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Lasiurus seminolus.

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Lasiurus seminolus (Rhoads, 1895)

Seminole Bat

Atalapha borealis seminola Rhoads, 1895:32. Type locality Tarpon Springs, Pinellas Co., Florida.

Lasiurus seminolus, Poole, 1932:162; apparently represents the first use of current name combination.

CONTEXT AND CONTENT. Order Chiroptera, Suborder Microchiroptera, Family Vespertilionidae, Subfamily Vespertilioninae, Tribe Lasiurini. *Lasiurus seminolus* is monotypic.

DIAGNOSIS. The only other species with which *Lasiurus seminolus* is likely to be confused is the red bat, *L. borealis*. Both sexes of seminole bats possess a deep mahogany-colored pelage bearing a faint frosted appearance caused by white tips of the dorsal hairs (Fig. 1). The fur of red bats, however, ranges from brick red in males to rusty red in females. Because frosting is more apparent and overall color is deeper in female *L. borealis*, seminole bats are more often mistaken for female red bats than for male red bats. Shump and Shump (1982) provided a key to species of this genus.

Skull size and form in seminole and red bats are similar (Schmidly, 1983). Lowery (1974) noted no cranial measurements that were reliable for distinguishing these species. A highly diagnostic qualitative feature is the lacrimal shelf, a ridge projecting anterolaterally from the lacrimal region, poorly developed in *L. seminolus*, but well developed in *L. borealis*. Illustrations comparing the skulls of these two species were presented by Lowery (1974) and Hall (1981).

GENERAL CHARACTERS. *Lasiurus seminolus* is a medium-sized bat. Its ears are short and rounded. The tragus tapers to a rounded tip that is turned slightly anteriorly (Fig. 2). The wings are long and pointed. As for other vespertilionids, the tail is contained entirely within the uropatagium. Fur covering the dorsal surface of the uropatagium is denser proximally. Body fur generally is of deep mahogany color with posterior portions of venter slightly paler than dorsum. Whitish fur is densest in patches near shoulders and thumbs, and in the neck region where, in some specimens, it gives the appearance of a faint collar. Pelage is shorter and paler (somewhat yellowish) in the facial area and around the base of the ears. Skin covering the forearms is sparsely haired and is deep brown, with that of the chiropatagium nearly black. Pelage features are not sexually dimorphic.

The skull (Fig. 3) has a large braincase that tapers slightly into a robust rostrum. Zygomatic breadth is about two-thirds skull length. The nasal and palatal emargination is broad and shallow. The dental formula is i 1/3, c 1/1, p 2/2, m 3/3, total 32 (Hall, 1981). The anterior peg-like premolar is much smaller, and is positioned lingual to, the posterior premolar. The third upper molar has an occlusal surface area much smaller than the other molars. Cusps are tall and sharp and arranged in the dilambdodont pattern.

Means for external, cranial, and postcranial measurements (in mm) for 12 males and 12 females (in parentheses) from Louisiana (Lowery, 1974) are: total length 97.7, (103.5); tail length, 39.7 (45.5); length of hind foot, 8.3 (8.2); ear length, 9.0 (11.1); forearm length, 39.7 (40.7); length of third metacarpal, 40.7 (42.0); condylobasal length, 12.3 (12.9); cranial height, 5.7 (5.7); cranial breadth, 7.3 (7.7); zygomatic breadth, 9.2 (9.6); interorbital breadth, 4.2 (4.2); palatal breadth, 6.2 (6.5); palatilar length, 4.0 (4.3); postpalatal length, 5.1 (5.4); length of maxillary toothrow, 4.1 (4.4). These measurements indicate that females are generally larger than males. Weights of four adults (sexes not indicated) from Georgia ranged from 10.8 to 13.8 g with a mean of 12.2 g (Golley, 1962). A male from Louisiana weighed 9.3 g, and five females (lacking embryos) averaged 10.7 g (Lowery, 1974).

DISTRIBUTION. The range of *Lasiurus seminolus* generally includes all or portions of the southeastern states along the Gulf of Mexico and the southern Atlantic seaboard ranging from eastern Texas to North Carolina (Fig. 4). Recent reports extend the range of *L. seminolus* into southern Tennessee (Kennedy et al., 1984), west-central Arkansas (Heath et al., 1983), and northwestern South Carolina (Neuhauser and DiSalvo, 1972). Extralimital records to the north include specimens from Berks and Lancaster counties, Pennsylvania (Poole, 1949) and from Ithaca, New York (Layne, 1955). The southernmost record is from the vicinity of Tecolutla, Veracruz (Villa-R., 1955, 1966), a record Honacki et al. (1982) reported as unverified. Other records, disjunct from the primary range, include a specimen from Brownsville in extreme southern Texas (Strecker, 1926) and two specimens collected in 1956 and 1957 on the island of Bermuda (Van Gelder and Wingate, 1961). Although Van Gelder and Wingate (1961) speculated about the remote possibility of *L. seminolus* being a permanent resident of Bermuda, seminole bats probably reached Bermuda, and perhaps other extralimital localities, by being blown off course by storms.

The seminole bat occurs primarily at low to intermediate elevations. No seminole bat has been taken in a region where elevations exceed 500 m (Golley, 1962; Heath et al., 1983; Kennedy et al., 1984; Lee et al., 1982; Schmidly, 1983; Sealander, 1979).

FOSSIL RECORD. *Lasiurus seminolus* has been identified only from the late Pleistocene (Wisconsinan) Vero deposit in Indian River Co., Florida (Martin, 1972; Webb and Wilkins, 1984; Weigel, 1962). Morgan (1985), however, reexamined the Vero speci-

FIG. 1. *Lasiurus seminolus* hanging from pine twig against background of Spanish moss. Specimen, from San Jacinto Co., Texas, photographed by John L. Tveten.

FIG. 2. Head of *Lasiurus seminolus* showing ear and facial features. Photograph by John L. Tveten.

mens and concluded that specific identification of the small lasiurine material was not possible; this material could also (or instead) represent *L. borealis*. Additionally, small lasiurine specimens from the Sangamonian Reddick site (Marion Co., Florida) referred previously to *L. borealis* (Gut and Ray, 1963) could also include seminole bat material (Morgan, 1985).

FORM AND FUNCTION. Little specific information regarding morphology and physiology of *L. seminolus* is available. Constantine (1958) captured a young male with its third tail vertebra bearing an enlarged (3 mm diameter) hard white nodule.

Constantine (1958) found that *L. seminolus* in Georgia select roosting sites with western and southwestern exposures that facilitate preflight warming by the sun. Seminole bats dropped from the hand are capable of immediate flight at ambient temperatures greater than 21°C, a temperature threshold that seemingly is lower at higher relative humidities (Constantine, 1958). Seminole bats apparently do not enter a deep hibernation that lasts the entire winter season, but arouse and forage, especially in the southern portions of their range, during winter evenings with warm temperatures. They have been taken during all seasons in Texas (Schmidly et al., 1977), South Carolina (Coleman, 1950), and Florida (Moore, 1949). Jennings (1958) determined that seminole bats generally do not fly when ambient temperature is less than 18°C.

ONTOGENY AND REPRODUCTION. Embryo counts in *L. seminolus* range from one to four with a mean of 3.3 in a sample (n=21) from north central Florida (Barbour and Davis, 1969; Jennings, 1958). Pregnant females were collected in South Carolina on 22 May (two embryos, crown-to-rump = 23 mm; Coleman, 1950), in Alabama on 9 and 12 May (two and three embryos, respectively; Barkalow, 1948), and in Florida from 21 May to 18 June (Jennings, 1958; Moore, 1949). The combined weight of the pair of embryos (sans extraembryonic membranes) taken from a

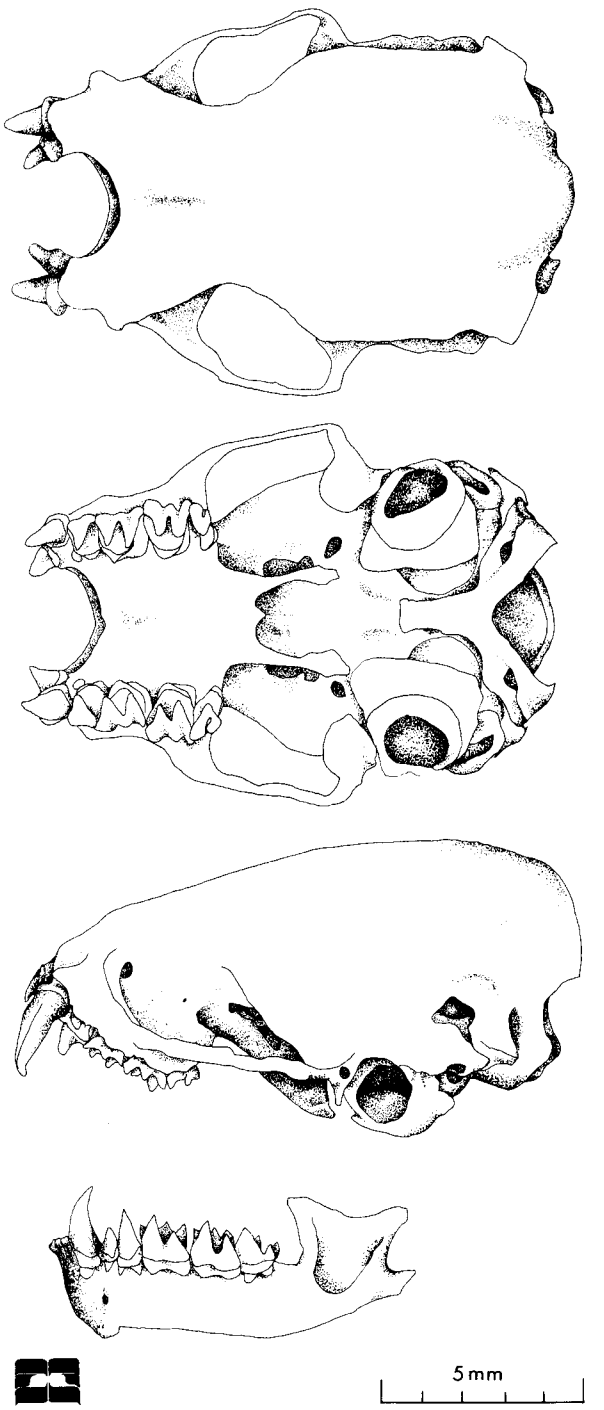

FIG. 3. Dorsal, ventral, and lateral views of upper skull and lateral view of mandible of *Lasiurus seminolus* (TCWC 34940, male) from 3.8 miles N, 1.9 miles W Spurger, Tyler Co., Texas. Drawings by Ellen Guelker.

16.9 g female (gross weight) on 3 June was 2.3 g, whereas a 20 g female carried four embryos totaling 6 g (Moore, 1949).

In Florida, parturition in most pregnant females occurs before the second week of June (Jennings, 1958). Lactating seminole bats have been collected in Florida on 3 June (Moore, 1949) and 27 June (Marion Co.). Barkalow and Funderburg (1960) found a lactating female in New Hanover Co., North Carolina, and interpreted this evidence to indicate that breeding in *L. seminolus* probably occurs at least that far north. Coleman (1950) took a lactating female on 2 July in South Carolina. Testes of three male seminole bats from Georgia were descended when examined in February and April; dimensions of testes with epididymides for these specimens

was 1.5 by 4 mm (8 February), 2 by 4 mm (12 February), and 1.5 by 2 mm (19 April; Constantine, 1958).

ECOLOGY. The ecological distribution of *L. seminolus* generally corresponds with that of epiphytic Spanish moss, *Tillandsia usneoides*, in which these bats frequently roost (Barbour and Davis, 1969). Constantine (1958) generally found only one or two individuals to occupy a particular clump of moss; two adult females were found roosting 30 cm apart in the same moss clump whereas an adult female and an immature male were hanging in adjacent clumps. Females with their litters also have been found in moss (Barbour and Davis, 1969). The height above ground of moss clumps occupied by seminole bats is variable, but is great enough for the bat, dropping into the unobstructed space beneath, to take flight. A banded seminole bat in Baker Co., Georgia, was found hanging at 4.5 m on one occasion and was later rediscovered hanging at only 1.8 m; the distance between these two roost sites was about 60 m. Constantine (1958) reported other individuals roosting at heights of 1.1, 1.8, 2.7, and 4.5 m. Seminole bats seem to select roost sites in moss hanging on the southwestern exposure of trees. Seminole bats sometimes roost beneath loose bark and in clumps of foliage (Sealander, 1979). The capture of a seminole bat in a mist net outside the entrance to an abandoned mine shaft in Polk Co., Arkansas, suggests that this species opportunistically might roost in caves (Heath et al., 1983).

Being tree bats, *L. seminolus* tends to occur in wooded habitats within its range. In Okefenokee Swamp, Georgia, seminole bats occur in and over the following habitats (Laerm et al., 1980): uplands, islands, prairies, shrub swamp, blackgum forest, pure bay forest, pure cypress, and mixed cypress. Predominant tree species in these habitats include blackgum (*Nyssa sylvatica*), pond cypress (*Taxodium ascendens*), red maple (*Acer rubrum*), loblolly bay (*Gordonia lasianthus*), red bay (*Persea borbonia*), sweet bay (*Magnolia virginiana*), loblolly pine (*Pinus taeda*), slash pine (*P. elliottii*), longleaf pine (*P. palustris*), water oak (*Quercus niger*), and live oak (*Q. virginiana*).

In Florida, seminole bats inhabit pine flatwoods, scrubby flatwoods, hammocks, lowland forests, and river swamps (Ivey, 1959; Jennings, 1958; Moore, 1949; Zinn, 1977). Lee et al. (1982) reported *L. seminolus* from the sand ridges plant association (longleaf pine and turkey oaks, *Quercus laevis*, as dominants) and listed it as an "expected species" in the savanna association in North Carolina (Barkalow and Funderburg, 1960). Seminole bats collected in Tennessee were netted over a stream and a pond in areas where dominant tree species were oak, hickory (*Carya* sp.), beech (Betulaceae), dogwood (*Cornus* sp.), buckeye (*Aesculus* sp.), birch (*Betula* sp.), maple and hemlock (family uncertain; Kennedy et al., 1984). In east Texas, *L. seminolus* is abundant in the pine-oak and longleaf pine forests and is less common in the oak-hickory woodlands (Schmidly et al., 1977).

Lasiurus seminolus feeds almost exclusively on insects, most of which these bats catch while foraging at treetop level (Barbour and Davis, 1969). In Okefenokee Swamp, Georgia, these bats forage over watercourses, pine barrens, clearings, and, less frequently, over prairies and hammocks (Harper, 1927). The diet of seminole bats from the vicinity of Gainesville, Florida, includes homopterans (Jassidae), dipterans (Dolichopodidae, Muscidae), and coleopterans (Scolytidae; Sherman, 1939). Zinn (1977) found that the diet of *L. seminolus* in a north-central Florida river swamp during July consisted (by volume) of 90% Odonata and 10% Coleoptera. During August, Coleoptera composed 90% of the diet, with the balance being Hymenoptera.

Not all insects eaten are taken in flight; Sherman (1935) collected a seminole bat holding in its mouth a flightless cricket, *Gryllus assimilis*. The green fly, *Tabanus flavus*, composes part of the diet in Georgia (Harper, 1927). The "theoretical rate of insect capture" calculated for an 8.7-g adult seminole bat in Georgia was 1.5 g/h (Gould, 1955). Sherman (1939) found a mite (no scientific name given) in the stomach of a seminole bat.

Migratory behavior has not been demonstrated conclusively in *L. seminolus* despite Barkalow's (1948) contention that seminole bats in northern Alabama move southward during fall and winter. Barkalow (1948) based this conclusion on the observation that red bats (*L. borealis*) but not seminole bats were active on warm winter evenings in northern Alabama. An alternate explanation is that seminole bats require higher minimum temperatures than red bats to become active and that this higher threshold is reached only

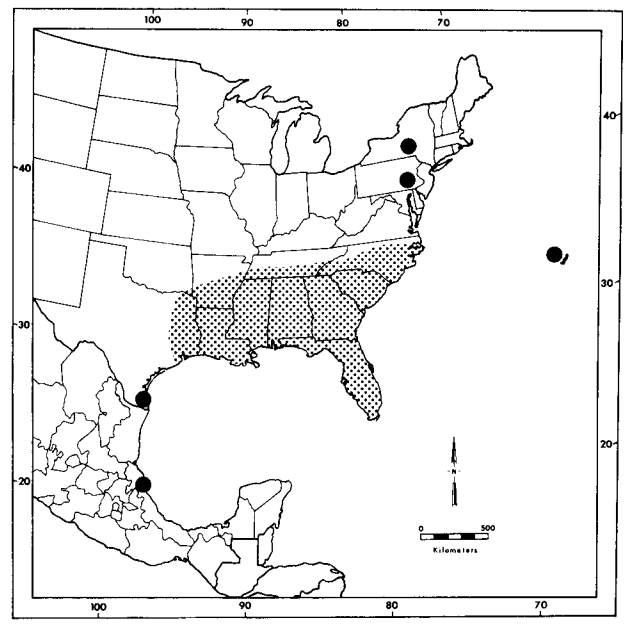

FIG. 4. Modern geographic distribution of *Lasiurus seminolus*. Extralimital records in New York, Pennsylvania, Bermuda, south Texas, and Veracruz are indicated by dots. Pleistocene records (not depicted) are restricted to peninsular Florida.

rarely in northern Alabama (Barbour and Davis, 1969). Following weaning, young seminole bats reportedly exhibit a tendency towards extensive wandering (Barbour and Davis, 1969). This trait, coupled with storm winds, might explain the extralimital records noted herein for which most of the collecting dates were during autumn.

At least one seminole bat died from an encounter with a domesticated bird, a peacock (*Pavo* sp.; Barkalow and Funderburg, 1960). Lowery (1974) suspected that blue jays (*Cyanocitta cristata*) are important predators, and further speculated that losses related to commercial collection of moss were greater than any other agent. Dunaway (1960) reported a seminole bat strangled by strands of Spanish moss. Doubtless, other vertebrates such as snakes, raptors, and others prey upon *L. seminolus* (Constantine, 1958).

Little published information is available regarding organisms parasitizing *L. seminolus*. Constantine (1958) specifically noted that "obvious external parasitism" was not evident in seminole bats he handled in Georgia. Yamaguti (1958–1963) reported no helminth parasites from *L. seminolus*. Similarly, Ubelaker (1970) noted neither endoparasites nor ectoparasites from *L. seminolus*. Although mites (Acari) are known for *L. borealis*, *L. cinereus*, and *L. intermedius*, none are listed for seminole bats (Radovsky, 1967; Whitaker and Wilson, 1974). Cooley and Kohls (1944) described no ticks (Argasidae) from *L. seminolus*.

In Florida, rabies has been detected in at least eight bat species, including *L. seminolus*. One of 61 seminole bats collected in 1953 tested positive for rabies (Venters et al., 1954). In another study, five (0.6%) of 785 seminole bats were positive for rabies (Schneider et al., 1957). This rate of rabies infection was lower than observed for other free-living Florida species (*L. borealis*, *L. floridanus*) and similar to or greater than recorded for colonial species (*Myotis austroriparius*, *M. grisescens*, *M. sodalis*, *Pipistrellus subflavus*, *Nycticeius humeralis*, *Eptesicus fuscus*, *Tadarida brasiliensis*, and *Eumops glaucinus*).

BEHAVIOR. Constantine (1958) fed a captive individual a diet of boiled egg, cooked liver, and crickets. This bat drank readily from a dish, and when released within the building, opened its mouth and dragged its chin along the shiny linoleum floor as it flew just above floor height. Apparently it perceived the floor as the surface of a body of water.

Seminole bats forage both on the wing within and around the tree canopy and on the ground surface. Barbour and Davis (1969) presented observations of a seminole bat capturing insects attracted to the inflorescences of cabbage palms (*Sabal palmetto*); the bat circled in the vicinity of the plant and on each pass landed on a

palm leaf and took an insect. These bats also forage opportunistically on insects attracted to street lights (Jennings, 1958).

GENETICS. The karyotype of male *L. seminolus* was figured by Baker and Mascarello (1969) who noted that seminole and red (*L. borealis*) bats possess indistinguishable karyotypes (2n = 28, FN = 48). The autosomal complement of *L. seminolus* includes 10 pairs of large- and medium-sized biarmed chromosomes and 3 pairs of small chromosomes, 2–4 of which are metacentric with the remainder acrocentric. The X chromosome is a moderately large submetacentric and the Y is minute. Bickham (1979) stated that the autosomal complements of *L. borealis*, *L. cinereus*, *L. ega*, and *L. seminolus* are similar and that their first three biarmed chromosomes are homologous to the large biarmed chromosomes of *Myotis*. On the basis of chromosome banding patterns, Bickham (1979) placed species of the chromosomally specialized genus *Lasiurus* into the "*Myotis*-like" group of vespertilionids with *Pipistrellus*, *Plecotus*, *Idionycteris*, and *Lasionycteris*.

REMARKS. The nomenclature of this taxon has undergone an unsettled history. At the generic level, application of *Lasiurus* resulted from a 1914 ruling of the International Committee on Zoological Nomenclature (ICZN) in which the Law of Priority was suspended. Hall and Jones (1961) followed this ICZN ruling and used the generic name *Lasiurus*, whereas Hall (1981) followed priority and retained *Nycteris*, originally used by Borkhausen in 1797. Hall (1981), therefore, referred to the seminole bat as *Nycteros seminola*. The seminole bat has been considered as a subspecies of the red bat (*L. borealis*; Koopman et al., 1957) and as a distinct species (Barkalow, 1948; Coleman, 1950; Lowery, 1974; Poole, 1932, 1949). Currently, the most widely accepted interpretation recognizes red and seminole bats as separate species. Mahogany bat is another widely used vernacular name.

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