

THE DISTRIBUTION OF THE BATS OF SOUTH CAROLINA

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ABSTRACT - There is a paucity of information available about the distribution of bats in the southeastern United States. Golley (1966) recorded the distribution and gave a brief summary of the natural history of 11 of 14 species of bats that occur in South Carolina and DiSalvo et al. (2002) recently reported on the distribution of 13 species of bats that occur in South Carolina based on bats submitted to the public health personnel for rabies testing. Maps provided by Golley are outdated and those provided by DiSalvo et al. are not inclusive of museum records, capture records reported in the literature, or records from the South Carolina Department of Natural Resources (SCDNR). We synthesized records from museums, bat captures, and bats submitted for rabies testing to provide a more accurate and useful distribution for natural resource managers and those planning to research bats in South Carolina. Distributional information, including maps, collection localities within counties, and literature references, for all 14 species of bats that occur in South Carolina has never been synthesized. To provide better information on the state's bat fauna, we have updated distributions for all species that occur in South Carolina.

INTRODUCTION

Few studies specifically investigating the natural history of bats in South Carolina have been published. Most data are contained in faunal surveys of specific regions within the state (Cothran et al. 1991, Golley 1966, Penney 1950, Sanders 1978), unpublished master's theses (Carter 1998, Menzel 1998), and unpublished museum records. Both Golley (1966) and DiSalvo et al. (2002) provided bat species distribution maps, though Golley's are outdated and DiSalvo et al.'s are limited to records maintained by the South Carolina Public Health Department, whereas museum records, captures reported in the literature, and records maintained by the SCDNR were not included. We believe that there is great value in knowing the current and accurate distribution of each bat species of South Carolina from a natural history and biodiversity stand-

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point. Furthermore, knowledge of species distributions makes future bat research easier to plan and successfully execute, particularly work focusing on land management impacts or those addressing the ecology of threatened, endangered or sensitive species.

Our objective was to synthesize all information from museum records and scientific literature about the distribution of bats in South Carolina as completely as possible. We plotted all museum records of bats collected in South Carolina (Appendix A). Additionally, we plotted collection records reported by Golley (1966), literature capture records, public health records, and capture records maintained by the SCDNR to fully illustrate the distribution of each bat species in South Carolina.

METHODS

Study Area

The 7,770,000 ha state of South Carolina is divided into four physiographic provinces, the Lower Coastal Plain, Upper Coastal Plain, Piedmont, and Blue Ridge Mountains (Fig. 1). A detailed description of the physiographic provinces and vegetational community types of South Carolina is provided by Horton (1991). The four physiographic provinces influence the structure and composition of both floral and faunal communities through their differences in physical location, climate, geology, topography, and historic and current landuse patterns. South Carolina has a warm temperate to subtropical climate, with a growing season of approximately 190–200 days in the mountainous northwest portion to nearly 300 days along the coast. Statewide, summers are long

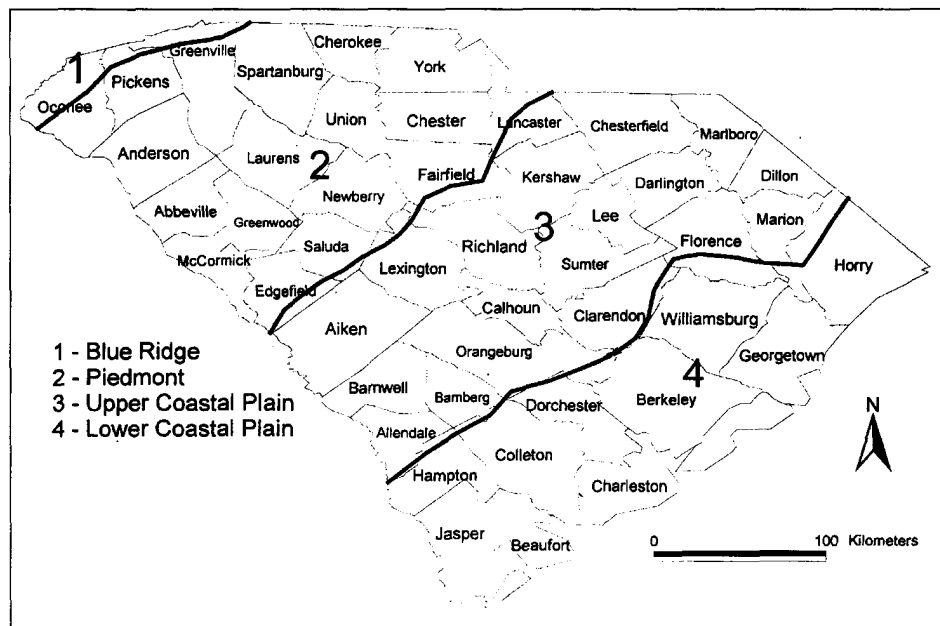


Figure 1. The location of the four physiographic provinces in South Carolina.

and warm with average temperatures of 27 °C and winters are short and mild with average temperatures of 9 °C (Horton 1991). In the Coastal Plain and Piedmont, annual precipitation averages 120 cm (Workman and McLeod 1990), whereas annual amounts can average ≥ 200 cm in the Blue Ridge (McNab and Avers 1994).

Distribution Determination

To determine the distribution ranges of bats in South Carolina, we plotted the location where individuals of each species were collected or captured in South Carolina. We determined collection and capture locations using museum records (Appendix A), capture records maintained by the SCDNR, records from rabies testing maintained by the state's epidemiology lab (DiSalvo et al. 2002), and captures recorded in published and unpublished literature. Because the reliability of distributional records differs among museum collections, published capture records, and unpublished capture records, we have used different symbols to plot records from each of these sources. We denote that a species was captured or collected from a county by placing a unique symbol in the center of the county. We included a symbol for each type of record existing for each county (i.e. Golley record, capture record). The size of the symbol indicates the number of individuals captured or collected within the county. There were no adjustments made for sampling effort; therefore, results are number of captures, not number of captures per sampling unit. A symbol with a 4-point font (n) indicates 1 to 10 bats, with a 5-point font (n) indicates 11 to 50 bats, and with a 6-point font (n) indicates greater than 50 bats.

The total number of bats collected in each county can be determined by examining species accounts and Appendix B. When available, we included detailed information about specimens in museums and bats captured during surveys. This system of delineating collection and capture records allows readers to: (1) determine counties where each species of bat has been documented, (2) determine methods used to document species from a county, (3) assess the relative reliability of records, and (4) for records from museums, to determine approximately where in the county each species was captured (Menzel et al. 2000).

For a species' range that does not encompass the entire state, we placed a line across the state indicating the species expected range. This expected range is the typical range for each species based on past surveys and distributions. We constructed a table to depict species occurrence by physiographic province using information contained in our maps (Table 1). We used X (= typical range) to denote that the species' range included at least a portion of that physiographic province. We used I (= isolated report) to indicate that the species was captured in the physiographic province, but the typical range of the species prob-

ably did not include that province. The typical range is based on known captures and collections for each species.

RESULTS

Species Accounts

A total of 1002 museum records and 2002 captures from surveys were examined and plotted, in addition to those records from DiSalvo (2002), Golley (1966), and Neuhauser and DiSalvo (1972) to document bat distributions as completely as possible for South Carolina. For each species, we indicated the number of individuals found in the state, as well as provided a description of the summer and winter roosting habits, home range size and habitat use (when known), and the statewide distribution.

Family Vespertilionidae

Vespertilionidae is the largest bat Family, consisting of 42 genera and 355 species (Nowak 1994). The Family distribution is cosmopolitan, with members found on every continent except Antarctica. Members occupy habitats ranging from deserts to tropical forests. Because this group lacks noseleaves and has simple, unmodified lips and nostrils, they are commonly called the "plain-faced" bats. The tragus usually is well-developed and the tail is not free from the uropatagium.

Nine genera and 31 species of vespertilionid bats occur in the United States. Of these, eight genera and 13 species occur in South Carolina.

Table 1. Distribution of the 14 species of bats that occur in South Carolina according to the four physiographic provinces (X = typical range, I = isolated report).

Species	Physiographic Province ¹				Total Documented	Probable Common Distribution ²
	BR	P	UCP	LCP		
Eastern pipistrelle	X	X	X	X	4	4
Evening bat	X	X	X	X	4	4
Small-footed myotis	X				1	1
Southeastern myotis		I	X	X	3	2
Northern long-eared myotis	X				1	1
Little brown bat	X	I		I	3	1
Silver-haired bat	X	X	X	X	4	4
Rafinesque's big-eared bat	X		X	X	3	3
Brazilian free-tailed bat		X	X	X	3	3
Big brown bat	X	X	X	X	4	4
Eastern red bat	X	X	X	X	4	4
Seminole bat	I	X	X	X	4	3
Northern yellow bat			X	X	2	2
Hoary bat	X	X	X	X	4	4
Total documented	11	12	11	12		
Probable common distribution	10	10	11	11		

¹ BR = Blue Ridge, P = Piedmont, UCP = Upper Coastal Plain, LCP = Lower Coastal Plain

² Number of physiographic provinces based on known distribution.

***Pipistrellus subflavus* (eastern pipistrelle).** The eastern pipistrelle is the second smallest bat in South Carolina. One of the four recognized subspecies, *P. s. subflavus*, occurs in South Carolina (Fujita and Kunz 1984). Average weight ranges from 3.5 to 7 grams and average total length is 85.1 mm (Whitaker and Hamilton 1998).

The eastern pipistrelle is common throughout much of the eastern half of North and Central America. In the United States, its range extends from Maine, west to Minnesota, and south through eastern Texas (Fujita and Kunz 1984). In South Carolina, its range is statewide (Brown 1993, Whitaker and Hamilton 1998).

No studies have quantitatively examined winter roosting habits of the eastern pipistrelle in South Carolina. Pipistrelles consistently are found in winter hibernacula surveys in the mountains of South Carolina. During these surveys, pipistrelles are most commonly found in abandoned mines and railroad tunnels as there are no Karst caves in the mountains of South Carolina (Bunch and Dye, 1998b). Golley (1966) collected a male eastern pipistrelle roosting under a house in Berkeley County during the winter. Golley (1966) also found a large colony of eastern pipistrelles roosting in caves near Parler in Orangeburg County during the winter and spring. Elsewhere, eastern pipistrelle hibernacula have been located in culverts (Moore 1949), storm sewers (Goehring 1954), tunnels (Mohr 1942), caves (Davis 1955, 1966; Hahn 1908, Raesly and Gates 1987, Swanson and Evans 1936) and mines (Menzel et al. 1997, Sealander and Heidt 1990, Whitaker and Rissler 1992).

There is a paucity of information about summer roosts throughout the range. In South Carolina, eastern pipistrelles have been found cavity-roosting in bottomland hardwood tree species such as swamp chestnut oak (*Quercus michauxii*), sweetgum, and laurel oak (*Quercus laurifolia*) during the summer along the Savannah River in Aiken County (Carter et al. 1999a). In Oconee

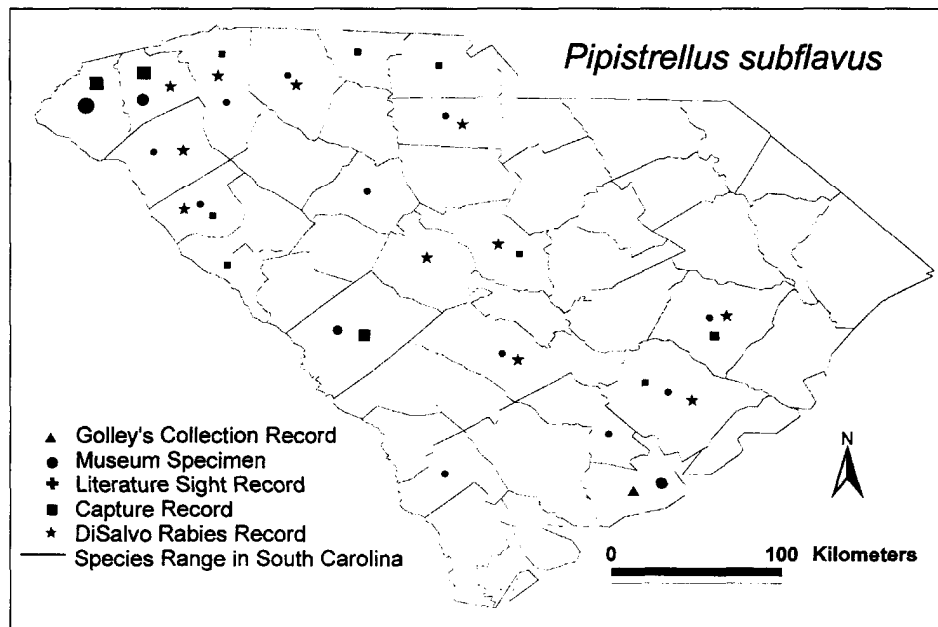


Figure 2. The distribution of the eastern pipistrelle (*Pipistrellus subflavus*) in South Carolina. $n = 1$ to 10 bats. $n = 11$ to 50 bats. $n =$ greater than 50 bats.

County, a summer colony was reported in the attic of a garage (Golley 1966). Across its range, maternity roosts most commonly are located in man-made structures such as barns (Lane 1946, Poole 1938) or houses (Allen 1921). Menzel et al. (1996) captured a female eastern pipistrelle and her non-volant young at the Savannah River Site in a pitfall trap set near a basal cavity in a large sweetgum (*Liquidambar styraciflua*), suggesting basal cavities may serve as maternity roosts for eastern pipistrelles. A few individuals of this species also have been found roosting in foliage within tree canopies (Findley 1954) and in Spanish moss (*Tillandsia usneoides*) during the summer (Jennings 1958, Menzel et al. 1999).

Little data exists about the home range of eastern pipistrelles. The size of the home-range of an eastern pipistrelle on Sapelo Island, Georgia covered 389.2 ha and was concentrated in high-marsh (47%), oak (*Quercus* sp., 24%), and loblolly-slash pine (*Pinus taeda*, *Pinus elliotii*; 17%) habitats (Krishon et al. 1997). The average distance from the roost area to a foraging location was 1137 m. In South Carolina, the home-range size of eastern pipistrelles was 395.5 ha (Carter et al. 1999a).

We located 95 specimens from South Carolina in collections and 685 live-capture records for the state (Appendix B). The eastern pipistrelle occurs in all four physiographic provinces in South Carolina (Fig. 2) and is common throughout the state.

***Nycticeius humeralis* (evening bat).** The evening bat is a small, brown bat that occurs throughout the southeastern United States. The species commonly is misidentified because of its lack of readily apparent distinguishing features. Only one of the three recognized subspecies, *N. h. humeralis*, occurs in South Carolina. The range extends from the border of Texas and Mexico, north to Nebraska, and east through Pennsylvania (Watkins 1972). In South Carolina,

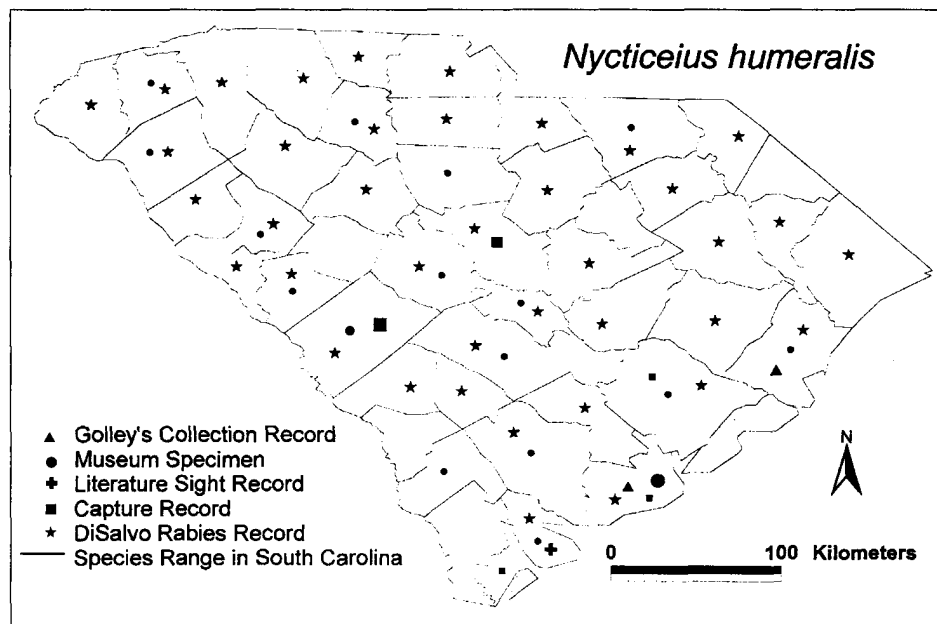


Figure 3. The distribution of the evening bat (*Nycticeius humeralis*) in South Carolina. $n = 1$ to 10 bats. $n = 11$ to 50 bats. $n =$ greater than 50 bats.

the distribution is statewide (Watkins 1972). Average weight ranges from 5 to 14 grams and average total length is 92.7 mm (Whitaker and Hamilton 1998).

Little is known about the winter roosting habits of evening bats. No studies have quantitatively examined winter roosting habits of evening bats in South Carolina or elsewhere in the United States (Whitaker and Hamilton 1998). Bain (1981) reported evening bats using buildings as winter-roosts in Florida. However, there are anecdotal accounts of evening bats roosting in attics in Legareville, Charleston County during the winter (Golley 1966).

Throughout their range, summer roosts of evening bats have been found in Spanish moss (Jennings 1958), under exfoliating bark (Bailey 1933, Barbour and Davis 1969, Chapman and Chapman 1990), and in tree cavities (Barbour and Davis 1969, Harper 1927). There is one record of this species cave-roosting in Missouri (Easterla 1968). Maternity roosts are commonly located in buildings (Cope et al. 1961, Watkins and Shump 1981). In the Upper and Lower Coastal Plain of Georgia, evening bats often share maternity roosts in buildings with *Tadarida brasiliensis* (Jim Ozier, pers. comm.). In South Carolina, Menzel et al. (2001a) found 62 roost trees used by evening bats at the Savannah River Site in Aiken County. The most common tree species used by evening bats was longleaf pine (*Pinus palustris*). Evening bats were found roosting either in cavities or under exfoliating bark. Maternity colonies use roosts where the height of the overstory, density of the canopy, and proportion of the basal area composed of conifers was greater than roost trees used by solitary bats (Menzel et al. 2001a).

The home-ranges of six adult evening bats on the Savannah River Site in Aiken County ranged from 38.7 to 761.0 ha and averaged 285.3 ha (Carter 1998). The habitat types used included pine stands (59%) and Southern bottomland hardwoods (37%; Carter 1998). These habitat types were used in the same proportion as they were available.

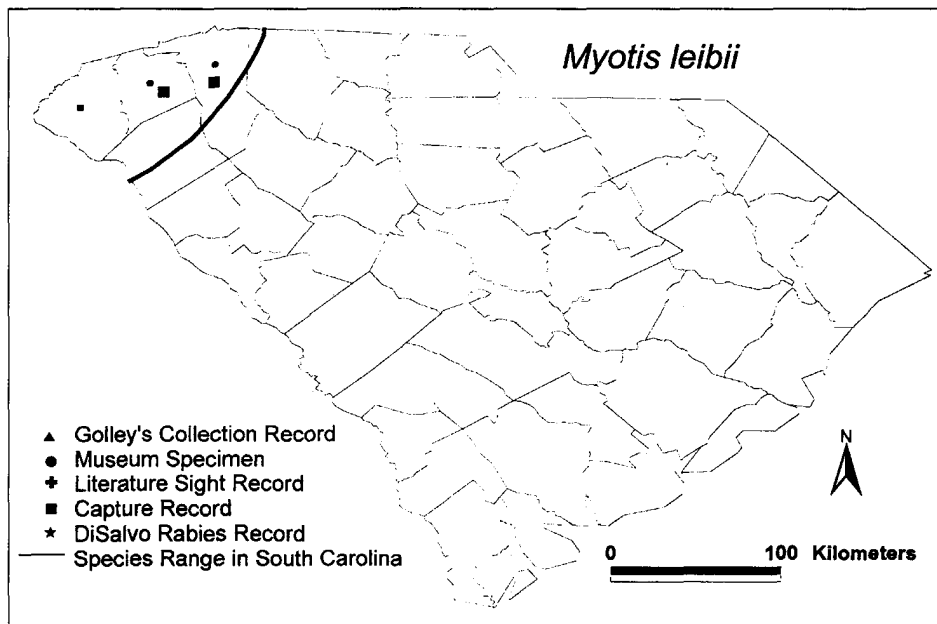


Figure 4. The distribution of the small footed myotis (*Myotis leibii*) in South Carolina. $n = 1$ to 10 bats. $n = 11$ to 50 bats. $n =$ greater than 50 bats.

We located 180 specimens from South Carolina in collections and 95 live-capture records for the state (Appendix B). The evening bat has been found in three physiographic provinces of South Carolina (Fig. 3) and is common.

***Myotis leibii* (eastern small-footed myotis).** The eastern small-footed myotis is the smallest bat in South Carolina. The range of the eastern small-footed myotis is restricted to northeastern North America. Capture records extend from extreme northwestern South Carolina, west into Oklahoma and Missouri, and north into the St. Lawrence forest region of Ontario and Quebec (van Zyll de Jong 1985). Weight ranger from 4 to 6 grams and the average total length is 77.5 mm (Whitaker and Hamilton 1998).

Eastern small-footed myotis roosting habits in South Carolina are unknown. In other states, hibernacula have been found in caves and mines (Davis 1955, Fenton 1972, Hitchcock 1945, 1949; Mohr 1936). During the summer, roosts of the eastern small-footed myotis have been located under rocks, bridges and in buildings (Barbour and Davis 1969, Hitchcock 1955, Tuttle 1964, J. MacGregor, pers. comm.). No studies have investigated the summer or winter roosting habits of this bat in South Carolina. In the mountains of Pickens County, a lone individual of undetermined sex was found using a rock crevice as a winter roost and a solitary male was found under loose tarpaper of an abandoned building in April (Bunch and Dye 1999a).

We located three specimens from South Carolina in collections and 41 live-capture records for the state (Appendix B). The range of this species in South Carolina is limited to the extreme northern portion of the state in the Blue Ridge (Fig. 4). The eastern small-footed myotis appears to be uncommon throughout its range. This species is listed as threatened in South Carolina (SC DNR 2001).

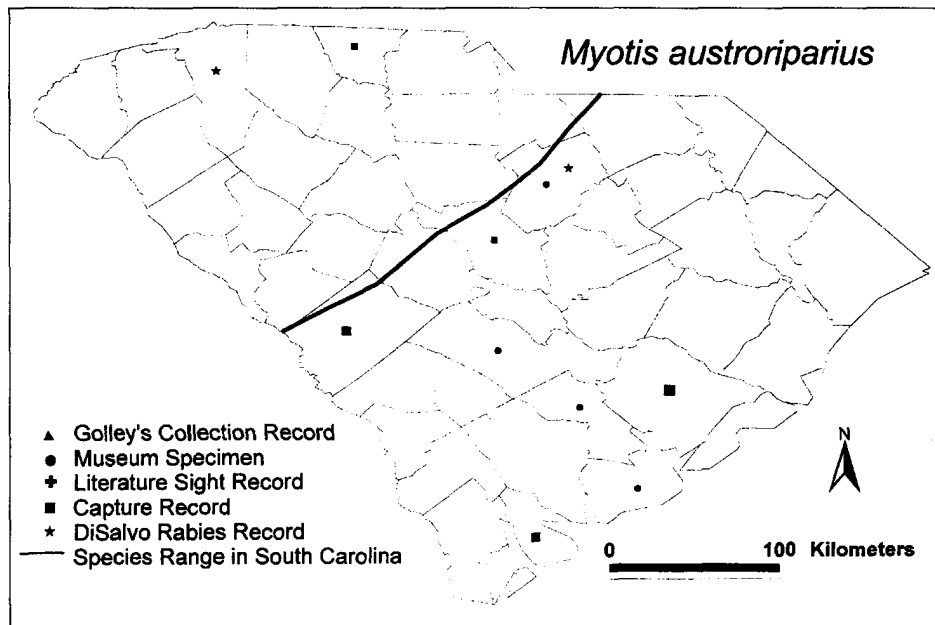


Figure 5. The distribution of the southeastern myotis (*Myotis austroriparius*) in South Carolina. n = 1 to 10 bats. n = 11 to 50 bats. n = greater than 50 bats.

***Myotis austroriparius* (southeastern myotis).** The southeastern myotis is a small, brown bat with woolly pelage and a calcar that lacks a keel (Jones and Manning 1989). Most authorities regard the southeastern myotis as monotypic (LaVal 1970, Whitaker and Hamilton 1998); although, three subspecies have been described in the recent past with only *M. a. austroriparius* occurring in South Carolina (Hoffmeister 1989). Weight ranges from 5 to 12 grams and total length averages 91.5 mm (Whitaker and Hamilton 1998).

The southeastern myotis occurs from Louisiana and east Texas up the Mississippi Alluvial Valley into southern Indiana and Illinois, and east along the coast of Georgia and the Carolinas. The range extends south into the upper half of peninsular Florida (Jones and Manning 1989).

The roosting habits of this species in South Carolina are poorly known. Limited studies investigating the winter or summer roosting habits of southeastern myotis have been conducted in South Carolina. A colony was discovered in a limestone sink in Orangeburg County, South Carolina. In other states, southeastern myotis have been found roosting in caves (Mumford and Whitaker 1982, Rice 1957), mines (Sealander 1979), trees (Lowery 1974, Sealander 1979) and buildings (Lowery 1974, Mumford and Whitaker 1982, Sealander 1979). Davis and Rippy (1968) banded members of a 300 individual colony roosting in a fertilizer plant in Georgia.

We located seven specimens from South Carolina in collections and 22 live-capture records for the state (Appendix B). The distribution in South Carolina is limited to the lower Piedmont, Upper and Lower Coastal Plain (Fig. 5). Because of its rarity within the state, the status of this species in South Carolina is listed as threatened (SC DNR 2001).

***Myotis lucifugus* (little brown bat).** The little brown bat is a small, brown bat with glossy pelage. Of the six subspecies of the little brown bat currently

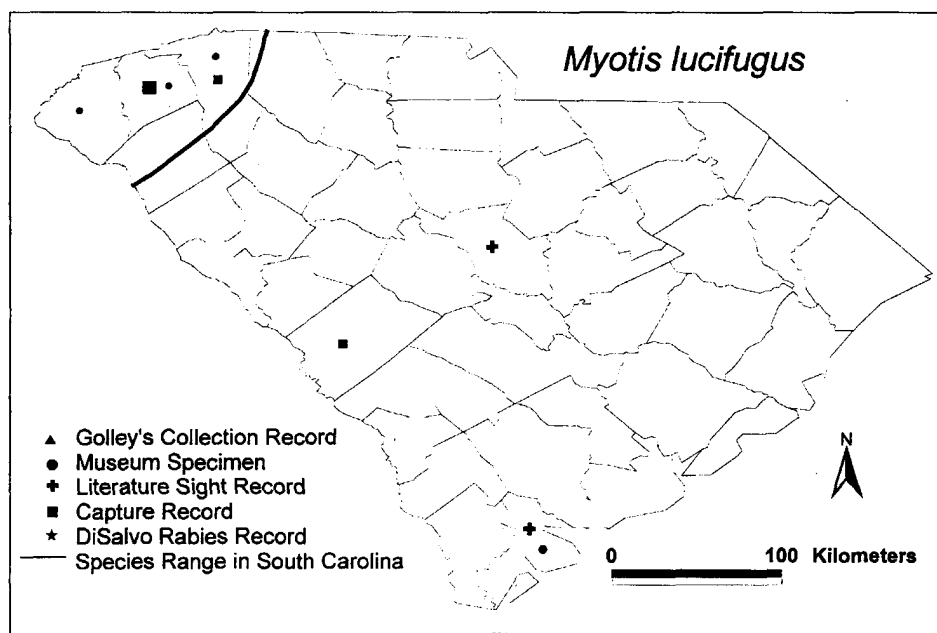


Figure 6. The distribution of the little brown bat (*Myotis lucifugus*) in South Carolina. $n = 1$ to 10 bats. $n = 11$ to 50 bats. $n =$ greater than 50 bats.

recognized, only *M. l. lucifugus* occurs in South Carolina (Fenton and Barclay 1980). The little brown bat is common throughout much of the United States. In the East, the little brown bat reaches the southern limit of its range in the northern portions of South Carolina, Georgia, Alabama, and Mississippi (Fenton and Barclay 1980). Weight ranges from 4 to 8 grams and average total length is 89.2 mm (Whitaker and Hamilton 1998).

Hibernacula of this species most commonly are located in caves and mines (Baker 1965, Humphrey and Cope 1976), although none have been found in South Carolina. In the summer, little brown bats have been found roosting under rocks, in piles of wood, and in trees (Fenton and Barclay 1980). Maternity roosts are commonly located in buildings (Davis and Hitchcock 1965, Griffin 1940). No studies have investigated any aspect of the summer or winter roosting habits of this species in South Carolina.

We located 14 specimens from South Carolina in collections and 67 live-capture records for the state (Appendix B). Although their distribution in South Carolina primarily is restricted to the Blue Ridge (Fig. 6), there have been confirmed captures recorded from Beaufort County in the Lower Coastal Plain (Davis and Rippey 1968). The little brown bat reaches the southern limit of its range in South Carolina and is listed as uncommon or rare in the state (SC DNR 2001).

***Myotis septentrionalis* (northern long-eared myotis).** The northern long-eared myotis is a medium-sized bat with long, glossy brown pelage (Fitch and Shump 1979). This species occurs throughout much of the eastern half of the United States. The range extends from Saskatchewan east to Quebec and south to Florida (Fitch and Shump 1979). Weight ranges from 5 to 10 grams and average total length is 84.1 mm (Whitaker and Hamilton 1998).

Northern long-eared myotis hibernacula have been located in caves in Minnesota (Griffin 1940, Swanson and Evans 1936), mines in Michigan (Stone and

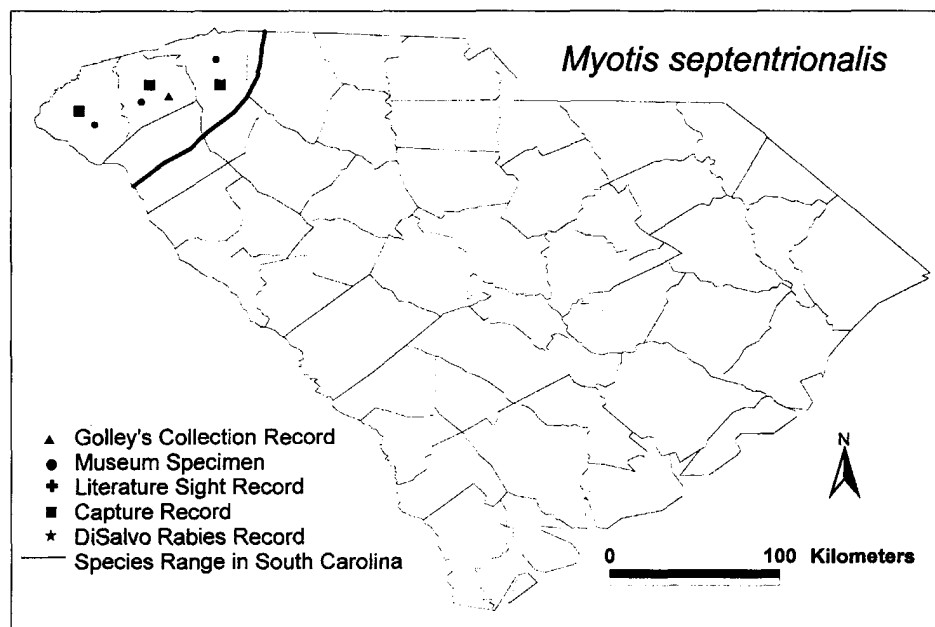


Figure 7. The distribution of the northern long-eared myotis (*Myotis septentrionalis*) in South Carolina. $n = 1$ to 10 bats. $n = 11$ to 50 bats. $n =$ greater than 50 bats.

Fritz 1969), and in a storm sewer in Minnesota (Goehring 1954). In the summer, northern long-eared myotis have been found roosting in buildings in Pennsylvania and Wyoming (Doutt et al. 1966, Turner 1974), behind shutters in Indiana (Mumford 1969), under the bark of trees in Indiana (Mumford and Cope 1964), and in tree cavities in West Virginia (Owen et al. 2002, Menzel et al. 2002). Only limited summer or winter roosting habit studies of the northern long-eared myotis have been conducted in South Carolina. Northern long-eared myotis have been detected in caves in winter hibernacula counts (Bunch and Dye 1998b). A female northern long-eared myotis was tracked to a dead pine tree in Oconee County during summer (Bunch and Dye 1999b).

We located seven specimens from South Carolina in collections and 69 live-capture records for the state (Appendix B). The distribution of northern long-eared myotis in South Carolina is restricted to the Blue Ridge (Fig. 7) where the species is common (SC DNR, 2001).

***Corynorhinus rafinesquii* (Rafinesque's big-eared bat).** Rafinesque's big-eared bat is a medium-sized bat. Both subspecies of Rafinesque's big-eared bat (*Corynorhinus rafinesquii rafinesquii* and *C. r. macrotis*) occur in South Carolina (Jones 1977). Rafinesque's big-eared bat is found throughout the southeastern United States. The range extends from southern Virginia, south along the Atlantic Coast into Florida, and west into Oklahoma and east Texas (Jones 1977). Weight ranges from 7 to 10 grams and average total length is 99.5 mm (Whitaker and Hamilton 1998).

Winter roosting habits of Rafinesque's big-eared bat are not well-known. Rafinesque's big-eared bats have been found roosting in the same structures, usually abandoned buildings, year round (Clark 1990). Winter roosts also have been found near cave entrances (Barbour and Davis 1969). Limited studies investigating winter roosting habits of Rafinesque's big-eared bats have been

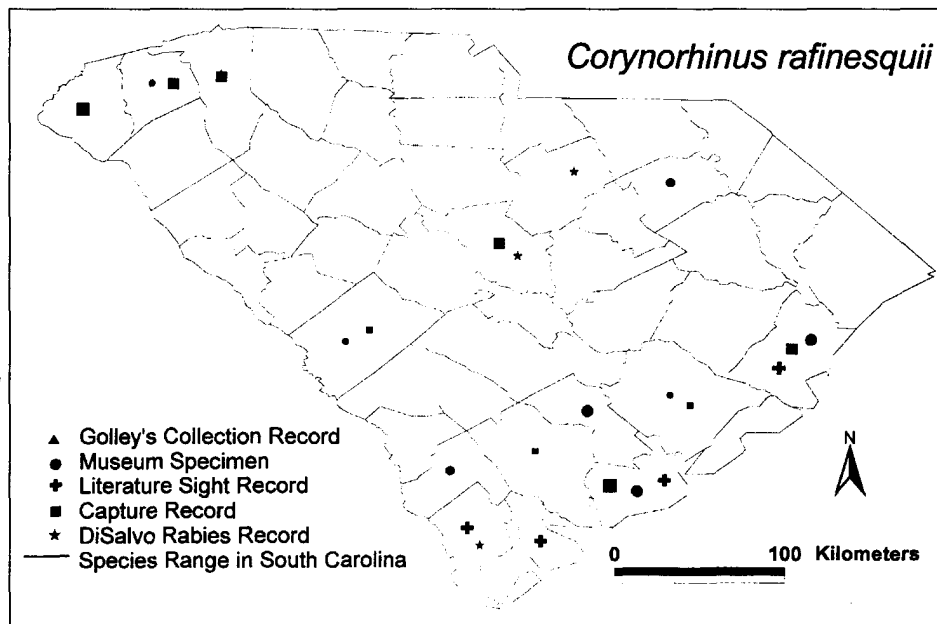


Figure 8. The distribution of Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) in South Carolina. $n = 1$ to 10 bats. $n = 11$ to 50 bats. $n =$ greater than 50 bats.

conducted in the Blue Ridge and Upper Coastal Plain of South Carolina (Bunch et al. 1998a, Bunch et al 1998b, Bunch and Dye 1999b).

During summer, Rafinesque's big-eared bats roost in abandoned buildings, hollow trees, and under bark (Barbour and Davis 1969, Hall 1963, Jones 1977, Lowery 1974). Typically, roosts are located in the twilight zone of caves and mines or in the dimly lighted sections of buildings (Whitaker and Hamilton 1998). Clark (1990) described roosting sites in North Carolina as "predominately frame, one-story [abandoned] homes with plaster walls and large attics." Lance et al. (2001) found the species roosting beneath 32 girder-type bridges in Louisiana. In South Carolina, bridges probably are also an important component of the roosting habitat of Rafinesque's big-eared bats (Bennett et al 2003). Lance et al. (2001) also found big-eared bats roosting in hollow blackgum trees (*Nyssa sylvatica*). Similarly, in Dorchester County, Rafinesque's big-eared bats have been reported using large-diameter, hollow bald cypress (*Taxodium distichum*) in the Four Holes Swamp (M. Clark, pers. comm.). Menzel et al. (2001b) found males roosting in abandoned houses in the Upper Coastal Plain in Aiken County, South Carolina. Summer roosts in the Blue Ridge Mountains include large hollow trees, abandoned buildings, caves, and tunnels (Bunch et al. 1998b, Bunch and Dye 1999b). On the coast, a large colony exists in an historic building in a state park. Based on unpublished museum records, several hundred were reported roosting in a house on Belle Isle in Georgetown County, South Carolina.

Based on a study conducted in Aiken County, South Carolina, the home range size of male Rafinesque's big-eared bats ranges from 23.9 to 260.5 ha and averages 93.2 ha (Menzel et al. 2001b).

We located 72 specimens from South Carolina in collections and 174 live-capture records for the state (Appendix B). Their distribution in South Carolina extends through the Upper and Lower Coastal Plain and the Blue Ridge, but may

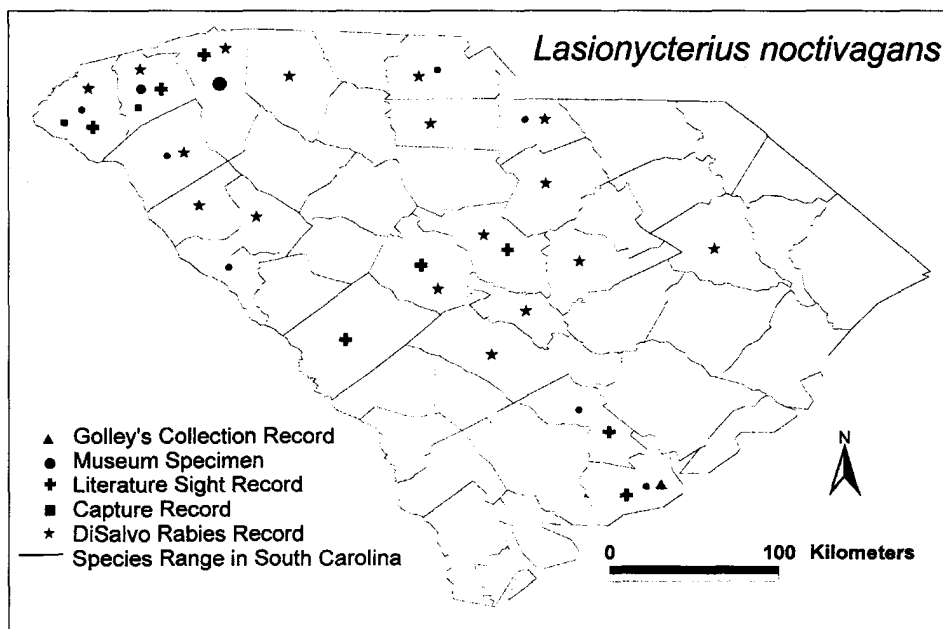


Figure 9. The distribution of the silver-haired bat (*Lasionycteris noctivagans*) in South Carolina. $n = 1$ to 10 bats. $n = 11$ to 50 bats. $n =$ greater than 50 bats.

be wholly absent from the Piedmont (Fig. 8). Rafinesque's big-eared bat is listed as State Endangered (SC DNR 2001).

***Lasionycteris noctivagans* (silver-haired bat).** The silver-haired bat is a medium-sized bat that occurs throughout southern Canada and most of the United States. It reaches the southern limit of its range in the southeastern United States (Kunz 1982). Weight ranges from 7 to 16 grams and average total length is 99.7 mm (Whitaker and Hamilton 1998).

No studies have investigated the roosting habits of silver-haired bats in South Carolina. In other states, silver-haired bats have been found using active and abandoned mines in Pennsylvania, Illinois and Georgia (Baker 1965, Layne 1958, Pearson 1962), caves in Georgia and Wyoming (Baker 1965, Beer 1956, Turner 1974), rock crevices in West Virginia (Frum 1953), buildings in West Virginia and North Carolina (Clark 1993, Frum 1953), and trees in Wisconsin (Cowan 1933, Jackson 1961). Summer roosts have been located in tree cavities and under bark in Canada and South Dakota (Betts 1996, Mattson et al. 1996, Parsons et al. 1986, Vonhof 1996). This species is migratory and may not occur in South Carolina during the summer (Barclay 1984b, Kunz 1982).

We located 36 specimens from South Carolina in collections and two live-capture records for the state (Appendix B). The distribution of this species is statewide occurring in all four physiographic provinces (Fig. 9); however, many of these occurrences were seasonal and occurred during migration.

***Lasiurus borealis* (eastern red bat).** The eastern red bat is a medium-sized bat that occurs throughout forested regions of the eastern United States (Shump and Shump 1982a). The range of the eastern red bat extends from southern Canada, south into Argentina and Chile (Shump and Shump 1982a). Weight

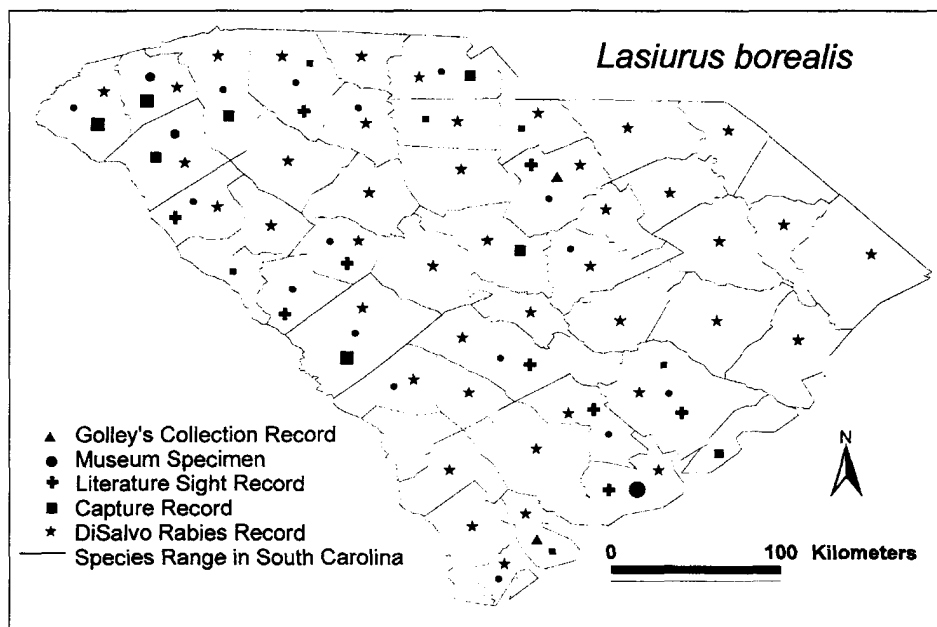


Figure 10. The distribution of the eastern red bat (*Lasiurus borealis*) in South Carolina. n = 1 to 10 bats. n = 11 to 50 bats. n = greater than 50 bats.

ranges from 9.5 to 16 grams and average total length is 112.3 mm (Whitaker and Hamilton 1998).

Eastern red bats migrate to the southern United States to hibernate in winter. Winter roosts generally include branches and leaf clusters in trees (Barbour and Davis 1969). Eastern red bats are well adapted for winter survival outside of caves and will become active on warm winter nights (Barbour and Davis 1969). No studies have investigated the winter roosting habits of eastern red bats in South Carolina.

During the summer, eastern red bats most commonly are found roosting on small branches and leaf petioles in the crowns of deciduous trees (Barbour and Davis 1969). Uncommon summer roosts have been located in woodpecker cavities (Fassler 1975) and caves (Myers 1960). Menzel et al. (1998) located 64 roost trees of the eastern red bat in Aiken County, South Carolina. Roosts typically were located in hardwood trees that were larger and taller on average than surrounding trees. Eastern red bats moved to new roost trees frequently, spending an average of 1.2 nights at each tree (Menzel et al., 1998). New roost trees were selected across an average area of 2.6 ha.

Five eastern red bats were radio-tracked at the Savannah River Site in Aiken County. The home ranges of these bats ranged from 125.8 to 878.5 ha and averaged 453.2 ha (Carter 1998). Habitat types used within home ranges were Southern bottomland hardwoods (55%), pine stands (40%), and upland hardwoods (5%; Carter 1998) with habitat types used in proportion to their availability on the landscape.

We located 136 specimens from South Carolina in collections and 583 live-capture records for the state (Appendix B). The eastern red bat is abundant in all four physiographic provinces of South Carolina (Fig. 10) and is common throughout the state.

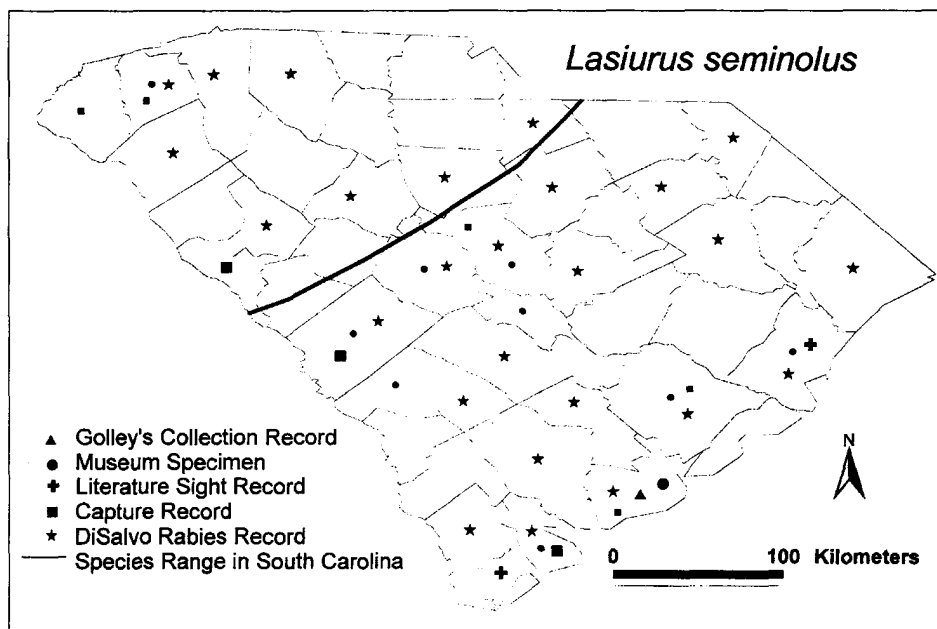


Figure 11. The distribution of the Seminole bat (*Lasiurus seminolus*) in South Carolina. n = 1 to 10 bats. n = 11 to 50 bats. n > 50 bats.

***Lasiurus seminolus* (Seminole bat).** The Seminole bat is a medium-sized bat and is common throughout the "Deep South." Although accidentals have been recorded in New York (Layne 1955) and Pennsylvania (Poole 1949), this species typically is found from the southeastern tip of Virginia, south into Florida, and west along the Gulf Coast into east Texas (Wilkins 1987). Weight ranges from 9 to 14 grams and average total length is 111 mm (Whitaker and Hamilton 1998).

During the winter, roosts of Seminole bats commonly are located in oak hammock communities in Spanish moss (Constantine 1958). However, Jennings (1958) examined the roosting habits of Seminole bats in Florida and noted that he could find no roosts in Spanish moss during July, August, and September. He noted that only a few litters were found in Spanish moss and suggested Seminole bats do not roost in moss while raising their young. No studies investigating the winter roosting habits of Seminole bats have been conducted in South Carolina.

During summer, Seminole bats primarily roost in Spanish moss (Barbour and Davis 1969). Seminole bats also may occasionally roost under loose bark (Sealander 1979). Based on a study conducted in Aiken County, South Carolina, Seminole bats roost on the terminal branches of limbs in pine-dominated communities during the summer (Menzel et al. 1998). Menzel et al. (1998) found that roost trees used by Seminole bats were taller and had larger diameters than trees surrounding roosts, and that Seminole bats move to new roost trees frequently, spending an average of 1.7 days on each tree. Seminole bats select new roost trees across an average area of 0.25 ha.

The home-range size of five Seminole bats radio-tracked on the Savannah River Site in Aiken County ranged from 189.2 to 704.4 ha and averaged 423.8 ha (Carter 1998). The habitat types within the home-range areas were pine stands (55%), Southern bottomland hardwoods (35%), and upland hardwoods (11%; Carter 1998).

We located 51 specimens from South Carolina in collections and 76 live-capture records for the state (Appendix B). The distribution of Seminole bats in South Carolina includes the Upper and Lower Coastal Plain (Fig. 11). There have been a few captures in the Piedmont and Blue Ridge. Seminole bat distribution in surrounding states suggest they are rare above the Fall Line region separating the Upper Coastal Plain from the Piedmont in the Southeast.

***Lasiurus intermedius* (northern yellow bat).** The northern yellow bat is the second largest bat in South Carolina. This species typically is restricted to coastal areas of the southeastern United States and Central America (Webster et al. 1980), although a lone individual has been reported from New Jersey (Koopman 1965). Weight ranges from 14 to 20 grams and average total length is 126.8 mm (Whitaker and Hamilton 1998).

Little is known about the winter roosting habits of the northern yellow bat. No studies have investigated the winter roosting habits of northern yellow bats in South Carolina. Summer roosts of northern yellow bats have been located in palm (*Sabal* sp.) grooves in Texas (Davis 1960), on hardwood stems in Virginia (Rageot 1955), in pine-oak woodlands in Florida and Mexico (Carter et al. 1966, Carter and Jones 1978, Jones 1964, Sherman 1944), and in Spanish moss in Georgia and Florida (Jennings 1958, Menzel et al. 1995). Northern yellow bats usually roost alone; however, Baker and Dickerman (1956) re-

ported seeing approximately 45 yellow bats fly from a communal roost located under corn stalks that were hanging from the side of an old tobacco-curing shed. No studies have investigated the summer roosting habits of the northern yellow bat in South Carolina.

The home-range of a northern yellow bat tracked on Sapelo Island, Georgia, was 10.5 ha (Krishon et al., 1997). The home range was located in oak (73%), and loblolly and slash pine (25%) communities. The average distance from center of the roost area to a foraging location was 109 m. No home range or habitat use studies of northern yellow bats have been conducted in South Carolina.

We located 11 specimens from South Carolina in collections and one live-capture records for the state (Appendix B). The distribution of northern yellow bats in South Carolina includes the Lower Coastal Plain and extends up into the Upper Coastal Plain along the Savannah River (Fig. 12). The status of the northern yellow bat in South Carolina is listed as undetermined (SC DNR 2001).

***Lasiurus cinereus* (hoary bat).** The hoary bat is the largest species of bat in South Carolina. One of three subspecies of the hoary bat (*L. c. cinereus*) occurs in South Carolina (Shump and Shump 1982b). The hoary bat has the most widespread distribution of all species of bats that occur in South Carolina with a range extending from northern Canada near the treeline to Chile and Argentina in South America (Shump and Shump 1982b). The hoary bat also occurs in the Hawaiian Islands, among the most isolated and distant of the oceanic landmasses (Whitaker and Hamilton 1998). Weight ranges from 18 to 38 grams and average total length is 134.8 mm (Whitaker and Hamilton 1998).

Although winter roosts of hoary bats typically are located in tree foliage, roosts also have been located in a tree cavity and squirrel nests (Constantine 1966, Cowan and Guiguet 1965, Neill 1952). Caves typically are not used as

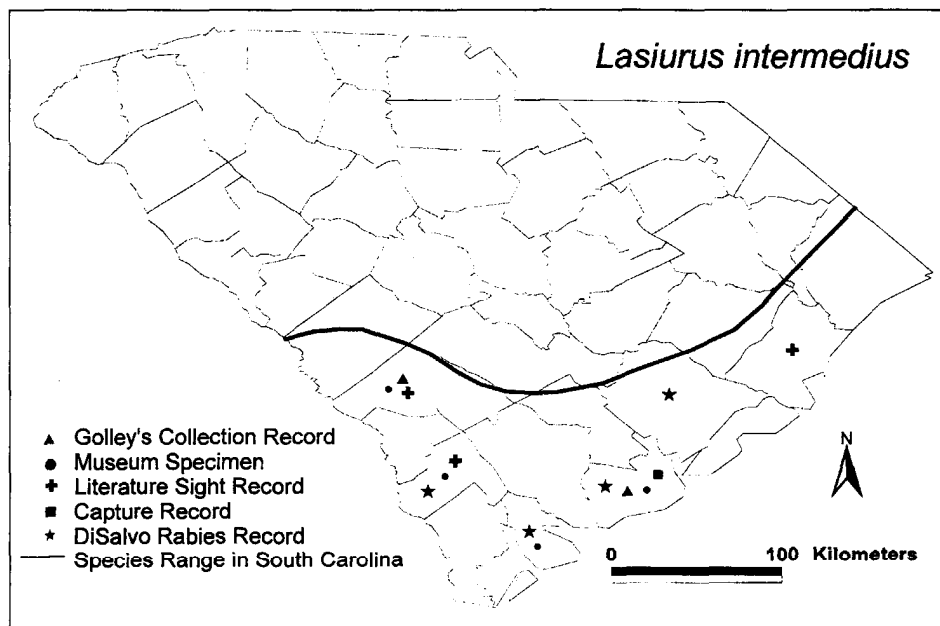


Figure 12. The distribution of the northern yellow bat (*Lasiurus intermedius*) in South Carolina. $n = 1$ to 10 bats. $n = 11$ to 50 bats. $n =$ greater than 50 bats.

roosting sites by hoary bats (Mumford 1953, Myers 1960). Little is known about summer roosting habits of hoary bats. There have been no studies investigating winter or summer roosts of hoary bats in South Carolina.

We located four specimens from South Carolina in collections and two live-capture records for the state (Appendix B). The distribution of the hoary bat in South Carolina includes all four physiographic provinces (Fig. 13). The status of the hoary bat in South Carolina is listed as undetermined (SC DNR, 2001). Because of their migratory patterns, they probably are rare in the state during the summer.

***Eptesicus fuscus* (big brown bat).** The big brown bat is the third largest bat in South Carolina. One of the 11 subspecies of big brown bat occur in South Carolina: *Eptesicus fuscus fuscus* (Kurta and Baker 1990). The range of the big brown bat extends from the Atlantic to the Pacific Coast and from Canada, south through Central America into Brazil (Kurta and Baker 1990). The big brown bat is found throughout the continental United States and often is the most common bat species encountered throughout much of its range. It is most abundant in the Deciduous Forest Biome that covers most of eastern North America (Kurta et al. 1989). Weight ranges from 13 to 25 grams and average total length is 114.3 mm (Whitaker and Hamilton 1998).

The big brown bat is one of the most studied bats in North America. Hibernacula of big brown bats have been located in mines, caves, crevices in rocks, storm sewers, and buildings (Barbour and Davis 1969, Beer 1955, Fenton 1972, Mills et al. 1975, Mumford 1958, Nagorsen 1980, Quay 1949, Phillips 1966) throughout the United States and Canada.

Summer roosts of big brown bat colonies have been located in hollow oak and American beech (*Fagus grandifolia*), but most commonly are located in human-made structures such as barns or houses (Barbour and Davis 1969, Christian 1956). In early August 1996, Carter (1998) and Menzel

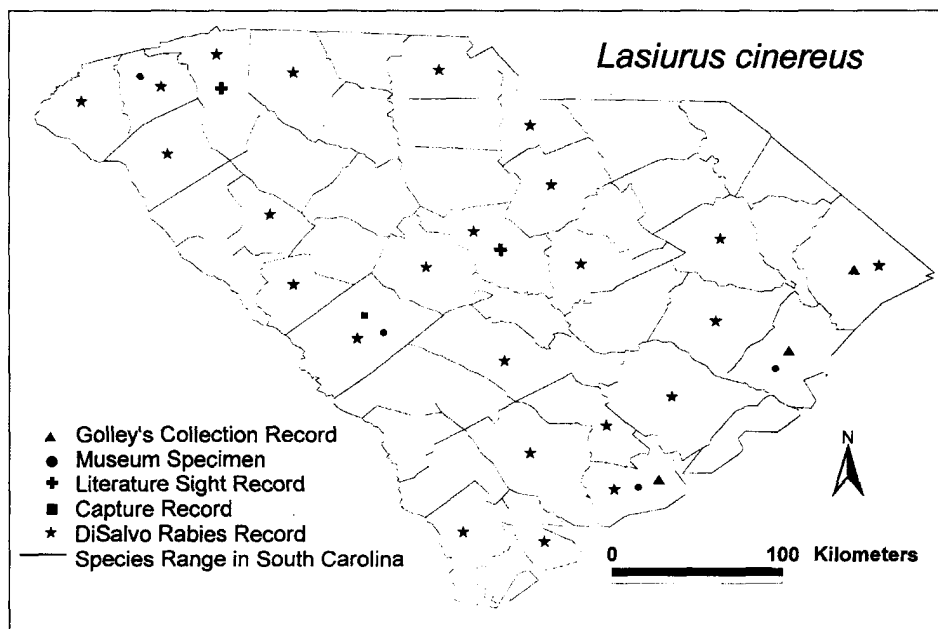


Figure 13. The distribution of the hoary bat (*Lasiurus cinereus*) in South Carolina. $n = 1$ to 10 bats. $n = 11$ to 50 bats. $n =$ greater than 50 bats.

(1998) radio-tracked two big brown bats in a bottomland hardwood swamp in Aiken County, South Carolina to a maternity roost in a hollow bald cypress snag (*Taxodium distichum*). Other than this anecdotal information, no studies have investigated the summer or winter roosting habits of the big brown bat in South Carolina.

We located 30 specimens from South Carolina in collections and 185 live-capture records for the state (Appendix B). The distribution in South Carolina is statewide and includes all four physiographic provinces (Fig. 14). Big brown bats are regarded as common.

Family Molossidae

There are 16 genera and 86 species in the Family Molossidae (Nowak 1994). Members of this Family are found in southern Europe, Asia, Africa, and from the northern half of South American north into the western and southeastern portions of the United States. Some members of this Family are highly colonial and form the largest aggregations of mammals documented. Davis et al. (1962) estimated that populations of molossid bats in four caves (Bracken, Goodrich, Rucker, and Frio) in Texas exceeded 10 million individuals in summer during peak periods. Members of this Family are medium to large in size. Because one of the most defining characteristics of this Family is that the tail extends beyond the posterior border of the uropatagium, members of this Family commonly are called the "free-tailed bats."

Two genera and six species of molossids occur in the United States. One species occurs in South Carolina.

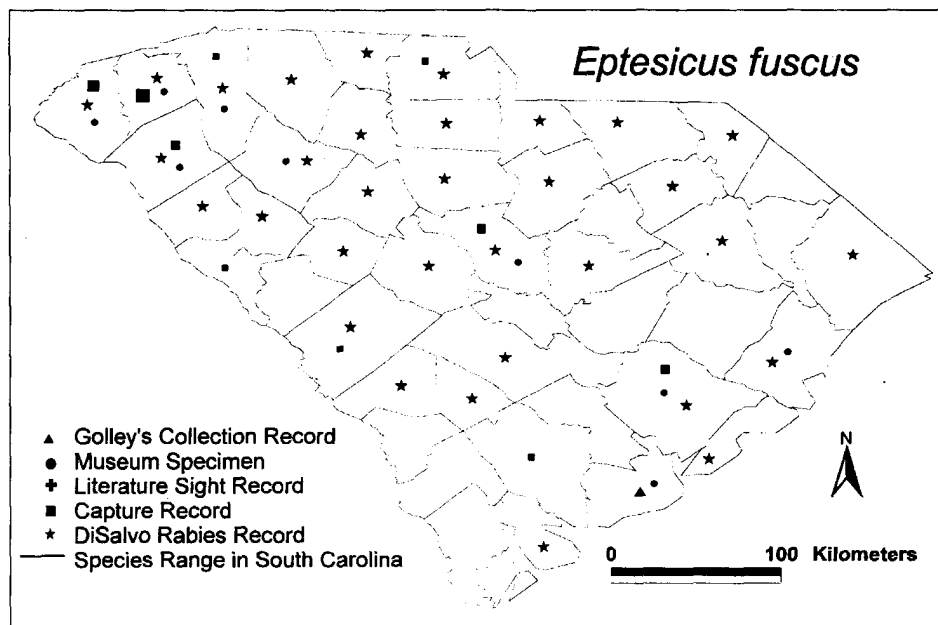


Figure 14. The distribution of the big brown bat (*Eptesicus fuscus*) in South Carolina. $n = 1$ to 10 bats. $n = 11$ to 50 bats. $n =$ greater than 50 bats.

***Tadarida brasiliensis* (Brazilian free-tailed bat).** The Brazilian free-tailed bat is the only species of free-tailed bat that occurs in South Carolina. It is the only member of its genus in the United States. Of the nine subspecies of the Brazilian free-tailed bat currently recognized, only *Tadarida brasiliensis cynocephala* occurs in South Carolina (Wilkins 1989). Weight ranges from 8 to 14 grams and average total length is 91.9 mm (Whitaker and Hamilton 1998).

The Brazilian free-tailed bat ranges from southern Oregon in the western United States south into the Patagonian region of Chile and Argentina (Wilkins 1989). There is little difference between the summer and winter roosting habits of Brazilian free-tailed bats. However, the roosting habits of the Brazilian free-tailed bat differ among different regions of the United States. Most roosts in the Southwest are located in caves, although buildings sometimes are used during migration. In the southeastern United States, roosts typically are located in buildings (Barbour and Davis 1969). Roosts are also located in hollow trees and in the expansion joints of bridges (Lowery 1974, Tuttle 1994). The Brazilian free-tailed bat is highly gregarious and almost always roosts in colonies (Barbour and Davis 1969). Although the size of colonies in caves in the southwestern United States commonly exceeds 1,000,000 individuals, colonies in the Southeast typically are composed of < 50,000 individuals. No studies have investigated the roosting habits of Brazilian free-tailed bats in South Carolina.

We located 356 specimens from South Carolina in collections (Appendix B). No live captures of Brazilian free-tailed bats have been recorded in South Carolina. The distribution in South Carolina includes the lower Piedmont and Upper and Lower Coastal Plain (Fig. 15). There have been captures in the upper Piedmont, but these isolated records probably do not reflect the typical distribution of Brazilian free-tailed bats in South Carolina.

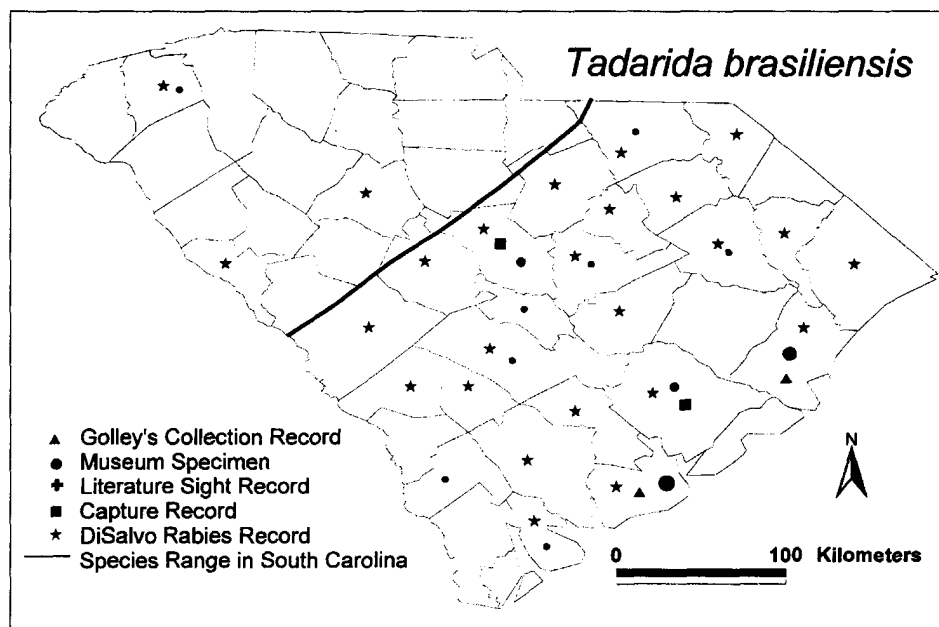


Figure 15. The distribution of the Brazilian free-tailed bat (*Tadarida brasiliensis*) in South Carolina. n = 1 to 10 bats. n = 11 to 50 bats. n = greater than 50 bats.

DISCUSSION

Six of the 14 species of bats that occur in South Carolina are found statewide, whereas the remaining 8 generally are restricted either to the Blue Ridge in the northwestern corner of the state or portions of the Upper and Lower Coastal Plain. Because distributions of many bat species that occur in South Carolina closely correspond with physiographic provinces, the lines demarcating the boundary of these provinces are indicated in Figure 1.

Distributions of most species of temperate zone bats are strongly influenced by the diversity of available roost structures (Findley 1993, Humphrey 1975). Bat community richness varies throughout South Carolina and closely corresponds with the diversity of available roost structures. The least rich assemblage of six species occurs in the Piedmont (Table 1) where topography is less complex, with little or no emergent rock, and both amounts and conditions of upland and lowland forests are vastly different from pre-settlement conditions. The Blue Ridge contains vegetational community types that offer similar roosting opportunities to foliage and cavity roosting bats as the Piedmont and Upper and Lower Coastal Plain. However, the Blue Ridge also contains abandoned mines and tunnels as well as crevices in vertical rock faces, resulting in the most diversity of roost structures in the state. The highest richness occurs in the Lower Coastal Plain where 12 species of bats are present including those with extreme southern affinities such as the Seminole bat and the northern yellow bat (Table 1). The Coastal Plain contains sizable swamp and bottomland areas with large diameter trees that probably provide locally abundant and diverse roosts. Austral plant species such as Spanish moss also add roosting complexity to these habitats.

Table 2. Typical roosting habitats of the 14 species of bats that occur in South Carolina. (W = winter roost, S = summer roost).

Species	Foliage	Bark/Cavity	Artificial structure	Cave/Mine	Rock crevices
Eastern pipistrelle	S	S	S	WS	
Evening bat	S	S	S		
Small-footed myotis			S	W	SW
Southeastern myotis		S	S	WS	
Northern long-eared myotis		S	WS	W	
Little brown bat		S	S	WS	
Silver-haired bat		WS	W	W	S
Rafinesque's big-eared bat		WS	WS	WS	
Brazilian free-tailed bat*		WS	WS	WS	
Big brown bat		WS	WS	WS	
Eastern red bat	WS				
Seminole bat	WS				
Northern yellow bat	WS				
Hoary bat	WS				

*No natural roosts known for this species in South Carolina.

The roosting habits of the bats of South Carolina are diverse (Table 2). Nine of the 14 species of bats in South Carolina typically roost in caves or mines during part of the year. Three species of South Carolina bats roost in mines or caves only during the winter. Humphrey (1975) predicted that in the Nearctic zone, if diversity of roost structures is the driving factor influencing structure and diversity of bat communities, community diversity would vary in a patchy rather than clinal fashion over the landscape. This prediction holds true for the bat communities of South Carolina (Table 1). The absolute role of climate and prey availability in shaping the extant bat fauna in South Carolina has not been investigated.

Conservation

One of the 14 species of bats, Rafinesque's big-eared bat, that occur in South Carolina is state-listed as endangered (Table 3). Two of the 14 bat species, eastern small-footed myotis and southeastern myotis, in South Carolina are state listed as "in need of management," the equivalent of threatened (Table 3). An additional two bat species, little brown bat and northern long-eared myotis, are state-listed as species of special concern (Table 3). The relatively high proportion (35%) of bat species considered threatened, endangered or sensitive is not limited to South Carolina. In the Southeast, 87% of all bat species carry special conservation designations somewhere within their regional range (Laerm et al., 2000). Internationally, all 15 species of bats that occur in Great Britain are now considered threatened or endangered (Nagorsen and Brigham 1990, Stebbings 1988) and bat populations appear to be declining throughout the world (Nowak 1994).

Table 3. The protection status of the bats of South Carolina (SC DNR 2001).

Species	State ranking in South Carolina*	Status in South Carolina
Southeastern myotis	ST - S1	Rare
Northern long-eared myotis	S4	Common
Little brown myotis	S3	Uncommon
Eastern red bat		Common
Hoary bat	SU	Uncommon
Northern yellow bat	SU	Rare
Seminole bat		Common
Silver-haired bat		Uncommon
Eastern pipistrelle		Common
Big brown bat		Common
Evening bat		Common
Rafinesque's big-eared bat	SE	Rare
Brazilian free-tailed bat		Common
Small-footed myotis	ST-S1	Rare

*SE = State Endangered, ST = State Threatened (Officially designated as "In Need of Management"), SU = Status Undetermined

S1 = Critically imperiled in state, S2 = Imperiled in state, S3 = Rare or uncommon,

S4 = Apparently secure in state, S5 = Demonstrably secure in state

There are some potential conservation concern issues specific to South Carolina. Agriculture is common throughout much of South Carolina. All 14 species of bats that occur in South Carolina are insectivorous and therefore may be impacted acutely or chronically by insecticides applied to agricultural crops such as cotton (*Gossypium* sp.), soybeans (*Glycine max*), and corn (*Zea mays*). Little is known about the long-term effects of these pesticides on bat populations. Studies have been conducted investigating the effects of organochlorine, organophosphate and carbamate insecticides on year-round or winter hibernation cavernicolous species such as the gray bat, Indiana bat, northern long-eared myotis, and little brown bat (Clawson 1989, McFarland 1998) in the Midwest; however, no studies have been conducted in South Carolina and no research has ever addressed impacts on species that tree-roost all year.

Vast areas in South Carolina are devoted to timber production, particularly loblolly pine plantation culture in the Piedmont and Coastal Plain. Research in other regions of the United States and Canada has begun to address forest management and bat habitat relationships (Barclay and Brigham 1996, Krusic et al. 1996, Owen et al. 2002). Little to no work has been reported in the Southeast where intensive, short-rotation pine management occurs, however, such studies currently are being conducted in the Piedmont and Lower Coastal Plain of South Carolina (M. Baughman, pers. comm. and S. Loeb, pers. comm.) as well as in the Upper Coastal Plain in Mississippi and Texas (D. Miller, pers. comm., and R. Thill, pers. comm.). Menzel et al. (2002) did examine the role of group-selection silviculture in southern bottomland hardwoods in South Carolina, finding that bat activity differed between harvested and unharvested stands. Moreover, research is desperately needed investigating effects of other alternative timber harvesting and regeneration techniques, such as seed-tree and shelterwood cuts, intermediate treatments such as thinnings and herbicide application in both pine and hardwood forests across all of South Carolina's physiographic provinces. In conjunction with traditional forest management activities of harvest and regeneration, prescribed burning is occurring on less acreage in traditionally burned portions in the lower Piedmont and Coastal Plain of South Carolina, in part due to air pollution and safety concerns (Johnson and Hale 2002, Van Lear and Harlow 2002, Wigley et al. 2002). Conversely, portions of the upper Piedmont and Blue Ridge that have experienced long periods of fire suppression are now actively being burned again. Impacts of fire suppression on bat communities are unknown and represent a significant knowledge gap (Carter et al. 2002).

Another conservation concern in the state's Coastal Plain is the use of bridge structures by bats. In some areas, such as Texas, bridges have been shown to serve as important roosting sites for many species of bats

(Keeley 1997). The state-endangered Rafinesque's big-eared bat, and state-threatened southeastern myotis, have been documented roosting under bridges in Mississippi and elsewhere (Lance 2001). Recent investigations have documented bridge use by maternity colonies in South Carolina as well (Bennett et al. 2003).

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Appendix A. The acronym and title of museum collections examined for bat specimens from South Carolina. An * indicates museums that did not house specimens from South Carolina.

Acronym	Museum
AMNH	American Museum of Natural History and Wildlife Service
ANSP*	Academy of Natural Sciences of Philadelphia
ASUMZ*	Arkansas State University
AZM*	Arkansas Zoology Museum
AUM*	Auburn Museum
CHM	Charleston Museum
CM	Carnegie Museum
CUVC*	Cornell University
CUSC	Campbell Museum of Natural History, Clemson University
DMNH	Delaware Museum of Natural History
EC*	Earlham College
FMNH	Field Museum of Natural History
FLMNH	Florida Museum of Natural History
FSUM	Florida State Museum
GMNH	Georgia Museum of Natural History
KU	University of Kansas, Natural History Museum
LSUMZ	Louisiana State University, Museum of Natural Sciences
MCZ	Museum of Comparative Zoology, Harvard University
MSU*	Michigan State University
MSB*	Museum of Southwest Biology
MVZ	Museum of Vertebrate Zoology, Univ. of California at Berkeley
NCSM*	North Carolina State Museum of Natural Science
NHMLO*	The Natural History Museum, London, England
NHMLA	Natural History Museum of Los Angeles County
NMNH	National Museum of Natural History, Smithsonian
ROM	Royal Ontario Museum
SUVM*	Shippensburg University
TCWC	Texas Cooperative Wildlife Collection, Texas A&M
TTU*	Texas Tech University
UIMNH	University of Illinois, Museum of Natural History
UMD*	University of Minnesota, Bell Museum
UMMZ	University of Michigan, Museum of Zoology
UM*	University of Memphis, Vertebrate Museum
UNCW*	University of North Carolina at Wilmington
USNM	National Museum of Natural History, Vertebrate Zoology Dept.
UWBM*	University of Washington, Burke Museum of Natural History
VCM*	Virginia Commonwealth University
VSU*	Valdosta State University
VPIMM*	Virginia Tech University
WFUVC*	Wake Forest University
YPM*	Yale University, Peabody Museum

Appendix B. Capture locations of museum specimens and survey captures in South Carolina. Captured by: AD = Amy Dye, JRH = J. Rob Harrison, MB = Mary Bunch, MM = Michael Menzel, JM = Jennifer Menzel, TC = Timothy Carter, RC = R. Coleman, JS = James Sorrow, MC = Mary Kay Clark, BL = Branden Louie, TP = Travis Perry.

Localities of Museum Specimens

Pipistrellus subflavus – Total of 95 from: Berkeley Co., Richmond Plantation, 1 (CHM), Hyde Park, 1 (CHM); Chester Co., no data, 1 (CHM); Williamsburg Co., Kingstree, 1 (CHM); Spartanburg Co., no data, 1 (CHM); Oconee Co., Tunnel Park, 1 (CHM), Stumphouse Mt. tunnel, 44 (CUSC), Walhalla, 1 (CUSC), Buzzard Mt. Heritage Preserve, 1 (CUSC), Lake Cheohee, 1 (CUSC), Chauga River corridor, 1 (CUSC); Charleston Co., Drayton Station, 1 (CHM), Old Fort Bull, 5 (CHM), St. Andrew's Parish, 2 (CHM), Charleston, 3 (CHM), McClellanville, 6 (TCWC); Abbeville Co., Martin's Mill, 1 (CHM); Orangeburg Co., Parler, 1 (CHM); Dorchester Co., 5 miles N of Charleston Co. line on Hwy 61, 1 (CHM), Summerville, 2 (KU), no data, 1 (KU); Newberry Co., Silverstreet, 1 (CHM); Aiken Co., UGA Field Station, 3 (CHM), Jackson, 1 (CM), Savannah River Site, 3 (GMNH); Greenville Co., Greenville, 1 (NMNH), Caesar's Head State Park, 1 (CUSC); Pickens Co., Easley, 1 (NMNH), Red-tailed Hawk Pond, 1 (CUSC), Clemson University, 1 (CUSC), Laurel Fork Creek, 1 (CUSC), Table Rock State Park, 1 (CUSC); Hampton Co., between Islandton and Crockettville, 1 (CUSC); Anderson Co., bridge over Big Beaver Dam creek and Hwy 243, 2 (CUSC).

Nycticeius humeralis – Total of 180 from: Charleston Co., Coburg Dairy, 2 (CHM), Otranto, 1 (CHM), St. Andrews Parish, 4 (MVZ); 6 (CMMZ); 57 (CHM); Ashley Hall Rd., 2 (CHM), John's Island, 2 (CHM), Raytowles Creek on Hwy 17, 5 (CHM), 1 (ROM), Dwight's Woods, 1 (CHM), James Island, 2 (CHM), College of Charleston, 1 (CHM), Ashley River Bridge, 3 (AMNH), McClellanville, 10 (TCWC), Steed Creek, 2 (CM), Charleston, 2 (KU), 12 (CHM), 3 (NMNH); Calhoun Co., St Matthews, 32 (CHM), 2 (ROM); Union Co., no data, 1 (CHM); Barnwell Co., Savannah River Site, 1 (CUSC); Aiken Co., UGA field station, 1 (CHM), Jackson, 3 (CM), Jackson Boat Landing, 1 (MVZ), Savannah River Site, 1 (GMNH); Hampton Co., Yemassee, 5 (CHM); Orangeburg Co., 1 mile E of Orangeburg on SC Hwy 310, 1 (CHM), Clafflin College, 1 (MVZ); Fairfield Co., Cedar Creek and Hwy 218, 1 (CHM); Chesterfield Co., Cheraw State Park, 2 (CHM); Edgefield Co., 1 mile E of Turkey Creek on SC Hwy 283, 1 (CHM); Pickens Co., Rocky Bottom, 1 (CHM), Red-tailed Hawk Pond, 1 (CUSC), Clemson, 1 (CUSC); Georgetown Co., Georgetown, 1 (KU); Anderson Co.,

Pelzer, 1 (NMNH), Church, 1 (CUSC), Pendleton, 2 (CUSC); Lexington Co., Cayce, 1 (CUSC); Greenwood Co., Greenwood, 2 (CUSC).

Myotis austroriparius – Total of 7 from: Kershaw Co., Camden, 1 (CHM); Charleston Co., Steed Creek, 3 (CM); Orangeburg Co., Santee State Park, 1 (CUSC); Dorchester Co., Four-Hole Swamp, 2 (CUSC).

Myotis lucifugus – Total of 14 from: Beaufort Co., Beaufort West, 1 (USNM), 2 (NMNH); Oconee Co., US Fish Hatchery, 5 (CUSC); Pickens Co., Table Rock State Park, 5 (CUSC), Chauga River corridor, 1 (CUSC).

Myotis septentrionalis – Total of 7 from: Pickens Co., Rocky Bottom, 2 (CUSC), Laurel Fork Creek, 1 (CUSC); Oconee Co., Buzzard Roost Heritage Preserve, 1 (CUSC); Greenville Co., Jones Gap State Park, 1 (CUSC), Greenville Watershed, 1 (CUSC), Ashmore Heritage Preserve, 1 (CUSC).

Myotis leibii – Total of 3 from: Pickens Co., Eastatoe Creek, 2 (CUSC); Greenville Co., Greenville Watershed, 1 (CUSC).

Corynorhinus rafinesquii – Total of 72 from: Charleston Co., McClellanville, 1 (TCWC), Santee River Delta, 1 (FLMNH); 3 (CHM), Charleston, 1 (FSUM), Hampton, 1 (CHM), 2 (CUSC), Dreyton Hall, 6 (CHM), Paco Sabo, 1 (CUSC); Georgetown Co., Durlington Plantation, 1 (MVZ); 12 (CHM), Georgetown, 5 (KU); Aiken Co., Savannah River Site, 2 (GMNH); 2 (CHM); Darlington Co., Society Hill, 3 (USNM), 4 (NMNH); Dorchester Co., Summerville, 15 (CHM); Berkeley Co., Huger, 1 (CHM); Hampton Co., Hampton Courthouse, 7 (CHM), between Islandton and Crockettville, 1 (CUSC); Pickens Co., Eastatoe Creek, 2 (CUSC), unknown, 1 (CUSC).

Lasiorycteris noctivagans – Total of 36 from: Greenville Co., Caesar's Head, 3 (MVZ); Cliff Road, 14 (CHM); Dorchester Co., Summerville, 1 (CHM); Pickens Co., Table Rock State Park, 1 (CHM), Clemson University campus, 3 (CUSC), Laurel Fork Creek, 4 (CUSC) Eastatoe Valley, 1 (CUSC), Central, 1 (CUSC); Oconee Co., Oconee State Park, 1 (CHM), 3.5 miles west of Clemson, 1 (CUSC); McCormick Co., John de la Howe School, 2 (CHM); Lancaster Co., no data, 1 (CHM); Anderson Co., no data, 1 (CHM); York Co., Rock Hill, 1 (CHM); Charleston Co., Cape Romaine Refuge, 1 (CHM).

Lasiurus borealis – Total of 136 from: Berkeley Co., Richmond Plantation, 9 (CHM), Cainho, 1 (KU); Charleston Co., Porcher's Bluff, 1 (CHM), Rockville, 2 (CHM); James Island, 1 (CHM), Seabrook Island, 1 (MCZ), Meggett, 1 (CHM), Woodlaural Shores, 1 (CHM), St. Andrews Parish, 18 (CHM), Orange Grove Rd., 1 (CHM), Withewood Swamp, 2 (AMNH), McClellanville, 10 (TCWC), Steed Creek, 1 (CM), Charleston, 4 (KU); 1 (MCZ); 3 (CHM), Millbrook, 1 (KU), Ravenell, 1 (KU), 6 miles offshore from Charleston, 1 (CHM); Pickens Co., Caesar's Head, 1 (CHM), Rocky Bottom, 4 (CHM), Easley, 3 (NMNH), Clemson University, 2 (CUSC), Laurel Fork Creek, 3 (CUSC), Lake Issaqueena, 1 (CUSC), Sassafras Mt., 1 (CUSC), Dacusville, 1 (CUSC), unknown, 4 (CUSC); Orangeburg Co., Orangeburg, 2 (CUSC), Cutawville, 3 (CHM), 9 miles N of Orangeburg on SC Hwy 210, 2 (CHM); Abbeville Co., Abbeville, 5 (CHM); Greenville Co., Caesar's Head, 1 (CHM), Greenville, 1 (FLMNH), 1 (NMNH), Hebb Home, 1 (CHM), Interstate 85, 1 (CUSC); Oconee Co., Oconee State Park, 2 (CHM), Hwy 11 and Co. Rd. 190, 1 (CUSC), Chauga River corridor, 1 (CUSC); Saluda Co., 5 miles W of Batesburg on SC Hwy 23, 1 (CHM); Spartanburg Co., Inman, 1 (CHM); Edgefield Co., 1 mile E of Turkey Creek on SC Hwy 283, 1 (CHM); Aiken Co., Savannah River Site, 1 (GMNH), Jackson, 2 (CM); Barnwell Co., Savannah River Site, 1 (CM), ; Kershaw Co., Camden, 2 (MVZ); Lugoff, 1 (CHM); York Co., Catawba, 1 (FMNH); Beaufort Co., Gray's Hill, 2 (CMMZ), Beaufort, 1 (NMNH); Dorchester Co., Summerville, 7 (KU); Sumter Co., Rembert, 1 (LSUMNS); Anderson Co., Anderson, 1 (NMNH), 4 (CUSC), Fant's Grove GMA, 2 (CUSC) Twin Lakes Rec. Area, 1 (CUSC), unknown, 3 (CUSC); Union Co., Union Center, 1 (NMNH).

Lasiurus seminolus – Total of 51 from: Charleston Co., McClellanville, 12 (TCWC), Awendaw, 1 (CM), Steed Creek, 7 (CM), St. Andrew's Parish, 1 (CM); 1 (MVZ); 6 (CMMZ); 5 miles NW of Charleston, 1 (CM); Raytowles Creek, 1 (ROM), Christ Church, 2 (NMNH); Lexington Co., no data, 1 (MVZ); Beaufort Co., Gray's Hill, 1 (CMMZ), unknown, 1 (CUSC); Bluffton, 2 (GMNH), 1 (NMNH); Aiken Co., Savannah River Site 1, (GMNH); Pickens Co., Clemson University, 1 (GMNH), 1 (CUSC); Richland Co., Eastover, 1 (LSUMNS); Calhoun Co., 39 km S of Columbia, 1 (ROM); Georgetown Co., Plantersville, 1 (NMNH); Barnwell Co., Savannah River Site, 7 (CUSC).

Lasiurus intermedius – Total of 11 from: Charleston Co., St. Andrews Parish, 2 (CHM), Dwight's Woods, 1 (CHM), Plantersville, 1 (USNM); Barnwell Co., Savannah River Site, 2 (GMNH); 2 (CHM); Hampton Co., no data, 1 (CHM); Beaufort Co., Bluffton, 1 (USNM), no data, 1 (CHM).

Lasiurus cinereus – Total of 4 from: Charleston Co., Mt. Pleasant, 1 (MCZ); Georgetown Co., Georgetown, 1 (NMNH); Aiken Co., Aiken, 1 (CUSC); Pickens Co., Table Rock State Park, 1 (CUSC).

Eptesicus fuscus – Total of 30 from: Berkeley Co., Richmond Plantation, 1 (CHM), Gough, 4 (CHM); Laurens Co., no data, 2 (CHM); Charleston Co., Navy Yard, 1 (CHM), Santee River Delta, 1 (AMNH), McClellanville, 2 (TCWC), Charleston, 1 (KU); 1 (MCZ); Greenville Co., Caesar's Head, 2 (NMNH); Anderson Co., Pendleton, 3 (CUSC); Georgetown Co., Hobeaw – Barony Plantation, 2 (CUSC); Pickens Co., Clemson University campus, 4 (CUSC); Oconee Co., Seneca, 2 (CUSC), US Fish Hatchery, 1 (CUSC); Richland Co., Columbia, 2 (CUSC), Hopkins, 1 (CUSC).

Tadarida brasiliensis – Total of 356 from: Berkeley Co., Richmond Plantation, 7 (CHM); Charleston Co., Richard's Warehouse, 45 (CHM), 4 (ROM), Archer School, 69 (CHM), Bethel Church, 1 (CHM), James Island, 1 (CHM), Rantowles, 5 (CHM), College of Charleston, 2 (CHM), St. Andrews Parish, 13 (CHM), Porter Military Academy, 1 (CHM), Dwight's Woods, 3 (CHM), Santee River Delta, 3 (AMNH), 8 Mill Street, 1 (UIMNH); Charleston, 28 (CM); 8 (KU); 2 (NHMLA); 23 (CHM), 1 (DMNH), 7 (CUSC); Beaufort Co., no data, 1 (CHM); Calhoun Co., St. Matthews, 4 (CHM), 3 (ROM); Georgetown Co., Georgetown, 8 (CM); 71 (KU), 12 miles S of Georgetown, Kinloch Plantation, 20 (CHM); Hampton Co., SC Hwy 28 at R.T. Dempsey, 2 (CHM); Sumter Co., Warren Court, 1 (CHM); Orangeburg Co., Claflin College, 1 (MVZ); Chesterfield Co., no data, 2 (MVZ); Richland Co., Columbia, 8 (NMNH), 9 (CUSC); Florence Co., Florence, 1 (CUSC); Pickens Co., Clemson University campus, 1 (CUSC).

Localities of Survey Captures

Pipistrellus subflavus – Total of 685 from: Abbeville Co., Parsons Mountain, 4 (MB/TP); Aiken Co., Savannah River Site, 9 (MM/TC); Berkeley Co., Francis Beidler Forest, 7 (MC); Cherokee Co., Mine near New Canaan Church, 1 (MB); McCormick Co., 1 (MB/IRH), Oconee Co., Buzzard Roost Heritage Preserve, 1 (MB), Brasstown Creek, 1 (MB), Clemson University South Forest, 1 (MB/AD), Stumphouse, Mountain, 1 (MB), Lake Cheohee, 221 (MB/TP/AD), Rockhouse Mountain, 9 (MB/AD), Village Creek, 1 (MB), Taylor Creek, 15 (MB), North Highway 107, 5 (MB), Bad

Creek, 3 (MB/JS); Pickens Co., Jocassee Gorges Lower Eastatoe, 2 (MB/AD), Table Rock State Park, 372 (MB/JS), Eastatoe valley, 8 (MB/JS), North Clemson Forest, 1 (MB/JS), Sassafras Mountain, 2 (MB/JS); Greenville Co., The Nature Conservancy Blue Wall Preserve, 1 (MB/AD), Cliffs at Glassy, 1 (AD), Glassy Mountain, 1 (AD); Table Rock Reservoir of Greenville Watershed, 2 (MB), North Saluda Reservoir area of Greenville Watershed 2 (MB); Richland Co., Ft. Jackson, 2 (MB), Leesburg Training Site tunnels, 1 (MB/AD); York Co., Smyrna area mines, 10 (MB).

Nycticeius humeralis – Total of 95 from: Berkeley Co., Francis Beidler Forest, 7 (MC); Beaufort Co., Laurel Bay, 1 (MB), Parris Island USMC, 1 (MB); Richland Co., Ft. Jackson, 13 (MB/TP), Downtown Columbia, 2 (MB/AD); Aiken Co., Savannah River Site, 63 (MM/TC), Silver Bluff Plantation, 5 (MM); Charleston Co., 2 km SW of Ravenel on New Road, 3 (MM).

Myotis leibii – Total of 41 from: Greenville Co., Table Rock Reservoir Area of Greenville Watershed 23 (MB); Pickens Co., Eastatoe Valley, 13 (MB), Flat Rock Mountain, 2 (MB), Diana Mountain 1 (MB/AD); Oconee Co., East Fork Chattooga River, 1 (MB/AD), Moody Cove of Lake Cheohee, 1 (MB), .

Myotis austroriparius – Total of 22 from: Berkeley Co., Francis Beidler Forest, 14 (MC), Naval Weapons Station, 1 (MB/BL); Beaufort Co., Laurel Bay, 3 (MB); Aiken Co., Savannah River Site, 1 (MM/TC); Cherokee Co., Mine near New Canaan Church, 1 (MB); Richland Co., Congaree Swamp National Monument, 2 (MB/TP).

Myotis lucifugus – Total of 67 from: Pickens Co., Jocassee Gorges Bully Branch, 1 (MB/AD), Table Rock State Park, 59 (MB), Sassafras Mountain, 3 (MB); Greenville Co., Cliffs at Glassy, 1 (MB/AD), Table Rock Reservoir of Greenville Watershed 1 (MB); Oconee Co., Lake Cheohee, 1 (MB/AD); Aiken Co., Savannah River Site, 1 (MM/TC)

Myotis septentrionalis – Total of 69 from: Pickens Co., Jocassee Gorges Bully Branch, 1 (MB/AD), Jocassee Gorges Bootleg Mountain, 1 (MB/AD), Jocassee Gorges Camp Adger, 6 (MB), Eastatoe Valley, 6 (MB/JS), Keowee Toxaway State Park, 6 (MB/AD), Table Rock State Park, 1 (MB/JS), Sassafras Mountain, 2 (MB/JS), Jocassee Gorges Flatrock Mountain, 2 (MB); Oconee Co., . Compartment 16 Stand 1 of Andrew Pickens District of Sumter, 1, (MB), Grapevine, 1 (MB), Burrells Ford, 2 (MB), Brasstown Creek Heritage Preserve, 1 (MB/AD), Buzzard Roost Heritage Preserve 6 (MB/AD), Cedar Creek in Sumter National Forest, 2 (MB), Long Mountain Sumter Forest, 2 (MB), Highway 107 Sumter National Forest, 2 (MB), Lake Cheohee Sumter National Forest, 3 (MB/AD), USFS Road Sumter Forest, 2 (MB/AD), USFS Road 2042 Sumter Forest, 1 (MB), Ellicott Rock area, 1 (MB/AD), Chauga, 1 (MB/AD), Oconee State Park, 1 (MB/AD), Coon Branch Natural Area, 1 (MB); Greenville Co., The Nature Conservancy Blue Wall Preserve, 1 (MB/AD), Table Rock Reservoir of Greenville Watershed, 5 (MB), North Saluda Reservoir of Greenville Watershed, 10 (MB), Chandler Heritage Preserve, 1 (MB).

Corynorhinus rafinesquii – Total of 174 from: Berkeley Co., Francis Beidler Forest, 9 (MC); Charleston Co., Old stable in Awendaw at Francis Marion National Forest, 2 (MB/JS), Hampton Plantation State Park, 50 (MB); Colleton Co., Mary's Island now Donnelley WMA, 1 (MB); Oconee Co., Bad Creek Whitewater River area, 2 (MB/AD), Coon Branch Natural Area, 5 (MB/JS), Oconee State Park, 1 (MB/AD), Lake Cheohee area, 45 (MB/AD), Village Creek, 3 (MB/AD), Stumphouse Mountain, 2 (MB); Pickens Co., Camp Adger Jocassee Gorges, 1 (MB); Pickens Co., Eastatoe Valley, 2 (MB), Diane Mountain Jocassee Gorges, 15 (MB/JS), Table Rock State Park, 2 (MB/JS); Greenville Co., Table Rock Reservoir area of Greenville Watershed, 1 (MB), Ashmore Heritage Preserve, 2 (MB/JS/AD), River Falls, 2 (MB/JS), Glass Mountain rockhouse, 7 (MB/AD); Richland Co., Ft. Jackson, 8 (MB/JS), Leesburg Training Site tunnels, 6 (MB/AD); Aiken Co., Savannah River Site, 2 (MM/TC), Silver Bluff Plantation, 6 (MM/JM).

Lasionycteris noctivagans – Total of 2 from: Pickens Co., Eastatoe Valley, 1 (MB), Oconee Co., off USFS Road 2659, 1 (MB).

Lasiurus borealis – Total of 583 from: Anderson Co., Eighteen Mile Creek in Clemson Forest, 13 (MB); Berkeley Co., Naval Weapons Station, 9 (MB/BL); Richland Co., Ft. Jackson, 35 (MB/JS/TP); Pickens Co., Jocassee Gorges Lower Eastatoe, 7 (MB/AD), Jocassee Gorges Bootleg Mountain, 2 (MB/AD), North Forest Clemson University, 28 (MB/AD), Clemson Park, 1 (MB), Camp Adger, 6 (MB/AD), Sassafras Mountain, 9 (MB/JS), Lower Cane Creek, 62 (MB), Eastatoe Valley, 200 (MB); Greenville Co., Chandler Heritage Preserve, 10 (MB), Paris Mountain State Park, 5 (MB/AD), Cliffs at Glassy Mountain, 1 (MB/AD); Oconee Co., Clemson Forest, 2 (MB), Clemson Forest Bayshore, 1 (MB/AD), Upper Brasstown Creek, 3 (MB), Stumphouse, 1 (MB/AD), Highway 107 Sumter Forest, 3 (MB), Buzzard Roost Heritage Preserve, 69 (MB), Cedar Creek in Sumter National Forest, 3 (MB), USFS Road 762 Sumter Forest, 2 (MB), USFS Road 2042 Sumter Forest, 1 (MB), Lake Cheohee, 22 (MB); Beaufort Co., Laurel Bay, 2 (MB); Aiken Co., Savannah River Site, 49 (MM/TC), Silver Bluff Plantation, 8 (MM); Charleston Co., 2 km SW of Ravenel on New Road, 4 (MM); McCormick Co., Clark's Hill, 1 (JRH/MB); Chester Co., Lansford Canal State Park, 3 (JS); Lancaster Co., near Lansford Canal State Park, 1 (JS); York Co., Crescent Resources Lake Wylie Dam, 2 (JS), White, 17 (JS); Spartanburg Co., Pacolet River Heritage Preserve, 1 (MB/AD).

Lasiurus seminolus – Total of 76 from: Beaufort Co., Laurel Bay, 10 (MB), USMC Air Base, 2 (MB); Pickens Co., Clemson University, 1 (MB); Berkeley Co., Francis Beidler Forest, 3 (MC), Naval Weapons Station, 2 (MB/BL); McCormick Co., Clark's Hill, 22 (MB/JRH); Oconee Co., Highway 107, 1 (MB), Richland Co., Ft. Jackson, 8 (MB/JS); Aiken Co., Savannah River Site, 18 (MM/TC), Silver Bluff Plantation, 4 (MM); Charleston Co., 2 km SW of Ravenel on New Road, 5 (MM).

Lasiurus intermedius – Total of 1 from: Charleston Co., 5 miles north of Charleston, 1 (RC)

Lasiurus cinereus – Total of 2 from: Aiken Co., Savannah River Site, 2 (MM)

Eptesicus fuscus – Total of 185 from: Pickens Co., Jocassee Gorges Bootleg Mountain, 1 (MB/AD), Eastatoe valley, 6 (MB), House at Mill Creek, 13 (MB/TP/JS), Ryobi plant downtown Pickens, 1 (MB), Table Rock State Park, 112 (MB/JS); McCormick Co., Clark's Hill, 2 (MB/JRH); Anderson Co., Clemson Forest at Eighteenmile Creek, 1 (AD/MB), Residence in Pendleton, 3 (MB/AD); Colleton Co., Donnelley WMA, 1 (MB/JS); Richland Co., Ft. Jackson, 2 (MB), Leesburg Training site tunnels, 4 (MB/AD); Berkeley Co., Francis Beidler Forest, 6 (MC), Naval Weapons Station, 2 (MB/BL); Aiken Co., Savannah River Site, 4 (MM/TC), Silver Bluff Plantation, 2 (MM); Greenville Co., Glassy Mountain, 1 (AD); York Co., Museum of York County, 1 (JS), White, 3 (JS); Oconee Co., Basement of residence on Chattooga Lake, 20 (MB/AD).