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Bobby H. Fokidis

Arkansas State University, bobby.fokidis@asu.edu

Stephen C. Brandebura

Arkansas State University

Thomas S. Risch

Arkansas State University

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Distributions of Bats in Bottomland Hardwood Forests of the Arkansas Delta Region

H. BOBBY FOKIDIS^{1,2}, STEPHEN C. BRANDEBURA¹ AND THOMAS S. RISCH¹

¹Arkansas State University, Department of Biology, State University, AR 72467

²Correspondent: e-mail, Bobby.Fokidis@asu.edu

Abstract

Bat distribution data is incomplete for the delta region of Arkansas. We extensively surveyed 16 counties within the Mississippi alluvial plain that comprises the delta from late spring to early fall 2004 using mist nets. We obtained 44 new county records for 9 species: *Myotis lucifugus*, *M. austroriparius*, *Pipistrellus subflavus*, *Eptesicus fuscus*, *Lasiurus seminolus*, *L. borealis*, *L. cinereus*, *Nycticeius humeralis*, and *Corynorhinus rafinesquii*. We generated updated distribution maps for these species and eastward Arkansas range expansions were documented for *L. seminolus*. Possible sampling concerns and research directions are discussed in relation to the needs of bats inhabiting bottomland forests of the delta, particularly *M. austroriparius* and *C. rafinesquii*.

Introduction

Published studies of bats within Arkansas have primarily focused on the Interior Highland region, which contains 3 endangered species (Sealander and Heidt, 1990), and where presence of caves and concentrations of foraging bats near limited water resources make sampling efficient. Much less research has occurred within the Mississippi Alluvial valley (MAV) of the Arkansas's Delta Region (although see Gardner and McDaniel, 1978). Historically, large tracts of bottomland hardwood forests dominated by white oak (*Quercus alba*), red oak (*Q. falcata*), sweet gum (*Liquidambar styraciflua*), sycamore (*Platanus occidentalis*), and bald cypress (*Taxodium distichum*) provided roosting opportunities for many bat species. However, agricultural practices composed primarily of monoculture farms of soybean, rice, winter wheat, and cotton have eliminated large forested areas, resulting in probable declines in bat populations associated with these habitats. Two species in particular, the southeastern myotis (*Myotis austroriparius*) and the Rafinesque big-eared bat (*Corynorhinus rafinesquii*), have gained recent attention due to their rare status and poorly known natural history (Horner, 1995, 1996; Mirowsky and Horner, 1997; Hoffman et al., 1999; Menzel and Menzel, 2001; Mirowsky et al., 2004). The distribution of these two species within Arkansas is largely incomplete with few records within the Delta region.

Additionally, other bat species, whose distributions have been well documented in other regions of the state, such as the highlands, have only anecdotally been reported within the Delta. Although Sealander and Heidt (1990) suggest the distribution of both *C. rafinesquii* and *M. austroriparius* encompass all bottomland forest regions of the state, few complete surveys of this region of Arkansas have been conducted for these bats (but see: Baker and Ward, 1967; Gardner and McDaniel, 1978). To better ascertain effects of local land-management practices on bat

populations, complete data are required on distributions of sensitive species. Here we report on new county records of bat species captured during an extensive county by county survey of *C. rafinesquii* and *M. austroriparius* in the bottomland, hardwood forests of the MAV (hereafter, Delta) in eastern Arkansas. We also provide an updated distribution map for 9 bat species in the state of Arkansas, resulting from an extensive review of published accounts and this study.

Methods

This survey was conducted in 12 of the 16 counties (Arkansas, Clay, Craighead, Crittenden, Cross, Desha, Greene, Jackson, Lee, Mississippi, Monroe, and Poinsett) that encompass the Arkansas Delta region, three Central region counties (White, Prairie and Lonoke), and one Ozark region county (Lawrence). The Central and Ozark counties were sampled due to a lack of records for the two target species and the similarity of habitats to those in the Delta region. The regional divisions were based on Arkansas Game and Fish conventions. All sampling sites consisted of the following public lands: Arkansas Game and Fish Commission (AGFC) Wildlife Management Areas (WMAs), National Wildlife Refuges (NWRs), national forests, and state parks. Counties that already had pre-existing records for both species were not sampled. Bats were captured using mist nets placed in potential flight corridors (foot paths, all-terrain vehicle trails, unpaved roads), streams, ponds, and river edges. Nets were checked every 15 minutes and were left open for at least 5 hours beginning at dusk. Data obtained from captured bats include species, gender, age (juvenile or adult, as determined by the degree of ossification of the epiphyseal-diaphyseal fusion in the finger bones, Edythe, 1988), mass, and forearm length. Additionally, we determined the reproductive status of males (scrotal, non-reproductive) and females (pregnant,

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lactating, non-reproductive), according to Racey (1988). All captured bats were fitted with a uniquely numbered plastic band and then released. As the study primarily focused on obtaining distribution data for *C. rafinesquii* and *M. austroriparius*, netting continued in each county until these two species were captured or a maximum number of 5 nights was reached. Distribution maps were generated from our own bat captures and from previously published county records for the state. The following sources were used for these records: Davis et al., (1955), Baker and Ward, (1967), Laval, (1970), Gardner, (1978), Gardner and McDaniel, (1978), Heath et al., (1983), Heath et al., (1986), Steward et al., (1986), Heidt et al., (1987), Saugey et al., (1988), Steward, (1988). Saugey et al., (1989), Sealander and Heidt, (1990), Tumilson et al., (1992), Saugey et al., (1993), McAllister et al., (1995), Saugey et al., (1998), Wilhide et al., (1998), Cochran, (1999), Caviness and James, (2001), Tumilson et al., (2002), and McAllister et al., (2005).

Results and Discussion

We captured 267 bats from 35 netting locations in 16 counties. The sampling period consisted of 41 nights beginning on 27 May 2004 and ending on 6 Sept 2004. Netting duration by county ranged from 1 to 6 nights with the total netting effort equal to 172 net nights. This study resulted in 44 new county records for 9 species of bats: the little brown bat (*M. lucifigus*, 3 records), the southeastern bat (*M. austroriparius*, 12 records), the eastern pipistrelle (*Pipistrellus subflavus*, 4 records), the big brown bat (*Eptesicus fuscus*, 1 record), the seminole bat (*Lasiurus seminolus*, 2 records), the red bat (*L. borealis*, 7 records), the hoary bat (*L. cinereus*, 2 records), the evening bat (*Nycticeius humeralis*, 6 records), and the Rafinesques' big eared bat (*C. rafinesquii*, 7 records). Dates and locations of county records organized by species are provided below.

Corynorhinus rafinesquii

- 1) Clay Co.–Dave Donaldson/Black River WMA 36°16' N 90°39' W, 2 June 2004. 5.1 km NW of Peach Orchard along shore of Little Black River. Two pregnant females, potentially indicating a nearby roost.
- 2) Desha Co.–Trusten Holder WMA 33°55' N 91°14' W, 20 Aug 2004. 3.7 km ENE of Pendleton. ATV trail leading into bottomland forest from the main road. Single non-reproductive (NR) female.
- 3) Lee Co.–Ozark-St. Francis National Forest 34°42' N 90°39'W, 20 Aug 2004. 0.5 km E of Jeffersonville. Cottonwood (*Populus deltoides*) forest at confluence of L'anguille and St. Francis rivers. Single NR female.
- 4) Monroe Co.–Dagmar WMA 34°51' N 91°14' W, 22 July 2004. 10.1 km SW of Brinkley. Netted ATV trail and camping area along shoreline of bayou. Two males (one scrotal, one NR) and one NR female.
- 5) Poinsett Co.–Earl Buss/Bayou De View WMA 35°33' N 90°53' W, 3 June 2004. 2.9 km W of Weiner. Netted on ATV trails and river underneath Bayou DeView road bridge. Single scrotal male.
- 6) Prairie Co.–Wattensaw WMA 34°51' N 91°28' W, 13 July 2004. 4.2 km S of Gospoda. Campground area in upland forest along main road going to White River. Single NR female.
- 7) White Co.–Henry Gray/Hurricane Lake WMA 35°12' N 91°21' W, 10 July 2004. 6.4 km E of Mitchell Corner. Forest ATV trail in mature bottomland stand with trail leading from open water. Single scrotal male.

Eptesicus fuscus

- 8) Lonoke Co.–Holland Bottoms WMA 34°51' N 92°03' W, 15 July 2004. 0.5 km E of Jacksonville. Secondary-growth bottomland forest along shoreline of Jacks Bayou. Three NR females, one lactating female, and one NR male.

Lasiurus borealis

- 9) Clay Co.–Dave Donaldson/Black River WMA 36°16' N 90°39' W, 2 June 2004. Locality same as #1. Two females, one pregnant and one in estrus.
- 10) Crittenden Co.–Wapanocca NWR 35°20' N 90°11' W, 23 June 2004. 5.5 km SSE of Turrell. Ephemeral ponds located in open fields near large tracts of bottomland forests. Single lactating female.
- 11) Jackson Co.–Cache River NWR 35°29' N 91°07' W, 5 Aug 2004. 1.2 km W of Algoa. Captured along shore of Cache river adjacent to soybean field. Single NR female.
- 12) Lee Co.–Ozark-St. Francis National Forest 34°42' N 90°39'W, 20 Aug 2004. Locality same as # 3. One scrotal male.
- 13) Monroe Co.–Dagmar WMA 34°51' N 91°14' W, 22 July 2004. Locality same as # 4. Single NR female.
- 14) Poinsett Co.–Earl Buss/Bayou De View WMA

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35°33' N 90°53' W, 3 June 2004. Locality same as #5. A single NR adult male.

- 15) Prairie Co.–Wattensaw WMA 34°51' N 91°28' W, 12 July 2004. 7.0 km NE of Center Point. Netted various points along river flowing towards main road in WMA. Four NR females.

Lasiurus cinereus

- 16) Crittenden Co.–Wapanocca NWR 35°20' N 90°11' W, 23 June 2004. Locality same as #10. Single unknown gendered individual landed in net but escaped before being further identified.
- 17) Jackson Co.–Cache River NWR 35°29' N 91°07' W, 5 Aug 2004. Locality same as # 11. Single inactive male.

Lasiurus seminolus

- 18) Crittenden Co.–Wapanocca NWR. 35°20' N 90°11' W, 3 Sept 2004. 3.2 km SSE of Turrell. On main dirt road in forested area at the easternmost end of levee. Single NR female.
- 19) Lonoke Co.–Holland Bottoms WMA 34°51' N 91°56' W, 30 July 2004. 3.5 km E of Jacksonville. Under bridge at Graham Road netted across creek. Single NR female.

Nycticeius humeralis

- 20) Arkansas Co.–Bayou Meto WMA 34°12' N 91°35' W, 10 Aug 2004. 13.4 km SE of Wabbaseka. Forest trail running along a large pond, netted both trail and pond. Two NR females, one NR male, and four scrotal males.
- 21) Crittenden Co.–Wapanocca NWR 35°20' N 90°11' W, 23 June 2004. Locality same as #10. Single NR male.
- 22) Lonoke Co.–Holland Bottoms WMA 34°51' N 92°03' W, 21 July 2004. Locality same as #8. Single scrotal male.
- 23) Mississippi Co.–Big Lake WMA 35°54' N 90°04' W, 13 June 2004. 13.0 km NE of Manila. Dense secondary bottomland forest intersection of ATV trail and ditch near MO border. Single pregnant female.
- 24) Prairie Co.–Wattensaw WMA 34°51' N 91°28' W, 12 July 2004. Locality same as # 15. Two scrotal males, one NR female, one pregnant female and one post-lactating female.

- 25) White Co.–Henry Gray/Hurricane Lake WMA 35°08'N 91°21' W, 9 July 2004. 5.1 km SE of Mitchell Corner. Ditch running out of bottomland forest toward a small lake. Single pregnant female.

Pipistrellus subflavus

- 26) Crittenden Co.–Wapanocca NWR. 35°20' N 90°11' W, 23 June 2004. Locality same as #10. Two pregnant females and one lactating female.
- 27) Lonoke Co.–Holland Bottoms WMA 34°51' N 92°03' W, 21 July 2004. Locality same as #8. Single NR male.
- 28) Poinsett Co.–Earl Buss/Bayou De View WMA 35°33' N 90°53' W, 3 June 2004. Locality same as #5. Single pregnant, adult female.
- 29) White Co.–Henry Gray/Hurricane Lake WMA 35°08'N 91°21' W, 9 July 2004. Locality same as #25. Three NR males and three NR females.

Myotis austroriparius

- 30) Arkansas Co.–Bayou Meto WMA 34°12' N 91°35' W, 10 Aug 2004. Locality same as #20. Three females and two males, all NR.
- 31) Clay Co.–Dave Donaldson/Black River WMA 36°16' N 90°39' W, 2 June 2004. Locality same as #1 Single scrotal adult male, one post-lactating and one NR female.
- 32) Craighead Co.–St. Francis Sunken Lands WMA, 35°46' N 90°18' W, 6 June 2004. 2.7 km SE of Lake City. Interior of cypress swamp netted in areas clear of obstructions on the water surface. Single pregnant female.
- 33) Crittenden Co.–Wapanocca NWR 35°20' N 90°11' W, 2 Sept 2004. 4.3 km SSE of Turrell. Forest trail leading to Wapanocca Lake. Single scrotal male and an accidental release of an unknown gender.
- 34) Jackson Co.–Cache River NWR 35°29' N 91°07' W, 15 Aug 2004. 0.7 km W of Algoa. Flooded forest and shoreline along the Cache river. Single NR male.
- 35) Lawrence Co.–Shirey Bay/Rainey Brake WMA 35°59' N 91°07' W, 11 June 2004. 5 km SW of Lynn. Netted at confluence of creek with CR 316. Single scrotal male.
- 36) Lee Co.–Ozark-St. Francis National Forest 34°42' N 90°39'W, 20 Aug 2004. Locality same as # 3. Single

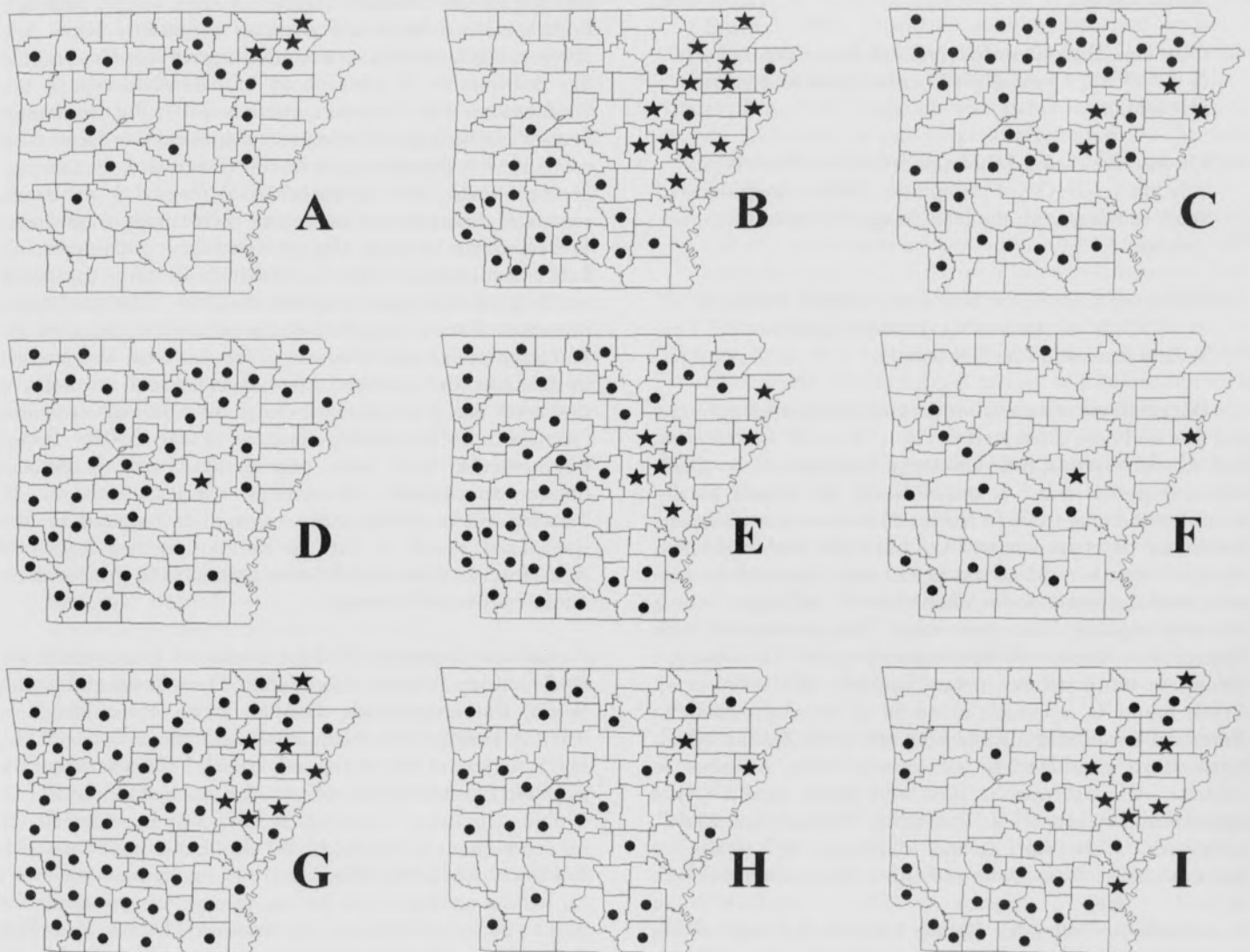


Fig. 1. Distributions for 9 species of bats encountered during a 2004 county by county survey of the Arkansas delta region. A. Little brown bat, *Myotis lucifugus*, B. Southeastern bat, *Myotis austroriparius*, C. Eastern pipistrelle, *Pipistrellus subflavus*, D. Big brown bat, *Eptesicus fuscus*, E. Evening bat, *Nycticeius humeralis*, F. Seminole Bat, *Lasiurus seminolus*, G. Red bat, *Lasiurus borealis*, H. Hoary bat, *Lasiurus cinereus*, I. Rafinesque's big eared bat, *Corynorhinus rafinesquii*. "Stars" indicate county records from this study and "solid circles" indicate previously published county records.

NR female that was likely attracted by the distress calls of a Rafinesque big-eared bat that was being removed at the time resulting in two county records at once.

37) Lonoke Co.—Holland Bottoms WMA 34°51' N 91°56' W, 30 July 2004. Locality same as # 19. One NR and one scrotal male.

38) Monroe Co.—Dagmar WMA 34°51' N 91°14' W, 22 July 2004. Locality same as # 4. Three NR females and one post-lactating female.

39) Poinsett Co.—Earl Buss/Bayou De View WMA 35°33' N 90°53' W, 3 June 2004. Locality same as # 5. Four females, three pregnant adults and one juvenile.

40) Prairie Co.—Wattensaw WMA 34°51' N 91°28' W, 12 July 2004. Locality same as # 15. Single post-lactating female.

41) White Co.—Henry Gray/Hurricane Lake WMA 35°08' N 91°21' W, 9 July 2004. Locality same as #25. Two scrotal males, one NR male, and one post-lactating female.

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Myotis lucifigus

- 42) Clay Co.–Dave Donaldson/Black River WMA 36°16' N 90°39' W, 2 June 2004 Locality same as #1. Three NR females.
- 43) Greene Co.–Lake Ashbaugh 36°11' N 90°46' W, 25 July 2004. 5.9 NW of Deleplaine. Netted along shore of ditch running from the lake. Single NR unknown gender.
- 44) Lawrence Co.–Shirey Bay/Rainey Brake WMA 35°59' N 91°07' W, 11 June 2004. Locality same as #35. One scrotal male and one NR female.

Distributions of bats from previous published accounts and this study are illustrated in Fig. 1. Both *M. austroriparius* and *C. rafinesquii* appear to occur throughout the Delta region (Fig. 1-B and 1-I, respectively) but appear locally abundant seeming to favor tracts of late-successional forests dominated by cypress-tupelo and oak trees. Although often captured together, *M. austroriparius* was captured in nets over standing water more often than *C. rafinesquii*, which was only captured once over water. This is consistent with Menzel and Menzel (2001) suggestion that *C. rafinesquii* forages in more upland areas. Similarly, Mirowsky et al. (2004) found *C. rafinesquii* roosts to be more prevalent in American beech (*Fagus grandifolia*) and oak (*Quercus*), which were more characteristic of upland sites, whereas in contrast, *M. austroriparius* preferred water tupelo (*Nyssa aquatica*) and sweetgum (*L. styraciflua*). The association of *C. rafinesquii* with bottomland habitats is somewhat paradoxical, as their roosts are more often associated with upland tree species. The capture of *L. seminolus* in Crittenden County expands the range of this species in Arkansas, eastward toward the Mississippi River, (Fig. 1-F). Captures of *M. lucifigus* in the northeastern corner of the state (Fig. 1-A) provide evidence for this species on the southern limit of its more northerly range, as it has rarely been reported in southern parts of the state (Sealander and Heidt, 1990).

In this study we targeted *M. austroriparius* and *C. rafinesquii*, and county sampling was completed when these species were captured. As a result of this, non-target bat species may have been overlooked when sampling in the area only consisted of a night or two. Repeated sampling of these areas may have revealed more uncommon species that were overlooked in this study. More intensive sampling in these areas would definitely be worthwhile, since distribution records for non-target species, such as *L. seminolus* and *L. cinereus* are similarly incomplete for the Delta region.

The range of both *M. austroriparius* and *C. rafinesquii* encompass most of the southeastern US, and Arkansas is

situated on the westerly portion of their range, although both species extend into portions of eastern Texas (see Horner, 1995; 1996). The westerly range of these bats mimic the distribution of bottomland hardwood forests in the Southeastern US. However, most research on the natural history and biology of these two bat species have focused on more easterly populations, with less research on the margins of their range. As late-successional forests in the Delta region of Arkansas are becoming increasingly fragmented and separated by large areas of agriculture, the impacts on bat communities could be substantial, thus increased research on these species in this area may aid conservation initiatives. For instance, knowledge of roosting behavior for *M. austroriparius* and *C. rafinesquii* has not been well studied in Arkansas (but see Reed, 2004), and research on roosts of the latter have primarily focused on artificial structures (Tumilson et al., 1992; Saugey et al., 1993). Forest fragmentation and water management may potentially impact specialized bottomland species, such as *M. austroriparius* and thus more research is required on the specialized needs of bats in the bottomland forests of Arkansas, so that suitable management and conservation initiatives can be devised.

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