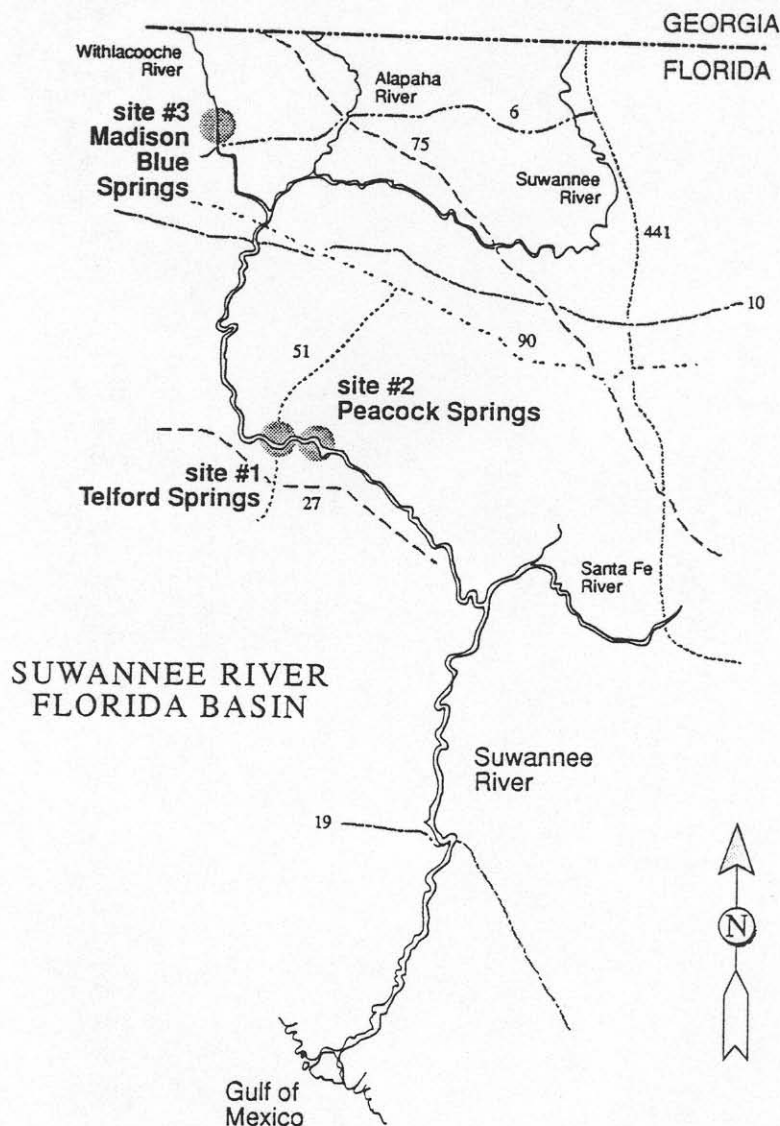


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DISTRIBUTION AND ABUNDANCE OF BATS (MAMMALIA: CHIROPTERA) IN COASTAL PLAIN CAVES OF SOUTHERN ALABAMA

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*A survey of bat fauna of caves located on the Coastal Plain of Alabama was conducted to determine species occupying the caves and their seasonal abundance. Three species of bats occupy the caves; *Myotis austroriparius*, *Pipistrellus subflavus*, and *Plecotus rafinesquii*. Most caves contained few or no bats in summer; however, relatively large numbers occurred in the caves during winter months. The only maternity colony known to occur in these caves was of *M. austroriparius*; the only maternity colony of this species known from Alabama.*

INTRODUCTION

Alabama's bat fauna includes 16 species; southeastern myotis (*Myotis austroriparius*), gray myotis (*M. grisescens*), small-footed myotis (*M. leibii*), little brown myotis (*M. lucifugus*), northern myotis (*M. septentrionalis*), Indiana myotis (*M. sodalis*), eastern pipistrelle (*Pipistrellus subflavus*), big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasiorycteris noctivagans*), red bat (*Lasiurus borealis*), hoary bat (*L. cinereus*), northern yellow bat (*L. intermedius*), Seminole bat (*L. seminolus*), evening bat (*Nycticeius humeralis*), Rafinesque's big-eared bat (*Plecotus rafinesquii*), and Brazilian free-tailed bat (*Tadarida brasiliensis*—modified from Hall, 1981).

Examination of listings of threatened and endangered species revealed six species of bats in Alabama that may be in danger of extinction. The United States Fish and Wildlife Service lists two endangered bat species; *M. grisescens* and *M. sodalis*. Five species are protected under regulations of the state of Alabama; *M. austroriparius*, *M. grisescens*, *M. sodalis*, *P. rafinesquii*, and *T. brasiliensis*. Species of "special concern" and "poorly known" include *L. intermedius*, *M. austroriparius*, *P. rafinesquii*, and *T. brasiliensis* (Mount, 1986). Little is known about the biology of these species within Alabama, and most of the information regarding them has been gleaned from studies in other states (e.g., Sherman, 1939; Quay, 1949; Rice, 1955, 1957; Hall, 1962; Crain and Cliburn, 1965; Crain and Packard, 1966; Barbour and Davis, 1969; Watkins, 1972; LaVal, 1973; Kennedy et al., 1974; Lowery, 1974; Humphrey, 1975; Jones

and Suttkus, 1975; Tuttle, 1976, 1979; Humphrey et al., 1977; Jones, 1977; Fitch and Shump, 1979; Fenton and Barclay, 1980; LaVal and LaVal, 1980; Webster et al., 1980; Kunz, 1982; Shump and Shump, 1982a, 1982b; Thomson, 1982; Fugita and Kunz, 1984; Wilkins, 1987, 1989; Jones and Manning, 1989; Kurta and Baker, 1990).

Although there is an overall paucity of information regarding bats in Alabama, there is a conspicuous lack of information for Coastal Plain species (e.g., Howell, 1921; LaVal, 1967; Linzey and Linzey, 1969; Linzey, 1970). In 1986, the Nongame Program of the Alabama Game and Fish Division listed the Coastal Plain caves as the highest-priority sites for future research and survey needs. Species identified to be in need of special attention in Coastal Plain caves include five species of bats; *M. austroriparius*, *M. grisescens*, *M. sodalis*, *P. rafinesquii*, and *T. brasiliensis*. The objectives of our research were to determine what species of bats occupy Coastal Plain caves of Alabama and to determine the relative abundance of bats in each cave. Herein, we list the species of bats found in Coastal Plain caves, present information on relative abundance of bats in each cave, and identify the most important caves for bats in southern Alabama.

Methods and Materials

Bat traps and mist nets were placed inside, at the entrance, or outside caves to capture bats for species identification, estimates of relative abundance, etc. Caves where this was especially important were those that are large, those

with numerous crevices where bats could remain undetected, and those that could not be entered safely. In caves where the bat fauna could accurately be determined without capturing bats, no nets and traps were used.

During surveys of caves, a bat detector was used to locate bats, and visual inspections of potential roosting places were made. For large colonies of bats, the area occupied by the colony was measured, and an estimate of abundance was determined. Otherwise, individual bats were identified and counted. An effort was made not to disturb hibernating bats, as this could cause them to arouse, burn up fat reserves, and die of starvation before spring. Caves were examined during both summer and winter to determine their use.

Numbers in parentheses following names of caves are those assigned by the Alabama Cave Survey (McGill, 1992). Researchers requesting information about Alabama caves should direct inquiries to the Alabama Cave Survey, P.O. Box 360231, Birmingham, AL 35236-0231.

RESULTS AND DISCUSSION

Preliminary investigations indicated that ca. 20 caves occurred in the coastal plains of Alabama. However, soon after the study was initiated, interviews with scientists from throughout the southeastern United States, information from landowners, and data from local residents indicated there were >50 caves in the region. As expected, several caves are known by a variety of names and others had never been visited by the person providing information (thus the precise locality was not known). Most of the cave-locating activity was concentrated in June, July, and August 1990. Because of dense summer vegetation, it was difficult to find many of the caves. In winter (February and March 1991), efforts were concentrated on revisiting the caves located in the summer of 1990.

Over 3,000 caves are known in Alabama (McGill, 1992); most occur in Paleozoic limestones of the Valley and Ridge, Cumberland Plateau, and Interior Low Plateau provinces in the northern half of the state. Caves there are numerous, and some are large or are part of extensive cave systems. Younger rocks of Cretaceous and Tertiary age crop out in the Coastal Plain. Caves here are fewer and smaller (almost all are <65 m in length) because the limestones in which they are developed generally are thin-bedded, discontinuous, and structurally incompetent. Sanders Cave (AL 167), Conecuh Co., is one of the largest and best known Coastal Plain caves. A spacious entrance room (height of ceiling, ca. 7 m) leads to ca. 360 m of passage, much >1.5 m in height. The entrance room is floored by breakdown; the passages by sandy clay and several deposits of bat guano. Unlike most Coastal Plain caves, Sanders Cave lacks a stream; however, water impounded behind beaver dams near the main en-

trance occasionally inundates the floor to a depth of 1 m.

Since 1982, S. D. Carey (SDC) has been involved in locating and mapping caves, and in recording species of invertebrates and vertebrates encountered in Coastal Plain caves. Preliminary data on caves visited by SDC, dates of observations, and numbers and kinds of bats are presented in Table 1. These data indicate that three species of bats currently oc-

Table 1
Preliminary Data on the Number of Bats Observed in Coastal Plain Caves of Southern Alabama During 1982-1990. Numbers in Parentheses Following Names of Caves are Those Assigned by the Alabama Cave Survey (McGill, 1992).

Cave	Date	Number and Kinds of Bats Observed
Buzzard's Den Cave, Clarke Co. (AL 2835)	12 November 1988 20 January 1989 24 February 1990	12 <i>P. subflavus</i> 2 <i>P. rafinesquii</i> 20 <i>P. subflavus</i> 100 <i>P. subflavus</i> 1 <i>P. rafinesquii</i>
Broadenax Cave, Clarke Co. (AL 128)	11 February 1989	0 bats
Broughton Cave, Monroe Co. (AL 2722)	12 February 1983	12 <i>P. subflavus</i>
February Cave, Monroe Co. (AL 2919)	25 February 1990	20 <i>P. subflavus</i>
Kimbrough Cave, Clarke Co. (AL 2920)	25 March 1990	3 <i>P. subflavus</i>
Lion's Den Cave, Clarke Co. (AL 2806)	22 October 1988	10 <i>P. subflavus</i>
Locklin Cave, Monroe Co. (AL 2853)	29 July 1989 24 February 1990	1 <i>M. austroriparius</i> 30 <i>M. austroriparius</i> 20 <i>P. subflavus</i>
McLean's Cave, Clarke Co. (AL 2738)	13 September 1986	1 <i>P. subflavus</i>
McVay Cave, Clarke Co. (AL 129)	21 April 1989	1 <i>P. subflavus</i>
Myrick's Cave, Clarke Co.	18 March 1989	2 <i>P. subflavus</i>
Oscar Braun Cave, Washington Co.	12 June 1989	0 bats
Rabbit Creek Cave, Clarke Co. (AL 2267)	19 March 1983	3 <i>P. subflavus</i>
Randon's Creek Cave, Monroe Co. (AL 2833)	13 February 1982	10 <i>P. subflavus</i>
Rock House Cave, Covington Co. (AL 1011)	3 May 1989 12 June 1989	0 bats 0 bats
Rock Pit Cave, Monroe Co. (AL 1013)	11 May 1985 25 February 1990	0 bats several <i>P. subflavus</i>
Smith Cave, Clarke Co. (AL 2266)	19 March 1983	1 <i>P. subflavus</i>
Steve's Solo Hole, Monroe Co. (AL 2918)	6 March 1990	3 <i>P. subflavus</i>
Stallworth Cave, Clarke Co. (AL 2832)	13 September 1986	0 bats
Upper Rabbit Creek Cave, Clarke Co.	18 March 1989	0 bats
Walker Cave, Clarke Co.	18 March 1989	0 bats
Whitehead Cave, Clarke Co. (AL 2834)	13 September 1986	0 bats

Table II
Numbers of Southeastern Myotis (*Myotis austroriparius*) and Eastern Pipistrelle Bats (*Pipistrellus subflavus*) Observed in Caves in Southern Alabama During Summer 1990 and Winter 1991. Numbers in Parentheses Following Names of Caves are Those Assigned by the Alabama Cave Survey (McGill, 1992).

Cave	Summer (June, July, and August 1990)	Winter (February and March 1991)
B. C. Barganier Cave, Butler Co.	2 <i>P. subflavus</i>	45 <i>P. subflavus</i>
Buzzard's Den Cave, Clarke Co. (AL 2835)	0 bats	175 <i>P. subflavus</i>
Cary Cave, Conecuh Co. (AL 1424)	0 bats	105 <i>P. subflavus</i>
Chimney Cave, Covington Co.	0 bats	8 <i>P. subflavus</i>
Broadenax Cave, Clarke Co. (AL 128)	0 bats	0 bats
Davis Hunting Club Cave, Monroe Co.	no data	9 <i>M. austroriparius</i>
		176 <i>P. subflavus</i>
February Cave, Monroe Co. (AL 2919)	0 bats	no data
Hodges Cave, Conecuh Co.	0 bats	8 <i>M. austroriparius</i>
		59 <i>P. subflavus</i>
Lion's Den Cave, Clarke Co. (AL 2806)	1 <i>P. subflavus</i>	517 <i>P. subflavus</i>
Locklin Cave, Monroe Co. (AL 2853)	3 <i>M. austroriparius</i>	40 <i>M. austroriparius</i>
		83 <i>P. subflavus</i>
Mt. Moriah Cave, Wilcox Co. (AL 134)	0 bats	25 <i>P. subflavus</i>
Myrock's Cave, Clarke Co.	0 bats	29 <i>P. subflavus</i>
Rock House Cave, Covington Co. (AL 1011)	1 <i>M. austroriparius</i>	8 <i>M. austroriparius</i>
		21 <i>P. subflavus</i>
Rock Pit Cave, Monroe Co. (AL 1013)	0 bats	19 <i>P. subflavus</i>
Sanders Cave, Conecuh Co. (AL 167)	ca. 8,000 <i>M. austroriparius</i>	47 <i>M. austroriparius</i>
	2 <i>P. subflavus</i>	314 <i>P. subflavus</i>
Sleaze Hole, Monroe Co. (AL 2921)	0 bats	no data
Stallworth Cave, Clarke Co. (AL 2832)	0 bats	7 <i>P. subflavus</i>
Stone's Cave, Wilcox Co. (AL 1110)	0 bats	no data
Walker Cave, Clarke Co.	0 bats	0 bats
Whitehead Cave, Clarke Co. (AL 2834)	0 bats	19 <i>P. subflavus</i>

cur in Coastal Plain caves (*M. austroriparius*, *P. subflavus*, and *P. rafinesquii*), and that most bats are observed during the cooler months of the year.

In the present survey, bats were absent from most Coastal Plain caves during the summer (Table 2). Attempts were made to trap or net bats as they entered or exited caves during the summer months. This effort yielded one *P. subflavus* from B. C. Barganier Cave. Sanders Cave contains a maternity colony of ca. 8,000 *M. austroriparius* during summer; additionally, one or two *P. subflavus* were observed in this cave during each visit. The maternity colony of *M. austroriparius* in Sanders Cave is the largest known concentration of bats and the only known maternity colony in any Coastal Plain cave in Alabama. Although a few *M. austroriparius* were observed during winter months, Sanders Cave is not used as a hibernaculum by this species. Caves that contained few or no *P. subflavus* during summer months had large numbers during winter months (Table 2); the number of *M. austroriparius* was also greater in winter. *P. subflavus* uses caves as hibernacula during the winter (the *P. subflavus* we observed were in deep hibernation); however, *M. austroriparius* was active (usually making noise and flying when disturbed) and apparently this species hibernates elsewhere.

Previously, *M. austroriparius* has been reported from Baldwin and Conecuh (Sanders Cave) counties (Linzey, 1970). Howell (1921:25) reported that *P. subflavus* "is

scarce or absent in southern Alabama." Subsequently, *P. subflavus* was reported from Cat Cave, Clarke Co. (Brennan and White, 1960).

Myotis lucifugus, *M. septentrionalis* (= *M. keenii*), and *M. grisescens* have been reported from Sanders Cave (LaVal, 1967). *M. grisescens* has been reported from "the cave near Fort Deposit" (Howell, 1921:24), which could be B. C. Barganier Cave (B. Autry, the landowner, indicated that J. S. White had collected parasites from bats there in the 1950s, but he was unaware of previous visits by scientists). No *M. lucifugus*, *M. septentrionalis*, and *M. grisescens* were observed during our study.

There are no records of occurrence of *M. sodalis* south of the Tennessee River Valley in Alabama (Barbour and Davis, 1969). However, populations are known to occur in northwestern Florida (Thomson, 1982).

Plecotus rafinesquii has been reported from southern Alabama at Greensboro, Hale Co., and Autaugaville, Autauga Co. (Howell, 1921). Two were observed at Buzzard's Den Cave (AL 2835), Clarke Co., on 12 November 1988 (Table 1), and one was observed there on 24 February 1990 (Table 1). These sightings represent the only records of this species from Coastal Plain caves in Alabama.

Tadarida brasiliensis has been reported from Mobile, Baldwin (Linzey, 1970), and Hale counties (Howell, 1921). This species often occupies buildings. Several old buildings

examined in Clarke, Conecuh, Covington, and Monroe counties, but no bats were discovered. However, we were able to locate a small colony of *T. brasiliensis* (cohabitating with *E. fuscus*) under a bridge near Georgiana, Butler Co.

Data obtained during our research has helped elucidate the distribution and relative abundance of *M. grisescens*, *M. sodalis*, *M. austroriparius*, *P. subflavus*, *P. rafinesquii*, and *T. brasiliensis* in Coastal Plain caves of Alabama. Unfortunately, all but *M. austroriparius* and *P. subflavus* are extremely rare or extirpated from the region. The maternity colony of *M. austroriparius* at Sanders Cave is extremely vulnerable to destruction. One report on *M. austroriparius* indicates that "the largest summer colony in Alabama, formerly inhabiting a limestone cave in Conecuh County, has reportedly been extirpated by vandals and careless cave explorers" (Mount, 1986:112). It is clear from the well-traveled trail through the woods to the cave, thrown mud that is stuck to the walls, and scattered litter, that there is considerable human traffic at Sanders Cave. This important bat cave was once occupied by *M. septentrionalis*, now one of the rarest bats in Alabama, and *M. grisescens*, a federally listed endangered species. Today it is occupied by the only maternity colony of *M. austroriparius* known to occur in Alabama and it serves as an important hibernaculum for *P.*

flavus, previously thought to be uncommon in southern Alabama.

The usefulness of the results of our research encompasses an area that is geographically larger than Alabama, and may have significant implications regarding the conservation of these and other species of bats in the southeastern United States. Future research should address the reproductive biology, habitat requirements, and food habits of *M. austroriparius* and *P. subflavus*. Special emphasis should be placed on determining hibernacula of *M. austroriparius* and summer roosting sites of *P. subflavus*. Because many of the hibernating *P. subflavus* were <1 m above the floor of caves, it would also be of interest to determine the influence that raccoons and other predators have on the survival of bats in Coastal Plain caves.

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