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Results of a Bat Survey in the Western Ozark National Forest

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Sixteen species of bats are known to occur in Arkansas (Sealander and Heidt, 1990). Most information on distribution of these species is based on scattered site records and cave surveys (Sealander and Young, 1955; Baker and Ward, 1967; Gardner and McDaniel, 1978). Studies on geographic distribution, status, and ecology of endangered bats in Arkansas have been conducted since 1978 (Wilhide et al., 1998). Although bats are commonly studied in caves, investigations of free-ranging bats in the summer also have been studied. In Arkansas such studies have been undertaken primarily in the Sylamore Ranger District of the eastern Ozark National Forest (Wilhide et al., 1998) and various ranger districts of the Ouachita National Forest (Saughey et al., 1989). However, few studies of that type have been conducted in the western Ozarks. Surveys of this northwestern region of Arkansas are needed to determine distribution and abundance of bats. The Ozarks appear to be an important area for biodiversity of bats, and the many caves found throughout the region provide locations for hibernacula, mating colonies, and maternity colonies (Harvey, 1986, 1994).

The study was conducted at two sites in northwestern Arkansas. One site was Whitzen Hollow, which is a small watershed located in the Lee Creek Unit of the Ozark National Forest near the Arkansas-Oklahoma border. Preliminary work in this area by J. D. Wilhide in spring 1999 verified the presence of five species of common bats, and a survey of small caves in the area documented that a small number of Ozark big-eared bats (*Corynorhinus townsendii ingens*) and eastern pipistrelles (*Pipistrellus subflavus*) were using the sites as roosts (J. Briggler and J. Prather, pers. comm.).

The other site was the Wedington Unit of the Ozark National Forest, which is a large forested tract in the northwestern corner of the Boston Mountain Ranger District. It is separated from the main national forest. This unit consists of Lake Wedington, as well as several ponds and streams, all of which should provide ideal habitat for bats. There has been no work done to ascertain the presence of bat species that inhabit this area.

Bats were captured using mist nets (Kunz, 1988; Tuttle, 1976). Netting was conducted 29 April through 19 October 2000. A total of 59 net nights (one net-night equals one mist net opened into the capture position for a netting session) was generated on 45 different dates, with one or two net-

nights per date. Nets were put up before sundown and were taken down at midnight. Twenty-two sites were netted including six streams and 16 ponds. Each site was netted twice, once during early summer (April – July) and once in late summer (August – October). Nets (3 x 6 or 3 x 9 m) were placed across ponds or stream crossings prior to dusk and checked at 10-min. intervals. Actual netting periods varied from 4 to 6 hours depending on the time of sundown. Bats were removed from nets and identified, and sex, reproductive status, length of forearm, and mass were recorded. Bats were banded with a numbered plastic band and released at the site of capture. Ambient temperature was recorded every hour.

During 45 nights of netting, a total of 142 bats was captured, representing eight species in six genera of the family Vespertilionidae. Only one bat, a male *Myotis septentrionalis*, was recaptured. Species caught were: big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), little brown bat (*Myotis lucifugus*), northern long-eared bat (*Myotis septentrionalis*), evening bat (*Nycticeius humeralis*), and the eastern pipistrelle (*Pipistrellus subflavus*). About twice as many bats were captured in Whitzen Hollow as compared to the Wedington Unit (Table 1). Sex ratios for the Wedington Unit were almost equal, whereas almost twice as many males as females were captured at Whitzen Hollow. Whitzen Hollow was a compact area with relatively few water resources, whereas the Wedington Unit was expansive and included many ponds and streams as well as the Illinois River and Lake Wedington. The smaller size of Whitzen Hollow permitted a more adequate sampling of the area. There are many caves there providing a great roosting habitat for bats. Since the Wedington Unit covered a larger area, it was more difficult to sample. Furthermore, most of the ponds there were too large and deep for netting, and because much of the land is privately owned or leased for cattle, many of the ponds and streams were not available for sampling. These differences in sites could explain the dramatic differences in the number of bats netted. Even though it was lacking in numbers of bats, the Wedington Unit supported a greater number of species than Whitzen Hollow (Table 1). Of the species captured, the big brown bat was the only species not found in the Wedington Unit. Three species, the hoary bat, the silver-haired bat, and the little brown bat, were lacking in the Whitzen Hollow sample. The most com-

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Table 1. Bats captured in the Wedington Unit and Whitzen Hollow study areas.

Species	<u>Wedington Unit</u>			<u>Whitzen Hollow</u>		
	Male	Female	Total	Male	Female	Total
Eastern Pipistrelle	8	5	13	10	0	10
Evening Bat	5	3	8	18	8	26
Eastern Red Bat	7	4	11	11	10	21
Big Brown Bat	0	0	0	5	1	6
Northern Long-eared Bat	1	6	7	14	15	29
Little Brown Bat	3	5	8	0	0	0
Hoary Bat	1	0	1	0	0	0
Silver-haired Bat	0	1	1	0	0	0
Grand Total	25	24	49	58	34	92

Table 2. Seasonal trends in species distribution between sites.

Species	<u>April - July</u>		<u>August - October</u>	
	Whitzen	Wedington	Whitzen	Wedington
Eastern Pipistrelle	8	4	2	9
Evening Bat	19	4	7	4
Eastern Red Bat	19	6	3	3
Big Brown Bat	5	0	1	0
Northern Long-eared Bat	6	5	23	2
Little Brown Bat	0	2	0	6
Hoary Bat	0	1	0	0
Silver-haired Bat	1	0	0	0
Grand Total	57	23	36	24

mon species found in the Wedington Unit were, in order of abundance, the eastern pipistrelle, the eastern red bat, the evening bat, and the little brown bat (Table 1). The most common species found in Whitzen Hollow were the northern long-eared bat, the evening bat, and the eastern red bat.

The Shannon Diversity Index, (H'), (Cox, 1996) was used to measure heterogeneity at both study areas analyzing differences based on time of year. Results showed that the Wedington Unit had a greater diversity of species in both the early ($H' = 1.03$) and late ($H' = 0.75$) parts of the season

as compared to Whitzen Hollow, with the greatest diversity being earlier in the year. This trend was not the same for species diversity in Whitzen Hollow with the greater diversity there being later in the season ($H' = 0.58$), rather than earlier ($H' = 0.51$). This phenomenon might be explained by noting that two species (the hoary bat and the silver-haired bat) were caught only early in the season (Table 2), which would influence the diversity calculations. Overall, the Wedington Unit had more than twice the number of species ($H' = 1.06$) compared to Whitzen Hollow ($H' =$

Table 3. Seasonal trends and habitat use by bats in the western Ozarks.

Species	April - July					August - October				
	Pond	Stream	Male	Female	Total	Pond	Stream	Male	Female	Total
Eastern Pipistrelle Bat	4	8	11	1	12	4	7	7	4	11
Evening Bat	19	4	15	8	23	9	2	8	3	11
Eastern Red Bat	17	8	12	13	25	5	2	6	1	7
Big Brown Bat	5	0	5	0	5	1	0	0	1	1
Northern Long-eared Bat	10	1	3	8	11	24	1	12	13	25
Little Brown Bat	1	1	1	1	2	0	6	2	4	6
Hoary Bat	1	0	1	0	1	0	0	0	0	0
Silver-haired Bat	1	0	0	1	1	0	0	0	0	0
Grand total	58	22	48	32	80	43	18	35	26	61

0.43). This contrasts with the population finding (Table 1) which reflects higher numbers of bats in Whitzzen Hollow suggesting a large population with few species whereas the Wedington Unit appears to support a small population of many species. Evenness, (J'), too, was calculated (Pielou, 1969) yielding almost equal values for overall evenness in both the Wedington Unit ($J' = 0.38$) and Whitzzen Hollow ($J' = 0.36$). However, there were differences between sites as well as seasonal differences within sites. The Wedington Unit had higher evenness values for both the early ($J' = 0.54$) and late ($J' = 0.53$) seasons than did Whitzzen Hollow. While the evenness values for the Wedington Unit were almost equal for both seasons, the values for Whitzzen Hollow varied between season with the greatest value later ($J' = 0.32$) as compared to earlier ($J' = 0.27$). Other important seasonal differences are sex ratio and habitat differences between seasons. More males than females were caught at both sites. Pond habitat had higher use during both seasons than streams due to more netting at ponds than streams. It is interesting to note, however, that certain species such as the eastern pipistrelle and little brown bat were captured over streams, whereas evening bats, eastern red bats, northern long-eared bats, and big brown bats all were captured over ponds (Table 3). Seasonal trends between sites show that Whitzzen Hollow had more activity than the Wedington Unit early in the season, but activity was much closer to the same in both sites in the latter part of the year (Table 2).

To summarize, this study is the first extensive bat survey conducted in the western part of the Ozark National Forest. Therefore, it represents a pioneer baseline study since the Arkansas literature on bats is lacking on published studies of this kind for comparison. It is important to conduct such a survey to document the species of bats present in an area. This study shows that a variety of bats inhabit the Wedington Unit and Whitzzen Hollow areas.

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