FINAL REPORT

SECTION 6

ENDANGERED SPECIES ACT

FEDERAL AID PROJECT E-3

BIOLOGY OF THREATENED AND ENDANGERED SPECIES IN OKLAHOMA

STUDY 3 - MANAGEMENT OF THE ENDANGERED OZARK BIG-EARED BAT: CONTINUED CAVE SEARCHES AND COLONY MONITORING

APRIL 1, 1991 - MARCH 31, 1993

FINAL REPORT

STATE: **Oklahoma** PROJECT NUMBER: **E-3**

PROJECT TITLE: Biology of Threatened and Endangered Species in Oklahoma

JOB NUMBER: **3**

JOB TITLE: **Management of the endangered Ozark big-eared bat: continued cave searches and colony monitoring**

PERIOD COVERED: 1 April 1991-31 March 1993

ABSTRACT

In summers 1991 and 1992, we continued (1) searches for caves used by the endangered Ozark big-eared bat (*Plecotus townsendii ingens*) and (2) monitoring of extant colonies that began in the mid-1980s. Field work was conducted in the Boston Mountains of northeastern Oklahoma (Adair and Delaware counties) and northwestern Arkansas (Crawford, Madison, Newton, and Washington counties). Over 800 hours were spent searching for caves, interviewing landowners, *etc.* in 1991 and 1992. Six new caves and 3 talus cracks occupied by Ozark big-eared bats were located, and 9 new caves were identified that had evidence of recent bat use. One of the new caves (CW-2385 in Arkansas) was used both as a summer day roost and a hibernaculum. None of the new roost sites contained >18 Ozark big-eared bats, and most contained <3 bats. The great majority of the known population of Ozark big-eared bats still depends on only 5 caves in northeastern Oklahoma. Summer and winter colony counts since 1986 are presented and suggest a persistent decrease in the sizes of known maternity colonies from 1990 to 1992 (*i.e.,* overall decrease of 38%). The decrease of the maternity colony at AD-13 is particularly troubling; it has decreased 68% from 1989 to 1992. Despite our efforts, we still do not know where the majority of the population of Ozark big-eared bats hibernates. Cave searches need to be intensified, and colony counts need to be continued to ensure protection of known colonies and to enhance recovery efforts.

I. OBJECTIVE NUMBER: 3

Search for additional caves used by the endangered Ozark big-eared bat (*Plecotus townsendii ingens*) in Oklahoma and Arkansas and continue to monitor sizes of colonies during summer and winter in caves that are traditionally used by this species.

II. INTRODUCTION

The Ozark big-eared bat was federally listed as an endangered species in 1979 (Bagley 1984). This non-migratory insectivore currently uses only a handful of caves as maternity roosts and/or hibernacula in northeastern Oklahoma and northwestern Arkansas (Clark et al. 1991). The subspecies is endangered because of its highly restricted distribution, dependence on a small number of known caves (Clark et al. 1991), small known population size, and susceptibility to human disturbance (Humphrey and Kunz 1976, Kunz and Martin 1982, Bagley 1984).

Recently completed studies have focused on (1) ecological aspects of the life history of the Ozark big-eared bat (*e.g.,* habitat use, food habits and prey availability, and activity patterns of females during the maternity season) (Clark 1991, Clark et al. 1993) and (2) landscape characteristics around used and unused caves (Clark et al. 1991). Ozark big-eared bats do not migrate, but they do move seasonally among limestone caves within their extant range. Extensive searches in northeastern Oklahoma have identified only 5 caves that receive regular use: 3 maternity caves, 1 hibernaculum, and 1 cave used as both a maternity roost and a hibernaculum. This study represented a continuation of ongoing efforts by the Oklahoma Department of Wildlife Conservation and the U.S. Fish and Wildlife Service to locate and protect additional caves important to the endangered Ozark big-eared bat.

III. STUDY AREA

This study was conducted in the Boston Mountains of northeastern Oklahoma and northwestern Arkansas. These mountains consist of about 1,300 km^2 of the southwestern corner of the Ozark Mountains. The Boston Mountains are thought to en-

compass the entire range of the Ozark big-eared bat. Numerous limestone caves, talus slopes, and bluffs throughout these mountains provide roosting sites for a variety of bat species, including 2 other endangered species (Gray bat [*Myotis grisescens*] and Indiana bat [*Myotis sodalis*]).

Upland vegetation of the Boston Mountains is dominated by blackjack oak (*Quercus marilandica*), post oak (*Q. stellata*), winged elm (*Ulmus alata*), and black hickory (*Carya buckleyi*). Eastern redcedar (*Juniperus virginianus*), winged elm, and various oaks dominate shallow soils on exposed limestone bluffs. On north facing-slopes, white oak (*Q. alba*), redbud (*Cercis canadensis*), chinquapin oak (*Q. muhlenbergii*), and sugar maple (*Acer saccharum*) are common.

IV. METHODS

Cave Searches.--We used 2 approaches to locate new caves used by the Ozark big-eared bat. First, we attemped to identify and then locate on the ground caves already known from information in museum records and to cavers and landowners. In some cases, landowners provided valuable insight on cave locations and even history of bat use. We reviewed museum records at area colleges and universities to provide information on possible cave locations (primarily for Arkansas).

Second, we identified cave-producing geological horizons in a particular area and conducted systematic searches on foot for caves in such horizons. After we located caves and/or talus cracks, they were entered (if possible) and examined for bat use. Caves that were difficult or impossible to examine in their entirety but had indications of bat use (*i.e.,* guano and/or insect remains; moth wings are particularly indicative of *Plecotus* use) were viewed with a night vision scope (Ni-Tec, Model NVS-100 in 1991 and Star-Tron, Model MK 426 in 1992) to observe emergence flights and identify Ozark big-eared bats.

Colony Monitoring.--June maternity counts in 1991 and 1992 were conducted through a night vision scope from dusk until emergence ended. Images were enhanced by placing wheat lamps, with infrared gels (Kodak, Wratten 87) over the lenses, around each maternity cave entrance. Hibernacula counts were made by 1-2 observers who

entered each cave briefly in late December to either directly count single bats and small clusters, or estimate bat numbers by assessing cluster dimensions (we assumed 150 bats/1 ft^2). If any Ozark big-eared bats were flying when observers entered a hibernaculum, the observers would leave immediately to minimize further disturbance; this no doubt has resulted in some incomplete counts. Sampling procedures followed those used by the U.S. Fish and Wildlife Service since 1986 (Clark 1991, Clark et al. 1991).

V. RESULTS AND DISCUSSION

Cave Searches.--Over 800 hours (*i.e.,* 100 8-hour person-days) were spent searching for new caves, interviewing landowners, *etc.* in 1991 and 1992. Cave searches were conducted in Adair and Delaware counties, Oklahoma, and Crawford, Madison, Newton, and Washington counties, Arkansas, during summers 1991 and 1992. None of the new roost sites contained >18 Ozark big-eared bats and most contained <3 bats (Table 1). Locations that were searched are identified in yellow for 1991 and green for 1992 on the USGS maps submitted under separate cover.

In 1991, 4 new caves (Oklahoma, AD-221 and Blue Moon; Arkansas, WA-3301 and WA-3233) and 2 new talus crack areas (Oklahoma, Sequoyah Talus; Arkansas, WA-62R1) were occupied by Ozark big-eared bats (Table 1). Site WA-3301 was used as a hibernaculum prior to 1991 and also seemed to serve as a transient night roost during summer 1991, perhaps for individual males. In addition, numerous talus cracks at Devil's Den State Park, Arkansas, were searched, and several of them contained Ozark big-eared bats (Table 1). Ozark big-eared bats have historically used Devil's Den. Seven sites (Arkansas, MD-8515, NW-5334, WA-3237, WA-3238, WA-4901, WA-4903, and the Quail Valley talus area [within Devil's Den State Park]) were identified as possible use sites for Ozark big-eared bats (Table 1), because of the presence of scattered guano and insect remains (typically moth wings).

In 1992, Ozark big-eared bats were found at only 2 new sites (Table 1). Both caves (WA-3243 and CW-2385) served as day roosts in summer; CW-2385 also served as a hibernaculum. Three sites (MD-5402, NW-53T1, and WA-5101) contained insect remains and scattered guano that suggested use by the Ozark big-eared bat.

Colony Monitoring.--Summer and winter colony counts at maternity roosts and hibernacula have been conducted with the same methodology since 1986 (Table 2). It is troubling that total counts of Ozark big-eared bats at maternity caves have continued to decrease from their high in 1990 (Table 2). Maternity counts in 1992 (n = 523-527) decreased about 16% from 1991 (595-653) and 38% from 1990 (852). There appears to have been a consistent decrease in the size of maternity colonies at AD-13, AD-17/18, and noteably AD-125 (Table 2).

Maternity colony AD-125 experienced an apparent decline of 46% from 1991 to 1992. The 1992 maternity count at AD-125 was conducted on 24 June, and a mist net sample at AD-125 on 26 June contained 2 adult females that had lactated and 2 young-of-the-year. Given that young were volant on 26 June, it is possible that the maternity colony at AD-125 had begun to break-up by the 1992 count date of 24 June and that individuals from the maternity colony had dispersed and were missed during the count. It is noteworthy that 38 Ozark big-eared bats were counted at AD-14 about 1.3 km south of AD-125. This cave is not known as a maternity roost but may be important after break-up of the maternity colony at AD-125.

The continued decline of Ozark big-eared bats in the maternity colony in AD-13 is puzzling and warrants further investigation. Upland forest clearing in this area has increased and may be having a negative effect on the suitability of AD-13 as a maternity roost. Numbers of bats using AD-13 have declined 68% from their peak in 1989 (n = 148) to their lowest level in 1992 (46-50).

Counts of Ozark big-eared bats at hibernacula have always been difficult. Some movement may occur between hibernacula (Clark 1991, Clark et al. 1991). Because of potential negative impacts of arousal during hibernation, clusters of hibernating bats have not been approached if any activity (*e.g.,* flying bats) has been apparent while entering the hibernaculum. For example, it is unlikely that a complete count of hibernating bats at AD-10 has been made since 1987 because either bats were active or evidence of human disturbance by unknown individuals was present. Because of the disturbance necessary to view the hibernating cluster, a complete count of bats at AD-125 has only been attempted in 1987. It is likely that AD-125 remains 1 of the 2

known primary hibernacula of the Ozark big-eared bat. Numbers of bats at AD-3 reached a low in 1991 but increased to their highest level in 1992 (Table 2).

Regardless of the variation in caves such as AD-3, it is clear that we have not located all of the hibernating Ozark big-eared bats. Assuming that (1) the sex ratio is 1:1 and (2) most individuals counted at maternity colonies are adult females (523-527 in 1992), the hibernating population should be at least 1,046-1,054 bats. We counted only 318 hibernating Ozark big-eared bats in 1992 (Table 2). A few other hibernacula are known in Arkansas (CW-2385, 9 bats in winter 1992; WA-3301, 1 bat; Devil's Den, 63 bats), but they do not account for the great majority of missing bats. Clearly, searches for hibernacula should be a high priority for future field investigations.

VI. MANAGEMENT RECOMMENDATIONS

1. Because the extant population of Ozark big-eared bats is restricted to so few caves and we lack knowledge of all hibernacula, it is critical that additional cave searches be conducted. Searching for new caves is time comsuming and of low reward, but discoveries of important caves will enhance recovery efforts. AD-125 was confirmed as a hibernaculum and maternity roost in 1987, and its discovery significantly increased the known population of Ozark big-eared bats (Table 2).

2. Colony monitoring should continue each summer and winter to establish long-term trends in population levels and cave use. Although several important maternity colonies appear to be decreasing (*i.e.,* AD-13, AD-17/18, and AD-125), it is unclear whether or not these represent actual losses to the extant population, use of unknown caves, or vagaries in census methodology (*e.g.,* timing of counts relative to break-up of the matenity colony).

3. Recovery efforts and consistency of data collection, use, security, and storage would be greatly enhanced if the Oklahoma Bat Caves National Wildlife Refuge was fully funded and staffed, as encouraged 2 years ago by a special task force of the U.S. Fish and Wildlife Service (Swanson 1991). Additionally, funds have not been available to adequately address basic research needed to improve our understanding of

bat life history, habitat needs, contaminant issues, *etc.* and thus to improve changes of recovery of this critically endangered species.

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Table 1. New caves and talus cracks that contained Ozark big-eared bats or their sign located during summers 1991 and 1992.

State	County	Cave No./ Name	Date Visited	No. of Plecotus	Description of Use
NEW CAVES WITH PLECOTUS					
Oklahoma	Adair	AD-221	12/23/91	3	Hibernaculum
			12/28/92	0	--
	Cherokee	Blue Moon	7/5/91	1	Day Roost
			7/16/91	1	Night Roost
Arkansas	Crawford	CW-2385	7/31/92	1	Day Roost
			12/28/92	9	Hibernaculum
	Washington	WA-3233	6/14/91	1	Day Roost
	Washington	WA-3301	6/28/91	1	Night Roost
			12/29/92	1	Hibernaculum
	Washington	WA-3243	7/28/92	1	Day Roost
TALUS CRACKS WITH PLECOTUS					
Oklahoma	Sequoyah	Talus	7/3/91	1	Day Roost
Arkansas	Washington	WA-62R1	6/12/91	1	Day Roost
	Washington	Devil's Den	7/11/91	3	Numerous Cracks; Day
			7/30/91	2	Roosts
			12/27/91	18	Hibernaculum[a]
CAVES WITH PLECOTUS SIGN[b]					
Arkansas	Madison	MD-8515	8/2/91	-	Insect Remains + Guano
	Madison	MD-5402	8/3/92	-	Insect Remains + Guano
	Newton	NW-5346	7/25/91	-	Insect Remains + Guano
	Newton	NW-53T1	8/6/92	-	
	Washington	WA-4901	7/15/91	-	Insect Remains + Guano
	Washington	WA-4903	7/15/91	-	Insect Remains + Guano
	Washington	WA-3237	7/29/91	-	Insect Remains + Guano
	Washington	WA-3238	7/29/91	-	Insect Remains + Guano
	Washington	WA-5101	6/17/92	-	Insect Remains + Guano

[a]These talus cracks also contained 37 endangered Indiana bat (Myotis sodalis).

[b]Moth wings are indicative of Ozark big-eared bat use.

Table 2. Annual maternity and winter estimates of Ozark big-eared bats, 1986-1992.

	Caves					
Year	AD-3[a]	AD-10	AD-13	AD-17/18	AD-125	Total
MATERNITY						
1986	-	262	103	76	-	441
1987	-	220	109	125	260	714
1988	-	226	110	75	169	580
1989	-	239	148	175	276	838
1990	-	274	137	132	309	852
1991	-	220	58-64[b]	107	210-262[b]	595-653
1992	-	231	46-50[b]	119	127	523-527
WINTER						
1986	242	12	-	-	-	254
1987	268	68	0	0	247[c]	583
1988	235	-	-	-	-	235
1989	242	1	1	-	-	244
1990	289	-	-	0	-	289
1991	182	0	-	0	1[d]	183
1992	316	2[e]	-	0	-	318

[a]Access to AD-3 has been denied by landowner during summer months.
[b]Two counts were conducted on separate nights.
[c]Ozark big-eared bats were first discovered in AD-125 in 1987; winter counts were discontinued to prevent disturbance.
[d]Hibernating cluster was not approached to avoid disturbance; there were likely considerably more bats in AD-125 in winter 1991.
[e]Bats were flying in the lower part of the pit; observers did not descend further to minimize disturbance.