the Genus Nyctis in Oklahoma

- 1. Total length averaging more than 95 millimeters . . . . . 2
- 1'. Total length averaging less than 95 millimeters . . . . . 3
  
- 2. Wing membrane attached to ankle; hair unicolor to base . . . . .  
     . . . . . grisescens
- 2'. Wing membrane attached to base of toes; hair darker  
     at base . . . . . velifer incautus
  
- 3. Ear large, 16 millimeters or more . . . . . keeni septentrionalis
- 3'. Ear usually less than 16 millimeters . . . . . 4
  
- 4. Calcar only slightly if at all keeled . . . . . 5
- 4'. Calcar keeled (if not, then hair with three distinct  
     color bands . . . . . 7
  
- 5. Hair with very glossy tips . . . . . lucifugus lucifugus
- 5'. Hair without very glossy tips . . . . . 6
  
- 6. Forearm more than 36 millimeters; wing membrane sometimes  
     attached at ankle . . . . . austrioriparius gatesi
- 6'. Forearm less than 36 millimeters; wing membrane not  
     attached at ankle . . . . . yumanensis yumanensis
  
- 7. Forearm more than 36 millimeters; hair with three  
     distinct color bands . . . . . sodalis
- 7'. Forearm less than 36 millimeters; face and ears  
     black . . . . . subulatus melanorhinus

## Account of Species

### 1. Myotis lucifugus lucifugus (Le Conte)

Myotis lucifugus lucifugus was reported from Oklahoma by Cross (1917). However the first verifiable records were established during the present study on the basis of a specimen taken from the cafe building at Beaver's Bend State Park in August of 1954. It was found hanging alone on the wall of the cellar. In the summer of 1955 the park was again visited. The manager reported that he had seen bats in the youth camp area. Droppings were noticed on the ground at the corners of several buildings and investigation resulted in the discovery of the bats hiding under the corner boards. These proved to be Myotis lucifugus and Eptesicus fuscus. It was possible to dislodge these by using a pair of 12" forceps and a series of 16 was secured.

The park is the only locality where these bats have been taken. This is in the southern edge of the Ouachita district where caves are scarce. As they are known to frequent caves, and the Ozark area is well within their expected range, further collecting in that area should yield additional records.

Type. No type specimen was designated, but a typical lucifugus in the British Museum is labeled "Vespertilio lucifugus, United States, Major Le Conte". This specimen may be one of the specimens upon which the original description was based. The type locality is in Georgia, probably Liberty County. (All information concerning Types, unless otherwise stated, from Miller and Allen, 1928).

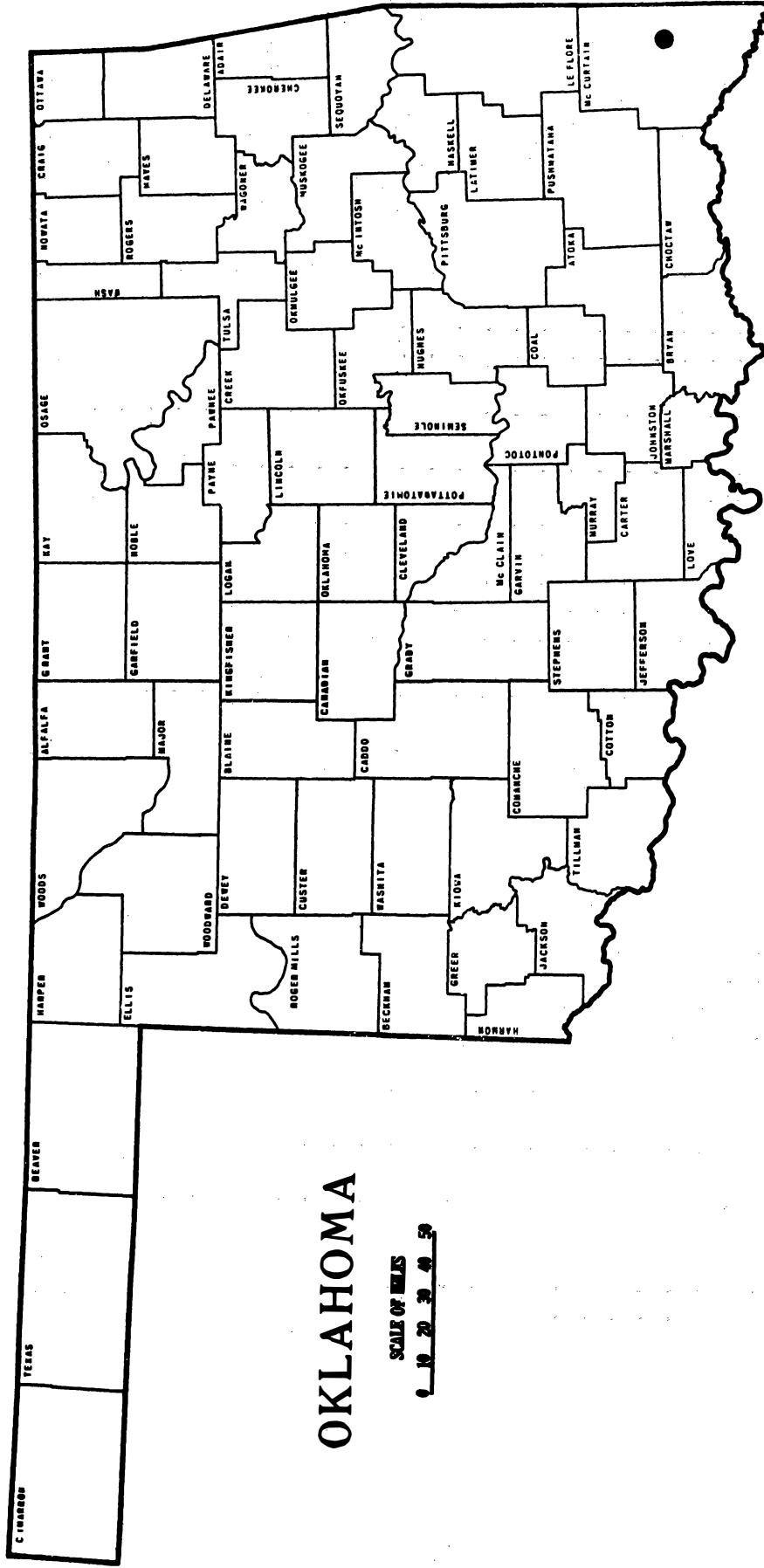


Figure 1. Distribution records of Myotis lucifugus lucifugus (Le Conte)

TABLE I<sup>1</sup>EXTERNAL MEASUREMENTS IN MILLIMETERS OF Myotis lucifugus lucifugus (Le Conte)

Cat. No.	Total Length	Tail	H. Foot	Ear	Tragus	Forearm	Third Metacarpal	Fifth Metacarpal	Tibia	Thumb
(From Beaver's Bend State Park, McCurtain Co.)										
2907	87	40	10	15	8	37.1	33.2	31.0	14.9	6.3
2915	89	38	10	14	7	36.2	32.4	30.1	14.9	6.3
2912	87	37	10	14	7	36.5	32.6	31.2	14.7	6.3
2908	88	38	10	15	8	36.5	34.0	32.5	14.8	6.0
2905	88	38	10	16	9	36.4	32.9	31.0	14.2	5.9
2910	90	37	10	14	7	36.0	32.9	30.9	15.1	6.6
2906	87	39	10	13	8	36.0	32.3	31.0	14.4	6.5
2911	87	38	10	14	7	34.7	32.0	30.0	14.3	6.0
2901	89	39	10	15	8	36.5	33.5	31.2	14.7	6.1
2332	86	36	11	14	7	36.7	33.1	29.8	15.0	5.8
2913	88	38	10	14	7	36.8	32.5	30.5	14.3	6.4
2909	87	36	10	15	8	36.9	33.0	30.6	15.4	6.4
2904	83	36	10	14	8	35.1	31.4	29.1	14.1	5.9
2903	86	44	10	14	7	35.3	32.7	30.2	14.2	6.3
2914	88	37	10	15	8	33.9	30.8	28.7	13.6	6.5
2902	92	43	10	15	8	35.8	33.1	31.0	14.9	6.4
Mean	87.6	38.4	10.1	14.4	7.6	36.0	32.7	30.6	14.6	6.2

<sup>1</sup>The arrangement of data in this and ensuing tables is patterned after Miller and Allen.

TABLE II

SKULL MEASUREMENTS IN MILLIMETERS OF Myotis lucifugus lucifugus (Le Conte)

Cat. No.	Total Length	Condylbasal Length	Zygomatic Breadth	Interorbital Constriction	Breadth of Brain Case	Occipital Depth	Mandible	Maxillary Tooth Row	Maxillary Breadth at P <sup>3</sup>	Mandibular Tooth Row
2910	14.10	13.41	9.04	3.96	7.33	5.03	10.10	5.10	5.69	5.39
2915	14.55	13.75	8.92	4.00	7.42	5.02	10.41	5.27	5.61	5.56
2914	14.27	13.63	9.07	4.05	7.18	4.81	10.18	5.27	5.58	5.50
2901	14.39	---	--	4.32	7.38	--	10.28	5.13	5.81	5.48
2911	14.47	13.70	9.00	3.95	7.36	5.03	10.61	5.37	5.82	5.74
2912	14.30	13.55	9.07	4.10	7.57	4.85	10.41	5.20	5.80	5.54
2909	14.45	13.82	9.02	4.00	7.20	4.90	10.62	5.20	5.67	5.50
2903	14.16	13.40	--	3.79	6.99	4.84	9.94	5.09	5.67	5.40
2908	14.31	13.66	8.92	4.05	7.46	5.10	10.28	5.27	5.64	5.51
2902	14.44	13.66	9.09	4.06	7.58	5.16	10.35	5.22	5.68	5.53
2906	14.45	13.66	8.92	3.90	7.29	4.82	10.09	5.22	5.82	5.48
2913	14.41	13.81	8.99	4.04	7.23	5.10	10.45	5.17	5.77	5.51
2904	14.37	13.45	--	3.94	7.35	4.94	10.45	5.30	5.56	5.58
2907	14.30	13.62	9.04	4.05	7.34	5.10	10.07	5.20	5.63	5.45
2332	14.16	13.61	8.87	4.21	7.39	4.95	10.52	5.20	5.58	5.48
Mean	14.34	13.62	9.00	4.03	7.34	4.98	10.32	5.21	5.69	5.51

(From Beaver's Bend State Park, McCurtain Co.)



Distribution. M. lucifugus lucifugus is found throughout the forested parts of the United States, Alaska and Canada, north and east of the Rocky Mountains. It is also found on the islands off the East Coast. (All range statements from Miller and Kellogg, 1955).

Description. Measurements in millimeters (average and extremes) of 16 specimens from McCurtain County. Total length 87.6 (83-92); tail 38.4 (36-44); hind foot 10.1 (10-11); ear 14.4 (13-16); tragus 7.6 (7-9); forearm 36.0 (33.9-37.1). The pelage is exceptionally long and lax with long glossy tips of rich brown. Oklahoma specimens have whitish tips to the hairs below. The hairs at their bases are blackish.

Oklahoma records. McCurtain Co., Beaver's Bend State Park (OAM).

Remarks. The skins of lucifugus taken in Oklahoma agree with the description of the form found west of the Mississippi by Miller and Allen (1928). The color above is a glossy olive-brown, having a rather bronzy appearance. The tips of the hairs below are whitish, differing in this respect from the buffy color found in specimens from the Northeast. Specimens, from Missouri, that were examined resemble Oklahoma skins, but because of discoloration the true color of the hair below was difficult to determine. No cranial distinctions were detected.

2. Myotis yumanensis yumanensis (H. Allen)

Oklahoma is on the eastern edge of the range of M. yumanensis yumanensis. In 1949 a series of these bats was collected by a party from Oklahoma A. & M. led by Dr. Glass. A number of these were found

in a cave in Tesse Equite Canyon and other specimens were shot on N. Carrizzo Creek, both in the Mesa de Maya district of the Panhandle. They were erroneously assumed at that time to be the species subulatus.

In June of 1955, Dr. Nelson Cooley and the writer returned to the Panhandle to collect bats. In the cave where the party collected in 1949, a cluster of nine or 10 bats were found hanging from the roof. Seven of these were collected and preserved. All were pregnant yumanensis females.

Some additional specimens were shot near the mouth of N. Carrizzo Creek in August, 1953. They were killed with the aid of artificial light. All individuals taken were flying very low above the surface of the water. Dr. Glass recalled that those shot in 1949 were flying in the same manner. By comparison the one specimen of subulatus, shot in that area, was flying at least 10 feet above the ground. Previous efforts by Cooley and Ward in the middle of June to shoot yumanensis had been unsuccessful. It is not known whether this was due to the absence of flying bats at the early date or to the fact that they were hard to detect near the surface of the water.

Examination of caves in the area in August gave negative results. Mist nets were hung one night each at both Pigeon and Tesse Equite caves, but only Antrozous pallidus was taken.

Insofar as known no collecting has ever been done by anyone in the Mesa de Maya area during the winter, and no winter records for the species have been established.

Type. In Allen's description of this bat he mentioned four specimens (USNM Nos. 5387, 6019-6021) from Old Fort Yuma, Imperial

County, California from the right bank of the river, opposite Yuma. These have apparently been lost. (Miller and Allen, 1928).

Distribution. M. y. yumanensis is found in the arid regions of the great basin, from the Sierra Nevada Mountains of California east to western Texas. Its range extends south into Baja, California and the State of Durango, Mexico.

Description. Measurements in millimeters (average and extremes) of 21 adults from Cimarron County. Total length 84.3 (78.0-89); tail 36.9 (34-40); hind foot 9.2 (8-10); ear 13.9 (12-15); tragus 8.0 (7-9); forearm 34.3 (32.3-35.4). In Oklahoma specimens the hair above is tipped with Tawny Olive to Buffy Brown. The hair on the underparts is tipped with Pale Cartridge Buff. The bases of the hairs both above and below is a Dusky Neutral Gray.

Oklahoma records. Cimarron Co., Tesse Equite Cave (OAM), mouth of North Carrizzo Creek (OAM), and six miles north of Kenton (OAM).

Remarks. The Oklahoma form has been assigned with some hesitancy to the subspecies yumanensis. A considerable color variation exists between the skins from Oklahoma and those examined from Rice, Arizona. Not only are the Oklahoma skins darker, but the fur is slightly longer. One skin from Clayton, N. M. resembled ours both in size and color. This skin is listed as atypical by Miller and Allen. Further cause for suspicion is provided by the average total length of 78.55 mm. for eight skins from Texas and Arizona compared with 82.7 mm. for twelve specimens from Oklahoma.

Although it falls outside the scope of the present study, these data suggest the need for a taxonomic review of the species yumanensis.

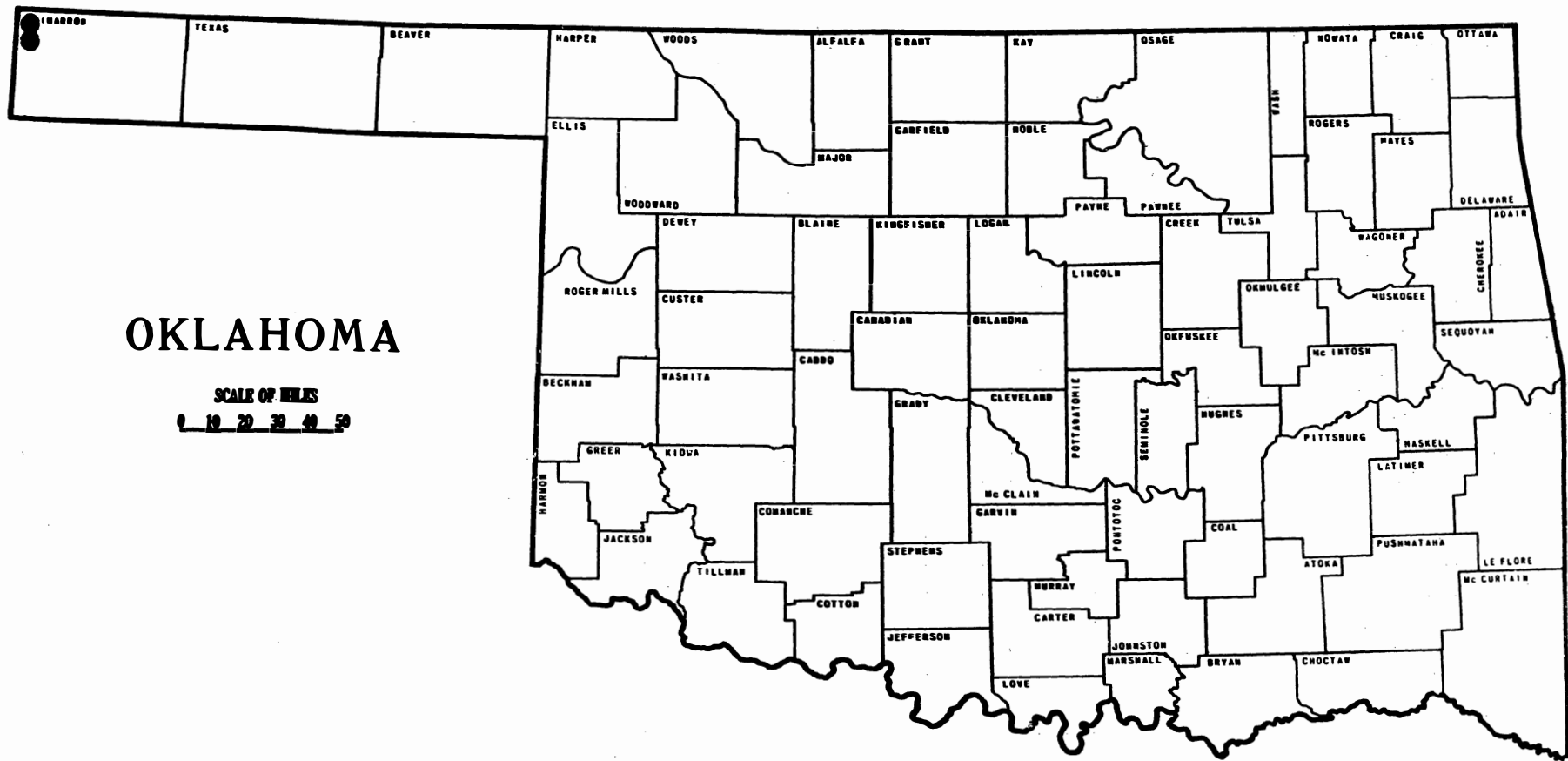


Figure 2. Distribution records of Myotis yumanensis yumanensis (H. Allen)

TABLE III

EXTERNAL MEASUREMENTS IN MILLIMETERS OF Myotis yumanensis yumanensis (M. Allen)

Cat. No.	Total Length	Tail	H. Foot	Ear	Tragus	Forearm	Third Metacarpal	Fifth Metacarpal	Tibia	Thumb
(From Tesse Equite Cave, Cimarron Co.)										
1464	83	36	9	14	9	34.7	31.5	30.4	14.5	6.0
1473	87	--	9	14	9	34.8	32.0	29.8	14.2	6.0
1472	84	37	9	14	8	35.3	33.0	30.6	15.3	6.0
1465	85	37	9	14	9	35.4	33.0	30.9	15.2	5.5
1474	89	40	10	14	9	34.8	33.3	31.6	15.4	6.3
984	--	--	--	--	--	32.4	30.8	29.3	--	--
989	85	--	9	--	--	34.9	32.8	30.7	15.0	6.2
2888	84	35	10	15	8	33.6	32.1	30.3	13.9	6.3
1470	85	37	9	15	8	35.0	32.2	30.3	14.3	6.1
2887	84	34	10	14	8	34.5	31.5	29.9	14.6	6.4
1466	87	38	10	14	8	35.3	33.5	31.9	15.1	6.3
1472	88	37	9	14	8	33.5	31.8	29.0	13.9	5.8
973	82	38	10	15	8	35.3	32.2	30.6	14.8	5.9
972	82	34	9	12	7	34.8	32.6	31.0	15.1	5.9
(From 6 miles north of Kenton, Cimarron Co.)										
980	78	38	8	13	8	32.3	30.4	28.8	14.4	5.8
(From mouth of North Carrizzo Creek, Cimarron Co.)										
2893	88	40	10	14	7	34.0	31.5	30.0	13.7	6.1
2894	80	35	9	14	7	34.4	31.3	29.1	13.3	5.3

TABLE III (Continued)

SKULL MEASUREMENTS IN MILLIMETERS OF *Myotis myotis myotis* (H. Allen)

Cat. No.	Total		Ear	Tragus	Forearm	Metacarpal	Third	Fifth	Tibia	Thumb
	Length	Tail								
2896	85	35	13	7	34.3	32.2	30.2	30.2	15.0	5.9
2899	85	40	14	9	32.5	30.8	29.0	29.0	15.7	5.7
2890	86	38	15	9	35.0	32.7	31.0	31.0	14.6	6.4
2895	83	36	14	8	34.7	--	30.0	30.0	14.7	6.6
2897	82	36	13	7	--	--	--	--	--	--
Mean	84.3	36.9	13.9	8.0	34.3	32.0	30.2	30.2	14.6	6.0

TABLE IV

SKULL MEASUREMENTS IN MILLIMETERS OF Myotis yumanensis yumanensis (H. Allen)

Cat. No	Total Length	Condylobasal Length	Zygomatic Breadth	Interorbital Constriction	Breadth of Brain Case	Occipital Depth	Mandible	Maxillary Tooth Row	Maxillary Breadth at $M^3$	Mandibular Tooth Row
(From Tesse Equite Cave, Cimarron Co.)										
1464	13.92	13.10	8.50	3.74	7.00	5.03	10.12	5.17	5.54	5.48
1473	14.22	13.35	--	3.70	7.16	5.23	10.21	5.20	5.60	5.54
1471	14.04	13.03	8.51	3.80	7.09	5.16	10.14	5.20	5.45	5.33
1465	14.04	13.32	--	3.63	7.18	5.04	10.31	5.22	5.45	5.59
1474	14.20	13.50	8.60	3.79	7.00	5.16	10.32	5.35	5.58	5.68
984	14.09	13.10	8.68	3.71	7.11	5.09	10.18	5.35	5.50	5.67
1469	14.23	13.43	8.94	3.78	7.31	5.17	10.37	5.29	5.68	5.62
989	14.60	13.53	--	3.80	7.20	5.26	10.65	5.41	5.75	5.80
2888	14.25	---	8.64	3.80	7.21	5.28	10.29	5.30	5.47	5.53
1470	13.93	13.00	8.54	3.72	7.05	5.10	10.35	5.23	5.43	5.51
2887	13.60	13.05	8.77	3.67	6.99	5.20	10.09	5.05	5.64	5.37
1466	14.31	13.55	8.38	3.65	7.10	4.94	10.35	5.29	5.50	5.59
1472	13.96	13.06	8.60	3.82	7.00	5.25	10.13	5.19	5.38	5.50
985	14.22	13.49	--	3.83	7.14	5.14	10.37	5.29	5.45	5.67
973	14.37	13.53	--	3.68	7.00	5.03	10.42	5.33	5.48	5.58

TABLE IV (Continued)

SKULL MEASUREMENTS IN MILLIMETERS OF Myotis yumanensis yumanensis (H. Allen)

Cat. No.	Total Length	Condylobasal Length	Zygomatic Breadth	Interorbital Constriction	Breadth of Brain Case	Occipital Depth	Mandible	Maxillary Tooth Row	Maxillary Breadth at M <sup>3</sup>	Mandibular Tooth Row
(From 6 miles north of Kenton, Cimarron Co.)										
980	13.81	12.92	8.41	3.82	6.90	5.00	10.19	5.28	5.51	5.67
(From mouth of North Carrizzo Creek, Cimarron Co.)										
2894	13.75	13.00	8.53	3.62	6.87	5.16	10.32	5.16	5.59	5.42
2895	13.88	12.90	8.55	3.69	7.12	5.23	10.04	5.22	5.53	5.49
Mean	14.08	13.23	8.59	3.74	7.08	5.14	10.27	5.25	5.53	5.56



3. Myotis austroriparius gatesi Lowery

Myotis austroriparius gatesi has been reported from only two localities, both in Louisiana, and its presence in Oklahoma was not suspected prior to its collection in August of 1955. At that time the party was encamped on the bank of the Mountain Fork River east of Smithville where some bats were noticed skimming the surface of the water during late twilight. Two were shot, and were recognized as being different from other Myotis that had been collected in the state. Identity as to species was not ascertained for some time. Although shooting was done in other similar situations in the southeast, no other specimens were collected.

In the spring of 1956, another trip was made to Smithville in an effort to collect a series of skins. The first night several bats were seen flying low in a pattern similar to those collected the previous year, but none were collected. The weather turned considerably colder overnight and the following evening only one or two bats were seen. In spite of this two mist nets were tied together end to end and stretched over the water. A single strand of heavy cord was stretched parallel to the nets about 18" from them and three feet above the water. This was done to distract the attention of the bats from the nets. The nets were left up all night, and a single specimen of Myotis, the first return from a net set over open water, was taken.

Type. The type is an adult male (No. 2074, La. State U. Mus. Zool.) collected on the University Campus near Baton Rouge, East Baton Rouge Parish, Louisiana by Rowland Abegg on Nov. 12, 1941. (Lowery, 1943).



TABLE V

EXTERNAL MEASUREMENTS IN MILLIMETERS OF Myotis austroriparius gatesi Lowery

Cat. No.	Total Length	Tail	H. Foot	Ear	Tragus	Forearm	Third Metacarpal	Fifth Metacarpal	Tibia	Thumb
(From 8 miles east of Smithville, McCurtain Co.)										
2853	95	41	11	14	8	38.3	34.7	30.7	15.2	6.7
2854	87	39	11	14	9	37.4	34.6	33.8	14.5	6.8
CMW192	90	37	11	14	7	37.6	34.6	32.7	15.4	7.0
Mean	90.7	39	11	14	8	37.8	34.6	32.4	15.0	6.8

TABLE VI

SKULL MEASUREMENTS IN MILLIMETERS OF Myotis austroriparius gatesi Lowery

Cat. No.	Total Length	Condylobasal Length	Zygomatic Breadth	Interorbital Constriction	Breadth of Brain Case	Occipital Depth	Mandible	Maxillary Tooth Row	Maxillary Breadth at M <sub>3</sub>	Mandibular Tooth Row
2853	14.85	14.00	9.39	3.90	7.49	5.60	10.84	5.40	5.84	5.62
2854	14.43	13.61	9.02	3.79	7.41	5.40	10.63	5.30	5.80	5.58
Mean	14.64	13.81	9.21	3.85	7.45	5.50	10.74	5.35	5.82	5.60

(From 8 miles east of Smithville, McCurtain Co.)

Distribution. This bat is known only from the type locality on the Louisiana State University campus, from Provencal, La., and from near Smithville, Okla. in McCurtain Co.

Description. Measurements in millimeters (average and extremes) of three specimens from McCurtain County. Total length 90.7 (87-95); tail 39 (37-41); hind foot 11; ear 14; tragus 8 (7-9); forearm 37.8 (37.4-38.3). The dorsal hair is tipped with Amber Brown to Cinnamon Brown and the ventral hair is tipped with Buff-Yellow to Ferruginous. The hair is thick and woolly, standing out from the body. In specimens examined the wing membrane is attached at the ankle, but the point of attachment was found to be more variable than in the grisescens with which they were compared. The skull is rather slender with a low but distinct sagittal crest. The brain case is large and expanded in comparison with other Myotis skulls. (Lowery, 1943).

Oklahoma records. McCurtain Co., eight miles east of Smithville, (OAM).

Remarks. The first two specimens collected (1955) were in molting pelage and due to some unknown cause had a wash of bright orange color on the fur, both above and below, most pronounced on the fore-parts of the body. The other specimen collected March 30, 1956, was in full pelage and had a buffy coloration. When compared with four skins of gatesi from Louisiana, they agreed both in color and texture of fur.

#### 4. Myotis grisescens Howell

Myotis grisescens is rather common in the caves of the Ozark district, but it was not until 1939 that its occurrence was reported in Oklahoma. At that time Blair noted two localities, one in Adair

County and another in Cherokee County.

Since 1954, grisescens has been taken from several Ozarkian caves. This species is gregarious, and both hibernating and breeding colonies have been reported from Adair Cave. Examination of both Adair and Dunaway Cave in the winter of 1955 - 1956 failed to produce positive results. Dunaway Cave has produced no records of grisescens, but huge piles of guano are to be found in two places within the cave. As grisescens is the only bat in that area, found in sufficient numbers to leave such sign, its presence is assumed. No summer search has been made of the cave, and it is suspected that these accumulations of guano indicate the presence of nursery aggregations.

Ordinarily the bats are easily collected by the use of a bat net with which they can be scraped from their positions on the roof of the cave. They also were taken, both entering and leaving the cave, by the use of a mist net. Only one specimen was shot. It was flying over a small stream.

Type. The type specimen is an adult male collected in Kickajack Cave in Marion County, Tennessee. The skin and skull are USNM No. 157517.

Distribution. Myotis grisescens occurs in the limestone area from northeastern Oklahoma southeast to northern Florida and northeast through Missouri to southern Indiana and Illinois.

Description. Measurements in millimeters (average and extremes) of 26 specimens from northeastern Oklahoma. Total length 102.5 (92-112); tail 41.7 (34-47); hind foot 11 (9-12); ear 15.5 (15-16); tragus 9.1 (8-10); forearm 42.2 (40.4-44.2). This bat is found in two color phases, either Dark Mouse Gray above and whitish below, or Cinnamon

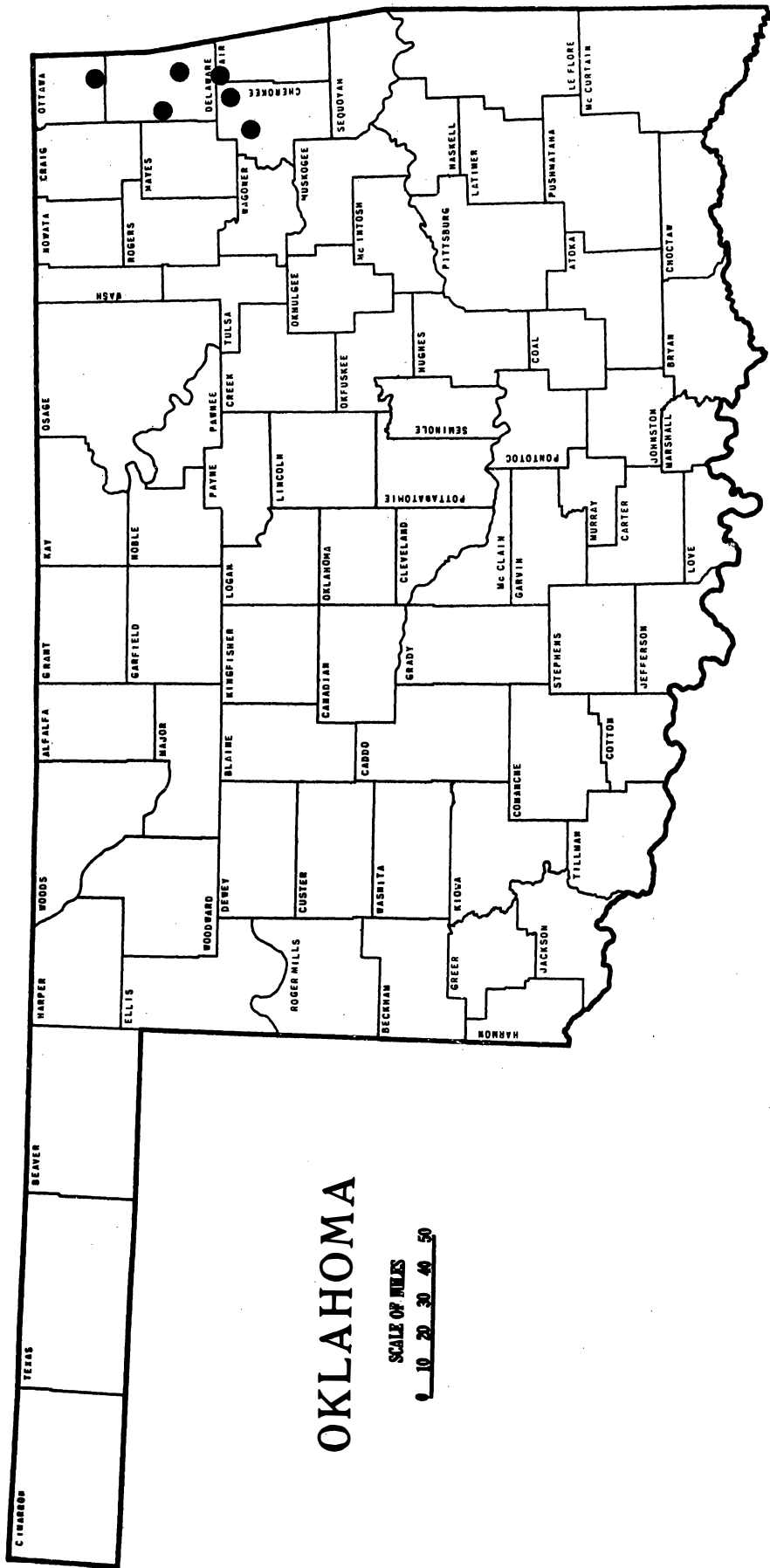


Figure 4. Distribution records of *Nyctis griseescens* Howell.

TABLE VII

METACARPAL MEASUREMENTS IN MILLIMETERS OF Myotis grisescens Howell

Cat. No.	Total Length	Tail	H. Foot	Ear	Tragus	Forearm	Third Metacarpal	Fifth Metacarpal	Fibia	Thumb
(From Spavinaw Creek Cave, Delaware Co.)										
2380	97	43	11	16	9	43.7	39.4	37.4	16.4	7.5
2384	102	43	11	15	9	42.8	40.4	37.3	16.5	7.1
(From Adair Bat Cave, Adair Co.)										
962	101	39	11	15	9	42.1	37.7	35.3	16.0	7.0
1451	95	41	11	15	9	40.7	36.9	34.1	15.9	6.8
952	97	41	11	15	9	41.4	37.4	35.7	15.8	6.9
961	104	45	11	16	9	42.7	38.6	36.6	16.0	7.4
1428	103	44	11	16	9	40.8	38.4	35.5	15.7	7.3
963	105	44	11	16	9	41.9	38.1	35.6	15.8	7.3
1426	102	42	11	16	9	42.7	39.8	36.3	16.0	7.5
1452	92	34	11	15	9	40.7	38.1	35.4	16.1	6.9
2898	96	39	11	15	8	41.8	39.0	36.4	15.7	6.7
956	112	40	12	16	9	42.7	39.7	37.0	16.0	7.6
1423	100	41	10	15	10	43.1	39.0	36.6	--	7.3
1429	101	43	10	15	9	41.3	38.0	36.1	16.1	7.5
946	110	40	11	15	9	41.5	39.3	36.3	16.1	7.4
948	110	41	9	16	10	42.8	38.9	36.4	16.5	7.4
954	112	40	11	16	9	41.8	38.7	36.2	16.2	7.5
1453	99	43	12	15	9	41.6	38.2	36.2	15.7	7.4
959	98	39	10	15	9	40.4	37.2	35.2	15.9	7.0
1425	98	40	11	16	--	41.3	38.1	36.3	--	6.7



TABLE VII (Continued)

EXTERNAL MEASUREMENTS IN MILLIMETERS OF *Sciurus arizonensis* Howell

Cat. No.	Total Length	Tail	H. Foot	Ear	Tarsus	Forearm	Metacarpal	Metatarsal	Third	Fifth	Stifle	Thumb
1163	107	45	12	15	9	44.2	40.3	37.9	16.9	16.9	7.0	7.0
1155	101	40	12	16	9	44.0	39.1	36.8	16.1	16.1	6.9	6.9
1159	102	43	11	16	9	42.5	38.6	35.3	16.0	16.0	6.8	6.8
1158	103	44	11	16	10	43.5	39.4	36.4	16.3	16.3	7.5	7.5
1156	104	44	11	16	9	43.3	40.5	37.6	16.6	16.6	7.3	7.3
(From Half-Moon Cave, Cherokee Co.)												
2828	104	47	11	16	9	41.0	38.1	35.8	16.2	16.2	7.0	7.0
Mean	102.5	41.7	11.0	15.5	9.1	42.2	38.7	36.2	16.1	16.1	7.2	7.2
(From Cave Springs Cave, Adair Co.)												

TABLE VIII

SKULL MEASUREMENTS IN MILLIMETERS OF Myotis grisescens Howell

Cat. No.	Total Length	Condylobasal Length	Zygomatic Breadth	Interorbital Constriction	Breadth of Brain Case	Occipital Depth	Mandible	Maxillary Tooth Row	Maxillary Breadth at 1/3	Mandibular Tooth Row
(From Spavineau Creek Cave, Delaware Co.)										
2380	15.90	15.20	10.22	4.14	7.87	5.92	11.98	5.99	6.27	6.30
2384	15.40	14.80	9.90	3.85	7.54	5.71	11.70	5.97	6.27	6.31
(From Adair Bat Cave, Adair Co.)										
962	15.23	14.64	9.88	3.90	7.48	5.48	11.50	5.93	6.18	6.20
961	15.76	15.19	10.02	3.94	7.69	5.65	11.77	6.01	6.20	6.37
963	15.85	15.09	10.10	4.05	7.55	5.80	---	6.04	6.39	--
1426	15.58	14.82	---	3.91	7.55	5.65	11.65	6.00	5.98	6.34
1452	15.80	15.09	10.13	4.12	7.80	5.65	11.72	5.97	6.17	6.18
2898	15.64	14.81	9.97	3.97	7.55	5.65	11.60	5.89	5.97	6.10
956	15.31	14.67	---	3.94	7.55	5.55	11.90	5.85	6.15	6.27
1429	15.57	14.95	---	4.04	7.67	5.78	11.80	--	--	6.30
946	15.44	14.78	9.95	3.84	7.53	5.48	11.68	5.80	6.10	6.07
948	15.79	14.91	10.22	4.17	7.74	5.94	11.57	5.83	6.14	6.14
1453	15.59	14.63	9.85	3.94	7.55	5.49	---	5.91	6.13	--
959	15.34	14.60	9.60	3.88	7.47	5.50	11.38	5.77	6.01	6.06

TABLE VIII (Continued)

SKULL MEASUREMENTS IN MILLIMETERS OF Haptia arisescens Howell

Cat. No.	Total Length	Condylobasal Length	Zygomatic Breadth	Interorbital Constriction	Breadth of Brain Case	Occipital Depth	Mandible	Maxillary Tooth Row	Maxillary Breadth at $\alpha^2$	Mandibular Tooth Row
952	15.20	---	9.75	4.03	7.52	5.60	11.55	5.87	6.04	6.18
(From Half-Moon Cave, Cherokee Co.)										
1455	15.53	14.90	9.78	3.90	7.45	5.50	11.66	5.97	6.26	6.30
1459	15.75	15.03	9.74	3.90	7.52	5.60	11.83	6.02	6.20	6.37
1458	15.69	14.92	10.14	4.00	7.64	5.69	11.57	5.98	6.30	6.31
(From Cave Springs Cave, Adair Co.)										
2823	15.52	14.85	---	3.96	7.63	5.53	11.80	5.93	6.22	6.24
Mean	15.57	14.88	9.95	3.97	7.57	5.64	11.69	5.93	6.16	6.24

Brown above and pale buff below. The hair above is uniformly colored to its base; below it is Dark Mouse Gray at the base. The wing membrane is attached at the ankle (Hamilton, 1943). Skulls of adults have a distinct sagittal crest.

Oklahoma records. Adair Co., five miles south of Kansas (UMMZ, Blair, 1939); Cherokee Co., Scraper (UMMZ, Blair, 1939), Half-Moon Cave (OAM); Delaware Co., Stansbury's Cave (OAM), Spavinaw Creek Cave (OAM); Ottawa Co., Boy Scout Cave (OAM).

Remarks. As these bats can hardly be mistaken for other species of Myotis that might occur in the area, no direct comparisons have been made. Specimens were collected from the cave where Blair collected and all Oklahoma specimens were taken within the expected geographic range of the species.

5. Myotis velifer incautus (J. A. Allen)

Myotis velifer incautus is the most common member of the genus found in Oklahoma. It is also the most widespread, being found in most of the western third of the state, exclusive of the Panhandle. Usually it is to be found in gypsum caves where it often occurs in large colonies.

Both hibernating and breeding populations are known to occur within the state. Frequently the species will occupy the same cave throughout most of the year.

Only two caves have been visited by the writer when very young bats were found in nursery chambers. These were Icebox Cave and Alabaster Caverns. In addition, bats in juvenile pelage were taken from Griever Creek Cave.

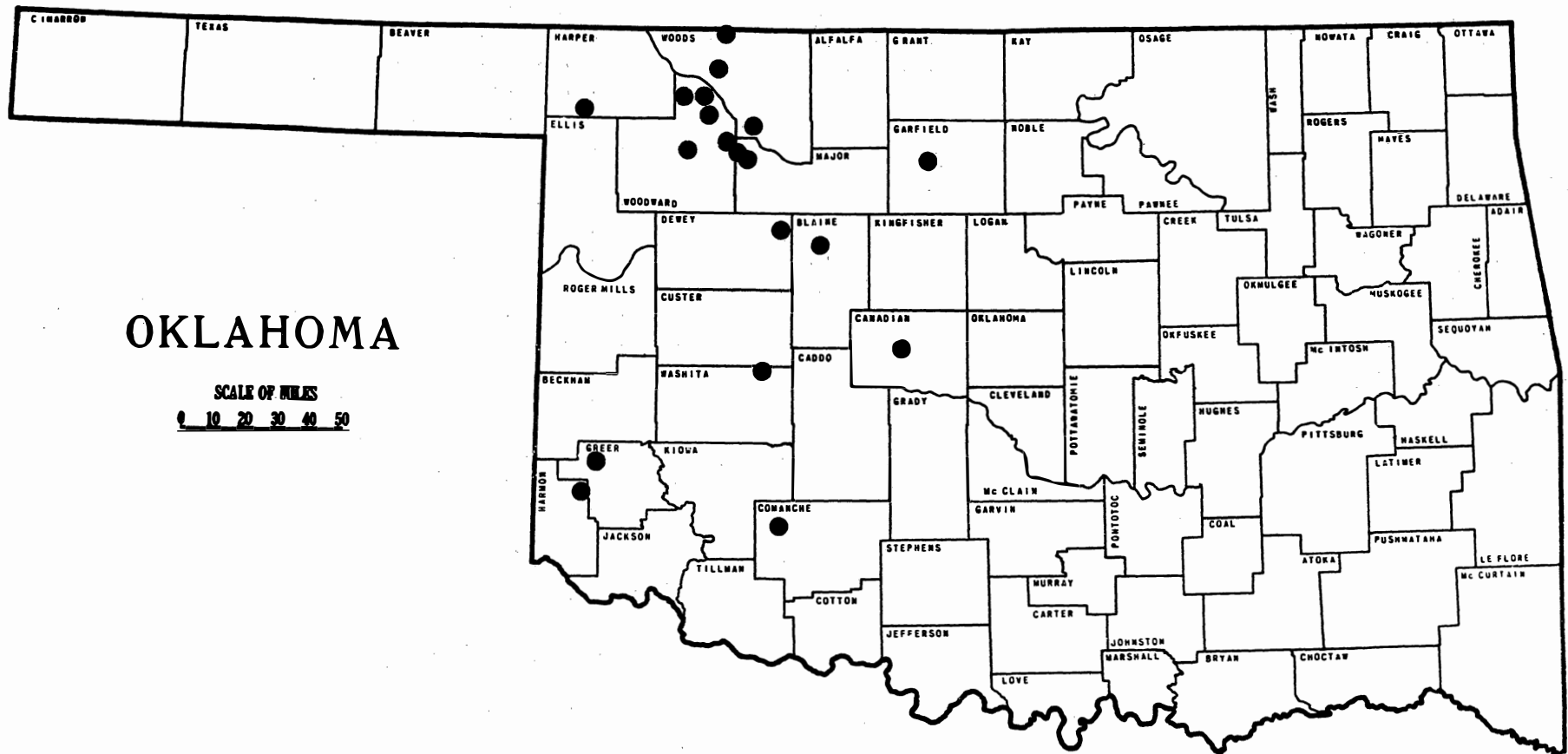
The young were found in the above caves on July 17. Some of these were able to fly while others appeared to be only a few days old. Dr. Glass has noted young found in Alabaster Caverns as early as June 26.

A single specimen of Tadarida mexicana (Saussure) was taken from the nursery chamber with a group of young M. velifer.

Samples of velifer were taken from caves in the winter from all parts of their range in Oklahoma. Hibernating colonies frequently are made up of several thousand bats, with clusters ranging in number from two to an estimated three thousand. The estimates are based on the 1.1 bats per square inch in clusters studied by Twente (1955) and would total 158.4 bats per square foot or a working figure of 160 bats per square foot.

There is a general shift of the velifer population in the fall. Twente (1955) reported banded bats were taken 43 miles from the banding point. On October 9, velifer were found in buildings in Mooreland, Okla. Four males were taken from a lumber warehouse, and 10 females from a barn. On October 23, velifer in Alabaster Caverns was found scattered throughout the cave singly or in small clusters. One specimen banded at Alabaster Caverns was reported from a barn 30 miles east of the cavern (Glass, pers. comm.). These records suggest that the fall groups of vagrant bats may be sexually segregated.

As could be expected, there is a long record of collection of the bat beginning with Miller and Allen (1928). In the present study the species was collected from at least nine different localities. These collecting points were scattered from the northern to the southern border of the state.



# OKLAHOMA

SCALE OF MILES  
 0 10 20 30 40 50

Figure 5. Distribution records of Myotis velifer incautus (J. A. Allen)

TABLE IX

EXTREMAL MEASUREMENTS IN MILLIMETERS OF *Myotis velifer incautus* (J. A. Allen)

Cat. No.	Total Length	Tail	H. Foot	Ear	Tragus	Forearm	Third Metacarpal	Fifth Metacarpal	Tibia	Thumb
(From Alabaster Caverns, Woodward Co.)										
1081	111	46	11	16	10	43.2	39.8	37.8	16.0	7.4
1904	105	47	11	16	10	45.1	41.7	39.4	16.8	7.5
1902	97	44	11	15	10	44.5	41.0	39.3	17.1	7.0
1066	110	47	11	16	10	42.3	38.6	36.7	--	7.3
1074	115	49	11	17	10	45.2	41.5	39.2	16.8	7.6
1379	115	46	10	17	10	45.3	40.8	39.1	16.5	7.5
1376	112	44	11	17	10	44.6	41.6	38.8	15.7	7.5
1903	98	49	10	16	10	44.0	42.3	39.8	16.9	7.3
1083	106	45	11	16	10	44.4	39.8	37.5	16.0	7.6
2366	107	48	13	15	10	43.2	40.7	38.2	16.8	7.3
1065	110	47	11	16	9	44.5	42.1	39.6	16.7	7.5
1070	105	45	10	17	9	45.5	40.9	37.5	16.8	7.2
(From Icebox Cave, Woodward Co.)										
1905	104	45	11	16	9	41.1	38.5	36.6	16.2	7.2
2286	103	45	12	16	10	44.4	39.9	37.9	16.8	7.2
2333	102	44	12	15	10	44.1	42.0	39.5	16.8	7.2
2305	97	41	12	16	9	43.3	39.3	37.1	16.9	6.9
(From Anderson Creek Cave, Woods Co.)										
2809	102	44	12	16	10	44.2	40.6	38.5	17.3	7.5

TABLE IX (Continued)

EXTERNAL MEASUREMENTS IN MILLIMETERS OF Myotis velifer incautus (J. A. Allen)

Cat. No.	Total Length	Tail	H. Foot	Ear	Tragus	Forearm	Third Metacarpal	Fifth Metacarpal	Tibia	Thumb
(From Marshew Cave, Woods Co.)										
2404	108	46	12	16	10	44.2	40.6	38.4	16.8	7.5
(From $\frac{1}{2}$ mile south of Mooreland, Woodward Co.)										
2344	104	44	10	17	9	42.5	38.6	35.9	--	7.5
Mean	106.0	45.6	11.2	16.1	9.7	44.0	40.6	36.7	16.6	7.4



TABLE X

SKULL MEASUREMENTS IN MILLIMETERS OF Myotis valifer incautus (J. A. Allen)

Cat. No.	Total Length	Condylobasal Length	Zygomatic Breadth	Interorbital Constriction	Breadth of Brain Case	Occipital Depth	Mandible	Maxillary Tooth Row	Maxillary Breadth at $m_3$	Mandibular Tooth Row
(From Alabaster Caverns, Woodward Co.)										
1081	16.53	15.92	11.15	4.19	7.34	6.09	12.88	6.50	7.19	6.95
1904	16.87	16.20	11.02	4.11	7.61	6.03	13.32	6.59	7.13	7.06
1902	16.97	16.23	10.82	4.26	7.66	5.81	12.90	6.71	6.96	7.14
1066	16.30	15.87	10.81	4.12	7.65	5.81	12.70	6.60	7.05	7.11
1074	17.00	16.33	11.32	4.16	8.02	5.94	13.54	6.75	7.04	7.24
1379	17.02	16.59	10.93	4.16	7.80	5.80	13.23	6.83	7.02	7.20
1903	16.51	16.22	10.34	3.99	7.50	5.75	13.10	6.79	6.82	7.15
2366	16.69	16.01	10.70	4.08	7.70	5.91	13.06	6.59	6.98	7.19
1065	16.42	15.86	10.93	4.11	7.61	5.85	12.95	6.62	6.92	7.05
1070	16.87	16.40	11.09	4.07	8.00	5.99	13.42	6.68	7.00	7.11
1376	17.27	16.57	11.25	4.25	8.00	5.93	13.42	6.92	7.23	7.35
(From Icebox Cave, Woodward Co.)										
1905	16.23	15.83	10.58	4.22	7.70	6.02	12.87	6.59	6.90	7.07
2286	16.74	16.29	10.95	4.15	8.04	6.03	13.02	6.49	7.02	6.97
2305	16.80	16.21	10.83	4.20	7.80	5.85	13.23	6.58	7.02	7.15

TABLE X (Continued)

SKULL MEASUREMENTS IN MILLIMETERS OF *Arotia velifer incautus* (J. A. Allen)

Cat. No.	Total Length	Condylobasal Length	Zygomatic Breadth	Interorbital Constriction	Breadth of Brain Case	Occipital Depth	Mandible	Maxillary Tooth Row	Maxillary Breadth at M <sup>3</sup>	Mandibular Tooth Row
2305	16.25	15.62	10.88	4.27	7.82	5.84	12.87	6.45	7.06	--
(From Anderson Creek Cave, Woods Co.)										
2809	16.58	16.01	10.85	3.99	7.80	5.61	12.92	6.55	6.83	7.01
(From Marshew Cave, Woods Co.)										
2404	16.62	16.04	10.86	4.17	7.94	5.94	13.10	6.57	6.79	6.90
(From $\frac{1}{2}$ mile south of Mooreland, Woodward Co.)										
2344	16.41	15.87	10.64	4.00	7.81	5.84	12.87	6.50	6.58	6.87
Mean	16.67	16.12	10.89	4.14	7.80	5.89	13.08	6.63	6.98	7.09

Type. The type is an adult male (AMNH No. <sup>12214</sup>10560) collected by H. P. Attwater at San Antonio, Texas.

Distribution. This bat occurs in the arid plains of Texas and New Mexico. Its range extends as far to the northwest as Utah and eastward to western Kansas and Oklahoma.

Description. Measurements in millimeters (average and extremes) of 19 adults from northwestern Oklahoma. Total length 106 (97-115); tail 45.6 (41-49); hind foot 11.2 (10-13); ear 16.1 (15-17); tragus 9.7 (9-10); forearm 44.0 (41.1-45.5). This is the largest bat of the genus found in Oklahoma. The adult pelage is tipped with Tawny Olive above and Cartridge Buff below. The base of the hair is Slate Color on all parts of the body.

Oklahoma records. Blaine Co., Salt Creek Canyon, four miles southeast of Southard (KU, Blair, 1939); Canadian Co., Ft. Reno (Miller and Allen, 1928); Garfield Co., Enid (KU, Blair, 1939); Major Co., 12 miles south of Waynoka (Blair, 1938), and Griever Creek Cave (OAM); Woods Co., Waynoka (KU, Blair, 1939), Marchew Cave (OAM), and Anderson Creek Cave (OAM); Woodward Co., 10 miles south of Freedom (UMMZ, Blair, 1939), Icebox Cave (OAM), Alabaster Caverns (OAM, Glass, 1955), and Mooreland (OAM), Greer Co., three and one-half miles north of Jester (OAM, Glass, 1955); Harmon Co., three miles west, one mile south of Reed (OAM); Washita Co., Corn Caves (OAM); Comanche Co., Cache Creek (USNM, Chas. Handley, Jr. pers. comm.).

Remarks. Because of established records and the place of Oklahoma in the range of the species, no direct comparisons have been made.

6. Myotis keeni septentrionalis (Trouessart)

Although Myotis keeni septentrionalis has been reported from Arkansas, Missouri, and Kansas, it was not known to occur in Oklahoma until July of 1954 when five specimens were taken from Crystal Cave in Adair County. These were found hanging singly at various places in the cave. On September 25, two more were taken from the same cave. Later, in the summer of 1955, specimens were taken in mist nets from four other caves (Figure 6).

Four of the five caves from which these bats were taken are in the Ozark Biotic District. The fifth lies across the Arkansas River Valley in the Ouachita district, where a single specimen was secured.

Apparently this bat is a fairly common inhabitant of the limestone caves in the Ozark area. Its distribution in adjoining states makes it rather surprising that it has not been reported, for Oklahoma, before now.

Its presence in the Ouachita area is not unexpected but it is probably not as abundant as in the Ozarks because of the fewer caves in the former area.

To date all specimens have been collected during the summer. This does not imply that hibernating keeni are not to be expected. Further work may produce winter records.

Type. Miller and Allen (1928) referred to a specimen (USNM No. <sup>8188</sup> 38663) from Halifax, Nova Scotia as the lecto-type. The individual was taken from a group of eight on which the name Vespertilio gryphus septentrionalis Trouessart was based. The revision of the genus by Miller and

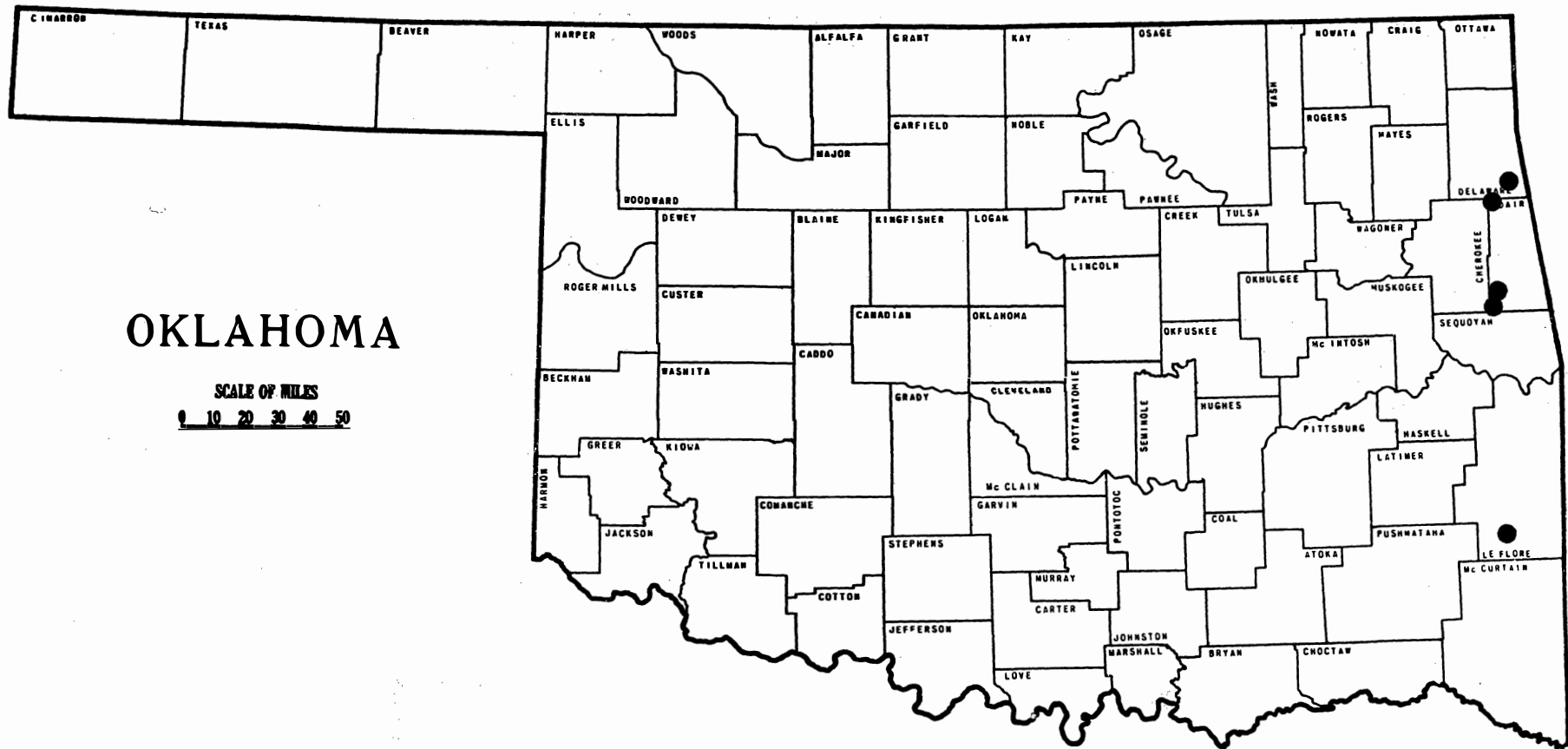


Figure 6. Distribution records of *Myotis keeni septentrionalis* (Trouessart)

TABLE XI

EXTERNAL MEASUREMENTS IN MILLIMETERS OF Myotis keenii septentrionalis (Trouessart)

Cat. No.	Total Length	Tail	H. Foot	Ear	Tragus	Forearm	Third Metacarpal	Fifth Metacarpal	Tibia	Thumb
(From Crystal Cave, Adair Co.)										
2323	90	40	10	18	10	35.6	32.6	31.2	15.1	5.9
2329	83	37	9	17	10	34.9	32.6	31.0	15.3	6.8
2325	85	38	9	18	--	33.9	31.8	30.0	14.9	6.1
2921	84	38	9	16	9	33.3	30.3	29.1	14.4	6.0
2328	86	36	9	18	12	33.7	31.5	30.9	15.0	6.1
2327	83	37	9	17	--	34.5	31.5	30.1	15.0	6.0
2326	82	37	8	17	--	33.6	30.7	29.8	16.0	6.1
2925	86	38	9	16	10	33.9	30.6	29.6	14.8	6.0
2324	84	36	9	16	--	31.0	28.0	27.0	14.0	6.1
2635	83	39	9	17	10	34.2	31.2	30.7	14.8	5.8
2634	--	--	--	--	--	33.8	31.1	30.0	14.7	6.0
(From Cave Springs Cave, Adair Co.)										
2918	86	38	9	16	9	32.0	29.0	28.8	14.4	5.8
2916	84	37	10	16	10	34.5	32.0	30.9	15.3	6.1
2924	83	38	10	15	9	33.2	30.5	29.3	14.5	6.4
2919	82	38	9	16	10	33.2	30.8	29.8	15.2	6.1
2920	86	39	9	15	9	33.5	30.5	29.4	15.4	6.1
2971	86	38	9	16	9	34.0	30.9	29.5	15.3	5.8

TABLE XI (Continued)

EXTERNAL MEASUREMENTS IN MILLIMETERS OF Myotis keenii septentrionalis (Trouessart)

Cat. No.	Total Length	Tail	H. Foot	Ear	Tragus	Forearm	Third Metacarpal	Fifth Metacarpal	Tibia	Thumb
(From Adair Bat Cave, Adair Co.)										
2930	84	40	8.5	17	10	32.2	28.6	28.0	14.7	6.3
(From Duncan Cave, Delaware Co.)										
2922	85	42	10	17	10	34.7	30.4	29.1	16.5	6.0
2923	84	38	8	16	10	34.4	30.5	30.3	15.5	5.5
Mean	84.5	38.1	9.1	16.5	9.2	33.7	30.7	29.7	14.3	6.1

TABLE XII

SKULL MEASUREMENTS IN MILLIMETERS OF Myotis keenii septentrionalis (Trouessart)

Cat. No.	Total Length	Condylbasal Length	Zygomatic Breadth	Interorbital Constriction	Breadth of Brain Case	Occipital Depth	Mandible	Maxillary Tooth Row	Maxillary Breadth at M <sup>3</sup>	Mandibular Tooth Row
(From Crystal Cave, Adair Co.)										
2323	14.65	14.10	9.32	3.65	7.13	4.87	11.31	5.87	5.98	6.30
2925	14.65	13.97	9.46	3.72	7.14	5.02	10.97	5.74	5.71	6.07
2329	15.50	14.65	9.41	3.64	7.60	5.20	11.53	6.07	5.75	6.43
2325	15.22	14.48	9.24	3.53	7.36	5.17	11.27	5.90	5.68	6.30
2921	14.34	13.57	--	3.29	6.90	4.86	10.95	5.64	5.30	5.99
2324	14.71	14.12	--	3.53	7.15	5.00	11.08	5.87	5.61	6.22
2635	14.80	14.13	9.05	3.62	7.00	4.80	11.26	5.89	5.68	6.19
2634	14.59	13.94	8.71	3.28	6.90	5.06	10.81	5.62	--	6.05
2328	14.93	14.42	9.03	3.61	7.05	4.72	11.38	5.94	5.44	6.26
2327	15.01	14.08	--	3.52	6.93	5.05	11.23	5.96	5.50	6.27
2326	14.04	13.46	8.78	3.54	7.00	4.80	10.93	5.61	5.42	6.05
(From Cave Springs Cave, Adair Co.)										
2916	14.81	13.98	8.90	3.40	6.98	4.98	---	5.93	5.49	6.25
2917	15.06	14.35	9.22	3.72	7.06	5.03	11.24	5.89	5.83	6.25
2920	14.66	14.00	8.89	3.48	6.95	4.97	11.35	5.90	5.33	6.24



TABLE XII (Continued)

SKULL MEASUREMENTS IN MILLIMETERS OF Myotis keenii septentrionalis (Trouessart)

Cat. No.	Total Length	Condylobasal Length	Zygomatic Breadth	Interorbital Constriction	Breadth of Brain Case	Occipital Depth	Mandible	Maxillary Tooth Row	Maxillary Breadth at M <sup>3</sup>	Mandibular Tooth Row
2924	14.68	13.99	9.35	3.67	7.42	5.20	10.97	5.79	5.70	6.17
2919	14.40	13.78	8.85	3.63	6.99	4.70	10.73	5.74	5.63	6.03
2918	14.24	13.57	9.05	3.29	6.91	5.09	11.02	5.62	5.61	5.97
(From Adair Bat Cave, Adair Co.)										
2930	14.45	13.62	8.92	3.58	7.23	4.93	10.44	5.73	5.57	6.02
(From Duncan Cave, Delaware Co.)										
2922	15.04	14.26	9.24	3.73	7.36	5.07	11.24	5.85	5.67	6.20
2923	14.65	13.88	9.05	3.41	7.27	4.96	10.97	5.85	5.69	6.09
Mean	14.72	14.02	9.08	3.54	7.12	4.97	11.09	5.82	5.61	6.17

Allen (1928) designated this form as Myotis keeni septentrionalis.

Distribution. This bat is found in the eastern United States and southern Canada. From eastern Oklahoma, the boundary of its range extends through Arkansas, Tennessee, and Georgia, northward along the Coast through Quebec to Newfoundland and Nova Scotia. From there it extends southwest through Ontario into the Dakotas, thence through Nebraska and eastern Kansas.

Description. Measurements in millimeters (average and extremes) of 19 adults from northeastern Oklahoma. Total length 84.5 (82-90); tail 38.1 (36-42); hind foot 9.1 (8-10); ear 16.5 (15-18); tragus 9.2 (9-12); forearm 33.7 (31.0-35.6). The most distinguishing characteristic of this bat is its long ears, which when laid forward extend beyond the end of the snout. The hair above has short burnished tips of bright Hazel Brown (Hamilton, 1943). The tips of the hair below are a Buffy Brown. The base of the hair is everywhere Fuscous-Black to almost Slate. The skull is rather narrow in proportion to its length.

Oklahoma records. Adair Co., Crystal Cave (OAM), Cave Springs Cave (OAM), and Adair Bat Cave (OAM); Delaware Co., Duncan Cave (OAM); LeFlore Co., Kiamichi Mountain Cave (OAM).

Remarks. No outstanding difference was noticed between these specimens and three skins from Michigan.

#### 7. Myotis sodalis Miller and G. M. Allen

Myotis sodalis was reported from Oklahoma for the first time in 1955 (Glass). Two specimens were taken with a group of Myotis grisescens from Adair Bat Cave, a cave known to harbor a colony of grisescens

during most of the year. The two sodalis were taken while hibernating in February 1952. Although many caves have been examined in the Ozark area, no other specimens of sodalis were found during 1954 and most of 1955. In late November, 1955, Phillip Pierce collected three specimens from Bower's Trail Cave. This cave is in the Ouachita district across the Arkansas River Valley from the Ozark District. Apparently this species is not common in the state as the two collections constitute the only known records. Twenty months of extensive collecting in the Ozark district should have yielded more returns if the species was of common occurrence.

Type. The type specimen (MCZ No. 10980, skin and skull) is an adult female from Wyandotte Cave, Indiana, collected by J. O. Sibert, March 7, 1904.

Distribution. Myotis sodalis is found in the eastern United States, from Vermont to Alabama, and as far west as eastern Oklahoma.

Description. Measurements in millimeters (average and extremes) of four specimens from eastern Oklahoma. Total length 85.5 (85-86); tail 36.3 (36-37); hind foot 9.3 (9-10); ear 13.6 (13-14); tragus 7.3 (7-8); forearm 38.2 (37.3-39.3). The hair of this bat is fine and fluffy, standing out from the body. The color is rather dark, having the general appearance of being a dull grayish chestnut. There are three color bands on the dorsal hair, basally a wide band of Fuscous Black, followed by a narrow gray band, and distally a band of Cinnamon Brown. The bases of the hairs below are Slaty with grayish-white and Cinnamon Brown tips. There is often a distinct keel on the calcar.

Oklahoma records. Adair Co., Adair Bat Cave (OAM, Glass, 1955); Pushmataha Co., Bowers Trail Cave (OAM).

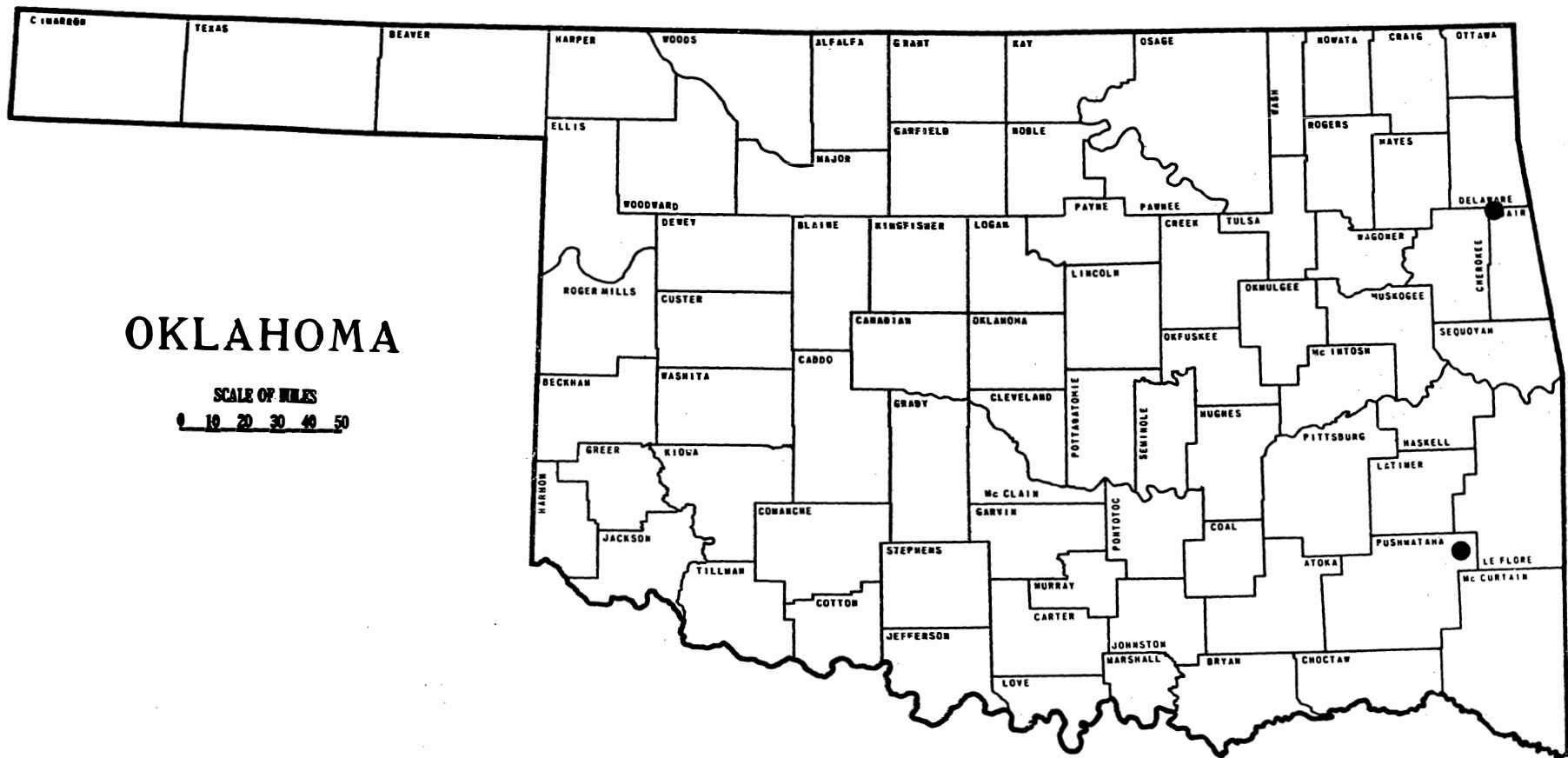


Figure 7. Distribution records of *Myotis sodalis* Miller and G. M. Allen

TABLE XIII

EXTERNAL MEASUREMENTS IN MILLIMETERS OF Myotis sodalis Miller and G. M. Allen

Cat. No.	Total Length	Tail	H. Foot	Ear	Tragus	Forearm	Third Metacarpal	Fifth Metacarpal	Tibia	Thumb
(From Adair Bat Cave, Adair Co.)										
2269	--	37	9	14	8	37.3	35.0	32.0	14.3	6.2
2289	--	--	--	--	--	37.9	34.5	31.7	--	6.2
(From Dower's Trail Cave, Pushmataha Co.)										
GMW179	85	36	10	13	7	38.3	34.6	31.5	14.4	5.7
GMW180	86	36	9	14	7	39.3	34.1	32.0	15.0	5.6
Mean <sup>2</sup>	85.5	36.3	9.3	13.6	7.3	38.2	34.6	31.8	14.6	5.9

<sup>2</sup>Because of a lack of a significant number of specimens, measurements of all individuals of this species regardless of locality were used in calculating the mean.

TABLE XIV

SKULL MEASUREMENTS IN MILLIMETERS OF Myotis sodalis Miller and G. M. Allen

Oat. No.	Total Length	Condylobasal Length	Zygomatic Breadth	Interorbital Constriction	Breadth of Brain Case	Occipital Depth	Mandible	Maxillary Tooth Row	Maxillary Breadth at M <sup>3</sup>	Mandibular Tooth Row
(From Adair Bat Cave, Adair Co.)										
2269	14.48	14.06	9.07	3.75	7.06	4.90	10.67	5.47	5.80	5.79
2289	13.83	13.40	--	3.77	6.93	4.86	10.42	5.24	5.65	5.53
(From Bower's Trail Cave, Pushmataha Co.)										
CMW180	14.89	14.42	--	3.70	7.09	5.04	11.07	5.54	5.77	5.90
Mean	14.40	13.96	--	3.74	7.03	4.93	10.72	5.42	5.74	5.74

Remarks. The skins from Oklahoma were compared with a small series from Arkansas, Tennessee, and Kentucky. No marked difference could be distinguished in texture of the fur, color, or size.

8. Nyctis subulatus melanorhinus (Merriam)

Nyctis subulatus melanorhinus was collected from four rather widely separated points in the state, but a total of only five specimens have been secured. The one taken by Blair (1939) was from the Mesa de Maya district three miles north of Kenton in Cimarron County. One specimen was shot at the edge of an open field near the foot of the Granite Mountain, Greer County on June 2, 1955. Another one was taken in a mist net over Windmill Cave on August 12, 1955. Three days later two more were taken at Radziminiski Mountain Cave, using a mist net. Later in August a single specimen was shot on North Carrizzo Creek in Cimarron County near the spot where the first record was established. Re-examination of the specimens reported by Glass (1949) has shown that they are not subulatus, but yumanensis.

Type. The type specimen is an adult male (USNM No. 13694) from the north base of San Francisco Mountain, Coconino County, Arizona.

Distribution. The periphery of the known range of the subspecies melanorhinus extends through northern Mexico and Baja California, along the Pacific Coast in Southern California, northward through Oregon and eastern Washington into southern British Columbia. From British Columbia it runs south through Idaho, southeast through central Utah, then eastward through Southern Colorado to western Oklahoma. From Oklahoma it extends southwestward through New Mexico into Mexico.

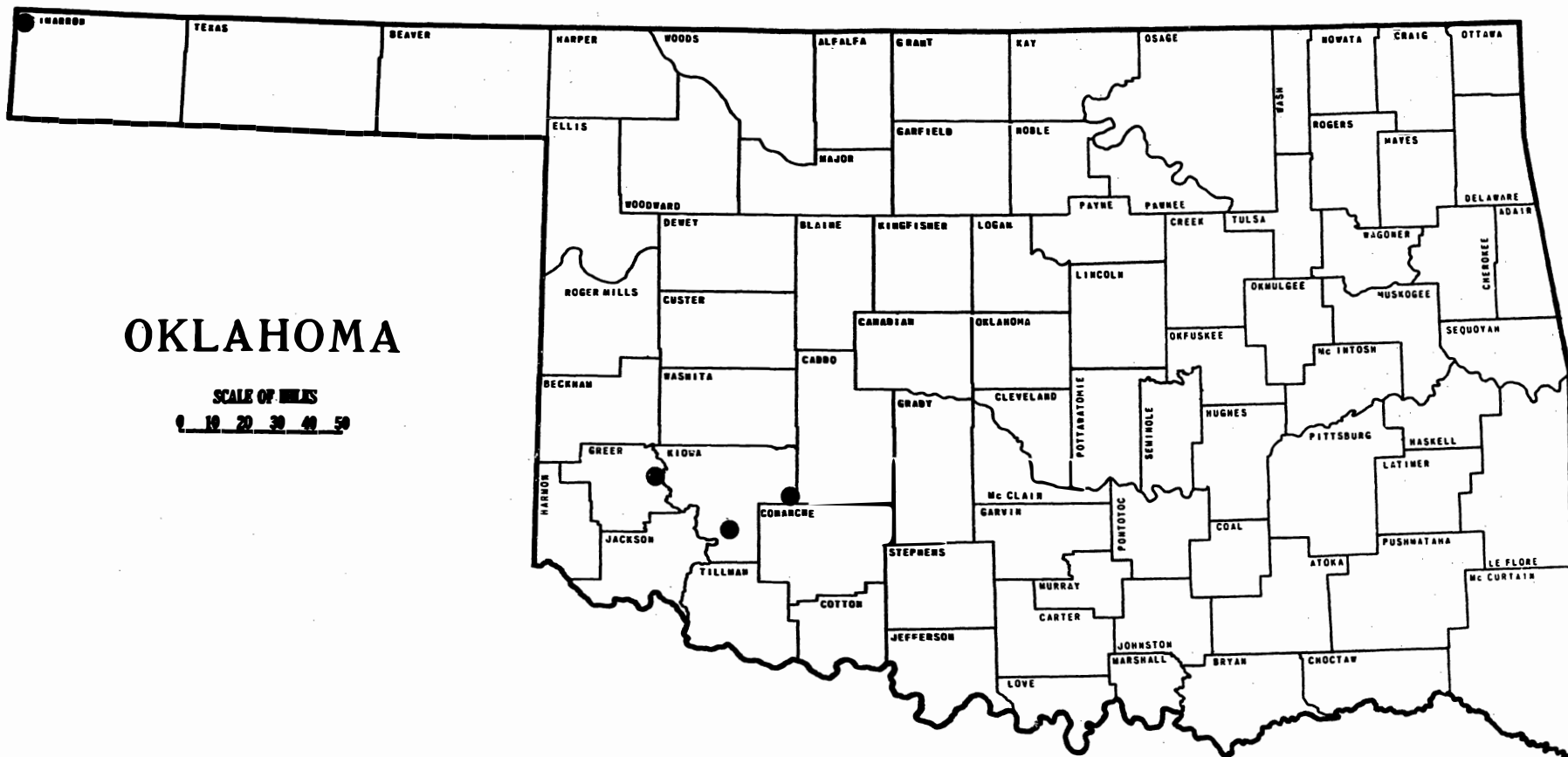


Figure 8. Distribution records of *Myotis subulatus melanorhinus* (Merriam)



TABLE XV

EXTERNAL MEASUREMENTS IN MILLIMETERS OF *Myotis subulatus melanorhinus* (Merriam)

Cat. No.	Total Length	Tail	H. Foot	Ear	Tragus	Forearm	Third Metacarpal	Fifth Metacarpal	Tibia	Thumb
(From Radziminski Mtn. Cave, Kiowa Co.)										
2856	80	36	8	13	8	31.0	29.3	27.8	13.8	5.4
2857	82	38	9	13	7	30.1	28.1	27.2	13.7	4.8
(From 1 mile north of Granite, Greer Co.)										
2664	84	34	8	13	7	30.6	28.1	27.3	13.2	5.2
(From Windmill Cave, Kiowa Co.)										
2855	87	39	8	14	8	32.2	29.8	28.5	13.7	4.9
Mean	83.3	36.8	8.3	13.3	7.5	31.0	28.8	27.7	13.6	5.1

TABLE XVI

SKULL MEASUREMENTS IN MILLIMETERS OF Myotis subulatus melanorhinus (Merriam)

Cat. No.	Total Length	Condylabasal Length	Zygomatic Breadth	Interorbital Constriction	Breadth of Brain Case	Occipital Depth	Mandible	Maxillary Tooth Row	Maxillary Breadth at M <sup>3</sup>	Mandibular Tooth Row
(From Radzinski Mtn. Cave, Kiowa Co.)										
2857	12.81	12.39	8.13	3.23	6.57	4.50	9.43	4.83	5.06	5.20
2856	13.45	12.96	8.35	3.30	6.58	4.20	9.67	5.09	5.27	5.39
(From 1 mile north of Granite, Greer Co.)										
2664	---	12.70	8.33	3.22	6.70	4.01	9.78	4.93	5.20	5.21
(From Windmill Cave, Kiowa Co.)										
2855	12.93	12.50	7.95	3.28	6.43	4.08	9.38	5.03	5.18	5.29
Mean	13.06	12.64	8.19	3.26	6.57	4.20	9.57	4.97	5.18	5.27

Description. Measurements in millimeters (average and extremes) of four specimens from the Wichita Mountains district. Total length 83.3 (82-87); tail 36.8 (34-39); hind foot 8.3 (8-9); ear 13.3 (13-14); tragus 7.5 (7-8); forearm 31.0 (30.1-32.2). This is the smallest member of the genus Myotis in Oklahoma. Its small size, long glossy fur, and black face and ears separate it from other members of the genus. The hair above is tipped with Ochraceous-Tawny to Dresden Brown, and below, with whitish to light Buckthorn Brown. The basal half of the hair is Slate Black. There is a prominent keel on the calcar. The dorsal profile of the skull is noticeably flattened.

Oklahoma records. Cimarron Co., three miles north of Kenton (UMMZ, Blair, 1939), and the mouth of North Carrizzo Creek (OAM); Kiowa Co., Windmill Cave (OAM), and Radzimirski Mountain Cave (OAM); Greer Co., one mile north of Granite. (OAM).

Remarks. The specimens taken in Oklahoma have been assigned to the subspecies melanorhinus on the basis of Blair's record. This specimen was not available to the writer for direct comparison. It should be noted, however, that the skins from the Wichita Mountains closely resemble the eastern form (leibi) in coloration, particularly on the face and ears, which appear somewhat paler than in skins of melanorhinus from New Mexico. Several skins of leibi at the University of Kansas were compared with Oklahoma specimens. Six adult melanorhinus from New Mexico were examined.

## SUMMARY AND CONCLUSIONS

A survey of the species of Myotis that occur in Oklahoma was made. Ninety-six specimens were collected and added to the Oklahoma Agricultural and Mechanical College Museum of Zoology collections.

Collecting was carried out in four ways: exploration of caves, shooting, netting, and examination of buildings. Collecting from caves produced specimens of velifer, grisescens, keeni, yumanensis and sodalis. M. austroriparius, grisescens, subulatus and yumanensis were taken by shooting. Netting resulted in the capture of austroriparius, subulatus, velifer, grisescens, and keeni. Specimens of lucifugus and velifer were taken from buildings. Altogether, eight species, each represented by a single subspecies, were collected.

Four species are reported for the first time in the state. These are lucifugus lucifugus, austroriparius gatesi, keeni septentrionalis and yumanensis yumanensis.

The range in Oklahoma of subulatus melanorhinus was extended 200 miles southeast and sodalis, 100 miles south.

One hundred and thirty-nine Oklahoma specimens were examined. Series of six subspecies were compared with specimens from other states.

Two subspecies were found to be atypical. These were designated as yumanensis yumanensis and subulatus melanorhinus on the basis of range, pending a review of the specific groups.

An original key to the Oklahoma forms is presented, using characters commonly found in bat keys (Miller and Allen, 1928, Krutzsch, 1954, Glass, unpubl., and Davis, unpubl.).

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APPENDICES

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ATLANTIC PACIFIC

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APPENDIX A

ATLANTIC PACIFIC

U.S.A.

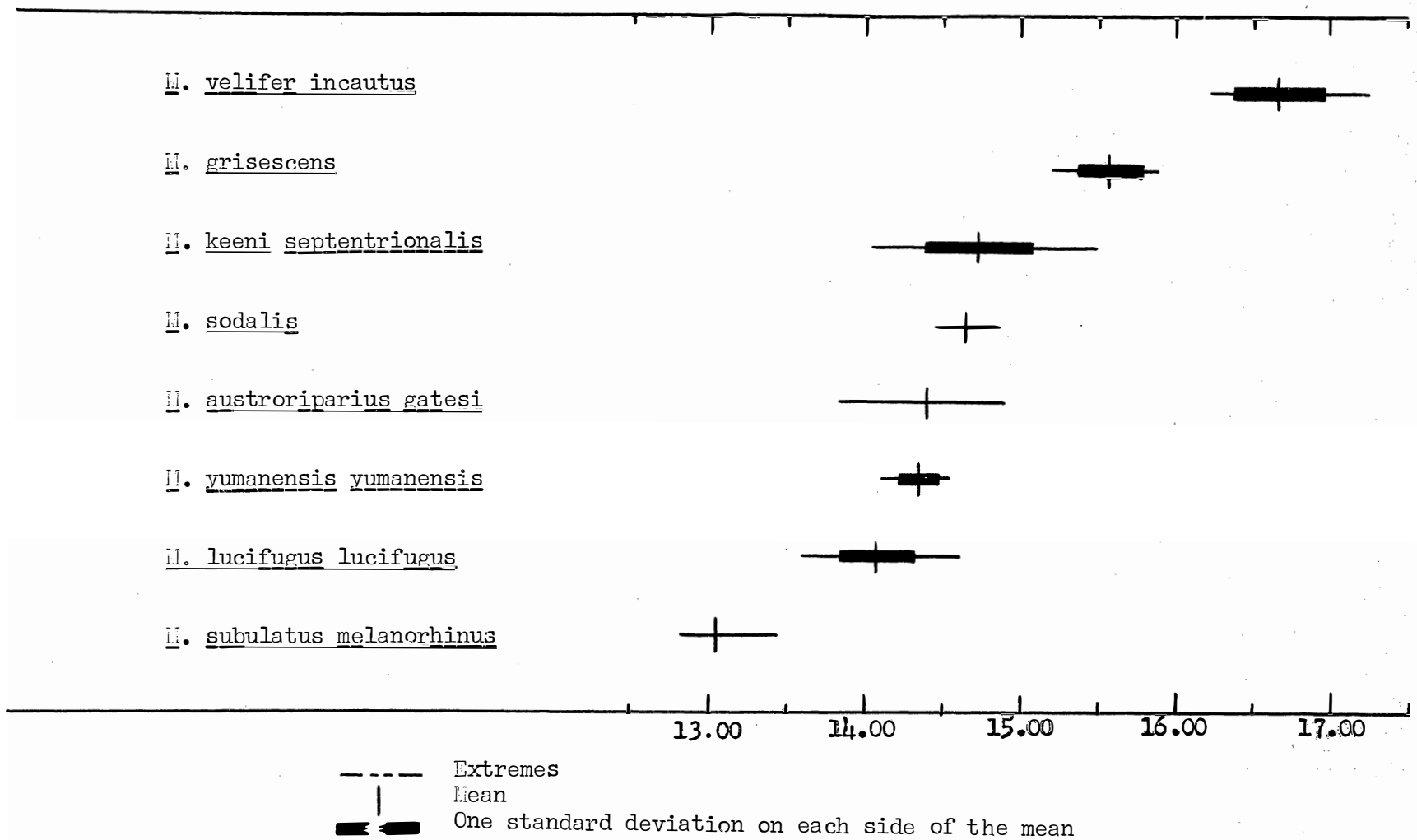


Figure 9. Total length, in millimeters, of skull in forms of *Myotis*.

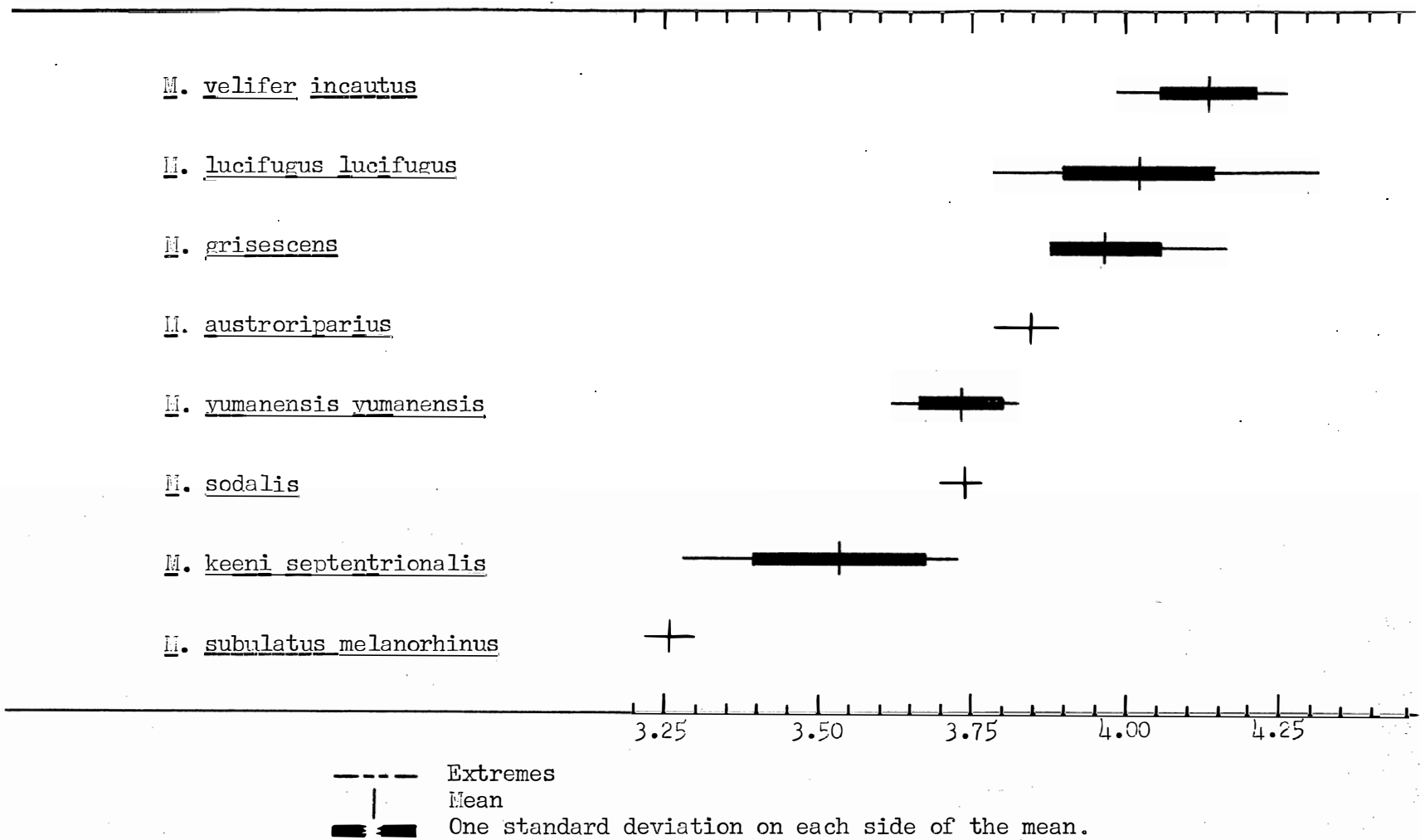


Figure 10. Interorbital constriction, in millimeters, in forms of Myotis.

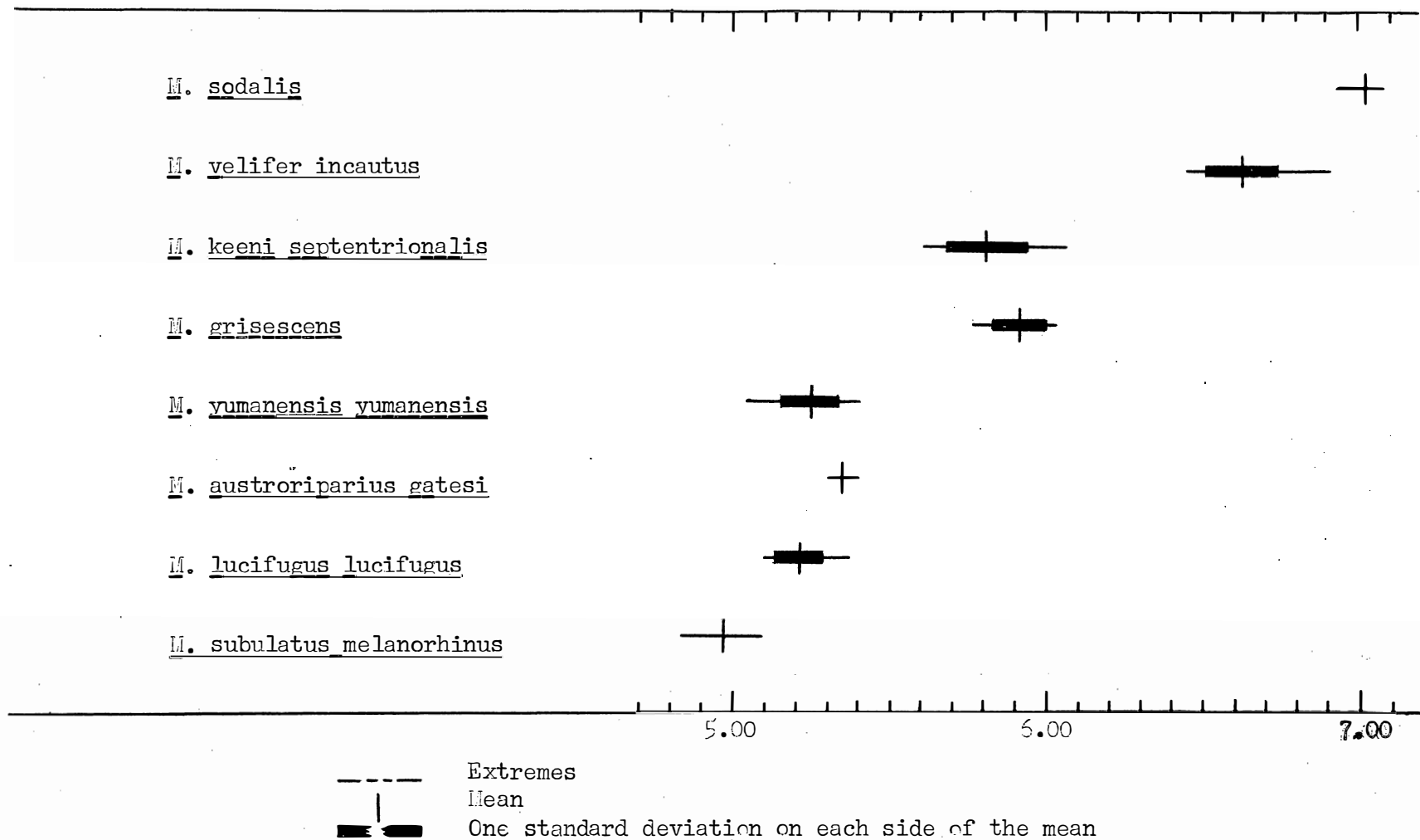


Figure 11. Length, in millimeters, of the maxillary tooth row in forms of *Myotis*.

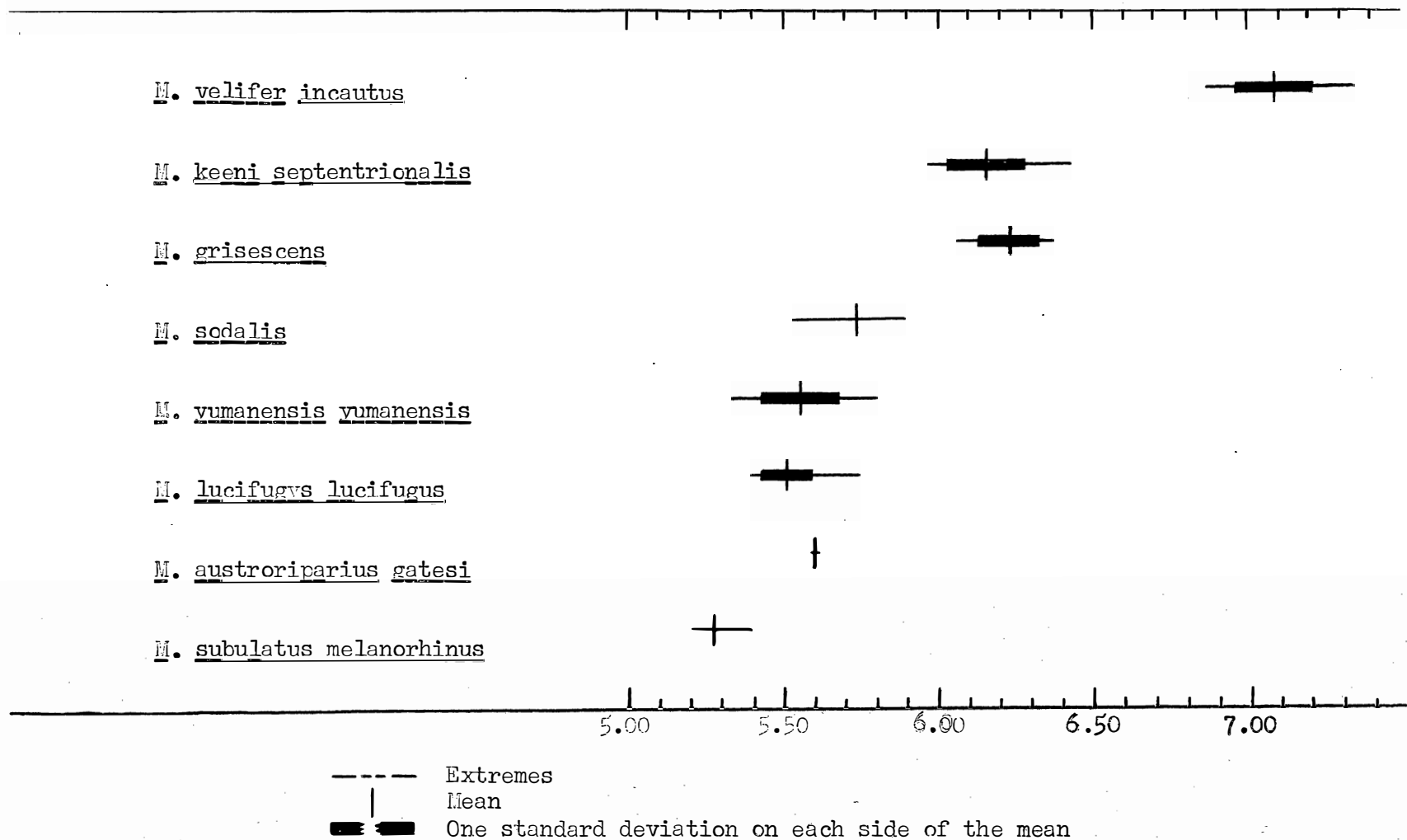


Figure 12. Length, in millimeters, of the mandibular tooth row in forms of *Myotis*.

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APPENDIX B

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## SPECIMENS EXAMINED

Myotis lucifugus lucifugus.

Museum and Number	Locality	Sex
OAH		
2332	Beaver's Bend State Park, McCurtain Co.	M
2901	" " " " " "	M
2902	" " " " " "	M
2903	" " " " " "	M
2904	" " " " " "	M
2905	" " " " " "	M
2906	" " " " " "	M
2907	" " " " " "	M
2908	" " " " " "	M
2909	" " " " " "	M
2910	" " " " " "	M
2911	" " " " " "	M
2912	" " " " " "	M
2913	" " " " " "	F
2914	" " " " " "	M
2915	" " " " " "	M

## UMMZ

97558	Carter Cave State Park, Carter Co., Ky.	M
97559	" " " " " "	F
97560	" " " " " "	M
97561	" " " " " "	M
97562	" " " " " "	M
97563	" " " " " "	M

Myotis yumanensis yumanensis.

## OAH

970	Carrizzo Creek, six miles N. of Kenton, Cimarron Co.	F
971	" " " " " "	M
972	Tesse Equite Cave, Cimarron Co.	F
973	" " " " "	F
974	" " " " "	F
975	" " " " "	F
976	" " " " "	M
977	" " " " "	F
979	" " " " "	F
980	Six miles north of Kenton, Cimarron Co.	M
981	Tesse Equite Cave, Cimarron Co.	M
983	" " " " "	M



Myotis yumanensis yumanensis. (continued)

984	Tesse Equite Cave, Cimarron Co.	F
985	" " " "	F
986	" " " "	F
987	" " " "	F
988	" " " "	F
989	" " " "	F
990	" " " "	F
991	" " " "	F
992	" " " "	F
993	" " " "	F
1164	" " " "	F
1165	" " " "	F
1166	" " " "	F
1167	" " " "	F
1168	" " " "	F
1169	" " " "	F
1170	" " " "	F
1171	" " " "	F
1172	" " " "	F
1173	" " " "	F
1174	" " " "	F
2887	" " " "	F
2888	" " " "	F
2889	Mouth of N. Carrizzo Creek, Cimarron Co.	F
2890	" " " "	F
2891	" " " "	F
2892	" " " "	F
2893	" " " "	F
2894	" " " "	F
2895	" " " "	F
2896	" " " "	F
2897	" " " "	F

Myotis austroriparius gatesi.

OAM		
2853	Eight miles E. of Smithville, McCurtain Co.	F
2854	" " " "	F
OMW192	" " " "	F
LSU		
1813	University Campus, East Baton Rouge Parish, La.	F
2101	" " " " " " " "	F
3319	One-half mile southeast of Kincaid, Rapides Parish, La.	-
6283	University Campus, East Baton Rouge Parish, La.	F



Myotis velifer incautus.

OAM

186	Twelve miles S. of Waynoka, Major Co.	M
187	" " " " "	M
188	" " " " "	M
189	" " " " "	M
191	" " " " "	M
1064	Alabaster Caverns, Woodward Co.	F
1065	" " " "	F
1066	" " " "	F
1067	" " " "	F
1068	" " " "	F
1069	" " " "	F
1070	" " " "	F
1071	" " " "	H
1072	" " " "	F
1073	" " " "	F
1074	" " " "	F
1075	" " " "	M
1076	" " " "	M
1077	" " " "	M
1078	" " " "	M
1079	" " " "	H
1080	" " " "	H
1081	" " " "	F
1083	" " " "	F
1084	" " " "	M
1085	" " " "	M
1364	" " " "	M
1365	" " " "	F
1366	" " " "	-
1367	" " " "	M
1368	" " " "	F
1369	" " " "	F
1370	" " " "	M
1371	Corn Caves, Washita Co.	H
1372	Alabaster Caverns, Woodward Co.	M
1373	Two miles W. of May, Harper Co.	M
1374	" " " " "	H
1375	Alabaster Caverns, Woodward Co.	H
1376	" " " "	F
1379	" " " "	F
1380	" " " "	M
1902	" " " "	M
1903	" " " "	F
1904	" " " "	F
1905	Icebox Cave, Woodward Co.	M
2268	Warehew Cave, Woods Co.	F

Myotis velifer incantus. (continued)

OAM

2272	Alabaster Caverns, Woodward Co.	F
2273	Marchew Cave, Woods Co.	F
2274	" " "	M
2275	" " "	F
2276	" " "	M
2277	Jester Cave, Greer Co.	M
2278	" " "	M
2279	Reed Caves, Harmon Co.	F
2280	" " "	M
2281	" " "	M
2282	" " "	M
2283	" " "	M
2284	" " "	M
2285	" " "	M
2286	Icebox Cave, Woodward Co.	F
2305	" " "	F
2306	Griever Creek Cave, Major Co.	M
2307	" " " "	M
2308	" " " "	M
2309	" " " "	M
2310	" " " "	M
2311	" " " "	M
2315	" " " "	M
2316	Icebox Cave, Woodward Co.	F
2333	" " " "	F
2334	" " " "	M
2335	" " " "	M
2336	Griever Creek Cave, Major Co.	M
2337	" " " "	M
2344	One-half mile S. of Mooreland, Woodward Co.	F
2345	" " " "	F
2346	" " " "	F
2347	" " " "	F
2366	Alabaster Caverns, Woodward Co.	F
2377	Mooreland, Woodward Co.	F
2404	Marchew Cave, Woods Co.	F
2405	Mooreland, Woodward Co.	M
2406	" "	M
2454	Jester Cave, Greer Co.	F
2809	Anderson Creek Caves, Woods Co.	F
2900	Corn Caves, Washita Co.	F

Myotis keeni septentrionalis.

OAM

2323	Crystal Cave, Adair Co.	F
------	-------------------------	---

Myotis keeni septentrionalis.

## OAM

2324	Crystal Cave, Adair Co.	M
2325	" " "	M
2326	" " "	M
2327	" " "	M
2328	" " "	M
2329	" " "	M
2330	Adair Bat Cave, Adair Co.	M
2634	Crystal Cave, Adair Co.	M
2635	" " "	M
2916	Cave Springs Cave, Adair Co.	F
2917	" " " "	M
2918	" " " "	M
2919	" " " "	M
2920	" " " "	M
2921	Crystal Cave, Adair Co.	M
2922	Duncan Cave, Delaware Co.	M
2923	" " "	M
2924	Cave Springs Cave, Adair Co.	M
2925	Crystal Cave, Adair Co.	M
2926	Kiamichi Mountain Cave, Leflore Co.	M

## UMZ

33095	Isle Royale, Mich.	M
33097	" " "	M
82515	Douglas Lake, Cheyboygan Co., Mich.	M

Myotis sodalis.

2269	Adair Bat Cave, Adair Co.	F
2289	" " " "	M
CMW179	Bower's Trail Cave, Pushmataha Co.	
CMW180	" " " "	

Myotis subulatus melanorhinus.

2664	One mile N. of Granite, Greer Co.	F
2855	Windmill Cave, Kiowa Co.	F
2856	Radzinski Mountain Cave, Kiowa Co.	M
2857	" " " "	M
2862	North Carrizzo Creek below tip of Black Mesa, Cimarron Co.	F



VITA

Claud Max Ward

Candidate for the Degree of

Master of Science

Thesis: SPECIES OF THE GENUS Myotis IN OKLAHOMA

Major Field: Zoology

Biographical:

Personal data: Born on December 29, 1924, at Benton, Arkansas; son of T. W. and Martha Ruth Ward.

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