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An annotated checklist of the bats of Bernalillo County, New Mexico.

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AN ANNOTATED CHECKLIST OF THE BATS OF BERNALILLO COUNTY, NEW MEXICO

By

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ABSTRACT

In 1960-61, Bernalillo County, New Mexico, was surveyed for bats. The purpose of this survey was to determine what kinds of bats occur in the county and to collect natural history data on these bats. Bats were obtained by cave and roost searching and by mist-netting and shooting over ponds, streams, and tanks. For all bats collected, standard museum study skins and skulls as well as alcoholic carcasses are preserved in the Museum of Southwestern Biology at the University of New Mexico.

Fourteen species of bats are known to occur in Bernalillo County. Of these the following six have not previously been reported from the county: Myotis keeni, Myotis volans, Myotis subulatus, Pipistrellus hesperus, Lasiurus cinereus, and Tadarida molossa.

From the ecological data, it is clear that no one factor or group of factors consistently influenced bat activity. However, temperature ranges indicated that most bats flew at temperatures of 15-20 C. Myotis keeni, Plecotus townsendi, and Lasionycteris noctivagans were found flying at lower temperatures. Myotis keeni and Plecotus townsendi were mostly taken at high altitudes, while Lasionycteris noctivagans was absent from the county in the hotter month of August and scarce in the equally warm month of July.

Parturition in ten species of bats occurs during the last week in June and the first week in July. Males are

producing sperm, while females are lactating. However, copulation probably occurs in fall in most vespertilionids.

Nine species of bats are known to breed in the county. Two other species do not breed here but occur during migration.

Two species, Myotis subulatus and Plecotus townsendi, are known to hibernate in the county, while Myotis keeni, Myotis californicus, Myotis thysanodes, Myotis volans, Eptesicus fuscus, Antrozous pallidus, Tadarida brasiliensis, and Tadarida molossa are known only as summer residents. Lasiurus cinereus and Lasionycteris noctivagans are migrants. A few male hoary bats, however, remain as summer residents.

Bats in Bernalillo County were most abundant in June when the migratory peak of the silver-haired and hoary bats was reached. There was a decline in numbers in July and August, followed by an increase in numbers in September. The second peak indicates a southward migration.

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INTRODUCTION

Few observations have previously been made on bats in Bernalillo County, New Mexico. Ivey (1957) lists six species from this county, while Clothier (1957) lists only two. The purpose of this study is to record the species of bats occurring in Bernalillo County and to present natural history data collected in a 1960-61 survey. Much of the natural history information collected is concerned with reproduction and is especially important because reproductive data on bats are scanty. This is shown by Cockrum (1955) in his summary of reproductive information on females and by Asdell (1946) in his book in mammalian reproduction patterns. Further evidence of lack of data is shown by Wimsatt (1945). Of the bats known to occur in Bernalillo County, extensive work has been done on four species. Pearson, Koford, and Pearson (1952) worked on Plecotus townsendi. Christian (1956) worked on Eptesicus fuscus. Orr (1954) worked on Antrozous pallidus, and Short (1961a, b) worked on Tadarida brasiliensis.

Bernalillo County is located in north-central New Mexico (Fig. 1). The eastern part of the county is occupied by two north-south trending mountain ranges separated by Tijeras Canyon. The Rio Grande Valley bisects the county into eastern and western halves. West of the Rio Grande, an extensive plain sloping upward to the west is partially bordered on the east by lava flows. In the extreme western

part of the county lies the Rio Puerco Valley (Fig. 2).

Vegetation is largely desert-grassland from the foothills of the Sandia and Manzano Mountains to the western edge of the county. The Rio Grande Valley is occupied by a riparian community dominated by cottonwood (Populus wislizeni) and with extensive riverside stands of tamarisk (Tamarix sp.) and willow (Salix exigua).

The mountains exhibit three plant communities. At elevations of 6,500-7,200 ft, pinyon-pine (Pinus edulis) and junipers (Juniperus monosperma and J. deppeana) prevail. This vegetation gradually gives way to ponderosa pine (Pinus ponderosa) at elevations of 7,200-8,200 ft. The higher elevations are occupied chiefly by Douglas fir (Pseudotsuga taxifolia), white fir (Abies concolor), and Engelmann spruce (Picea engelmanni). An occasional blue spruce (Picea pungens) is found in these higher elevations. Where cooler more mesic slopes occur, these plant communities extend down to lower elevations. The converse is also true. In the drier Manzano Mountains, these plant communities are at higher elevations.

Fig. 1. Map of New Mexico showing the position of Bernalillo County in the state. Bernalillo County is shaded.

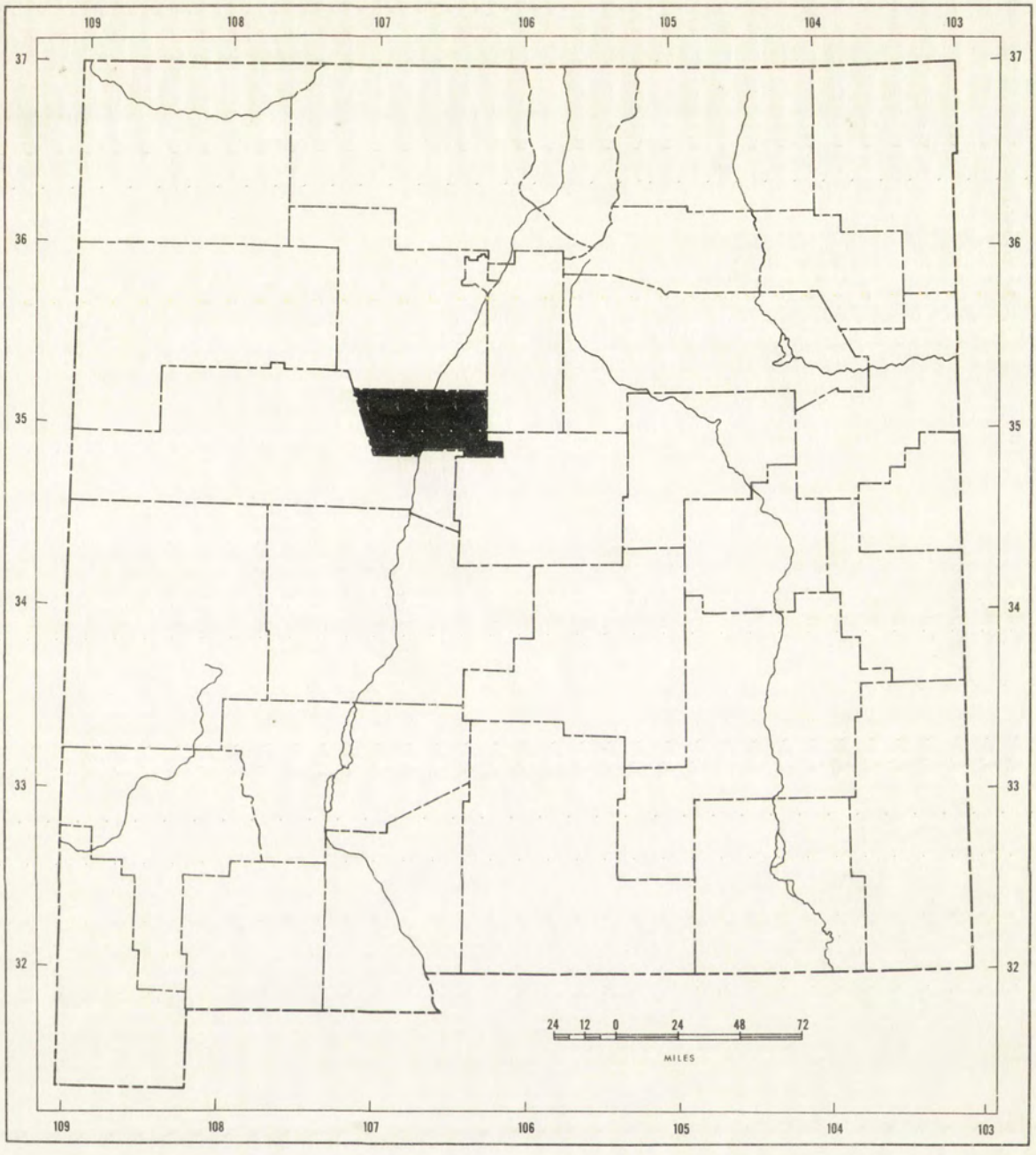


FIGURE 1

Fig. 2. Map of Bernalillo County showing major physical features and collecting stations by number.

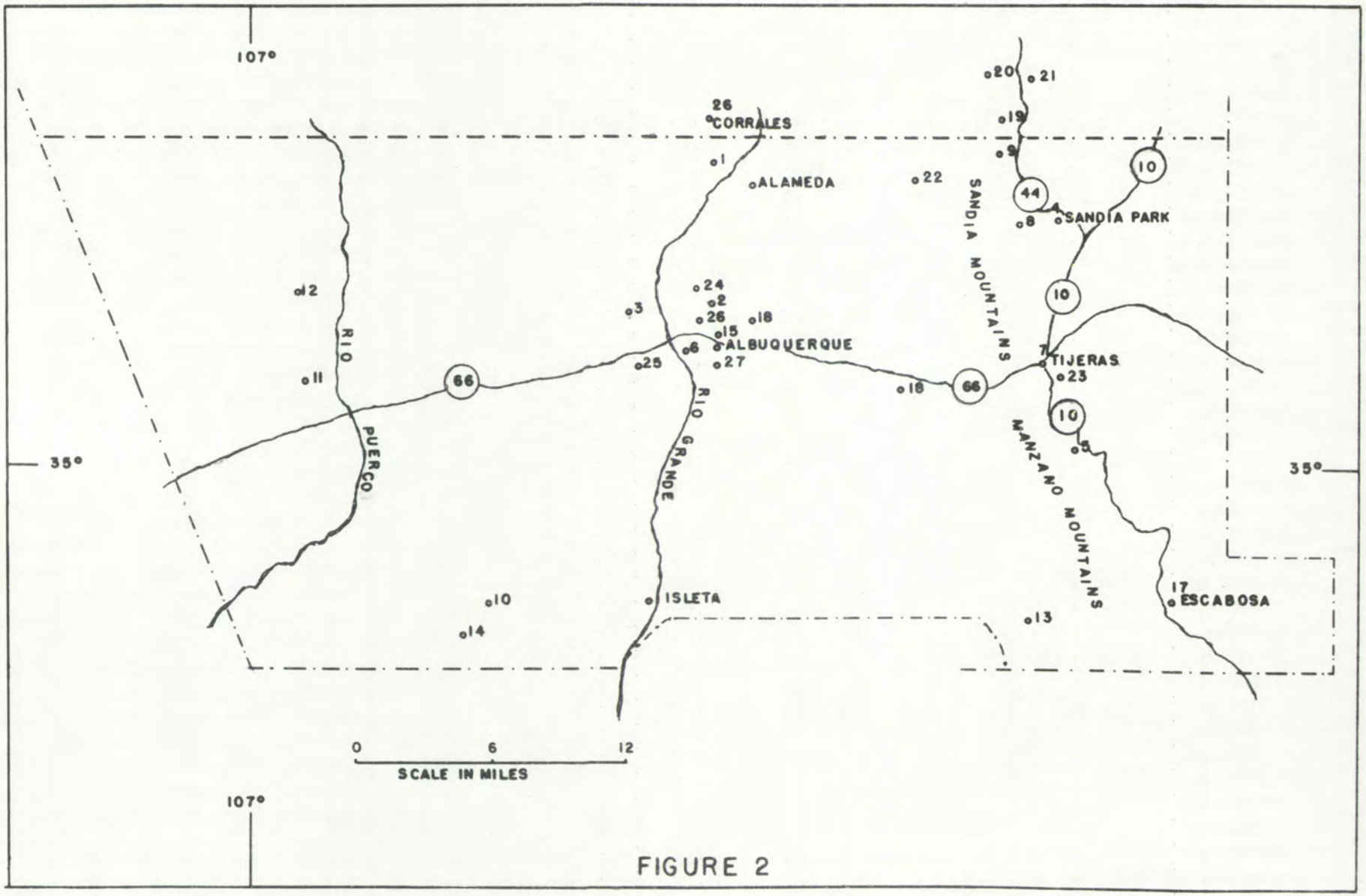

107°
35°
CORRALES
ALAMEDA
ALBUQUERQUE
SANDIA PARK
TIJERAS
ISLETA
ESCABOSA
SANDIA MOUNTAINS
MANZANO MOUNTAINS
RIO PUERCO
RIO GRANDE
66
44
10
0 6 12
SCALE IN MILES

FIGURE 2

MATERIALS AND METHODS

This study is based on 608 bats collected in 1960-61 and 82 specimens previously preserved in the Museum of Southwestern Biology at the University of New Mexico. Reproductive and ecological data in this paper are from bats collected in 1960-61. In most cases this information was not available for specimens taken in earlier years.

Bats were obtained by cave and roost searching and by mist-netting or shooting over ponds, streams, and tanks. For all bats collected, standard museum study skins and skulls as well as alcoholic carcasses are preserved.

Temperature, cloud cover, wind, phases of the moon, and time of moonrise were recorded for each collection night. Major vegetation and physical features of each collecting station were described.

All bats were examined to determine reproductive condition. The uteri of females were examined for embryos, and the development of mammary gland tissue was recorded. Testis length was taken for males, and a microscopic examination of testis and epididymis smears in normal saline solution was used to reveal the presence of sperm.

Young of the year were identified by unfused phalangeal epiphyses or in some cases by the presence of juvenile pelage.

Bats were taken at 27 stations in Bernalillo and Sandoval counties. Descriptions of all collecting stations

used by the writer are given in the following list. Stations 22-27 were not personally used and no description can be given. Each station is numbered and localities are read directly from tags affixed to specimens. The number of the station is used for localities plotted on the map, in Table 1, and in the specimens-examined list following each species account. In all lists of specimens examined, the first number indicates the collecting station. The second number, which is given in parenthesis, is the number of bats taken at that station.

1. 3 mi W Alameda on State Road 46, W bank of Rio Grande, elevation 4,900 ft.

   This area is a cottonwood-willow complex typically found along the Rio Grande in Bernalillo County. Bats were netted over a fast-water drainage ditch. The area surrounding the drainage ditch is heavily wooded, but not far from the ditch are extensive areas of irrigated farm land.

2. 3½ mi N and 12 mi W of Yale and Central avenues in Albuquerque, elevation 5,200 ft.

   One bat was taken from a residence about 2 miles from the foothills of the Sandia Mountains. Formerly an arid grassland, the area is now a suburban neighborhood.

3. 4.2 mi W and 3.4 mi N of 1st and Central avenues in Albuquerque, elevation 5,200 ft.

   The attics of the buildings at the College of St. Joseph

afford an excellent place for a nursery roost of pallid bats. Entrance is easily gained through slat-type ventilators in the peaked roofs. Bats were taken as they entered a pillared porch used as a resting place. Vegetation around the college is arid grassland, but the Rio Grande with its characteristic vegetation is less than a mile to the east.

4. Sandia Park, R 5 E, T 11 N, Sec 24, Sandia Mountains, elevation, 7,100 ft.

   Bats were netted over a wide, shallow pond surrounded by slopes densely wooded with pinyon pine, juniper, and to a lesser degree ponderosa pine. The pond is situated in the center of Sandia Park, a small town of a few residences and a general store.

5. Cedro Canyon, R 5 E, T 9 N, Sec 2, Manzano Mountains, elevation 6,800 ft.

   Bats were netted over small foot-deep pools formed by a shallow stream in the bottom of a steep, rocky-walled canyon. The sparse pinyon-juniper vegetation is found primarily on the canyon walls above the stream. An occasional ponderosa pine is found along the stream.

6. Tingley Beach, Rio Grande Park, Albuquerque, elevation 4,900 ft.

   Bats were netted over shallow, stagnant ponds of water which cover more than an acre. This area was formerly a swimming pool, but has become filled in and weed-clogged from lack of care. The Rio Grande is less

than a mile west of the park and the river-bottom vegetation is characteristically the same as in the park.

7. Tijeras, Tijeras Canyon, elevation 6,300 ft.
(a) Bats were taken over a small stream in an arroyo. The stream is located less than 30 ft south of the post office. The steep banks of the arroyo are sparsely covered with juniper and to a lesser degree pinyon pine. To the north and south of the arroyo are the rocky slopes of the Sandia and Manzano Mountains.
(b) A roost was located about one-half mile east of the Tijeras Post Office. The bats were occupying small openings behind the rafters of a tin-roofed dining hall of a summer camp. Entrance was gained through openings along the fireplace chimney. Nets were set over these openings. The building was surrounded by sparse pinyon-juniper vegetation.
8. Cienega Canyon, 1½ mi W of Sandia Park, R 5 E, T 11 N, Sec 3, Sandia Mountains, elevation 8,000 ft.
Netting was done over a narrow, shallow spring which runs through a well-wooded rocky canyon. Major vegetation is ponderosa pine, Douglas fir, and Engelmann spruce. An occasional blue spruce is found along the stream.
9. Embudo Cave, R 5 E, T 11 N, Sec 9, Sandia Mountains, elevation 8,800 ft.

A net was placed over the entrance to a damp limestone cave. The opening is about 6 ft wide and 3 ft high. The area around the cave is densely wooded with white fir, Douglas fir, and Engelmann spruce.

10. Isleta Cave, 8 mi W of Isleta, boundary between NW¼ and NE¼, Sec 31, R 1 E, T 8 N, elevation 5,680 ft. Nets were placed over two entrances to a dry lava cave. The original opening is in the ceiling, but the cave was once mined for guano and a second more accessible side opening was made. The area around the cave is a series of lava flows covered by grassland. A number of stock tanks are available for water.

11. 19½ mi W and 2½ mi S of 1st and Central avenues in Albuquerque, R 2 W, T 10 N, Sec 24, elevation, 5,700 ft. This area is an arid grassland west of Albuquerque in the Rio Puerco Valley. Netting was done over a large concrete stock tank and several troughs. There are sandstone cliffs about 3 miles northwest of the tank. An occasional house is found in the vicinity.

12. 21 mi W and 2½ mi N of 1st and Central avenues in Albuquerque, R 2 W, T 10 N, Sec 11, elevation 5,700 ft. Netting was done over a concrete stock tank located in an arid grassland of the Rio Puerco Valley. The area is characterized by rolling grass-covered hills. No continuously occupied dwellings or rocky areas were located within a 2 mile radius of the tank.

13. Hell Canyon, R 5 E, T 8 N, Sec 22, Manzano Mountains, elevation 6,800 ft.

Bats were collected over a small, metal, spring-fed tank. The canyon has gently sloping walls which are sparsely covered with pinyon-juniper growth. Junipers are more abundant than pinyon pines.

14. 7 mi W and 1 mi S of Isleta, R 1 W, T 8 N, Sec 35, elevation 5,700 ft.

Bats were collected over a low concrete tank about one-half mile north of a lava outcrop. The area surrounding the tank is a flat, arid grassland interrupted abruptly by a series of lava bluffs.

15. 1st and Central avenues, Albuquerque, elevation 4,900 ft.

One bat was taken from a curtain in a downtown beauty shop.

16. Tijeras Canyon, 9½ mi E and 1½ mi S of list and Central avenues in Albuquerque, R 4 E, T 10 N, Sec 26, elevation 5,700 ft.

Bats were netted over a deep fish pond surrounded by cultivated cottonwood trees. To the north and south of the pond the rocky slopes of the Sandia and Manzano Mountains are sparsely covered with juniper and some pinyon pine.

17. Escabosa, R 6 E, T 8 N, Sec 15, Manzano Mountains, elevation 7,200 ft.

Bats were taken from a roost in a tin-roofed barn. The bats were found behind the rafters which support the roof. Vegetation around the barn was dense pinyon-juniper.

18. Albuquerque Heights, Albuquerque, elevation 5,200 ft.
A single bat was taken from a residence in Albuquerque Heights.

19. Ellis Cave, NW¼, Sec 33, R 5 E, T 12 N, Sandia Mountains, Sandoval County, elevation 8,200 ft.
Bats were netted entering a damp limestone cave situated in the face of a rocky cliff. The entrance is a high, narrow slit which rapidly narrows to an opening about 3 ft wide and 4 ft high. The cave is located on a warm, dry slope which exhibits pinyon-juniper vegetation, but on the slope opposite the cave and in the intervening depression, dense white fir, Douglas fir, and Engelmann spruce are found. At the base of the rocky cliff, a small, cold stream runs through a gully.

20. Las Huertas Canyon, R 5 E, T 12 N, Sec 22, Sandia Mountains, Sandoval County, elevation 6,400 ft.
Bats were taken over a pool about 2 ft deep in a fast-moving stream. The canyon walls are sparsely covered with pinyon-juniper growth. However, there is an abundance of New Mexican locust (Robinia neomexicana) along the stream.

21. Shallow Cave, R 5 E, T 12 N, Sec 22, Las Huertas Canyon, Sandia Mountains, Sandoval County, elevation 6,500 ft.

    Bats were taken entering a large opening to a shallow sandstone cave. The cave, consisting of a single large room, is found 100 ft above the canyon floor. A steep hillside leading up to the cave is sparsely covered with pinyon-juniper and gambel oak (Quercus gambelii). At the base of the hillside is a small fast-moving stream.

22. Mouth of Juan Tabo Canyon, T 11 N, R 4 E, Sec 2.

23. Camp Easter Seal.

24. Ranchos School, Albuquerque.

25. 8 mi SW of Coors Road.

26. Corrales, Sandoval County.

27. Albuquerque.

RESULTS

Fourteen species of bats were found in Bernalillo County. Six of these are reported herein for the first time.

Table 1 presents ecological data for all bats personally collected. In this Table, bats are arranged by species. Sundown time, sky cover, moon observations, and wind observations taken each collection night are presented. All observations were taken after sundown within the collecting hours.

Temperature ranges, throughout which each species was active, are presented in Fig. 20. Overlap in range is seen for all species where more than 20 bats were taken. For three species (Pipistrellus hesperus, Myotis californicus, Tadarida molossa), the numbers taken were too small to indicate a valid range. For two species (Myotis keeni, Plecotus townsendi), a low temperature range is shown.

Table 2 shows percentage of each species taken in each plant community and total percentages of all bats collected in each plant community. The data in this table may be somewhat biased as nine stations are in grassland communities and ten are in pinyon-juniper communities. The remaining eight are in riparian, fir, or ponderosa communities. Bats taken in riparian communities have been included in the grassland community.

Fig. 21 summarizes reproductive data on males of nine

species of bats. Variability among species in time of sperm production is noticeable.

Fig. 22 summarizes reproductive data on females of eleven species of bats. Parturition in most species occurs between late June and early July.

Fig. 23 presents number of bats taken per hour during collecting hours for each month. Bernalillo County bats are most abundant in June.

SPECIES ACCOUNTS

Myotis californicus (Audubon and Bachman)

A single male of this species was collected from Isleta Cave on 3 August. This bat, along with seven Myotis thysanodes and ten Antrozous pallidus, was taken from a dry lava cave.

The testis of this animal measured 5 mm in length, and no sperm was found in the testis or epididymis.

The only other record of this bat in the county was reported by Clothier (1957, p. 24-27) who acquired a dried and partially decomposed specimen from a barn at Tijeras Ranger Station in the Manzano Mountains. Unfortunately, this specimen was not available for examination and its identity remains open to question.

Specimens examined: (total number, 1), 14(1)

Myotis keeni (Merriam)

Myotis keeni inhabits pinyon-juniper, ponderosa pine, and fir communities in Bernalillo County. The majority of

my specimens are from areas of ponderosa pine and fir.

The earliest record of occurrence is 10 May, while the latest record is 31 October. There are no records of this bat in the winter months.

Each of eight females taken in May and June contained a single embryo. Lindsay (1956, p. 544) reports two females taken 21 May and 27 May as containing four and two embryos respectively.

My latest record for a pregnant female is 20 June. Two females taken 29 June were lactating. Additional reproductive data on the females is shown in Fig. 3.

All males taken after 4 August had sperm in the testes and epididymides. Fig. 4 shows presence of sperm relative to testis length and date.

Specimens examined: (total number, 36), 4(1), 5(1), 8(1), 9(23)

Myotis subulatus (Say)

Myotis subulatus inhabits grassland, pinyon-juniper, ponderosa pine, and fir areas in Bernalillo County. The earliest date of activity is 30 May. However, two females taken 6 January from Embudo Cave indicate that this species hibernates in the county.

One female taken 18 June contained a single well-developed embryo. Koford and Koford (1948, p. 417) report a single embryo per litter in this species as did Bailey (1931, p. 391), Hall (1946, p. 144), and Quay (1948, p. 181).

Specimens examined: (total number, 30), ♂(1), ♀(1), ♀(2), ♀(32)

Females taken 3 July and 22 July were lactating. This indicates that parturition occurs between the end of June and early July (Fig. 5). Koford and Koford (1948, p. 417) report parturition on 26 May in California, while Quay (1948, p. 181) reported a pregnant female on 12 July in the badlands area of Nebraska and Wyoming.

Males taken 20 July, 4 August, and 5 August had sperm in the testes and epididymides. Females taken from hibernation in Embudo Cave on 6 January had sperm in their reproductive tracts, although no males were found in the cave. Wimsatt (1945, p. 32) observed a single copulation in this species in a Pennsylvania cave in mid winter. One male, perhaps a first-year animal, netted 1 October had small testes and no sperm.

Specimens examined: (total number, 20), 4(4), 5(1), 8(6), 9)4), 13(1), 14(2), 22(2)

Myotis thysanodes (Miller)

Myotis thysanodes inhabits primarily grassland and pinyon-juniper areas in this county. I have two specimens from a fir community and one from a ponderosa pine community, but all others are from lower elevations. Hall (1946, p. 138) reports this bat from ponderosa pine and grassland areas in Nevada, while Cahalane (1939, p. 422) reports its occurrence at the border of the Upper and Lower Sonoran zones in Arizona.

In May, pregnant females, each containing a single

embryo, were taken from two roosts. Fourteen were collected from a dry lava cave on 12 May, while another 29 were collected on 13 May from behind the rafters supporting the tin roof of a barn near Escabosa. The latest pregnant female was taken 26 June, and lactating females were taken 23 July. By 3 August, young of the year were flying. For additional information on young of the year, see Fig. 6. Hall (1946, p. 138) reports young of the year 13 July in Nevada, while Dalquest (1953, p. 49) noted young of the year nearly grown 23 June in San Luis Potosí.

Few adult males were taken; sperm was noted only on 5 August. All other males taken in August and September were young of the year.

I took this bat mostly from roosts. Nursery colonies are apparently formed by mid-May. Young are born near the end of June and are flying by the first week in August. The nursery colony in Isleta Cave appeared to have dispersed in August, with the adults vacating earlier than the young. By September, all bats of this species taken at the cave were young.

Isleta Cave was also used as a nursery colony by Antrozous pallidus. The pallid bats occupied crevices in a dimly lit room just inside the ceiling entrance where the temperature was similar to that outside, while the fringed bats were found in a cooler, darker room and hung from the open ceiling. When the bats left the cave in the evening,

the pallid bats left earlier than Myotis and preferred the ceiling shaft, while Myotis used either opening.

Specimens examined: (total number, 69), 8(1), 9(2), 10(35), 11(1), 17(29), 19(1)

Myotis volans (H. Allen)

Myotis volans was taken in grassland, pinyon pine, ponderosa pine, and fir communities, but seemed to be more abundant in pinyon-juniper and ponderosa pine.

There seems to be some correlation between seasonal distribution and altitude in this species. All bats from May through the end of July were taken in pinyon-juniper or higher, while a series of August specimens came from grassland areas.

The earliest record of occurrence in the county is 10 May and the latest 21 October. The bat taken on the latter date was banded.

Pregnant females, each containing a single embryo, were collected 31 May, 7 June, and 18 June. A single embryo per litter has been reported for this species by Dalquest and Ramage (1946, p. 62), Hall (1946, p. 140), and Quay (1948, p. 181).

The earliest lactating female was taken 3 July and the latest 31 August. Seemingly, there is a great deal of variation in gestation period or parturition in this species. Dalquest and Ramage (1946, p. 62) report pregnant females 4 June giving birth shortly after capture at Fort Tejon,

California, while Findley (1954, p. 434) reports that he took pregnant females on 11 July and 13 July in Teton County, Wyoming, which he judged would give birth in a week.

I believe that parturition occurs in this county between the end of June and early July (Fig. 7).

Pearson, Koford, and Pearson (1952, p. 319) state that gestation length in Plecotus townsendi probably depends on the mother's body temperature and the presence or absence of other bats. Possibly similar factors operate to explain the variation noted above.

Sperm was noted first on 10 July. Fig. 8 gives a summary of the presence of sperm relative to date and testis length.

Young of the year were taken 3 August, 4 August, and 5 August. For additional records by month of young of the year, see Fig. 7.

Specimens examined: (total number, 68), 4(12), 5(7), 8(27), 9(8), 11(4), 12(4), 13(2), 14(1), 18(1), 20(1), 22(1)

Myotis yumanensis (H. Allen)

Ivey (1957, p. 493) reported this bat on the basis of a single specimen donated by a student. The exact site of capture in the county is uncertain. Mr. Ivey very kindly allowed me to examine his specimen.

The localities for two other specimens in the lot from Valencia County very closely approach the Bernalillo County

line. A female taken 1 mile north of U.S. Highway 66 on the Canoncito Road is less than a mile from the western boundary of Bernalillo County, while the other, a male taken at Correo Snake Pie, 1 mile south of Correo, is about 3 miles from the western boundary of Bernalillo County.

Lasionycteris noctivagans (Le Conte)

The silver-haired bat is most frequently taken in pinyon-juniper communities in this county. Of 50 specimens, only two came from the Rio Grande Valley.

The earliest record for this bat is 20 April, while the latest is 19 October. The bat taken 19 October was banded and released.

In April, both males and females are present, but there are no other records of females from any other month. Males are abundant in June (Fig. 9) and absent in August. They are again present in September and October. Records for this county indicate a migratory wave which reaches its peak in June. Absence of these animals in August followed by reappearance in September indicates a movement through the county in the fall. Migration (Thomas, 1921; Manville, 1942), as well as hibernation (Bear, 1956; Smith and Parmalee, 1954; Pearson, 1962), has been reported for this species.

Each of two females taken in April contained a single embryo, while two others taken on the same dates appeared unbred. Bailey (1929, p. 155) in Minnesota and Bailey (1926,

p. 213) in North Dakota report pregnant females with two embryos per litter. Bailey (1926, p. 213) reports a female with two young taken in North Dakota on 22 June.

Males taken in September had sperm in the testes and epididymides. Fig. 10 shows presence of sperm relative to testis length and date.

Specimens examined: (total number, 50), 4(7), 5(29), 16(12), 27(2)

Pipistrellus hesperus (H. Allen)

Four specimens of the western pipistrel were taken 9 August and 11 August near or over a tank in a semi arid grassland. On both dates, these bats appeared shortly before sundown, their flight overlapping with the dusk foraging of the common nighthawk. Early evening flight is well known in this species (Bailey, 1931; Davis, 1939; Hall, 1946; and others). These bats appeared to be attracted to the cattle that came to the tank. They flew out to meet the cattle and followed them in as the cattle approached the water. The bats appeared to feed on insects disturbed by or attracted to the cattle.

Probably the nearby lava bluff was used for roosting, as the only other available site was a nearby cave which was searched frequently for bats. Pipistrellus hesperus has been reported roosting on the undersides of boulders (Hardy, 1941; von Bloeker, 1932) and in crevices (Burt, 1934; Hall, 1946) as well as in caves (Stager, 1943; Hardy, 1949).

All four specimens proved to be young of the year.

Specimens examined: (total number, 4), 14(4)

Eptesicus fuscus (Beauvois)

Eptesicus fuscus is more common in pinyon-juniper communities than elsewhere in this county. Only one of ninety-five specimens was taken in the Rio Grande Valley. Bailey (1931, p. 384) describes the center of abundance of this bat in the ponderosa pine areas of New Mexico. Forty-five of these bats were taken at Sandia Park, which closely approaches the ponderosa pine community.

Five pregnant females and one lactating female were netted 18 June, while four others appeared unbred. Hall (1946, p. 152) reports pregnant females from Nevada between 24 June and 28 June, while Howell and Little (1924, p. 261), reporting on studies of California bats, noted females with young, some of which were half grown on 16 June. Krutzsch (1946, p. 241) reported parturition in late May and early June in California. I estimate time of parturition in central New Mexico to be approximately the end of June. Thirteen females taken 3 July were lactating as were females taken later in the month (Fig. 11), while the latest female in this condition was noted 8 August. Christian (1956, p. 87) states that the period of parturition probably extends from the second week of May to the end of the third week in June.

Young of the year were flying on 10 July. Smith and

Goodpaster (1956, p. 441-442) reported 26 juveniles collected 31 July in Ohio.

Each pregnant female contained a single embryo. Cockrum, (1955, p. 500) in his summary of literature on reproduction in North American bats, states that the big brown bat has one young per litter in the western part of its range, but has two young per litter in the eastern part. Christian (1956, p. 84) also noted this when he surveyed the literature.

Males taken as early as 7 June showed sperm in the testes and epididymides. Few adult males taken in June, July, and August were without sperm (Fig. 12). Christian (1956, p. 81) found three adult males with spermatids on 19 June and 22 June. He presumed that full-scale spermatogenesis would be reached by August. One young male taken 11 August had sperms. Christian (1956, p. 88) found that all male Eptesicus fuscus appear to reach sexual maturity in their first summer, producing sperm somewhat later than the adult males.

This species has been noted in Bernalillo County from 26 May to 7 September. There are no winter records. Specimens examined: (total number, 98), 2(1), 4(45), 5(34), 7(3), 13(14), 16(1)

Lasiurus cinereus (Beauvois)

Hoary bats have been taken chiefly in pinyon-juniper communities in Bernalillo County. There is some indication

that these bats appear in the Rio Grande Valley and lower pinyon-juniper areas in April and move to higher pinyon-juniper in May and June.

The earliest date of occurrence is 14 April, while the latest is 7 September. The females arrive first in April and May. By June, males are present in abundance, but only three females were taken during this month. Males remain through the summer, but become less abundant (Fig. 13). I have a single September record for a female.

Pregnant females are recorded from 14 April through 24 June. All pregnant females contained two embryos each. Litters of two embryos have been reported by a number of authors, for example, Provost and Kirkpatrick (1952, p. 110, 112), Bailey (1931, p. 208), and Hall (1923, p. 192). Two females taken in June appeared unbred. There is no evidence that the hoary bat breeds in this county.

Five males taken 15 July had sperm in the testes and epididymides, as did most males taken subsequently. For information concerning testis length relative to date and presence of sperm see Fig. 14.

The hoary bat is migratory in this county. The spring movement appears to reach its peak in June; however, there is no evident peak in the fall.

Specimens examined: (total number, 152), 1(1), 4(85), 5(60), 8(1), 13(1), 16(4)

Plecotus townsendi (Cooper)

Plecotus townsendi has been taken primarily in fir communities in the county, with a few records from grassland and pinyon-juniper communities. All of these bats were taken from caves. Suitable roosting places, not the type of dominant plants, may operate as a limiting factor in the distribution of these bats in Bernalillo County.

The types of caves inhabited by Plecotus varied greatly. Embudo and Ellis caves are damp limestone structures surrounded by fir communities, while Isleta Cave is a dry lava cave in a grassland community.

Embudo and Ellis caves are used throughout the year. In the summer, these bats use the caves for night roosting. In the winter, these same caves are used as hibernacula. Isleta Cave appears to be used only in the fall. In September and October, several of these bats were collected in this cave, but a February search of the cave proved that it was not used for hibernation.

Twenty-nine of these bats were banded 6 January, 1962, in Embudo Cave. At this same time, I found two bats hibernating in the cave with bands I had placed on them in October at the same locality. Seven more of these bats were banded 3 February at Ellis Cave. In both hibernacula, the females greatly outnumbered the males.

Females taken 25 June and 20 July were lactating. I have found no pregnant females (Fig. 15). Pearson, Koford,

and Pearson (1952, p. 318) found that gestation period in these bats varied from 56-100 days, probably depending on the body temperature of the mother, and that parturition date varied considerably, as a result.

Males taken in September and October had sperm in the testes and epididymides. Pearson, Koford, and Pearson (1952, p. 291) found that females after 21 October were inseminated and that copulation occurs in winter roosts. For information concerning testis size relative to date and presence of sperm, see Fig. 16.

Females taken 6 January from Embudo Cave had sperm in their reproductive tracts.

Specimens examined: (total number, 23), 7(1), 9(17), 10(3), 19(2)

Antrozous pallidus (Le Conte)

This is chiefly a grassland species in Bernalillo County; however, a roost was located in pinyon-juniper in May. Some males were taken in pinyon-juniper and fir areas during the summer months when the females had formed nursery colonies. However, all three nursery colonies searched contained both adult males and females. The females greatly exceeded the males in numbers. Orr (1954, p. 188) reported finding both sexes in nursery colonies in California, while Hall (1946, p. 163) reported segregation of sexes in spring before the young are born.

I took the earliest records of pallid bats in this

county on 22 April, but these bats were lost before they were skinned. The latest date is 24 September; there are no winter records.

Most records of females are from nursery roosts. Nursery roosts are formed by mid-May and persist through mid-August. Pregnant females were taken 21 May, 14 June, and 26 June. With a single exception, all contained a single embryo. Storer (1931, p. 247) reported 15 females, each containing two embryos, while Hardy (1941), Burt (1934), Vaughan (1954), and others report a single embryo for this species. Parturition in this species occurs from mid-June to the end of June. Females taken in July were lactating (Fig. 17). Orr (1954, p. 239) reports young born between early May and mid-June in California, while Beck and Rudd (1960, p. 266) report parturition from late April through mid-May and as late as mid-June.

Young males taken 3 August had sperm in the testes and epididymides (Fig. 18). Adult males taken in August also showed sperm. Orr (1954, p. 214) found two females inseminated 22 October and observed copulation in captive bats in November and February.

Young of the year were netted on 9 July, 23 July, 3 August, and 6 August. The young taken 9 July were from a roost at the College of St. Joseph, while the others were from Isleta Cave roost. There seems to be some variation in time of parturition in animals from Isleta Cave and from

the College of St. Joseph. On 14 June most females at the College of St. Joseph had given birth. One captive female gave birth 17 June. A female taken 26 June from Isleta Cave was pregnant, while two others were lactating. Earlier birth date would account for young of the year flying on 9 July at the College of St. Joseph, while the young from Isleta were not flying until 23 July.

Specimens examined: (total number, 122), 3(42), 4(3), 7(9), 10(31), 11(1), 12(19), 13(1), 14(2), 16(1), 19(1), 21(7), 23(1), 24(1), 25(1), 26(1), 27(1)

Tadarida brasiliensis (St.-Hilaire)

The little freetail bat is abundant in the Rio Grande Valley in June, July, and August. Most of my specimens are females taken in the city of Albuquerque. A few isolated males and a single female were taken in pinyon-juniper communities.

The earliest record for this bat in the county is 20 April while the latest is 7 September. These bats apparently migrate into the county in April and leave the county in September. Migration in this species has been substantiated (Villa R. and Cockrum, 1962).

Four pregnant females, each containing a single embryo, were taken 4 June and 14 June, while all females from July were lactating (Fig. 19). The latest date for a lactating female is 27 August. Parturition occurs between 14 June and 20 July. Short (1961a, p. 157) gives time of parturition

at Davis Blowout Cave, Texas, from 3 June to 16 June, while Cagle (1950, p. 401) reports young being born between mid-June and 7 July in another Texas colony.

I found no evidence of sperm in any of five males taken. Sperm has been found in males taken in April by other authors (Sherman, 1937; Short, 1961a).

Specimens examined: (total number, 45), 5(1), 6(36), 13(1), 15(1), 16(4), 27(2)

Tadarida molossa (Pallas)

Three specimens of this bat have been taken in the Rio Grande Valley at Albuquerque, while the fourth was brought to the University on 22 May, 1958, when the animal was found hanging on a barracks wall at Sandia Base.

One female was taken 27 July between 10 PM and 1:30 AM. Two more females were netted 30 July between 9 PM and 11 PM.

Three specimens are from a riparian community, while the fourth is from an arid grassland area. Constantine (1961, p. 92) collected 61 of these bats in a pinyon-juniper community, while Harris (In press) located a roost in pinyon-juniper.

The three females taken in July were lactating. The fourth specimen is an adult female, with no further reproductive data available.

Specimens examined: (total number, 4), 6(3), 27(1)

Fig. 3. Numbers of Myotis keeni taken by month. Males and females are shown separately and the females are subdivided into pregnant females, lactating females and females neither lactating nor pregnant. Included with the latter are females for which no reproductive data is available.

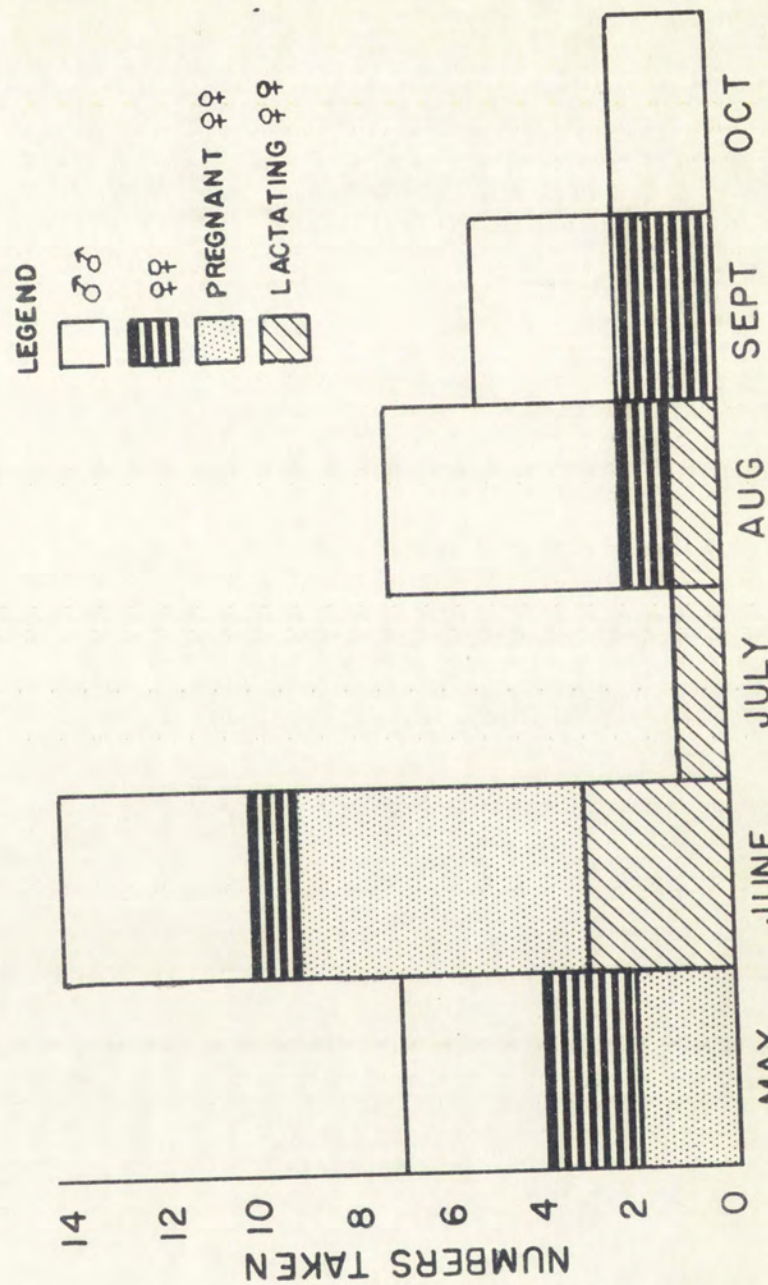

LEGEND
♂♂
♀♀
PREGNANT ♀♀
LACTATING ♀♀
NUMBERS TAKEN
0
2
4
6
8
10
12
14
MAY
JUNE
JULY
AUG
SEPT
OCT

FIGURE 3

Fig. 4. Sexual condition of male Myotis keeni. For each male, testis length is plotted against date and the presence of sperm is indicated by triangles.

FIGURE 4

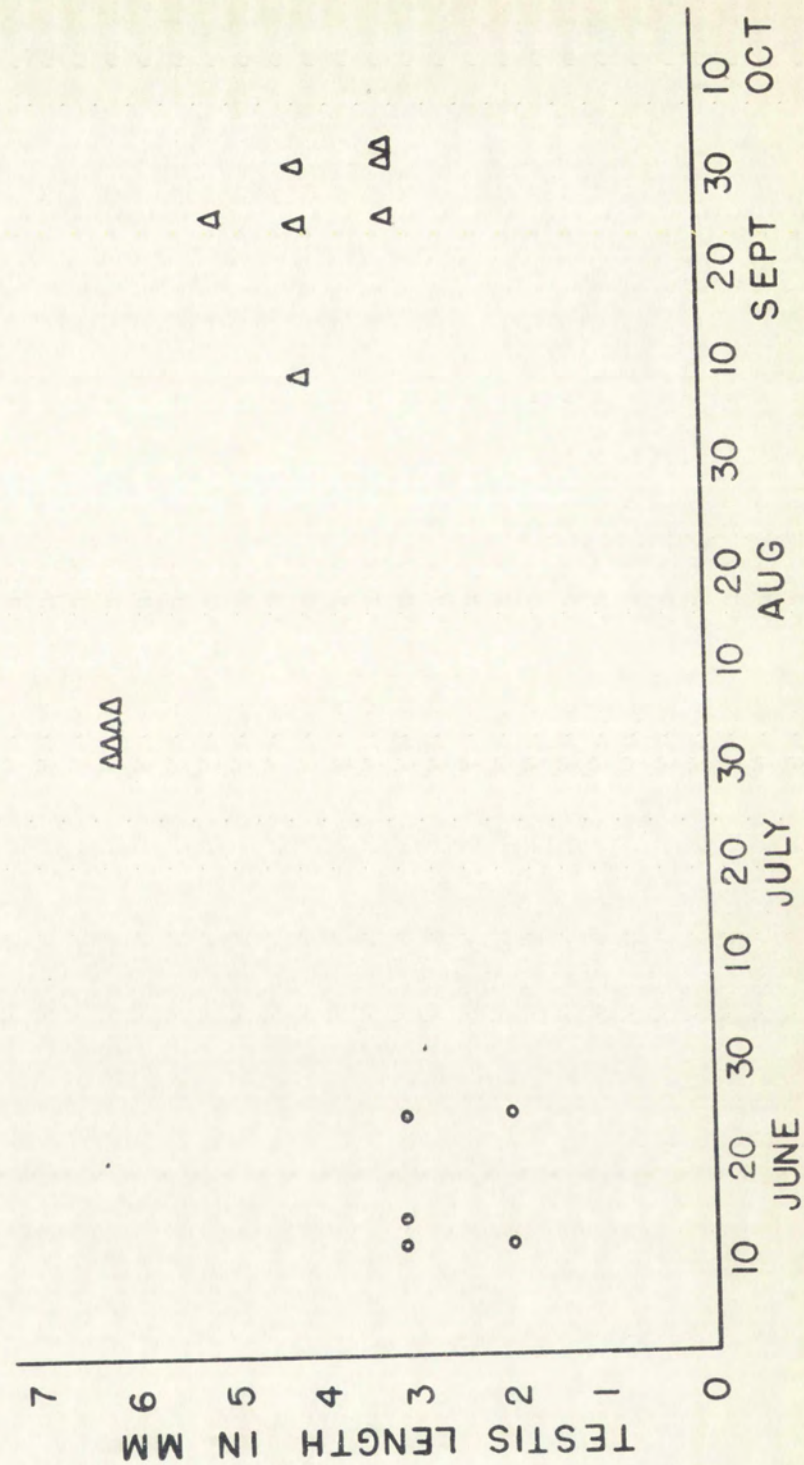

TESTIS LENGTH IN MM
0
1
2
3
4
5
6
7
10
20
30
JUNE
10
20
30
JULY
10
20
30
AUG
10
20
30
SEPT
10
OCT

Fig. 5. Numbers of Myotis subulatus taken by month. Males and females are separated, and the females are further subdivided into pregnant females, lactating females, or females without reproductive data.

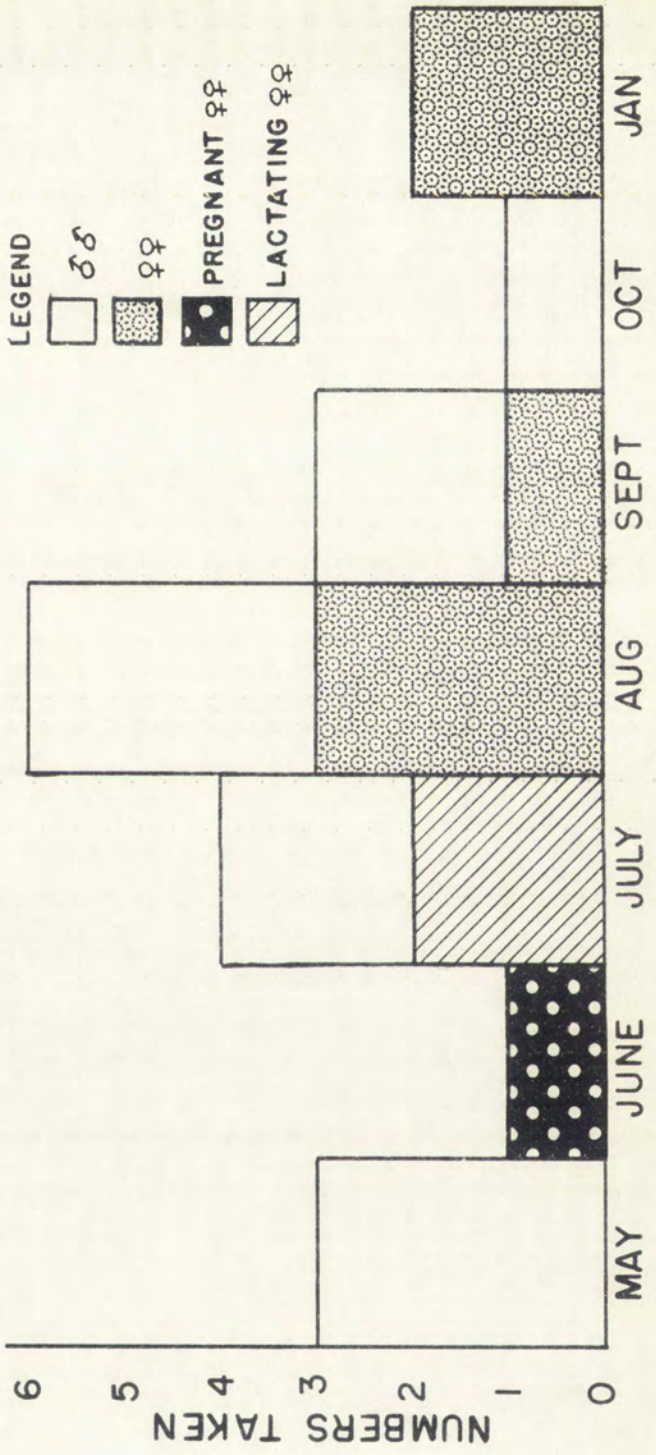
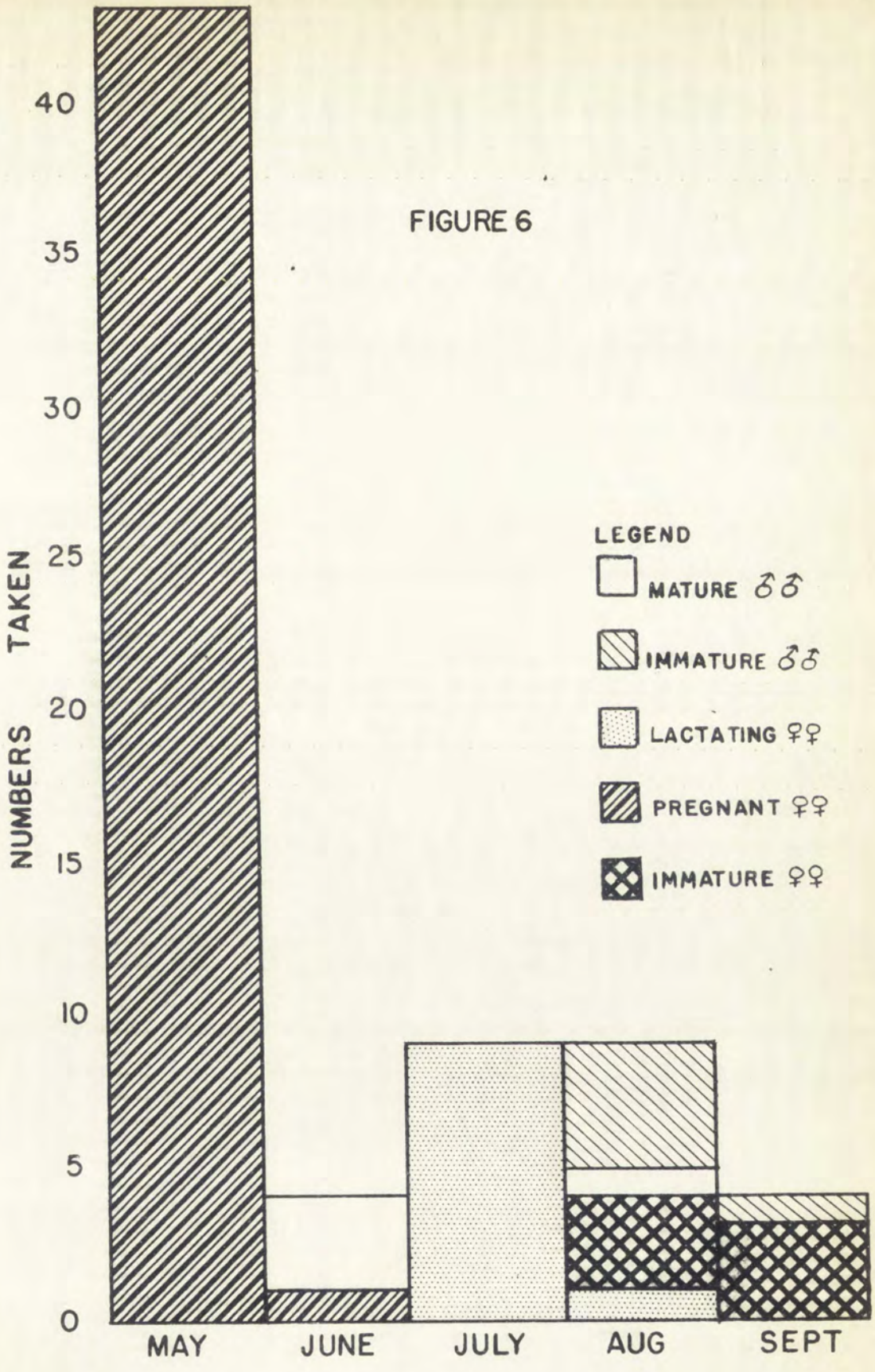

LEGEND
♂♂
♀♀
PREGNANT ♀♀
LACTATING ♀♀
NUMBERS TAKEN
0
1
2
3
4
5
6
MAY
JUNE
JULY
AUG
SEPT
OCT
JAN

FIGURE 5

Fig. 6. Numbers of Myotis thysanodes taken by month. The males and females are separated and the males are further subdivided into mature and immature, while the females are subdivided into pregnant, lactating, and immature.

FIGURE 6


NUMBERS TAKEN
40
35
30
25
20
15
10
5
0
MAY
JUNE
JULY
AUG
SEPT
LEGEND
MATURE ♂♂
IMMATURE ♂♂
LACTATING ♀♀
PREGNANT ♀♀
IMMATURE ♀♀

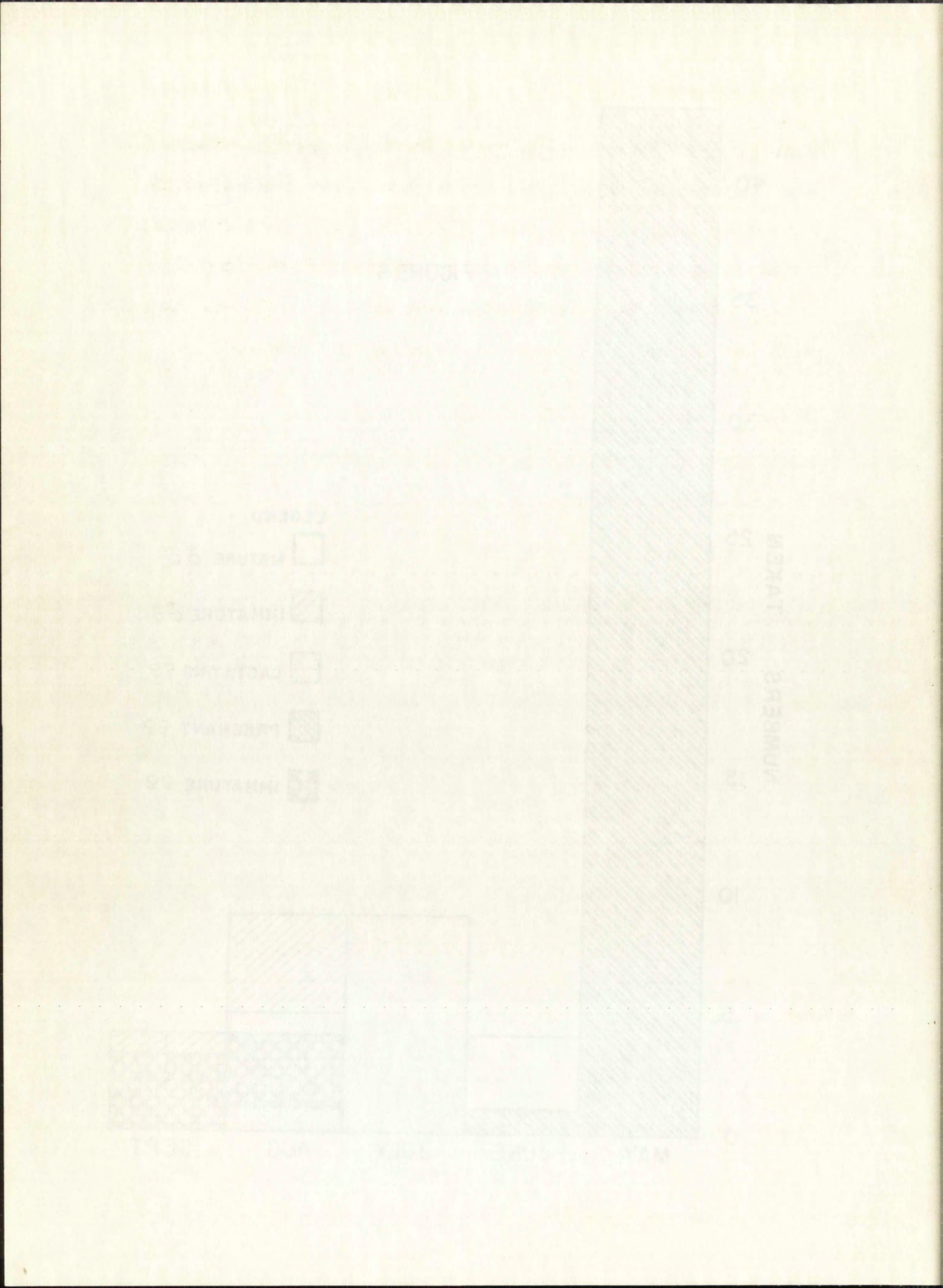


Fig. 7. Number of Myotis volans taken by month. The males and females are separated and the males are indicated as mature or immature. Females are subdivided into pregnant females, lactating females, and females neither lactating nor pregnant. Females without reproductive data are included with the latter. No immature females were taken.

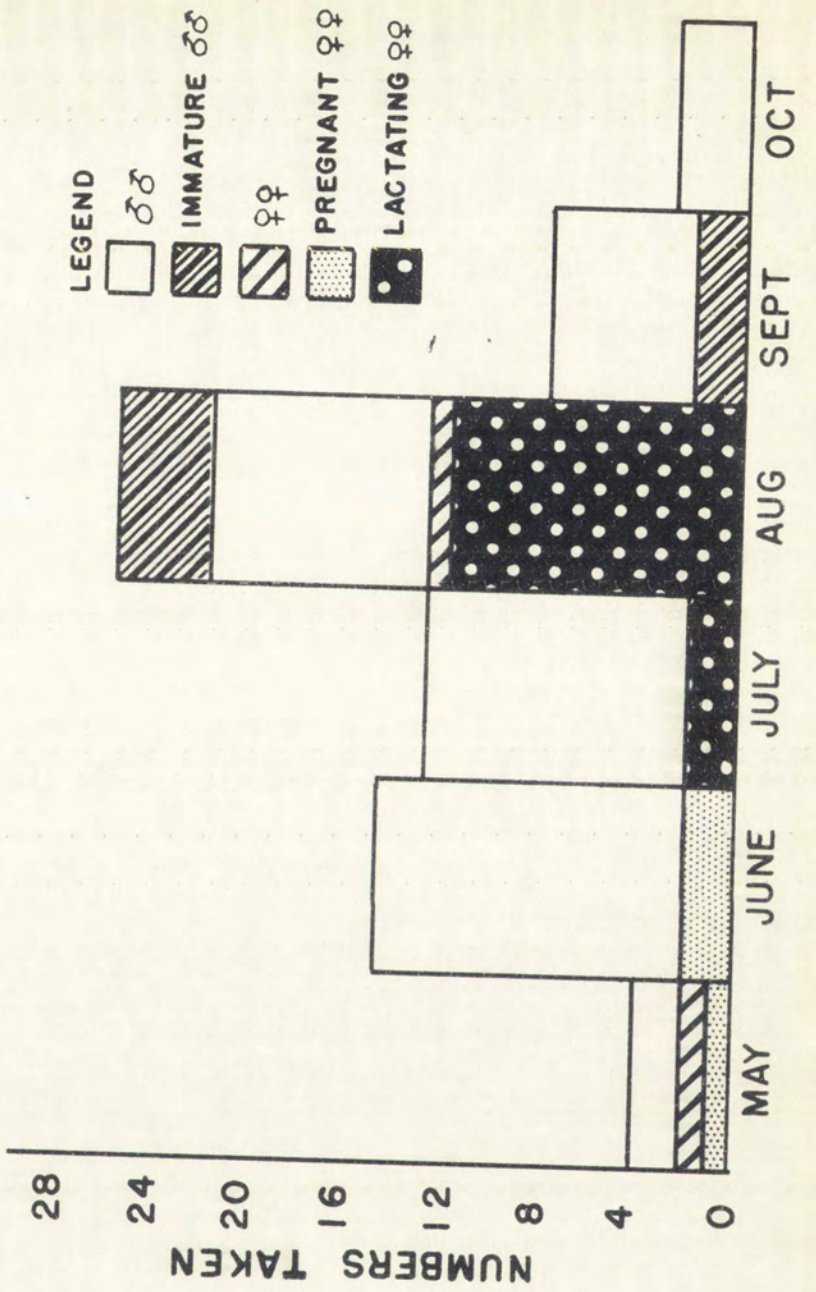

LEGEND
♂♂
IMMATURE ♂♂
♀♀
PREGNANT ♀♀
LACTATING ♀♀
NUMBERS TAKEN
0
4
8
12
16
20
24
28
MAY
JUNE
JULY
AUG
SEPT
OCT

FIGURE 7

Fig. 8. Scatter diagram showing testis length relative to date and sperm production in Myotis volans. The triangles indicate presence of sperm.

FIGURE 8

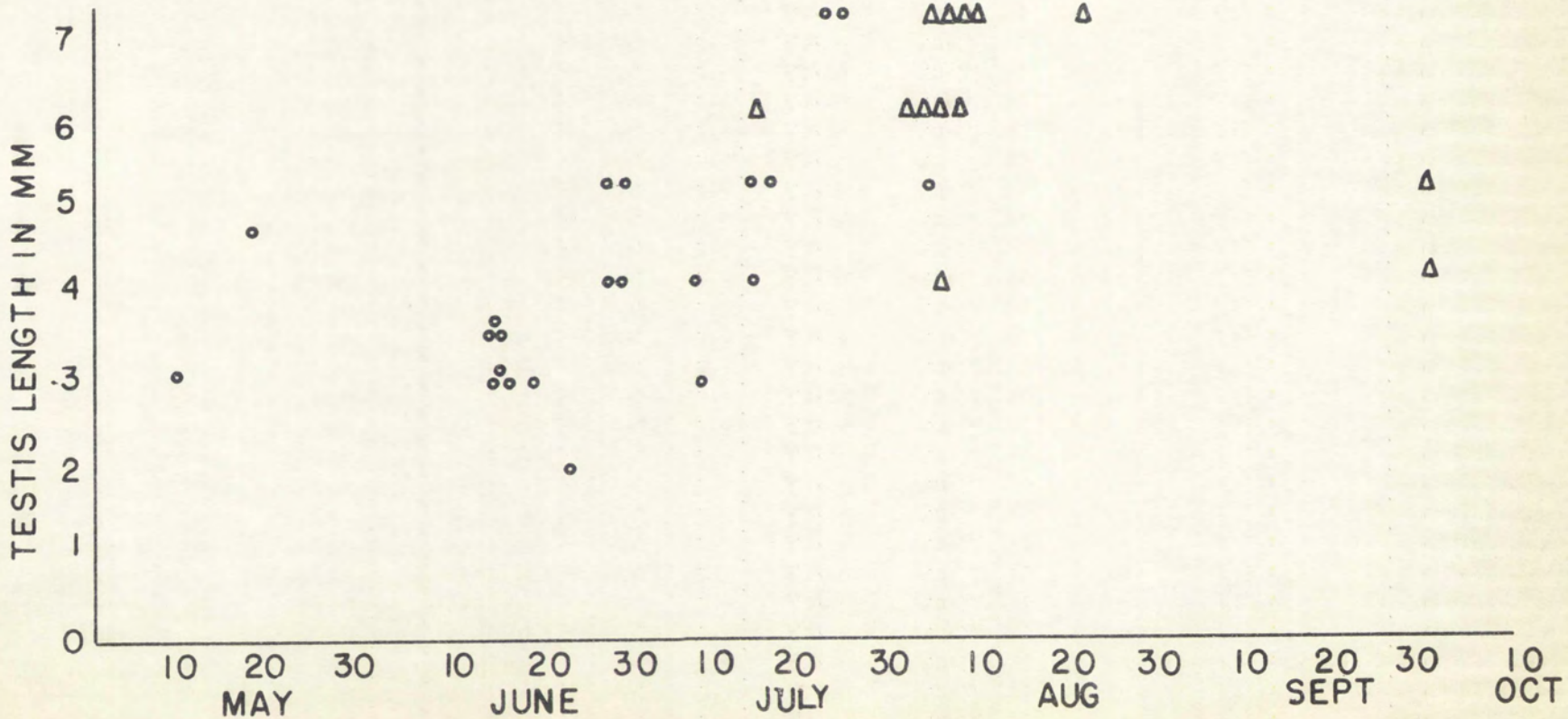
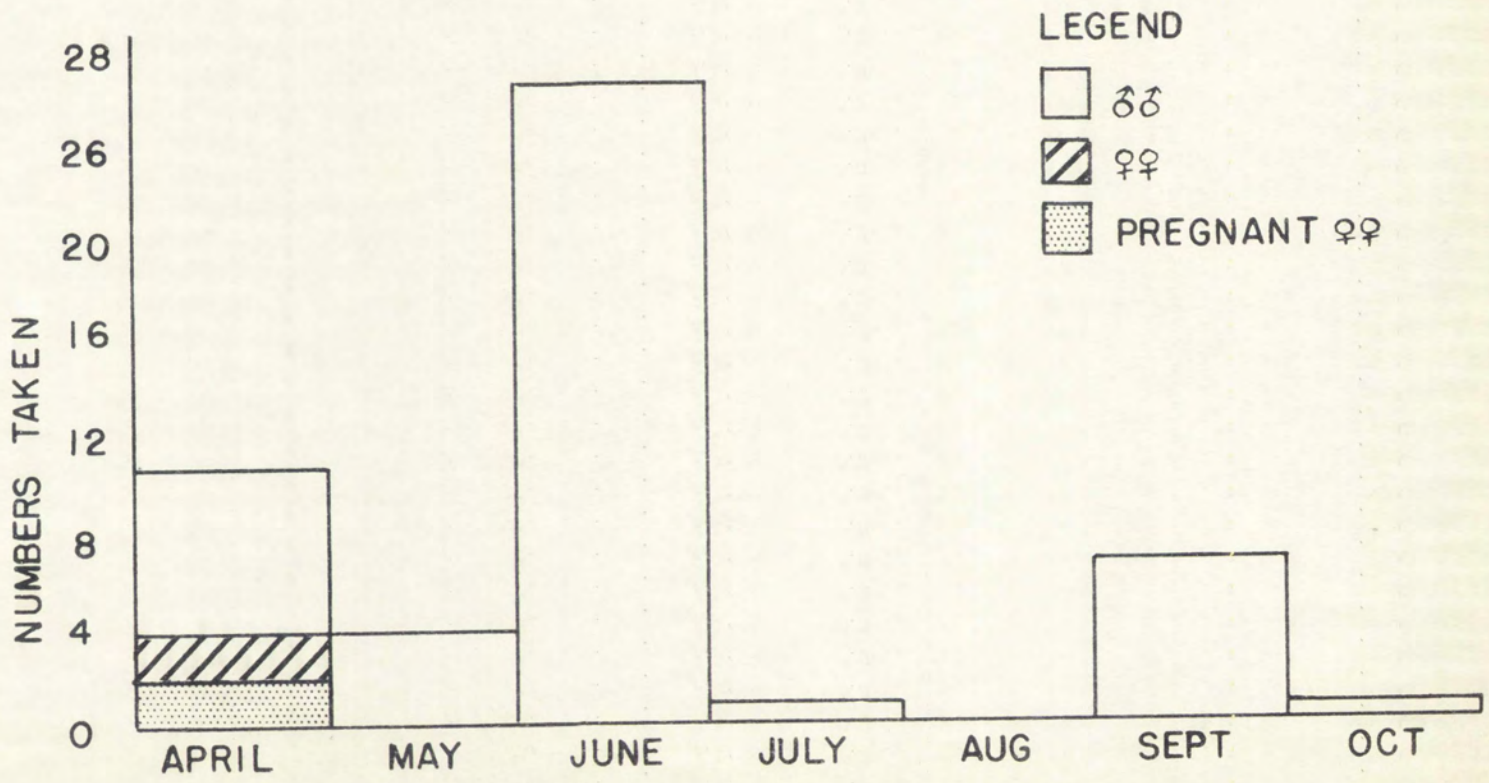

TESTIS LENGTH IN MM
0
1
2
3
4
5
6
7
10
20
30
MAY
JUNE
JULY
AUG
SEPT
OCT

Fig. 9. Numbers of Lasionycteris noctivagans taken by month. The sexes are separated and the females are further subdivided into pregnant and non-pregnant.

FIGURE 9


LEGEND
♂♂
♀♀
PREGNANT ♀♀
NUMBERS TAKEN
28
26
20
16
12
8
4
0
APRIL
MAY
JUNE
JULY
AUG
SEPT
OCT

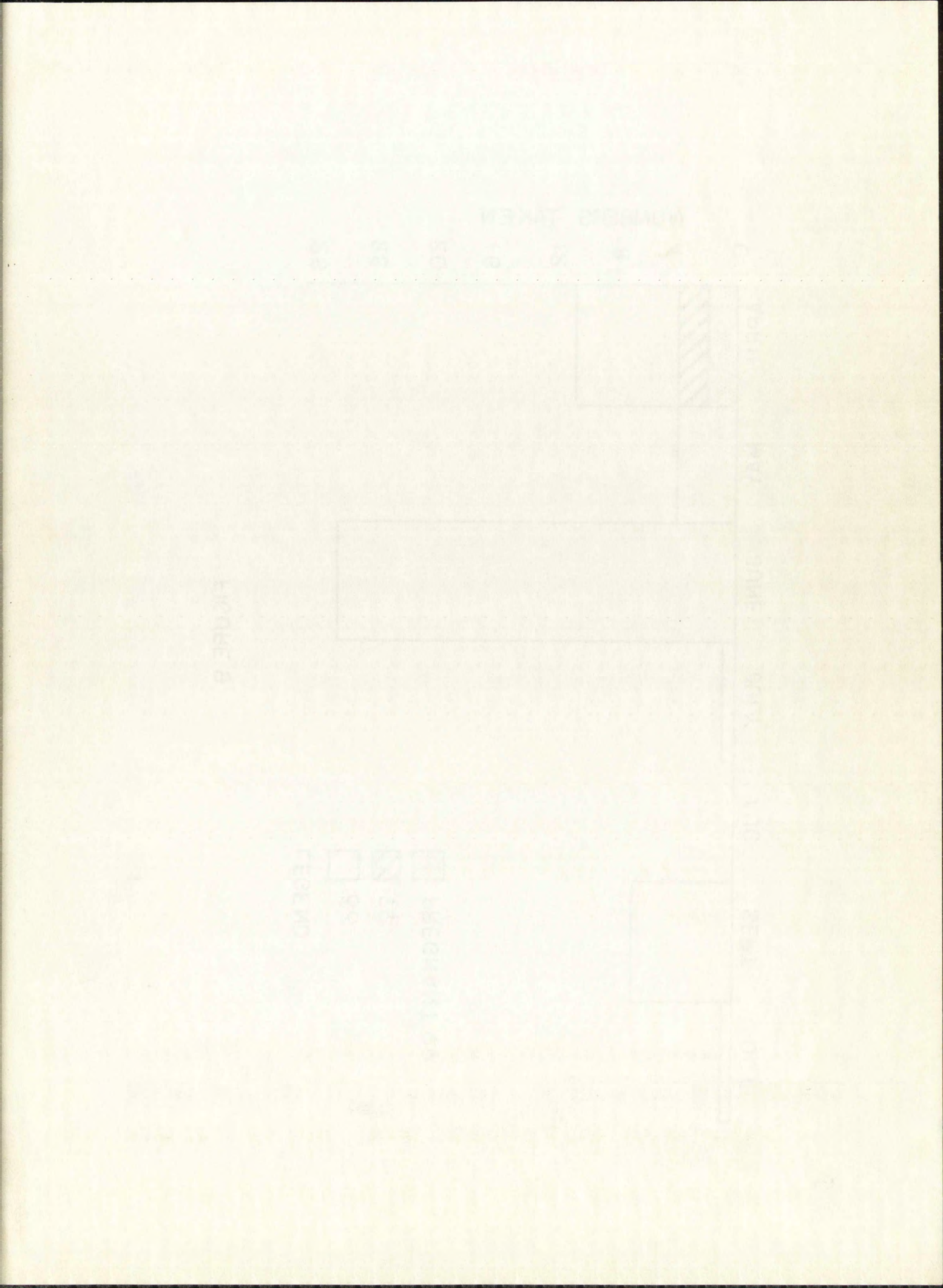


Fig. 10. Scatter diagram indicating the testis length relative to date and the presence of sperm for Lasionycteris noctivagans. Triangles indicate presence of sperm.

FIGURE 10

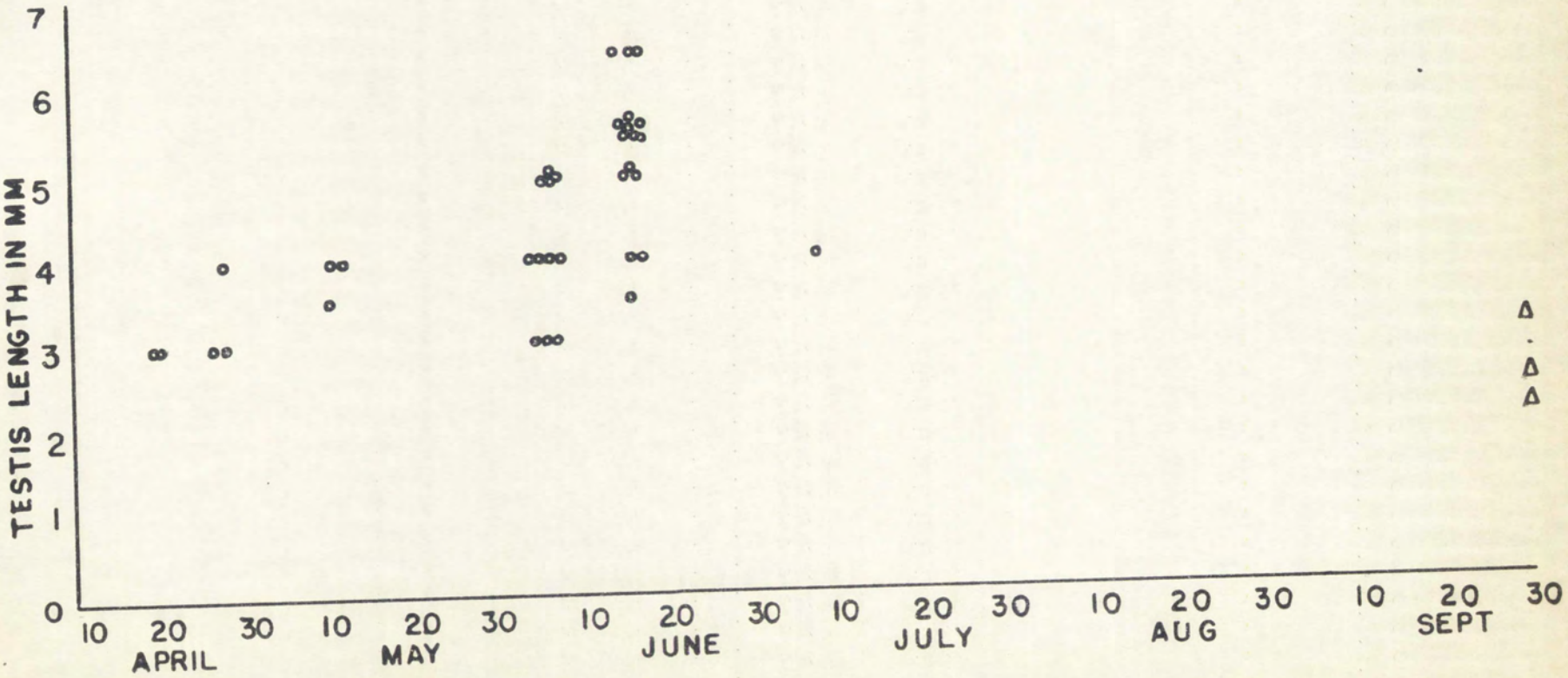

TESTIS LENGTH IN MM
0
1
2
3
4
5
6
7
10
20
30
APRIL
MAY
JUNE
JULY
AUG
SEPT

Fig. 11. Numbers of female and male Eptesicus fuscus taken by month. The females are subdivided into pregnant, lactating and neither reproductive condition. Females without reproductive data are included with females neither lactating nor pregnant.

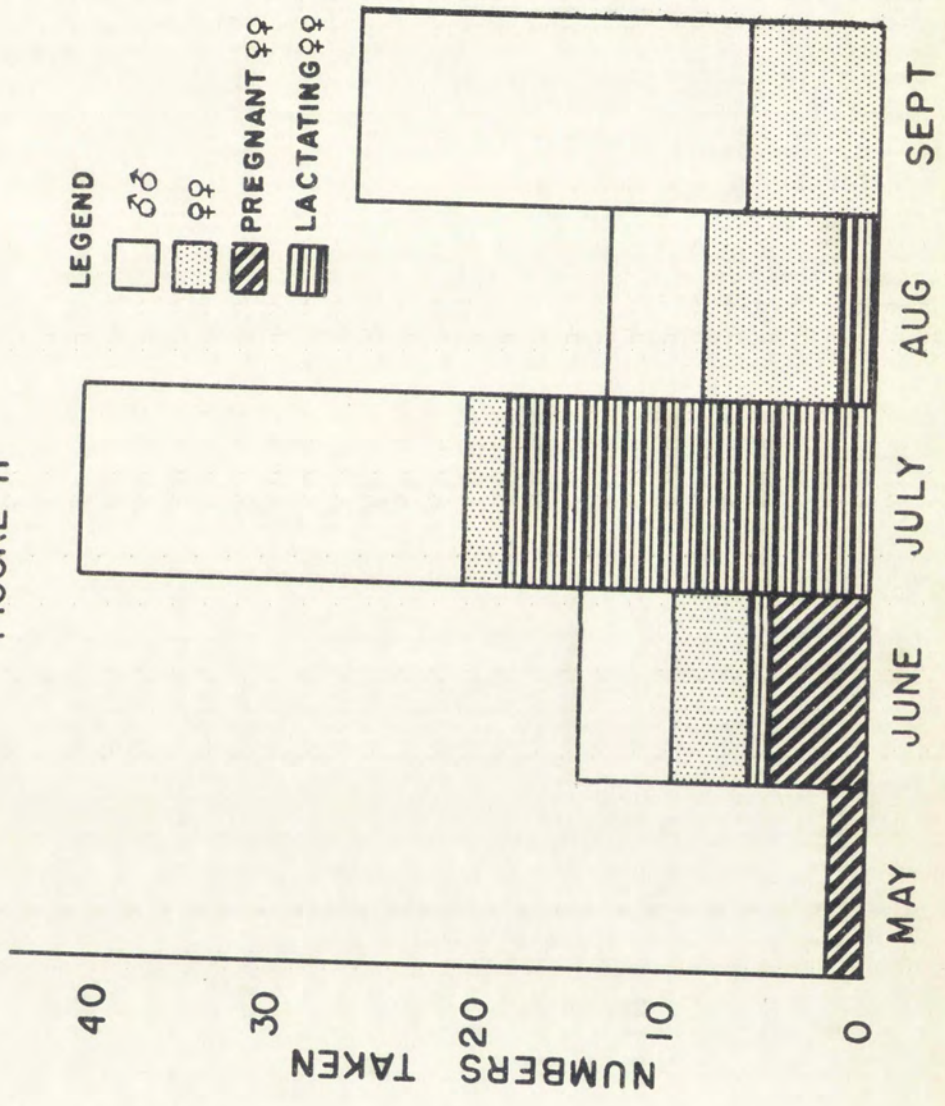

LEGEND
♂♂
♀♀
PREGNANT ♀♀
LACTATING ♀♀
NUMBERS TAKEN
0
10
20
30
40
MAY
JUNE
JULY
AUG
SEPT

FIGURE 11

Fig. 12. Scatter diagram showing testis length by date for Eptesicus fuscus. The triangles indicate the presence of sperm. A young of the year with sperm is indicated by a triangle followed by the letter y.

FIGURE 12

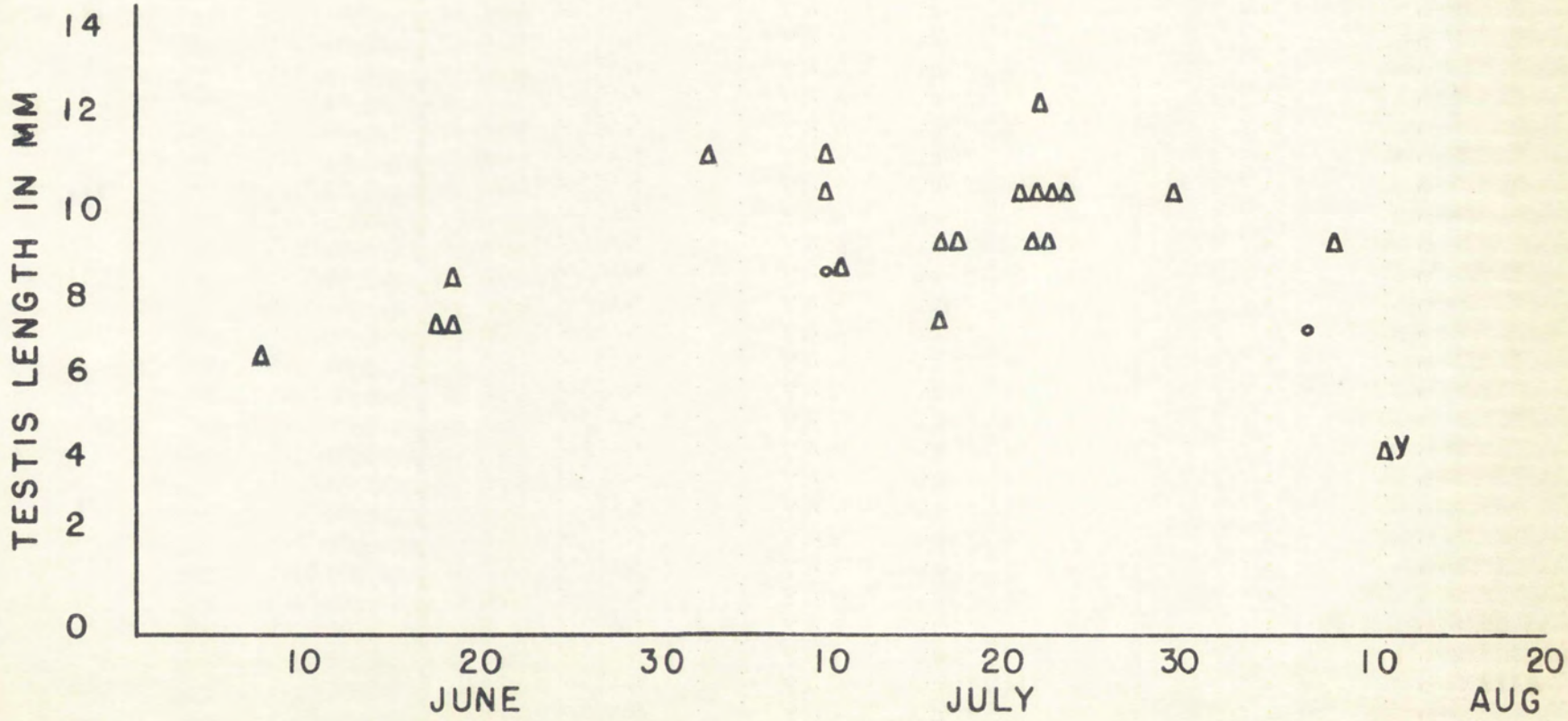

TESTIS LENGTH IN MM
14
12
10
8
6
4
2
0
10
20
30
10
20
30
10
20
JUNE
JULY
AUG

Fig. 13. Numbers of male and female Lasiurus cinerus by month. The females are divided into pregnant and non-pregnant.

FIGURE 13

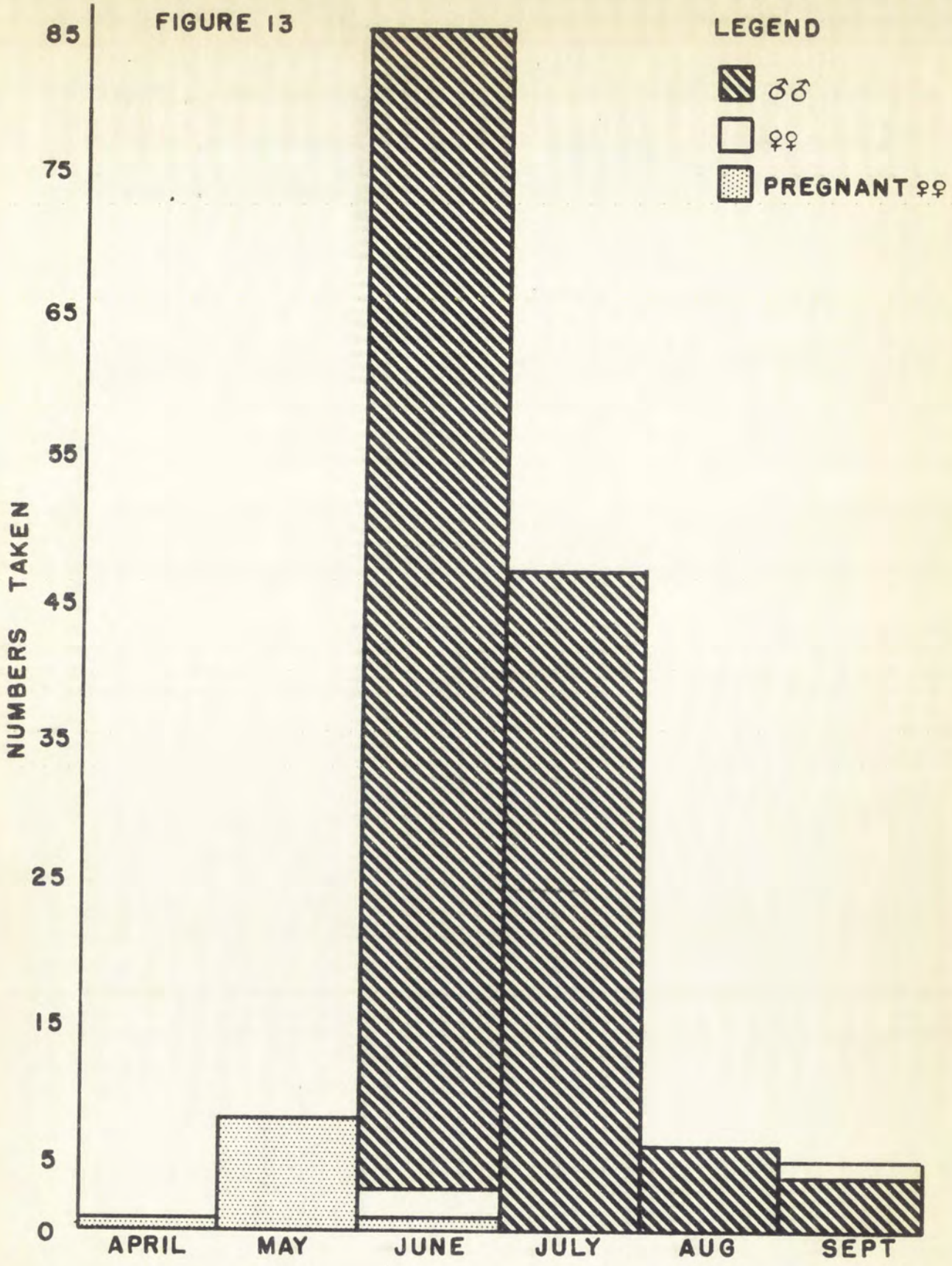
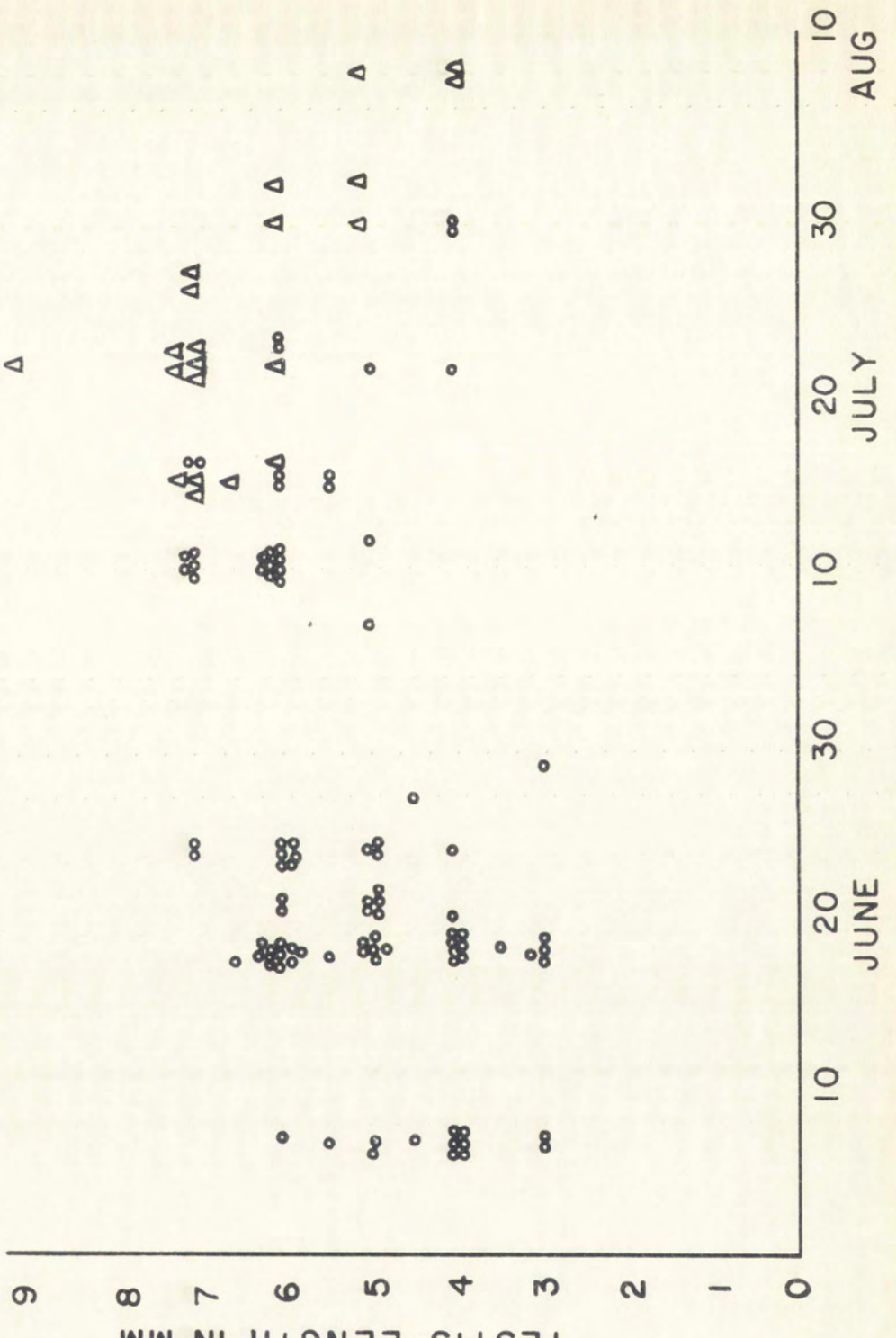

LEGEND
♂♂
♀♀
PREGNANT ♀♀
NUMBERS TAKEN
85
75
65
55
45
35
25
15
5
0
APRIL
MAY
JUNE
JULY
AUG
SEPT

Fig. 14. Scatter diagram representing testis length relative to date and presence of sperm in Lasiurus cinereus males. Triangles represent presence of sperm.


TESTIS LENGTH IN MM
0
1
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3
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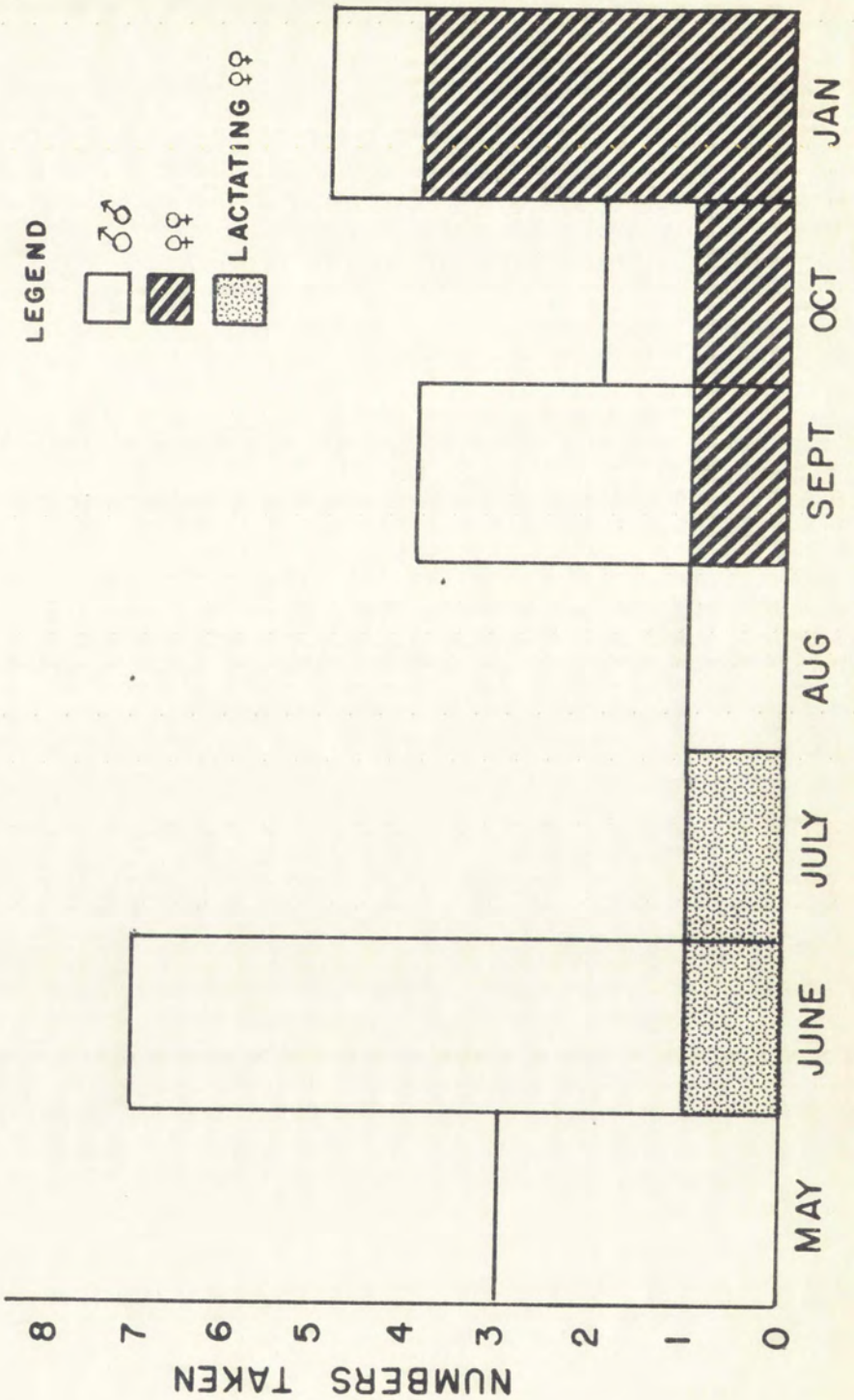
5
6
7
8
9
10
20
30
JUNE
10
20
30
JULY
10
AUG

FIGURE 14

Fig. 15. Numbers of Plecotus townsendi taken by month. The females are divided into lactating, non-lactating or females without reproductive data.


LEGEND
♂♂
♀♀
LACTATING ♀♀
NUMBERS TAKEN
0
1
2
3
4
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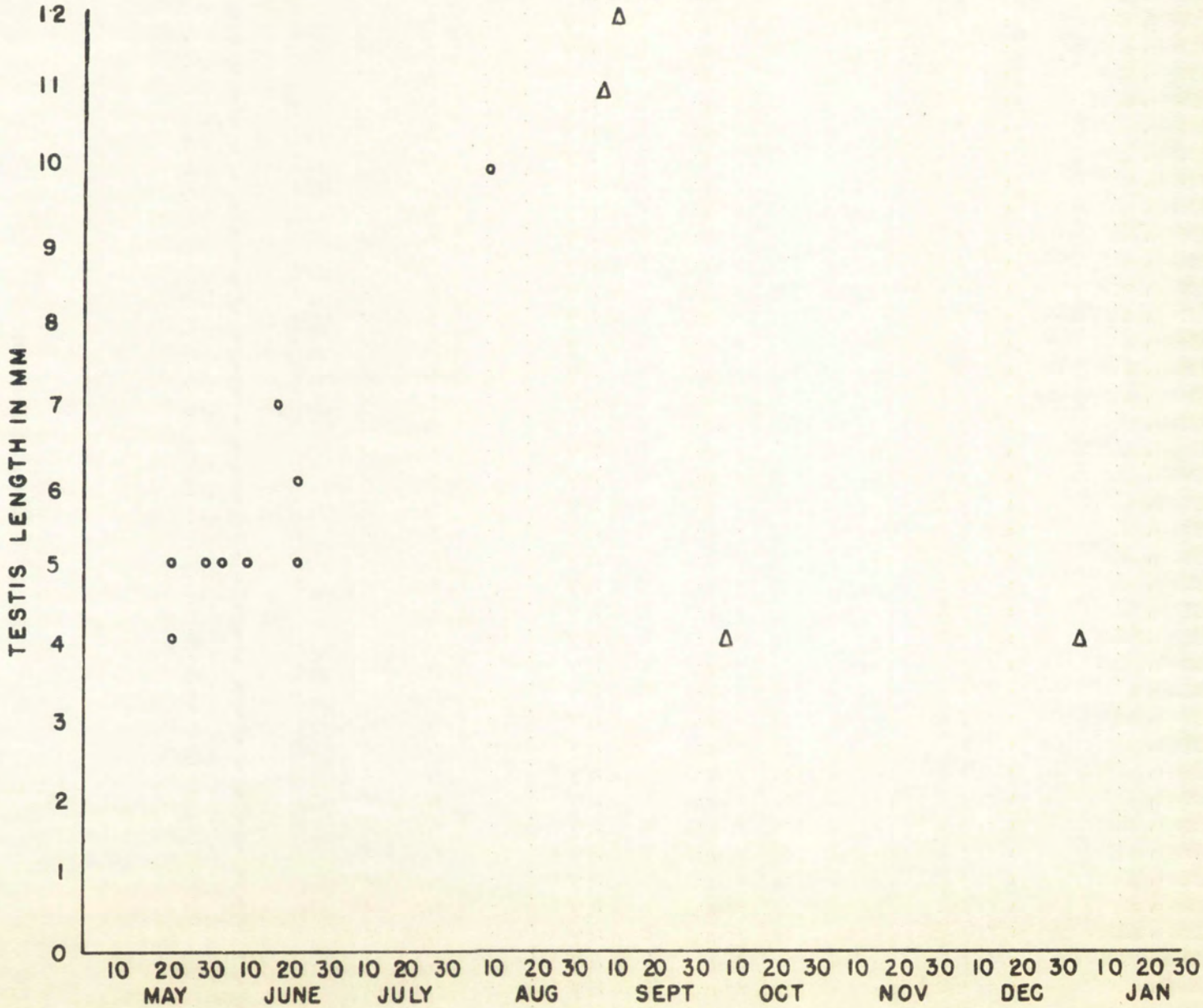
6
7
8
MAY
JUNE
JULY
AUG
SEPT
OCT
JAN

FIGURE 15

Fig. 16. Scatter diagram showing testis length in male *Plecotus townsendi* relative to date and presence of sperm. Presence of sperm is indicated by triangles.

FIGURE 16


TESTIS LENGTH IN MM
0
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6
7
8
9
10
11
12
10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
JAN

Fig. 17. Numbers of male and female Antrozous pallidus taken by month. The females are subdivided into pregnant females, lactating females, and females without reproductive data. Young females are included in females without reproductive data.

FIGURE 17

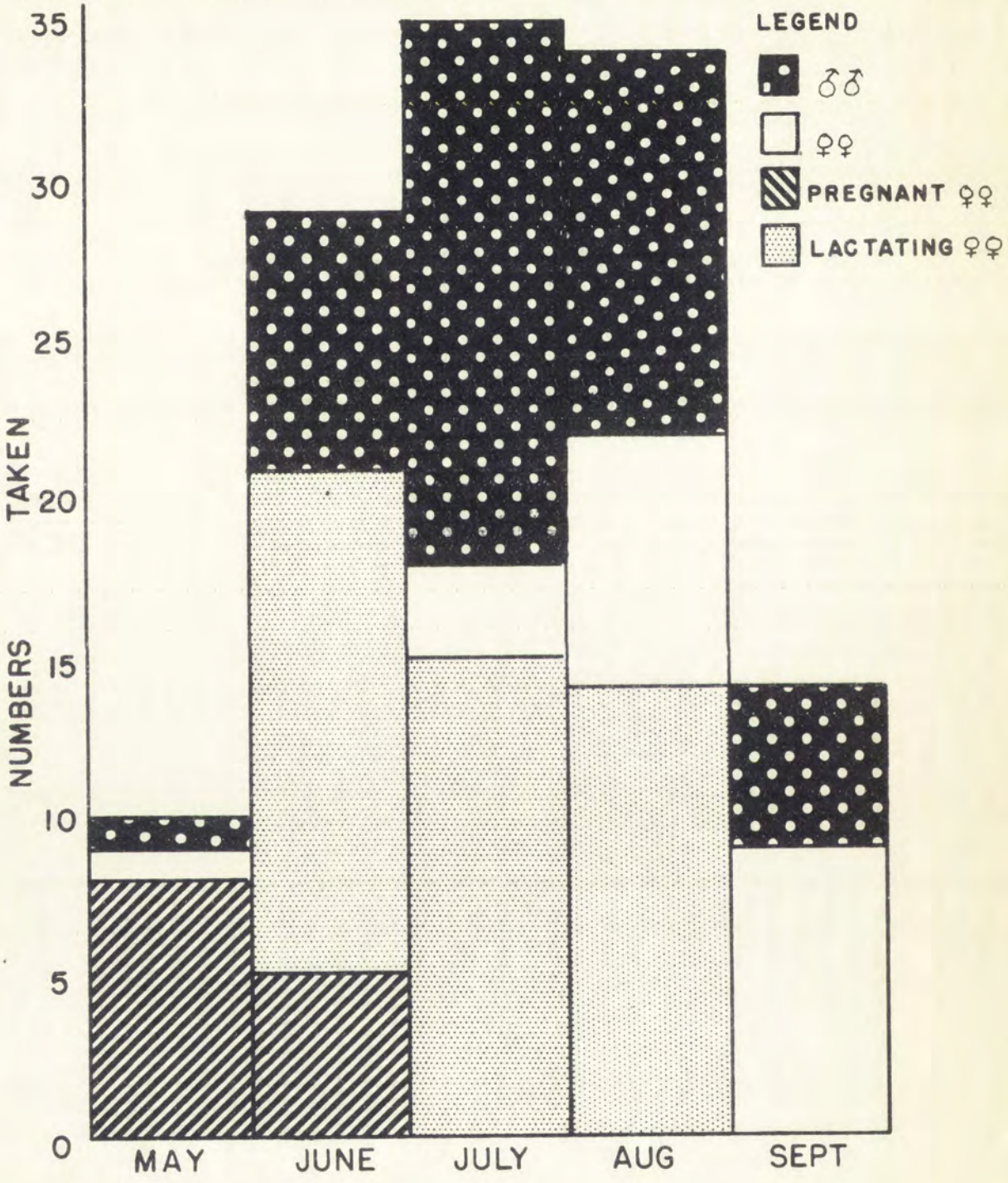

35
30
25
20
15
10
5
0
NUMBERS TAKEN
MAY
JUNE
JULY
AUG
SEPT
LEGEND
♂♂
♀♀
PREGNANT ♀♀
LACTATING ♀♀

Fig. 18. Scatter diagram of male Antrozous pallidus. The testis length of each male is plotted against the date and presence of sperm is indicated by triangles. Young of the year with sperm are indicated by a y following the triangles.

FIGURE 18

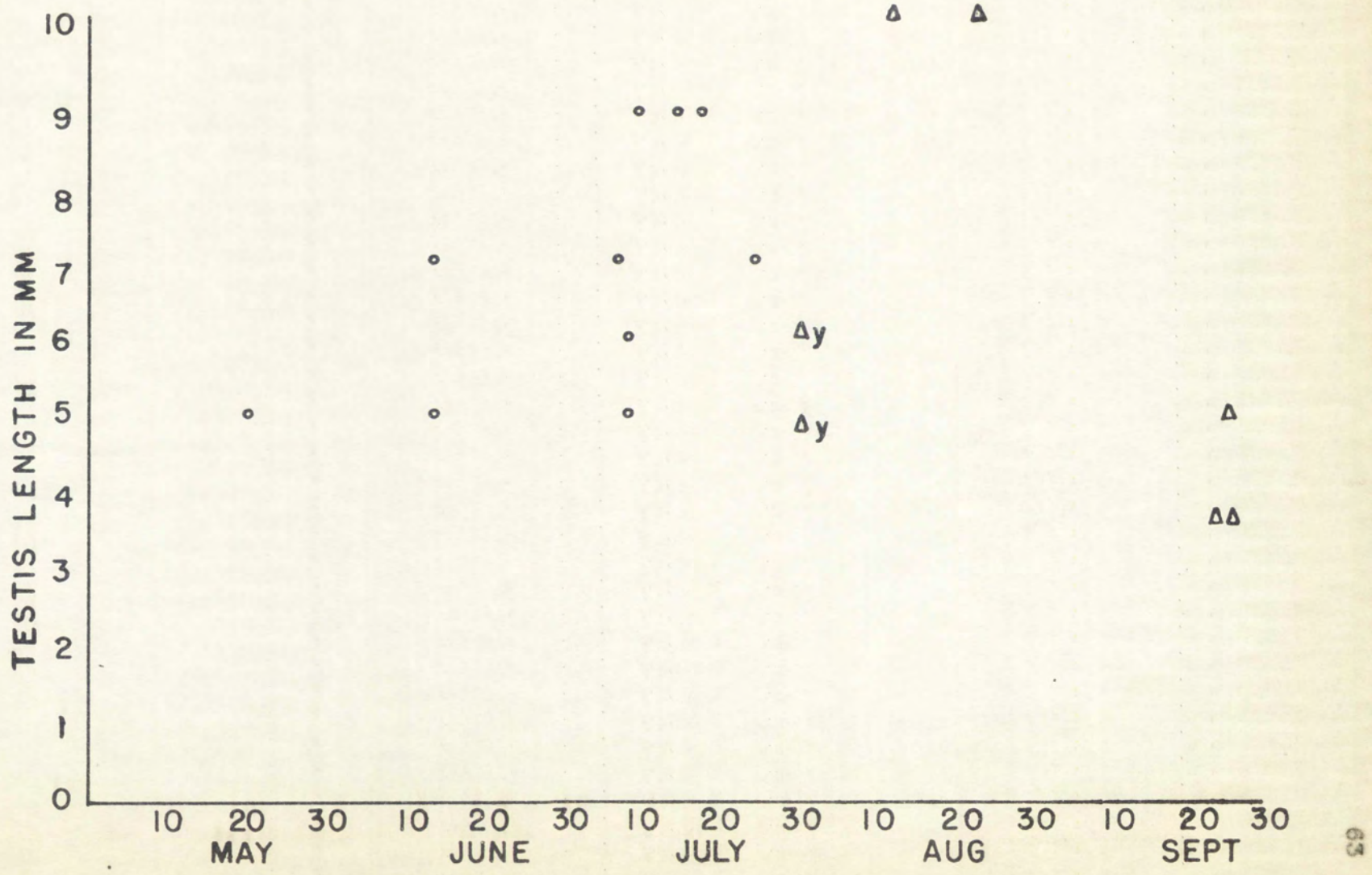

TESTIS LENGTH IN MM
0
1
2
3
4
5
6
7
8
9
10
10 20 30 10 20 30 10 20 30 10 20 30 10 20 30
MAY
JUNE
JULY
AUG
SEPT

Fig. 19. Numbers of male and female Tadarida brasiliensis taken by month. The females are divided into pregnant females, lactating females, and females which are neither lactating nor pregnant. Included with the latter are females for which no reproductive data is available.

FIGURE 19

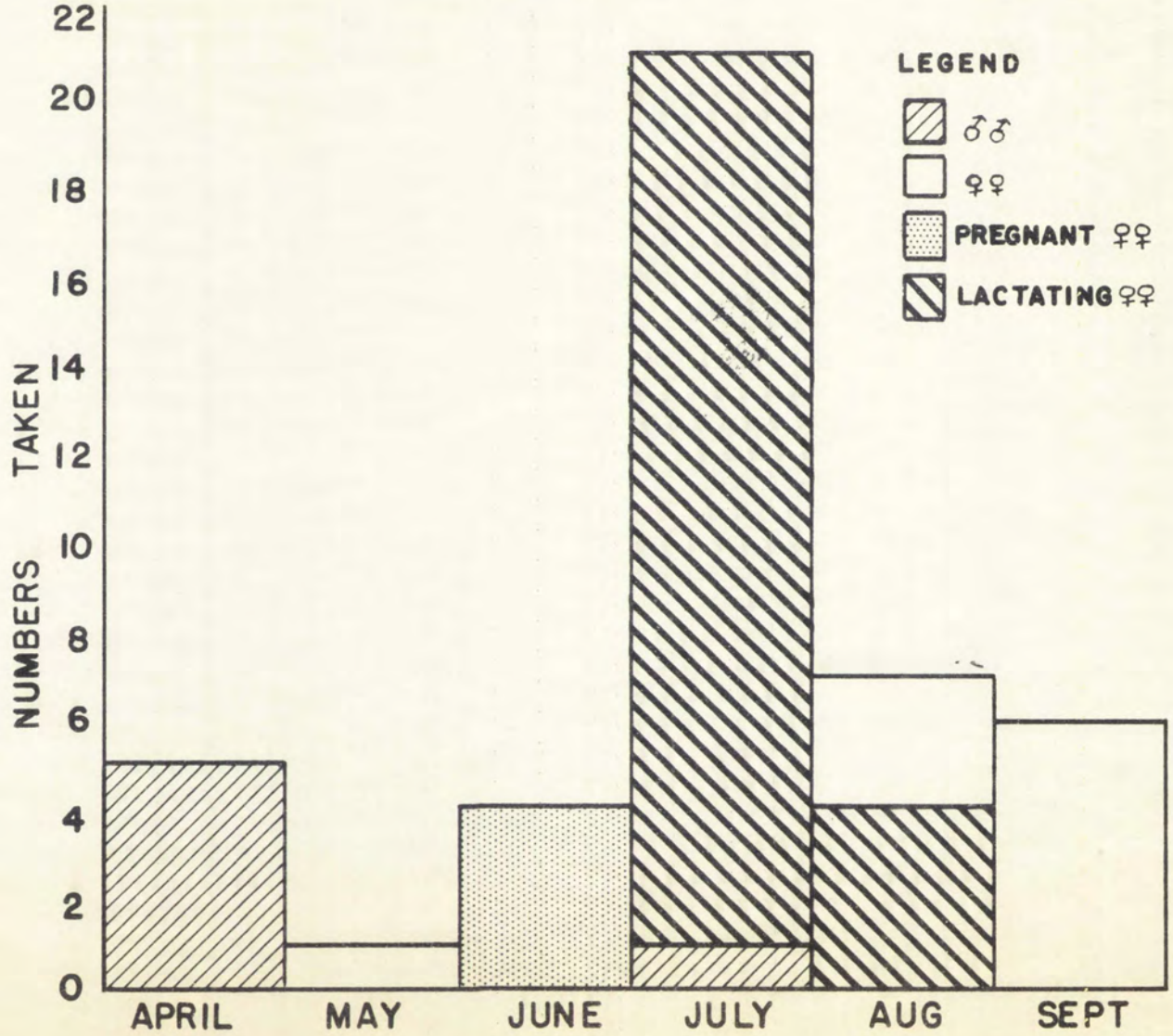

22
20
18
16
14
12
10
8
6
4
2
0
NUMBERS TAKEN
APRIL
MAY
JUNE
JULY
AUG
SEPT
LEGEND
♂♂
♀♀
PREGNANT ♀♀
LACTATING ♀♀

Table 1. Ecological data for collections taken in 1960-61. For each species, the date and number of each sex taken is indicated. Sky cover, moon, wind, and temperature data were taken after sundown during the period of time in which netting was conducted.

TABLE 1

Myotis californicus

Observed

Date	♂♂	♀♀	Sun-down MST	Sky Cover	Moon	Wind	Temp C	Hours netted after sun-down	Locality
3 Aug 61	1		7:30	partly cloudy	full	gusty	26-25	2	10

Myotis keeni

10 May 61		1	7:05	cloudy	none	breeze	14-12	2½	8
20 May 61	4	1	No data						9
24 May 61		1	7:30	clear	half	calm	8-4	2	9
7 Jun 61		1	7:40	cloudy	none	breeze	18-17	2	5
11 Jun 61	2	4	7:40		full	calm-windy	11	2½	9
14 Jun 61	1		7:45	cloudy-rain	obscured	strong gusty	13-12	2¼	9
20 Jun 61		2	7:45	clear	over half	gusty	12-10	2½	9
25 Jun 61	2		7:50	clear	almost full	breeze	12½-11	2¼	9
29 Jun 61		2	7:50	clear	full	breeze	16-14	2	8
27 Jul 61		1	7:30	cloudy-rain	none	gusty	14-12	2	9
4 Aug 60	3	1	7:15	cloudy-clear	full	calm breeze	17-10	9	8

TABLE 1 (continued)

Date	♂♂	♀♀	Sundown MST	Sky Cover	Moon	Wind	Temp C	Hours netted after sundown	Locality
			Observed						
5 Aug 60	1		7:15	cloudy-clear	full	breeze	18-10	9	8
9 Aug 60	1	1	7:20	overcast	none	breeze	14	2½	9
3 Sep 59	1		No data						4
10 Sep 61	1	1	6:45	partly cloudy	none	breeze	8½-7	3¼	9
26 Sep 61	2	1	6:45	clear	full	calm	12-9	2½	9
1 Oct 61	3		6:30	clear	none	gusty-calm	14-9	3	8
			Myotis subulatus						
20 May 61	1		No data						9
30 May 56	2		No data						22
18 Jun 61		1	7:45	cloudy	crescent	calm	15-13	3	5
3 Jul 61		1	7:45	cloudy	obscured	calm-gusty	23-21	3¼	13
19 Jul 61	1		7:45	cloudy-rain	almost half	gusty	12-10	2¼	9
20 Jul 61	1		7:30	partly cloudy-rain	half	breeze-gusty	12-11	2½	9
22 Jul 61		1	7:15	clear	crescent	breeze	13	2½	4
4 Aug 60	1		7:15	cloudy-clear	full	calm breeze	17-10	9	8

TABLE I (continued)

Observed

Date	♂♂	♀♀	EST	Sky cover	Moon	Wind	Temp C	Sun-down	Hours hunted after sun-down	Temperature
4 Nov 50	1		7:15	cloudy-clear	Full	Breeze	10-10	4		9
9 Nov 50	1	1	7:30	overcast	none	breeze	14	5		0
3 Dec 50	1		No data							4
10 Dec 51	1	1	4:40	partly cloudy	none	breeze	01-7	5		9
24 Dec 51	3	1	4:55	clear	full	calm	12-9	5		9
1 Oct 51	3		5:30	clear	none	pretty calm	14-9	5		8

Hunts subsidized

21 Dec 51	1		No data						9
22 Dec 50	2		No data						22
16 Jan 51		1	4:55	cloudy	pressent calm		15-13	3	5
3 Jul 01		1	7:45	cloudy	observed calm-ready		20-21	35	15
19 Jul 51	1		7:40	cloudy-rain	slight	pretty cold	13-10	35	8
20 Jul 51	1		7:30	partly cloudy-rain	hail	breeze-rainy	13-11	45	0
20 Jul 51		1	7:15	clear	pressent	breeze	15	05	4
4 Aug 50	1		7:10	cloudy-clear	full	calm	17-13	8	9

TABLE 1 (continued)

Observed

Date	♂♂	♀♀	Sun-down MST	Sky Cover	Moon	Wind	Temp C	Hours netted after sun-down	Locality
5 Aug 60	2	1	7:15	cloudy-clear	full	breeze	18-10	9	8
9 Aug 61		1	7:00	cloudy-rain	none	strong-gusty	28	2	14
26 Aug 61		1	6:50	partly cloudy	obscured	calm	26-24	2½	14
7 Sep 59	2	1	No data						4
1 Oct 61	1		6:30	clear	none	gusty	14-9	3	8
6 Jan 62		2	In hibernation				3		9

Myotis thysanodes

12 May 61		14	Daytime roost-search						10
13 May 61		29	Daytime roost-search				10		17
6 Jun 61	1		7:40	cloudy	none	gusty	18-17½	4	19
14 Jun 61	1		7:45	rained	none	strong-gusty	17-13	2¼	9
25 Jun 61	1		7:50	clear	almost full	breeze	12½-10	2½	9
26 Jun 61		1	7:50	partly cloudy	full	breeze	28-22	2	10
23 Jul 61		9	7:45	clear	full	calm	26-25	2	10
3 Aug 61	4	3	7:30	partly cloudy	full	gusty	26-25	2	10

TABLE 1 (continued)

Observed

Date	♂♂	♀♀	Sun-down MST	Sky Cover	Moon	Wind	Temp C	Hours netted after sun-down	Locality
5 Aug 60	1		7:15	cloudy-clear	full	breeze	18-10	9	8
25 Aug 60		1	7:10	clear	crescent	gusty	22-20	3	11
5 Sep 61	1	3	6:45	clear	none	calm	18-16	3	10
Myotis volans									
10 May 61	1		7:05	cloudy	none	breeze	14-12	2½	8
20 May 61	1		No data						9
30 May 56		1	No data						22
31 May 61		1	7:35	clear	full	breeze	12-11½	2½	9
7 Jun 61		1	7:40	cloudy	none	breeze	18-17	2	5
11 Jun 60	1		7:45	cloudy	obscured	windy	11	2	9
14 June 61	2		7:45	cloudy-rain	none	gusty	13-12	2¼	9
18 Jun 61	4	1	7:45	cloudy	crescent	calm	15-13	3	5
19 Jun 61	1		7:45	cloudy-rain	half obscured	gusty	12-10	2½	8
25 Jun 61	1		7:50	clear	almost full	breeze	12½-11	2¼	9
29 Jun 61	4		7:50	clear	full	breeze	12-14	2	8
3 Jul 61	1	1	7:45	cloudy	obscured	calm-gusty	22-21	3½	13
10 Jul 60	1		7:40	cloudy	none	calm-gusty	20	2½	4

TABLE 1 (continued)

Observed

Date	♂♂	♀♀	Sun-down MST	Sky Cover	Moon	Wind	Temp C	Hours netted after sun-down	Locality
10 Jul 61	1		7:40	cloudy	none	gusty	17	2½	8
11 Jul 60	1		7:40	clear	none	gusty	20	2	9
15 Jul 60	3		7:30	partly cloudy	none	gusty	16½	2½	4
26 Jul 60	1		7:30	clear	crescent	gusty	19-18	2½	5
27 Jul 61	1		7:30	cloudy	none	gusty	14-12	2	9
31 Jul 60		1	7:30	cloudy	none	calm-windy	26½-24½	2	12
3 Aug 60	1	1	7:20	cloudy	quarter full	calm	17	3¼	8
4 Aug 60	1	1	7:15	cloudy-clear	full	calm breeze	17-10	9	8
5 Aug 60	10	2	7:15	cloudy-clear	full	calm	18-10	9	8
6 Aug 61		2	7:10	partly cloudy	none	breeze	28-22	3½	12
8 Aug 61		1	7:15	cloudy	none	breeze	26-24	2	8
21 Aug 60	1		7:05	clear	none	breeze	20	2½	20
23 Aug 60		1	No data						18
23 Aug 60		1	7:05	clear	crescent	gusty	18	2	12
25 Aug 60		2	7:05	clear	crescent	gusty	22-20	3	12
26 Aug 60	1	1	7:00	clear	crescent	gusty	22	2½	11
31 Aug 61		1	7:00	rain-cloudy	none	strong	18-15	2	14
1 Sep 59	1		No data						4

TABLE 1 (continued)

Observed

Date	♂♂	♀♀	Sun-down MST	Sky Cover	Moon	Wind	Temp C	Hours netted after sun-down	Locality
3 Sep 59	7		No data						4
1 Oct 61	2		6:30	clear	none	gusty-	14-9	3	8
21 Oct 61	1		banded			calm			8
				Lasionycteris noctivagans					
8 Apr 54	1		No data						27
20 Apr 60		2	No data						16
20 Apr 61	3	1	6:50	cloudy	half	gusty	20-17	3½	16
28 Apr 61	3	1	7:00	hazy	full	breeze	17-14	3	16
10 May 39	1		No data						18
11 May 61	1		7:05	cloudy	none	gusty	21-19	3	16
19 May 61	1		7:15	clear	crescent	gusty	22-21	2½	16
26 May 61	1		7:30	cloudy	none	calm	13-11	2	5
7 Jun 61	12		7:40	cloudy	none	breeze	18-17	2	5
18 Jun 61	12		7:45	cloudy	crescent	calm	15-13	3	5
20 Jun 60	3		7:45	clear	none	windy	15	1½	4
10 Jul 61	1		7:40	cloudy	none	gusty	17	2¼	5
1 Sep 59	2		No data						4
3 Sep 59	2		No data						4
30 Sep 61	3		6:15	clear	none	gusty	11½-7	2	5
19 Oct 61	1		banded						5

TABLE 1 (continued)

Pipistrellus hesperus

Observed

Date	♂♂	♀♀	Sun-down MST	Sky Cover	Moon	Wind	Temp C	Hours netted after sun-down	Locality
11 Aug 61		1	7:00	rain-cloudy	none	strong	24	1	14
9 Aug 61	2	1	7:00	rain-cloudy	none	strong gusty	28	2	14

Eptesicus fuscus

26 May 61		2	7:30	cloudy	none	calm	13-11	2	5
27 May 60		1	found hanging in residence N. E. Heights						27
7 Jun 61		1	7:40	cloudy	none	breeze	18-17	2	5
18 Jun 61	3	10	7:45	cloudy	crescent	calm	15-13	3	5
27 Jun 61	1		7:50	hazy	full	strong	24-20	2¼	7
2 Jul 61	1		7:50	cloudy	none	gusty	19-18	3¼	7
3 Jul 61	1	12	7:45	cloudy	obscured	calm-gusty	22-21	3¼	13
6 Jul 60		1	7:50	cloudy-rain	none	strong	18	1½	4
8 Jul 60		2	7:50	rain-cloudy	full	gusty	16	2½	4
10 Jul 60	6		7:40	cloudy	none	gusty	17	2¼	4
16 Jul 61	1		7:30	clear	crescent	breeze	24-23	3¼	13
17 Jul 61	2	3	7:25	cloudy	crescent	breeze	23-21	2¼	5

TABLE 1 (continued)

Tripleurospermum inodorum

Observed

Date	Eggs	Pupae	Adults	Sky Cover	Rain	Wind	Temp C	Sun-down	Hours rested after sun-down	Locality
11 Aug 61		1	7:00	rain-cloudy	none	strong	24	7		14
9 Aug 61	2	1	7:00	rain-cloudy	none	strong	20	7		14

Unobserved Eggs

26 Jul 61		2	7:30	cloudy	none	calm	18-21	7		5
27 Jul 61		1	found in residence							27
27 Jul 61		1	8:15	cloudy	rain	trees	17-27			5
28 Jul 61		4	10:00	cloudy	overcast	calm	21-28			6
29 Jul 61		1	7:30		rain	strong	24-30			1
29 Jul 61		1	7:00	cloudy	none	ready	19-28			7
3 Aug 61		1	7:15	cloudy	observed	calm-gusty	22-31	7:45		13
4 Aug 61		1	7:30	cloudy-rain	none	strong	20	7:8		4
6 Aug 61		2	7:15	rain-cloudy	rain	gusty	16	8:3		6
10 Aug 61		2	7:00	cloudy	none	rainy	17	7:2		8
11 Aug 61		1	7:00	clear	evaporated	trees	24-33	8:4		13
12 Aug 61		2	7:30	cloudy	evaporated	breeze	19-21	7:3		9

TABLE 1 (continued)

Date	♂♂	♀♀	Observed Sun-down MST	Sky Cover	Moon	Wind	Temp C	Hours netted after sun-down	Locality
22 Jul 60	9	2	7:15	clear	crescent	breeze	13½	2½	4
24 Jul 61	1		7:10	cloudy-rain	almost full	calm	26-24	2	13
29 Jul 60	1		7:10	cloudy	none	gusty	18	1½	4
6 Aug 60	1		7:10	cloudy	full	gusty	21	2	7
8 Aug 61	2	6	7:10	cloudy	obscured	breeze	26-24	2	5
25 Aug 61	1	1	6:50	cloudy	eclipse	calm	18-16	2	5
1 Sep 59	2	1	No data						4
3 Sep 59	15	3	No data						4
7 Sep 59	3	1	No data						4
13 Sep 61		2	6:30	cloudy	obscured	gusty	17-14	3½	5
Lasiurus cinereus									
14 Apr 60		1	6:45	cloudy	none	breeze	18-15	3	1
3 May 61		1	7:00	cloudy	none	gusty	20-17	3	5
11 May 61		2	7:05	cloudy	none	gusty	21-19	3	5
19 May 61		2	7:15	clear	crescent	gusty	22-21	2½	16
26 May 61		2	7:30	cloudy	none	calm	13-11	2	5
30 May 61		1	7:35	clear	full	calm	20-19	2½	16
7 Jun 61	12		7:40	cloudy	none	breeze	18-17	2¼	5
18 Jun 60	29		7:45	cloudy	none	calm	20	2	4
18 Jun 61	14	1	7:45	cloudy	crescent	calm	15-13	3	5
20 Jun 60	12	1	7:45	clear	none	windy	15	1½	4

TABLE I (continued)

Observed

Date	δδ	ϕϕ	MST	Sky Cover	Moon	Wind	Temp C	Sun-down	Hours melted	Quality
28 Jul 00	0	2	7:15	clear	crescent	breeze	15½	8½	4	
24 Jul 01	1		7:10	cloudy-trail	almost full	calm	20-09	8	15	
29 Jul 00	1		7:10	cloudy	none	gusty	16	1½	4	
6 Aug 00	1		7:10	cloudy	full	gusty	21	9	7	
8 Aug 01	2	6	7:10	cloudy	obscured	breeze	20-04	8	6	
28 Aug 01	1	1	6:50	cloudy	eclipse	calm	13-10	2	3	
1 Sep 00	2	1	No data						4	
3 Sep 00	15	3	No data						4	
7 Sep 00	3	1	No data						4	
15 Sep 01		2	6:30	cloudy	obscured	gusty	17-14	7½	3	

Leaving Glacier

14 Apr 00		1	6:45	cloudy	none	breeze	15-03	8	1	
3 May 01		1	7:00	cloudy	none	gusty	20-07	6	5	
11 May 01		2	7:05	cloudy	none	gusty	21-10	6	6	
19 May 01		2	7:15	clear	frequent	gusty	09-21	2½	10	
26 May 01		2	6:50	cloudy	none	calm	13-11	8	9	
05 Jun 01		1	7:30	clear	full	calm	20-10	8½	12	
7 Jun 01	12		7:40	cloudy	none	breeze	14-17	9	5	
16 Jun 00	80		7:45	cloudy	none	calm	20	8	4	
18-Jun 01	14	1	7:45	cloudy	occasional	calm	16-13	8	6	
20 Jun 00	10	1	7:40	clear	none	windy	18	11	1	

TABLE 1 (continued)

Observed

Date	♂♂	♀♀	Sun-down MST	Sky Cover	Moon	Wind	Temp C	Hours netted after sun-down	Locality
24 Jun 61	14	1	7:50	cloudy	obscured	calm	22-19	2	5
27 Jun 61	1		7:50	hazy	full	strong	24-20	2¼	7
29 Jun 61	1		7:55	clear	full	breeze	16-14	2	8
8 Jul 60	1		7:50	rain-cloudy	full-obscured	gusty	16	2½	4
10 Jul 60	12		7:40	cloudy	none	gusty	17	2¼	4
11 Jul 60	3		7:40	clear	none	gusty	17	1½	5
12 Jul 61	1		7:30	cloudy	none	strong	21-20	2	13
15 Jul 60	10		7:30	cloudy	none	gusty	16½	2½	4
17 Jul 61	2		7:25	cloudy	crescent	breeze	23-21	2¼	5
19 Jul 60	1		7:25	clear	crescent	gusty	16½	2½	5
22 Jul 60	12		7:15	clear	crescent	breeze	13½	2¾	4
26 Jul 60	2		7:15	clear	crescent	gusty	19	2	5
29 Jul 60	3		7:10	cloudy	none	gusty	18	1½	4
1 Aug 60	2		7:10	cloudy	quarter	calm	21-16½	6½	5
8 Aug 61	3		7:10	cloudy	none	breeze	26-24	2	5
1 Sep 59	1		No data						4
3 Sep 59	1	1	No data						4
7 Sep 59	2		No data						4

Antrozous pallidus

13 May 60		1	No data						26
21 May 61	1	8	7:30	clear	half	calm	20-15	2	7

TABLE 1 (continued)

Observed

Date	♂♂	♀♀	Sun-down MST	Sky Cover	Moon	Wind	Temp C	Hours netted after sun-down	Locality
6 Jun 61	1		7:40	cloudy	none	gusty	18-14	4½	19
13 Jun 60	1		7:45	clear	none	breeze	20-16	6	21
14 Jun 60	3	14	7:45	cloudy	none	breeze	22-20	7	3
15 Jun 60	1		7:45	cloudy	none	calm	16	1½	21
26 Jun 60	1	2	7:45	clear	crescent	calm-gusty	24-22	2½	3
26 Jun 61		3	7:45	clear-cloudy	full	breeze	28-22	2	10
5 Jul 61		2	7:40	cloudy	none	calm	26-24	2¼	12
9 Jul 60	7	10	7:40	cloudy	none	calm	22	3	3
10 Jul 60	1		7:30	cloudy	none	gusty	20	3½	4
11 Jul 61	3	2	7:30	clear	none	gusty	22-20	3	12
14 Jul 61		1	7:30	partly cloudy	crescent	gusty	26-24	2	12
16 Jul 61	1		7:30	clear	crescent	mild-gusty	24-23	2½	13
21 Jul 60	3		7:30	clear	none	breeze	21	2¼	21
23 Jul 61	2	4	7:30	clear	full	calm	26-25	2	10
29 Jul 49		1	No data						25
31 Jul 61		1	7:30	cloudy	obscured	gusty-calm	26-24	2	12
1 Aug 61	1		No data						23
2 Aug 60	2	3	7:30	cloudy	quarter	calm	24	3	3
3 Aug 61	2	8	7:30	partly cloudy	full	gusty	26-25	2	10

TABLE 1 (continued)

Observed

Date	♂♂	♀♀	Sun-down MST	Sky Cover	Moon	Wind	Temp C	Hours netted after sun-down	Locality
6 Aug 61	2	7	7:10	partly cloudy	none	gusty	28-22	3	12
11 Aug 60	1		No data						16
11 Aug 60	1		7:10	cloudy-rain	none	gusty	15	2	4
17 Aug 59	1		No data						24
19 Aug 60	1		7:05	clear	none	windy	20-18	2½	21
22 Aug 60	1		No data						21
25 Aug 61		1	7:05	clear	crescent	gusty	22-20	3	12
26 Aug 61		2	7:05	cloudy	half	calm	26-24	2	14
29 Aug 61		1	7:05	cloudy	obscured	strong	25	2	12
3 Sep 61	1		No data						4
5 Sep 61		5	7:00	clear	none	calm	18-16	2	10
14 Sep 38	1		No data						27
24 Sep 61	3	4	6:50	clear	not up	breeze	18-15	2	10

Plecotus townsendi

20 May 61	1		No data						9
24 May 61	2		7:30	clear	half	calm	8-4	2	9
3 Jun 61	1		7:40	clear	none	gusty	14-12	1½	19
6 Jun 61	1		7:40	cloudy-clear	none	gusty	18-14½	4	19
11 Jun 60	1		7:30	overcast	up	windy	11	2½	9

TABLE 1 (continued)

Observed

Date	♂♂	♀♀	Sun-down MST	Sky Cover	Moon	Wind	Temp C	Hours netted after sun-down	Locality
20 Jun 61	1		7:45	clear	half	gusty	12-10	2½	9
25 Jun 61	2	1	7:50	clear	almost full	breeze	12½-11	2¼	9
20 Jul 60		1	7:40	cloudy-rain	obscured	breeze	13-11	2½	9
9 Aug 60	1		7:10	rain-overcast	none	breeze	14	2½	9
5 Sep 61	1		7:00	clear	none	calm	18-16	2	10
7 Sep 59	1		No data						7
10 Sep 61	1		6:50	partly cloudy	none	breeze	8½-7	3½	9
26 Sep 61		1	6:45	clear	full	calm	12-9	2½	9
10 Oct 61	1	1	6:15	clear	crescent	calm	12-10	3½	10
6 Jan 62	1	4	hibernating in cave				3		9

Tadarida brasiliensis

20 Apr 60	2		No data						16
20 Apr 61	2		6:50	cloudy	half	gusty	20-17	3¼	16
22 Apr 39	1		No data						27
20 May 60		1	No data						27
4 Jun 61		3	7:40	clear	half	calm	22-13	4½	6
14 Jun 60		1	7:45	cloudy	none	breeze	22-20	7	6
3 Jul 61	1		7:50	cloudy	obscured	calm-gusty	22-21	3¼	13

TABLE 1 (continued)

Observed

Date	♂♂	♀♀	Sun-down MST	Sky Cover	Moon	Wind	Temp C	Hours netted after sun-down	Locality
20 Jul 60		2	7:45	clear	none	calm	22½	7½	6
26 Jul 61		14	7:40	clear	full	calm	30-22	4	6
27 Jul 60		2	7:40	cloudy-rain	none	breeze	22	7½	6
30 Jul 61		3	7:35	cloudy	obscured	windy	27-26	5	6
3 Aug 61		2	7:20	cloudy-rain	none	gusty	28-26	3	6
8 Aug 60		2	7:10	cloudy	none	gusty	26-24	2	6
9 Aug 61		1	taken from beauty shop						
25 Aug 61		1	7:10	cloudy	eclipse	calm	18-16	2	5
27 Aug 61		1	7:10	cloudy	full	brisk	26-23	3	6
7 Sep 61		6	7:00	clear	none	calm	18-14	4	6

Tadarida molossa

22 May 58		1	No data						27
27 Jul 60		1	7:40	cloudy-rain	obscured	breeze	22	7½	6
30 Jul 60		2	7:35	cloudy	obscured	windy	27-26	5	6

Fig. 20. Air temperature ranges taken at time of capture for 18 species of bats. The median of all nightly temperature ranges is indicated by a vertical line on the temperature range bar.

FIGURE 20

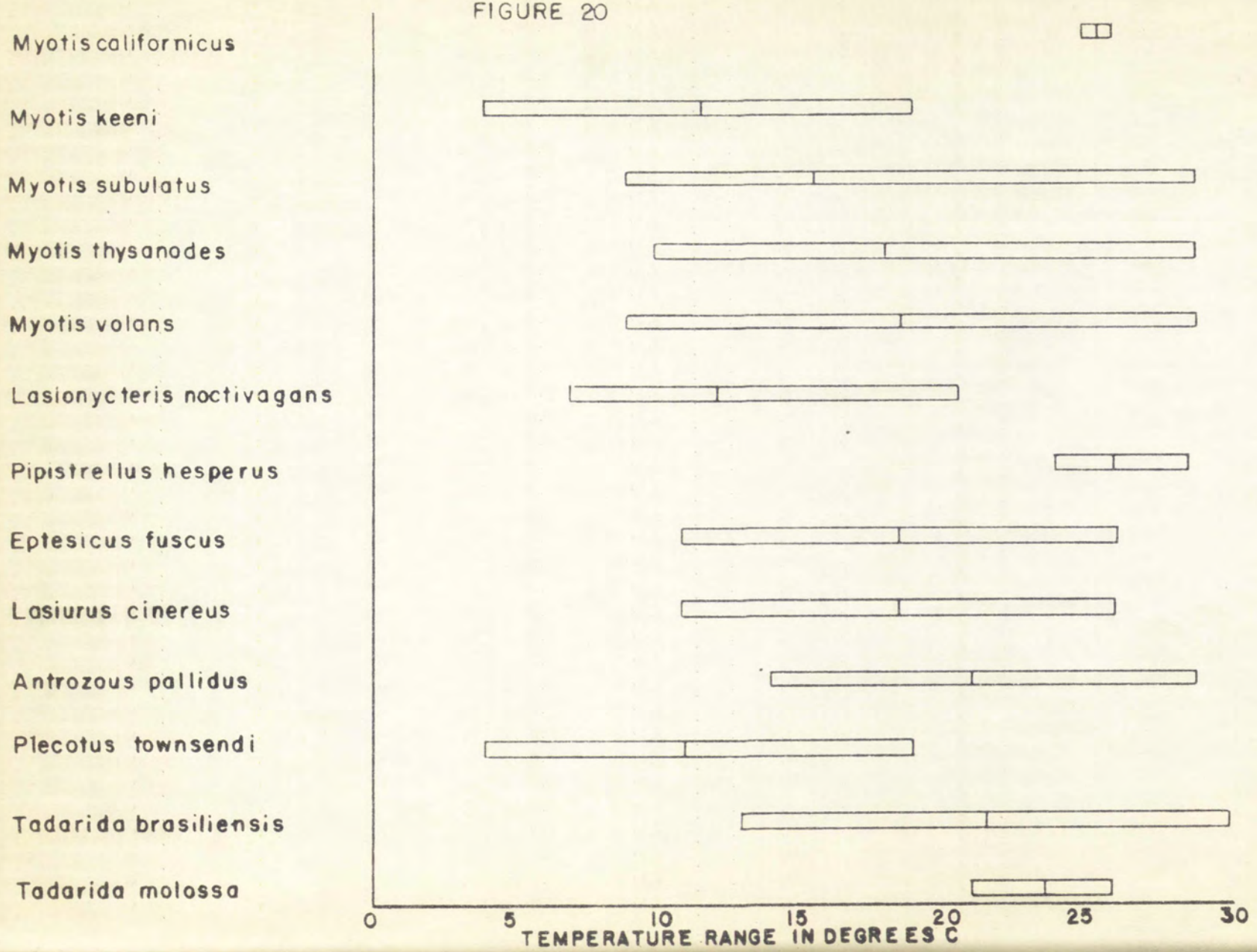

Myotis californicus
Myotis keeni
Myotis subulatus
Myotis thysanodes
Myotis volans
Lasionycteris noctivagans
Pipistrellus hesperus
Eptesicus fuscus
Lasiurus cinereus
Antrozous pallidus
Plecotus townsendi
Tadarida brasiliensis
Tadarida molossa
0
5
10
15
20
25
30
TEMPERATURE RANGE IN DEGREES C

Table 2. Percentage of bats taken in four vegetation communities in Bernalillo County. Data are given for each species separately, as well as for all species combined.

TABLE 2

Species	No. taken 100%	% in grass-land	% in pinyon-juniper	% in yellow pine	% in fir
Myotis californicus	1	100	-	-	-
Myotis keeni	36	-	5	41	54
Myotis subulatus	20	10	40	30	20
Myotis thysanodes	89	52	42	2	4
Myotis volans	68	16	32	40	12
Lasionycteris noctivagans	50	4	96	-	-
Pipistrellus hesperus	4	100	-	-	-
Eptesicus fuscus	98	1	99	-	-
Lasiurus cinereus	152	1	98	1	-
Plecotus townsendi	23	12	4	-	84
Antrozous pallidus	122	83	17	-	-
Tadarida brasiliensis	45	84	16	-	-
Tadarida molossa	4	100	-	-	-
Total	692	29	56	7	8

| | | |

Fig. 21. Summary of reproductive data for males of nine species. The range shown is the earliest and latest date for males of each species. Presence of sperm is indicated by oblique bars.

FIGURE 21

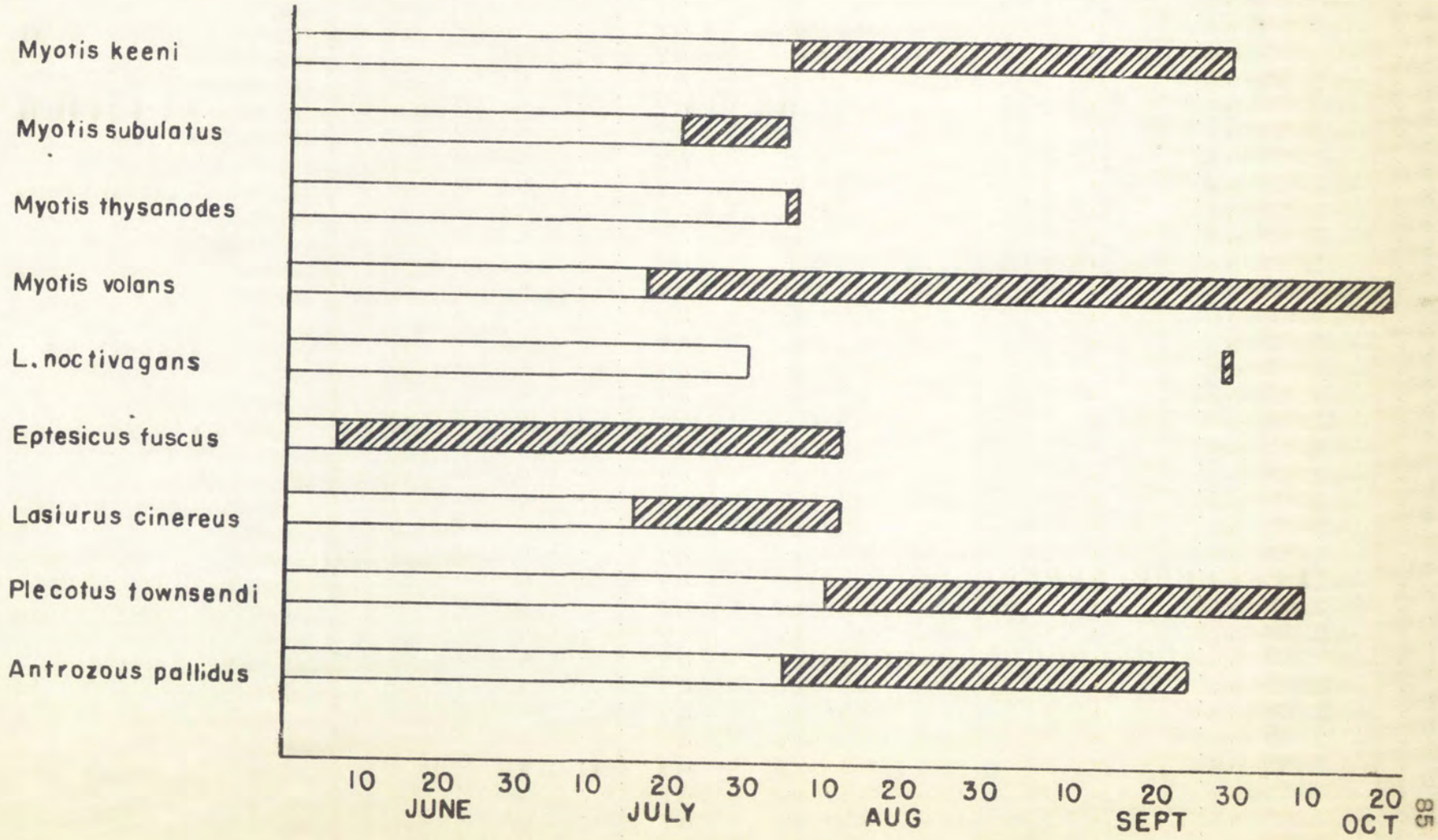
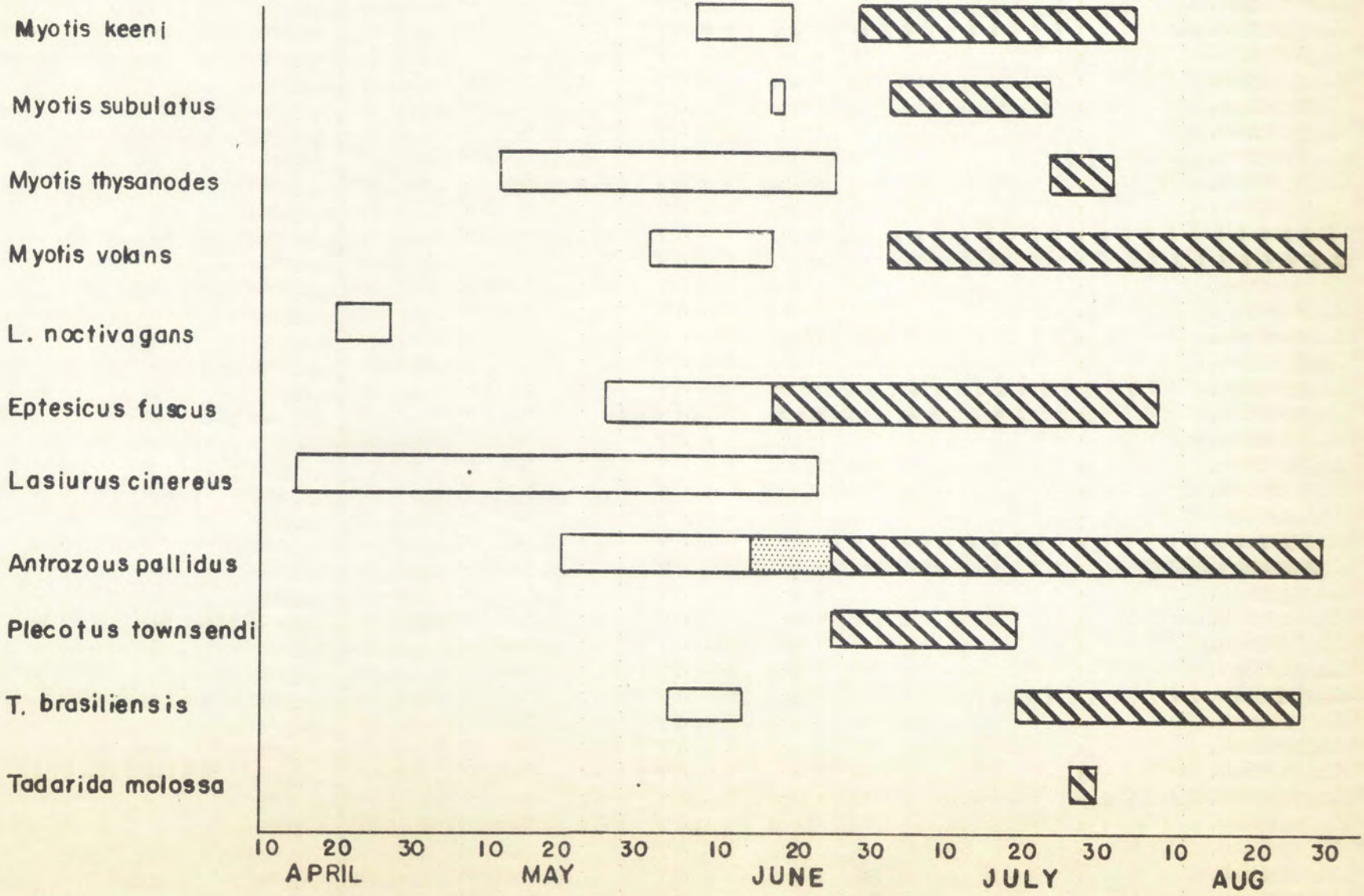

Myotis keeni
Myotis subulatus
Myotis thysanodes
Myotis volans
L. noctivagans
Eptesicus fuscus
Lasiurus cinereus
Plecotus townsendi
Antrozous pallidus
10
20
30
JUNE
JULY
AUG
SEPT
OCT

Fig. 22. Summary of reproductive information for females of 11 species. Ranges are earliest and latest date for lactation or pregnancy. Lactation is indicated by oblique bars and an area of overlap between pregnancy and lactation is indicated by stipling.

FIGURE 22


Myotis keeni
Myotis subulatus
Myotis thysanodes
Myotis volans
L. noctivagans
Eptesicus fuscus
Lasiurus cinereus
Antrozous pallidus
Plecotus townsendi
T. brasiliensis
Tadarida molossa
10 20 30 10 20 30 10 20 30 10 20 30 10 20 30
APRIL
MAY
JUNE
JULY
AUG

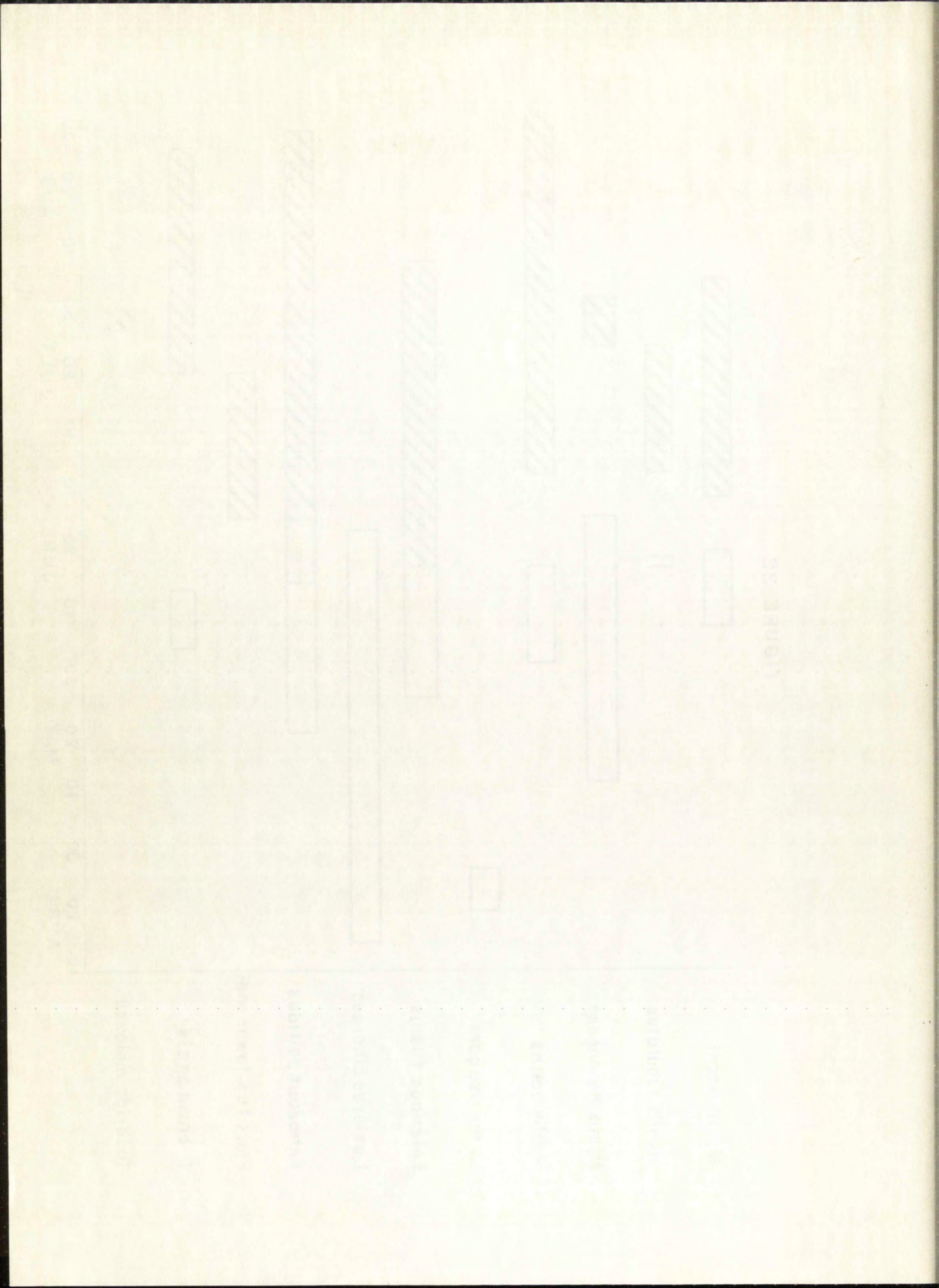
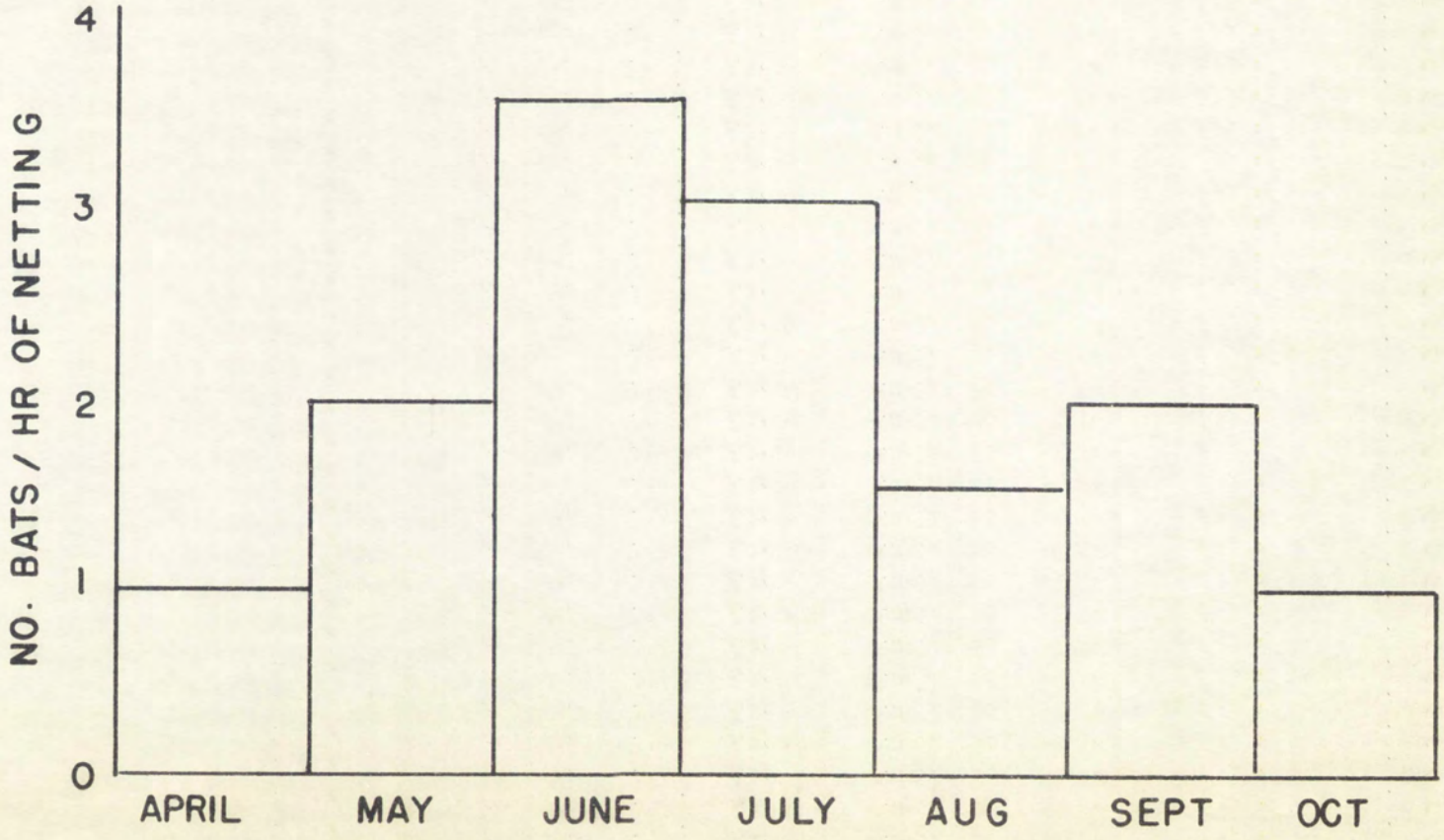


Fig. 23. Numbers of bats taken per hour during collecting hours for each month.

FIGURE 23



DISCUSSION

Although 14 species of bats are presently known to occur in Bernalillo County, two other species are to be expected. Myotis evotis occurs to the west, north, and south of the county and further investigation may reveal its presence here. The other species, Euderma maculatum, occurs sporadically both north and south of here. Due to the apparent scarcity of this bat, it may occur here but never be captured. I suspect that Myotis yumanensis and Myotis californicus occur in the county in greater numbers. The lack of specimens for these two bats is probably due to chance and to the net-dodging ability of some bats of the genus Myotis. I observed Myotis drinking so close to a net that their wings brushed it; yet, these bats were not captured.

A factor which influences the number of bats taken is the effectiveness of equipment used. I estimated that less than 10% of the bats I saw flying were captured. Although mist-netting is far better than shooting as a means of capturing bats, it may be more efficient for capturing some species than others.

No one ecological factor or group of factors consistently influenced bat activity. Personal observations indicate that bats flying in the full moon flew from shadow to shadow and their flight seemed agitated. Roost observations at the College of St. Joseph indicated that wind

slowed down activity, but this was not substantiated by observations at Isleta Cave.

Ten species were active between 15 and 20 C. Two species, Myotis keeni and Plecotus townsendi, were flying at lower temperatures than all other species. Both of these species were collected mostly at high elevations and showed preference for caves. Both were taken mainly in ponderosa pine and fir communities, but their distribution may be influenced by the availability of suitable roosting sites rather than temperature or vegetation. The silver-hairs fly at a fairly low temperature range. Perhaps the higher temperatures in July and August explain why these bats are scarce or absent in the county during these months. For three species (Myotis californicus, Pipistrellus hesperus, and Tadarida molossa), too few bats were taken to produce a clear picture. The little freetail seems to prefer higher temperatures as it is abundant in the Rio Grande Valley throughout the summer.

For most species, parturition occurs between the end of June and early July (Fig. 22). This may be necessary, if growth in other bats is similar to that in the little freetail (Short, 1961b). The little freetail is flying at 6 weeks and has reached adult size in forearm length by 8 weeks. My observations at pallid bat roosts indicate that young are flying 6 to 8 weeks after birth. Observations indicate this is also true for Myotis thysanodes. Christian

(1956) found this true for Eptesicus fuscus as did Orr (1954) for Antrozous pallidus. As a result, young of the year are well developed by the time cooler weather arrives. In Plecotus townsendi, the young are able to fly 3 weeks after birth, but nurse for several weeks longer (Pearson, Koford, and Pearson, 1952). This would indicate that at 6 weeks or so after birth, the young of Plecotus are no longer dependent on the mother.

Males are producing sperm while females are lactating. However, the presence of sperm in the testis and epididymis of a male does not necessarily imply that mating is taking place. My observations indicate that the testis reaches a peak in size when sperm is produced. Following this a rapid decrease in size coincides with the swelling of the epididymis. Probably copulation occurs at this time. Pearson, Koford, and Pearson (1952) found this to be true in Plecotus townsendi as did Christian (1956) in Eptesicus fuscus and Orr (1954) in Antrozous pallidus. For all three of the above mentioned species, copulation was found to occur in October at the time these bats were entering winter roosts. Copulation has also been observed in hibernacula of some species, for example, Myotis subulatus (Wimsatt, 1945), Eptesicus fuscus (Mumford, 1958), and Plecotus townsendi (Pearson, Koford, and Pearson, 1952). In the little freetail, copulation seemingly occurs in the spring (Short, 1961a). However, I did not find sperm

in any of the males taken in April, when they are reported to be in mating condition.

Bats in Bernalillo County are most abundant in June. Migratory peaks of hoary and silver-hair bats perhaps account for this. A second peak is reached in September when migratory bats are passing through the county. Possibly other bats besides hoary and silver-hair bats pass through the county in the fall because only two species are known to hibernate here at the present time. Another possible interpretation for the decrease in numbers after June is the July-August rainy season. With the increased availability of water, the chances of capturing as many bats decreases because bats can drink in a greater variety of places.

SUMMARY

1. Fourteen species of bats are known to occur in Bernalillo County. Of these, the following six have not previously been reported: Myotis keeni, Myotis subulatus, Myotis volans, Pipistrellus hesperus, Lasiurus cinereus, and Tadarida molossa.
2. Ecological data are presented on 13 species. No factor or group of factors consistently influenced bat activity.
3. Temperature ranges indicate that most bats fly at 15 to 20 C. Plecotus townsendi, Myotis keeni, and to a lesser degree Lasionycteris noctivagans seem to fly at lower temperatures.
4. Reproductive data on females indicate that parturition occurs between the last week in June and the first week in July.
5. Reproductive data on males indicate that males begin producing sperm while the females are lactating, but copulation occurs in the fall or in the winter within the hibernacula. Probably this is true for most vespertilionids.
6. Myotis keeni, Myotis subulatus, Myotis thysanodes, Myotis volans, Eptesicus fuscus, Antrozous pallidus, Pipistrellus hesperus, Tadarida brasiliensis, and Tadarida molossa are known to breed in Bernalillo County.

7. Lasiurus cinereus and Lasionycteris noctivagans are migratory and were not found breeding in the county.
8. Plecotus townsendi and Myotis subulatus are residents, while Myotis keeni, Myotis californicus, Myotis thysanodes, Myotis volans, Eptesicus fuscus, Antrozous pallidus, Tadarida brasiliensis, and Tadarida molossa are so far known only as summer residents.
9. Bats in Bernalillo County are most abundant in June. This peak is probably due to the silver-hair and hoary bats migrating at this time. A second peak occurs in September, probably indicating a southern migration in the fall.
10. The decrease in number of bats taken in July and August may be due to scattering because of increased availability of water.

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