

# OZARK BIG-EARED BAT

## REVISED RECOVERY PLAN



**U.S. Fish and Wildlife Service**

**March 1995**

# OZARK BIG-EARED BAT

Plecotus townsendii ingens (Handley)

## REVISED RECOVERY PLAN

February 1995  
(Originally Approved: May 8, 1984)

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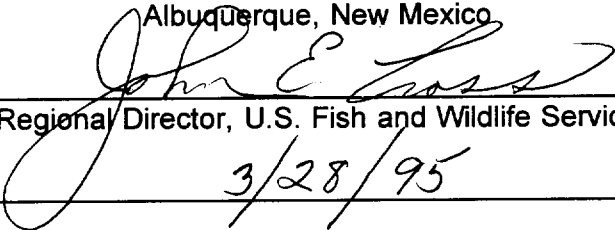
for

Region 2  
U.S. Fish and Wildlife Service  
Albuquerque, New Mexico

Approved:

  
Acting Regional Director, U.S. Fish and Wildlife Service

Date:

  
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## DISCLAIMER PAGE

Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, and sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. Recovery plans represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

This revised recovery plan was essentially completed when the Secretary of Interior's policy initiatives regarding public participation in recovery plan preparation and implementation was announced on July 1, 1994. The Notice of Opportunity for Public Review and Comment for this revised recovery plan was published in the Federal Register on September 21, 1993. Although there has been considerable communications with the public, experts on the species, and affected agencies, the implementation schedule has not been expanded to include a participation plan as envisioned by the new policy initiatives. As implementation continues, the U.S. Fish and Wildlife Service will work with affected stakeholders to ensure recovery proceeds in a manner that minimizes the social and economic costs to the affected publics while recovery is achieved. Future revisions will incorporate a participation plan.

Literature Citations should read as follows:

U.S. Fish and Wildlife Service. 1995. Ozark Big-Eared Bat (*Plecotus townsendii ingens* [Handley]) Revised Recovery Plan. Tulsa, OK 51pp.

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Fish and Wildlife Reference Service  
5480 Grosvenor Lane 110  
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## EXECUTIVE SUMMARY

**Species Current Status:** The Federally listed endangered Ozark big-eared bat's original range included eastern Oklahoma, northwestern and north-central Arkansas, and southwestern Missouri. It is no longer known to occur in Missouri. There are ten known caves in Oklahoma and four in Arkansas considered essential to the Ozark big-eared bat's continuing existence. The present population is estimated to be 1,600 to 2,300 bats.

**Habitat Requirements and Limiting Factors:** The Ozark big-eared bat is associated with caves and cliffs in Ozark forests. Maternity caves and hibernacula occur in diverse areas, from large blocks of forest to small forest tracts interspersed with open areas. Maternity colonies are in cooler portions of caves from mid-April to late July. Solitary males usually occur in caves, talus cracks, and cliff overhangs during summer. Both sexes hibernate at cold locations in cold caves during winter months. The Ozark big-eared bat is endangered because of its small population size, reduced distribution, and vulnerability to human disturbance. The major threats are human disturbance at maternity and hibernation sites, and loss of habitat.

**Recovery Objective:** Delisting

**Recovery Criteria: Upgrading to Threatened:** The Ozark big-eared bat may be upgraded to threatened status when: (1) stable or increasing populations exist at all 14 essential caves, plus all other essential caves discovered during the 10-year period addressed in this recovery plan and (2) the Oklahoma Bat Caves National Wildlife Refuge is operational with authority, funds, and manpower to (a) enhance management of Refuge caves and properties, (b) construct cave gates and fences where needed, (c) monitor populations, (d) deter human disturbance through law enforcement, (e) implement cave management agreements with private landowners, and (f) coordinate recovery efforts on an ecosystem basis across State and Fish and Wildlife Service regional boundaries.

**Upgrading Actions Needed:**

1. Search for and identify additional maternity caves and hibernacula.
2. Acquire essential caves and foraging habitat in fee or easement.
3. Enhance management of caves owned or administered by the U.S. Fish and Wildlife Service.
4. Enhance management of caves owned by conservation organizations and States.
5. Develop landowner agreements to protect caves and foraging habitat on private land.
6. Construct, regularly inspect, and maintain cave gates, fences, and signs where needed.
7. Monitor the population in summer and winter to determine if management efforts are effective.
8. Develop landowner and public support by an information/education program.

**Delisting:** Interim criteria for delisting the Ozark big-eared bat are: (1) protect all limited use sites; (2) reestablish stable or increasing populations at all available historic caves in Oklahoma, Arkansas, and Missouri; (3) determine self sustaining population level in order to define delisting criteria; and (4) provide long-term protection for the Ozark big-eared bat after delisting.

**Delisting Actions Needed:**

1. Search for and identify limited use caves and structures.
2. Protect by acquisition, easements, landowner agreements, fencing, and/or gating known limited use sites.
3. Map essential caves to identify their extent and overlying land use.
4. Determine a self sustaining population level by conducting a population viability analysis.
5. Monitor contaminants to identify problems.
6. Reestablish stable or increasing populations at all available historic caves in Oklahoma, Arkansas, and Missouri.
7. Provide long-term protection after delisting.

The Revised Recovery Plan presents an ecosystem approach to recovering the Ozark big-eared bat. Not only will tasks presented in the plan benefit the Ozark big-eared bat, but they will protect a number of other Ozark cave and surface fish and wildlife resources. Delisting criteria are interim because the opportunity and potential locations for reestablishing additional populations are uncertain. Final delisting criteria can be developed once all essential caves in the three State area are identified and the self sustaining population level determined.

**Date of Upgrading:** 2005

**Date of Delisting:** A delisting date cannot be accurately determined at this time.

**Estimated Cost for Upgrading to Threatened and Delisting (\$1,000's):**

Year	Upgrading Needs								Delisting Needs								
	1	2	3	4	5	6	7	8	Total	1	2	3	4	5	6	7*	Total
1996	2	116	127	42	5	9	2	4	307	2	20	2	20	25	140		209
1997	2	116	127	42	5	9	2	4	307	2	20	2	20	25	140		209
1998	2	116	118	42	5	9	2	4	298	2	20	2	10	25	50		109
1999	2	116	102	42	5	9	2	4	282	2	20	2		25	45		94
2000	2	20	85	42	5	9	2	4	169	2	20	2			38		62
2001	2	20	85	42	5	9	2	4	169	2	20				38		60
2002	2	20	85	42	5	9	2	4	169	2	20				38		60
2003	2	20	85	42	5	9	2	4	169	2	20				38		60
2004	2	20	85	42	5	9	2	4	169	2	20				38		60
2005	2	20	85	42	5	9	2	4	169	2	20				38		60
<b>Total</b>	20	584	984	420	50	90	20	40	2,208	20	200	10	50	100	603		983

**Total Cost for Upgrading: \$2,208,000    Total Additional Cost for Delisting: \$983,000**

Costs will be revised when delisting date is determined or before year 2005.

\* \$85,000/yr. continued funding for the Oklahoma Bat Caves National Wildlife refuge after delisting.

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## PART I. INTRODUCTION

On November 30, 1979 the Ozark big-eared bat (*Plecotus townsendii ingens* [Handley]) and Virginia big-eared bat (*P. t. virginianus*) were listed as endangered under the Endangered Species Act of 1973, as amended (Federal Register, Vol. 44, No. 232, Friday, November 30, 1979). Both subspecies originally were included in the same recovery plan published on May 8, 1984 (Bagley 1984). Considerable progress has been made on recovery tasks for the Ozark big-eared bat since 1984. In order to update biological information and management techniques and identify important new recovery tasks, the original recovery plan has been revised to specifically address the Ozark big-eared bat. A separate plan for the Virginia big-eared bat is being prepared. This Revised Recovery Plan presents an ecosystem approach to recovering the Ozark big-eared bat. Not only will tasks presented in the plan benefit the Ozark big-eared bat, but they will protect a number of other Ozark cave and surface fish and wildlife resources.

### A. Description

The Ozark big-eared bat was first described on December 4, 1950 from Hewlitt Cave in Arkansas (Handley 1959). It is a medium-sized bat: total length 90-116 millimeters (mm); tail 35-54 mm; foot 8-13 mm; ear 30-39 mm; forearm 39-48mm; wingspan 295-325 mm; weight 7-13 g; and 36 teeth (Handley 1959; Harvey et al. 1981). Females are usually slightly larger than males. Just prior to hibernation Wethington (1994) found several females exceeding the weight 7-13g range and weighing as much as 15.25 g. The difference may reflect built up fat reserves. The ears of both sexes are large compared to most other bats of similar size (Figure 1) and connected across the forehead. The ears are often curled when the bats are at rest or torpid, resembling ram horns. Two large mitten shaped lumps are found along the side of the snout and the nostril openings are elongated. Body coloration is most often reddish brown, with tan underparts, but can vary from pale brown to nearly black. Immature bats are darker than adults. Hair on the foot does not extend beyond the toes. The tragus is relatively long and broad. The upper incisor frequently has two cusps, whereas other *P. townsendii* subspecies only have one cusp (Handley 1959).

Besides the Ozark and Virginia big-eared bats, three other subspecies have been described. They include *P. t. townsendii*, *P. t. pallescens*, and *P. t. australis*. *P. t. pallescens*, and *P. t. australis* are not Federally listed as endangered or threatened, but *P. t. townsendii* is a category 2 candidate species being considered for possible listing. The Ozark big-eared bat is the largest and reddest of the five subspecies. It can be distinguished from *P. t. pallescens*, the only geographically adjacent subspecies, by its darker and redder coloration, larger average size, relatively more robust molariform teeth, and more frequent development of a secondary cusp on the first upper incisor (Handley, 1959).

The Ozark big-eared bat also resembles the eastern big-eared bat (*P. rafinesquii*). They can be distinguished most easily by hair color. The Ozark big-eared bat has tan underparts and brown dorsal fur in contrast to the whitish underparts and the gray dorsal fur of the eastern big-eared bat (Barbour and Davis, 1969). Also, long hairs on the feet extend beyond the toes in the eastern big-eared bat. In addition, the Ozark big-eared bat seems to be more docile than the eastern big-eared bat (Dalton pers. comm. 1993).

### B. Distribution/Abundance

The Townsend's big-eared bat (*P. townsendii*) has a relatively wide distribution. *P. t. townsendii*, *P. t. pallescens*, and *P. t. australis*, occur along the west coast and throughout much of western North America from British Columbia, Idaho, southern Montana and the Black



**Figure 1. Ozark big-eared bat (Plecotus townsendii ingens)  
(by Brenda and Bryon Clark)**



Hills of South Dakota, south across western Texas through Mexico to Oaxaca and east to the edge of the Edwards Plateau. *P. t. australis* does not occur in the United States, except for possibly a few individuals along the Mexican border (Dalton pers. comm. 1993). Isolated populations of *P. t. pallescens* are found in the gypsum cave region of Kansas, northern Oklahoma and Texas. The other Federally endangered subspecies, the Virginia big-eared bat (*P. t. virginianus*), is found in the eastern United States (Kunz and Martin 1982). The historic range of the Ozark big-eared bat (Figure 2) includes eastern Oklahoma, northwestern and north-central Arkansas, and southwestern Missouri (Harvey 1992). However, Ozark big-eared bats are no longer known to occur in Missouri (Figg and Lister 1989). The known present distribution and counties where Ozark big-eared bats could possibly be found are shown in Figure 3.

**Oklahoma** There are ten known caves in Adair and Delaware counties, Oklahoma, considered essential to the continuing existence of the Ozark big-eared bat (Table 1). Of these:

- o AD-13<sup>1</sup>, AD-17, AD-18, AD-24 are solely maternity caves,
- o AD-10 is a maternity cave and minor hibernaculum,
- o AD-125 is a maternity cave and major hibernaculum,
- o AD-3 serves as a major hibernaculum,
- o AD-14 is a very large cave, with historic Ozark big-eared bat use, serving as a possible alternative site for AD-125,
- o AD-15 is a hibernaculum and gray bat roost site,
- o AD-16 is a transient roost site used by large numbers of males and females in the spring and fall.

Puckette (pers. comm.) found 38 caves in Oklahoma, that receive limited use or are used as transient roosts (Table 1) He also found signs of Ozark big-eared bat use, such as scattered guano and moth wings, in five additional caves, indicating that they are possible-use sites. The definitions of the terms essential caves, limited-use sites, transient roosts, and possible-use sites are summarized as follows:

- o **Essential caves** - Caves that are essential to the continuing existence of the Ozark big-eared bat because they are used as maternity sites and/or hibernacula. Some large or otherwise important transient roosts sites may be included this category.
- o **Limited-use sites** - Sites used by single individuals and small groups of Ozark big-eared bats.
- o **Transient roosts** - Sites that are infrequently used by relatively large numbers of Ozark big-eared bats between periods of colony formation and hibernation.
- o **Possible-use sites** - Sites with signs of Ozark big-eared bat use, such as scattered guano and moth wings.

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<sup>1</sup> Cave names are coded, to safeguard their locations, as follows: AD -Adair County, Oklahoma; CZ - Cherokee County, Oklahoma; DL - Delaware County, Oklahoma; CW - Crawford County, Arkansas; MR - Marion County, Arkansas; WA - Washington County, Arkansas

Table 1. Essential Ozark big-eared bat caves and caves with limited, transient, and possible Ozark big-eared bat use.

<u>OKLAHOMA CAVES</u>			
<u>Essential caves</u>			
AD-3	AD-14	AD-17	AD-125
AD-10	AD-15	AD-18	
AD-13	AD-16	AD-24	
<u>Limited-use and transient caves</u>			
AD-12	AD-53	AD-95	AD-188
AD-19*	AD-54	AD-110	AD-199
AD-21	AD-57	AD-111	AD-206
AD-22	AD-65	AD-118	AD-211
AD-29	AD-69	AD-134	AD-215
AD-30	AD-76	AD-142	AD-221
AD-41	AD-87	AD-145*	CZ-19
AD-42	AD-89	AD-164	CZ-35
AD-49	AD-92	AD-167	DL-4
AD-50	AD-93	AD-186	DL-21
<u>Possible-use caves</u>			
AD-127	AD-150*	AD-153	AD-205
CZ-18	AD-152		
<u>ARKANSAS CAVES</u>			
<u>Essential caves</u>			
MR-0702	MR-9702	MR-979A	Devil's Den
<u>Limited-use and transient caves</u>			
CW-2309	CW-2365	MR-FWS2**	WA-3233
CW-2318	CW-2367	MR-FWS3**	WA-3243
CW-2337	CW-2385	WA-3103	WA-3301
CW-2339	MR-FWS1**	WA-3203	WA-3302
			WA-4903
<u>Possible-use caves</u>			
CW-2306	CW-2379	WA-3215	WA-4214
CW-2311	CW-2388	WA-3237	WA-4215
CW-2373	WA-3209	WA-3238	WA-4901

\* Identified by Wethington (pers. comm.)

\*\* Identified by Harvey (pers. comm.)

The remainder identified by Puckette (pers, comm.)

Figure 2. Historic and Present Ozark Big-Eared Bat Distribution

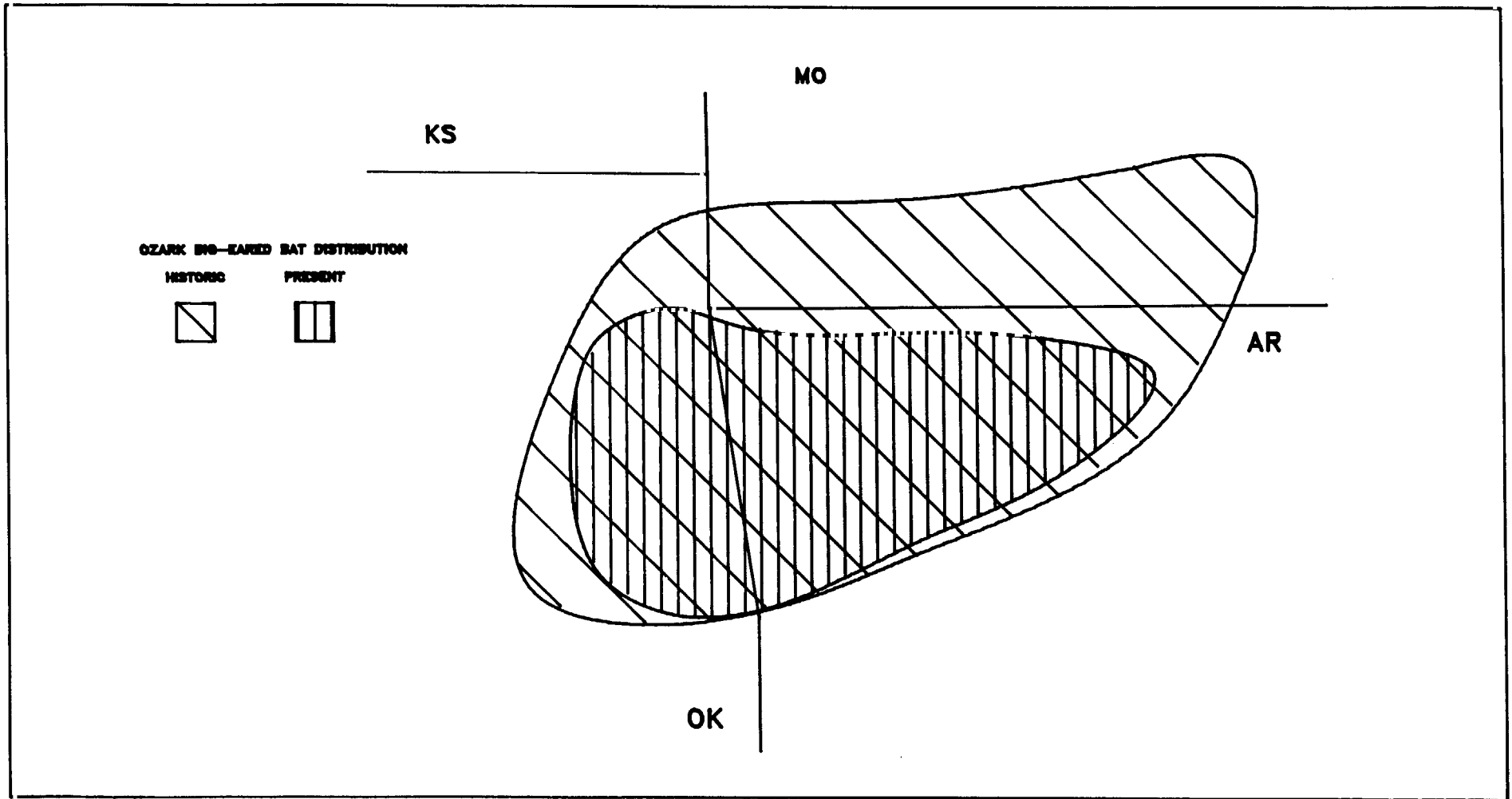
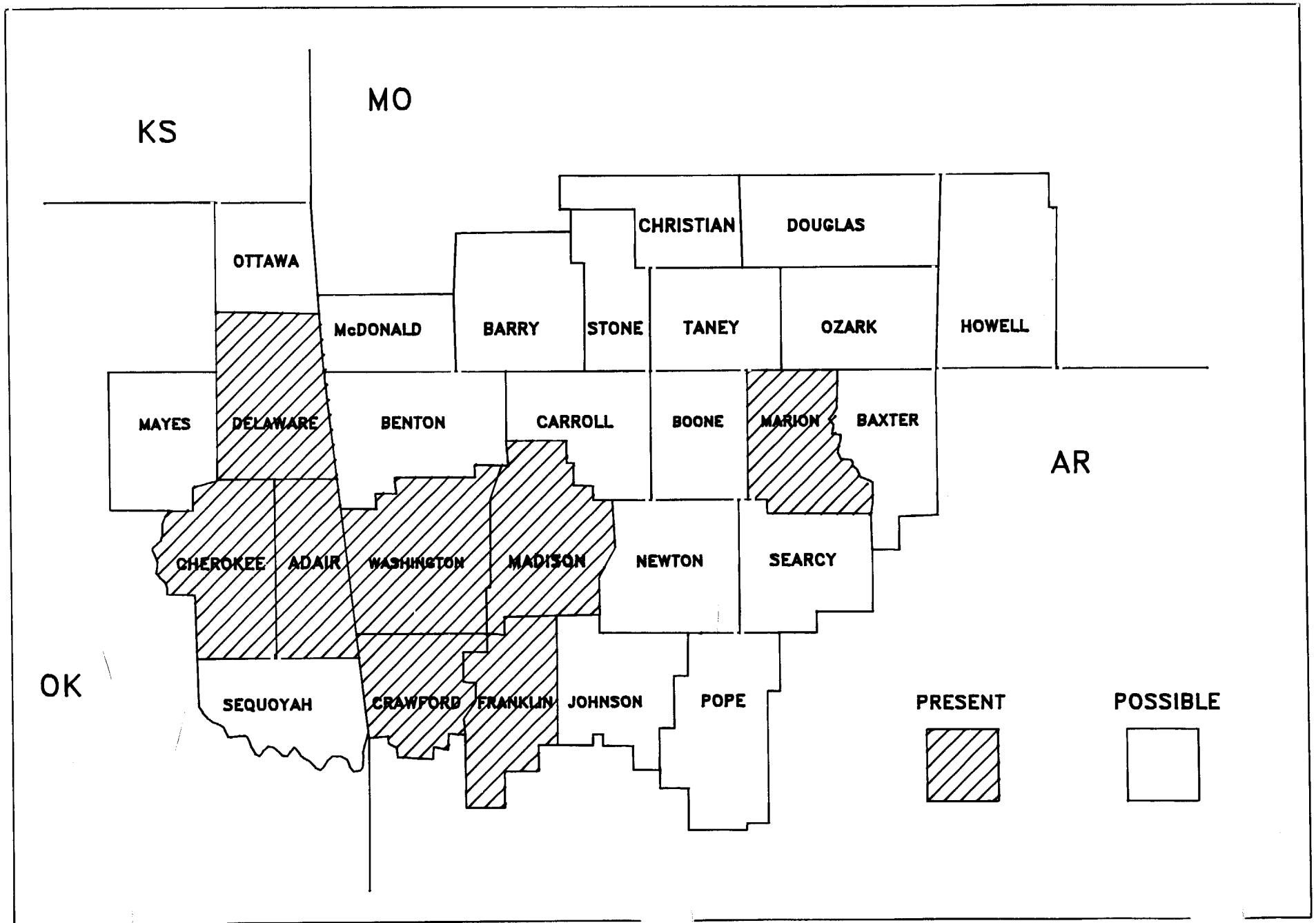


Figure 3. Present and Possible Ozark Big-Eared Bat Distribution



Limited use sites, transient roosts, and possible use sites may be important in:

- o Providing habitat for solitary males during maternity season.
- o Indicating the presence of maternity/hibernaculum sites in the area for the researcher.
- o Providing sites for fall/spring population movements before and after maternity season.
- o Providing locations so interaction/movement between different populations can occur therefore improving genetic diversity.
- o Providing future sites should populations growth occur.

During Wethington's (1994) telemetry study, she identified two additional limited-use caves and one possible-use cave, also included in Table 1. Numerous other caves have been identified in Adair and Delaware counties that may serve, or have served as summer/winter roost sites, but few are presently known to be used by Ozark big-eared bats. There are historic reports of Ozark big-eared bats from three caves in Cherokee County and one cave in Sequoyah County.

Between 1986 and 1994, the Ozark big-eared bat maternity populations at both AD-10 and AD-125 averaged around 210 to 240 bats annually. The population at AD-10 has remained fairly constant, but AD-125's maternity population dropped to only 42 in 1993 but was up to 157 in 1994. AD-125 is an extremely important hibernaculum, but the bats usually roost in an inaccessible area of the cave, preventing them from being regularly censused. The hole into the chamber where the Ozark big-eared bats hibernate is about 1 foot long and 6 inches high, too small for a human to enter. When AD-125 was discovered in 1987, surveyors tunneled into the chamber, and found 247 hibernating Ozark big-eared bats. The chamber was resealed and has not been reentered, to prevent disturbance to the roost. During subsequent years, the bats could be heard and some individuals could be seen through the small hole; however, the entire colony was not visible. Also, Bryon Clark (pers. comm.) saw about 130 Ozark big-eared bats during the winter, in an accessible outer chamber. At AD-13 the maternity population, that may alternate between AD-24, averaged 121 bats from 1986 to 1990, but has dropped to only about 50 over the past 3 years. The maternity population at AD-17 and AD-18 moved between the two caves, fluctuated between 71 and 175, and averaged 109 bats from 1986 through 1994. The hibernating population at AD-3 has been relatively constant, averaging around 262 bats; however, the number of bats dropped to a low of 182 in 1991 then increased to 316 in 1992 and a high of 323 in 1993.

During 1990, Clark (1991) counted 852 Ozark big-eared bats, mainly females, emerging from four known Oklahoma maternity caves. Because these were mostly females, there were a number of males uncounted. Assuming that there was an equal number of males, the total Oklahoma population in 1990 was estimated to be less than 1,700. Since 1990, Oklahoma population estimates based on similar maternity counts have declined to about 800 in 1991 and increased to about 1,300 in 1994. These changes in numbers may be due to movement among caves (some of which may be unknown) and not an actual decrease in bat numbers.

Arkansas In Arkansas, only four essential caves are presently known to be regularly inhabited by Ozark big-eared bats: a maternity cave (MR-9702); a possible alternate maternity cave (MR-

979A); and two hibernacula (MR-0702 and Devil's Den State Park). All are in Marion and Washington counties. Puckette (pers. comm.) found 14 limited-use caves and 12 possible-use caves in Crawford and Washington counties, and Harvey (pers. comm.) reported three other limited-use caves in the Marion County and verified several of the caves identified by Puckette in Washington County (Table 1).

MR-9702 had a population of 99 individuals when surveyed on May 22-23, 1983, but dropped to 48 in 1987. This cave has experienced human disturbance and was gated in 1989. The Ozark big-eared bat population at MR-9702 has now increased to 302 (Harvey pers. comm. 1993), probably as a result of the gating. Another nearby cave (MR-979A) may serve as an alternate maternity site. Numbers of Ozark big-eared bats have fluctuated from zero in 1987 up to 100 in 1990, down to 10 in 1991, back up to 185 in 1992, and down again to zero in 1993 (Harvey pers. comm. 1993). This fluctuation could be the result of movement among caves. At one time, MR-0702 housed the largest hibernating colony of Ozark big-eared bats known to exist. During 1978-1981, this colony numbered up to 420 individuals (Harvey et al. 1981), but in 1993 only 120 were counted (Harvey pers. comm. 1994). Since Harvey (1975) first found a hibernating colony in Devil's Den State Park (Washington County) in 1974, the number of bats in this cave has fluctuated from 60 to 2. In 1993, 43 Ozark big-eared bats were found hibernating in Devil's Den. A fifth cave, a hibernaculum, appears to have been abandoned in recent years.

Prior to the 1992 summer maternity counts, Harvey (1992) estimated the Arkansas population to be about 260 individuals. Since the 1993 maternity colony population was estimated to be 302 Ozark big-eared bats, mainly females (Harvey pers. comm. 1993), and assuming an equal number of males, the Arkansas population is estimated to be over 600 bats. Recent findings of single bats in caves and talus cracks in western Arkansas (Puckette pers. comm. 1994), suggest other unknown essential caves in that area.

With the Oklahoma Ozark big-eared bat population estimated to be 1,000 to 1,700 bats and Arkansas's population about 600, the total population is estimated to be from 1,600 to 2,300. The result of emergent counts from known essential Ozark big-eared bat maternity caves and hibernacula surveys over the past several years are shown in Table 2. These numbers are summarized graphically in Figures 4 and 5. The inability to regularly survey the hibernating population at AD-125 since 1987 can be seen in the results presented in Figure 5.

### C. Habitat/Ecosystem

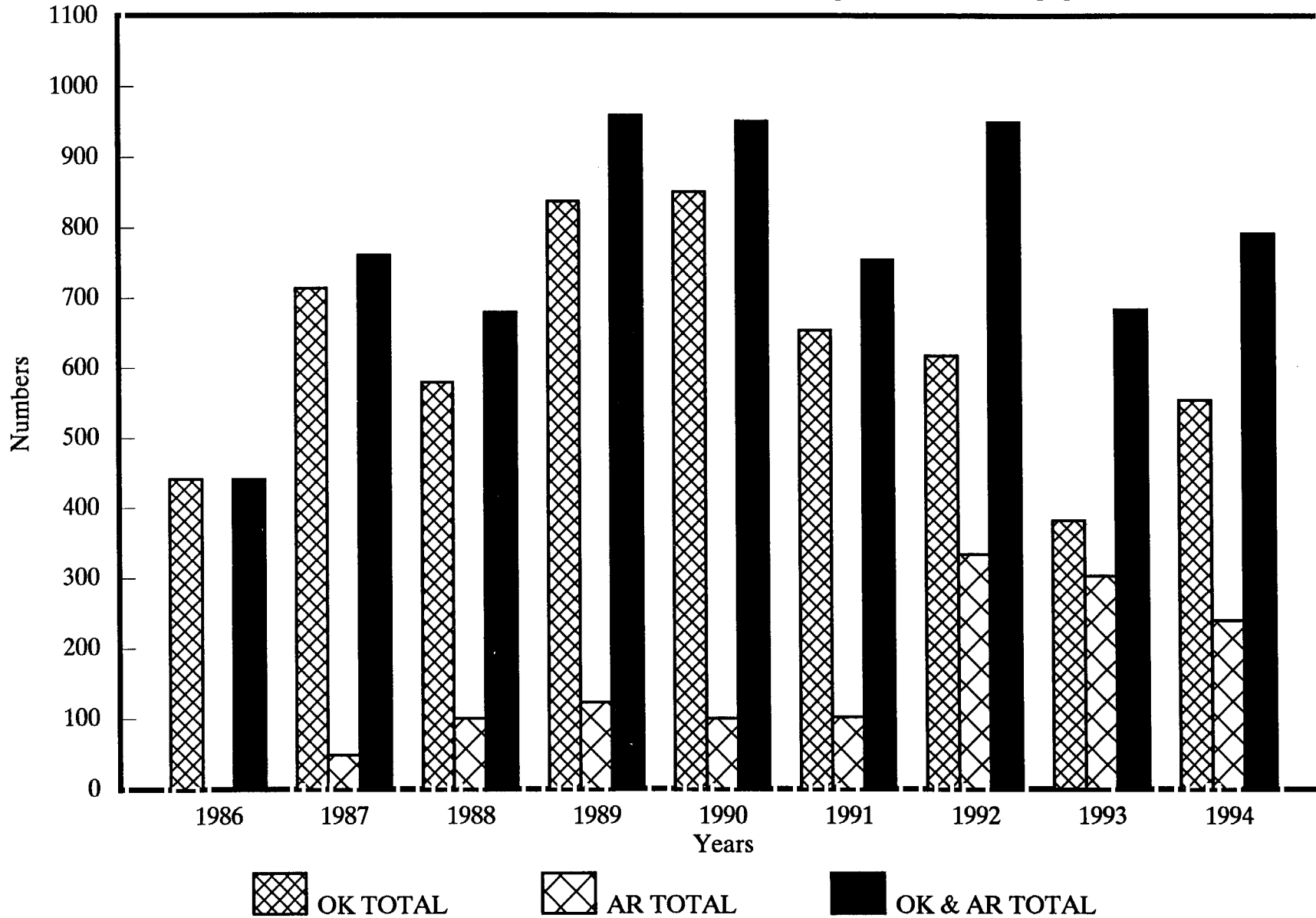
The Ozark big-eared bat is generally associated with caves, cliffs, and rock ledges in well drained, oak-hickory Ozark forests. Maternity caves and hibernacula occur in a number of different surroundings, from large continuous blocks of forest, to smaller forest tracts interspersed with open areas. Clark et al. (1993) found that adult female Ozark big-eared bats from maternity colonies preferred to forage along woodland edges. By foraging along woodland edges the bats may benefit from a less cluttered environment, but cover is nearby and prey densities are high. Wethington (1994) did not show female preference of any habitat type after maternity colony breakup and concluded habitat use was likely determined by prey distribution. Clark et al. (1991) found no significant differences in surrounding land-use patterns, (such as buildings, cropfields, rangeland, oak-pine forests, oak-hickory forest, and water) between occupied maternity caves and hibernacula and unoccupied caves. Possible reasons for not being able to distinguish

Table 2. Results of Annual Ozark Big-Eared Bat Summer Maternity Colony Emergent Counts and Winter Hibernacula Surveys. (Not all sites were surveyed each year so this is not a true representation of the population level.)

YEAR	OKLAHOMA CAVES					ARKANSAS CAVES						
	AD-3	AD-10	AD-13/24	AD-17/18	AD-125	OK Total	MR-9702	MR-0702	Dev-11's Den	MR-979a	AR Total	OK & AR Total
<b>Summer Maternity Colony Emergent Counts</b>												
1986		262	103	76		441						441
1987		220	109	125	260	714	48				48	762
1988		226	110	75	169	580	60		40		100	680
1989		239	148	175	276	838	82		40		122	960
1990		274	137	132	309	852			100		100	952
1991		220	65	107	262	654	91		10		101	755
1992		231	50	119	217	617	148		185		333	950
1993		190	44	105	42	381	302		0		302	683
1994		275	50	71	157	553	154	20	65		239	792
<b>Winter Hibernacula Survey</b>												
1974-75									60		60	60
1978									35		35	35
1979-81							420		4		424	424
1986	242	12				254	145		45		190	444
1987	268	68	0	0	247	583	200		60		260	843
1988	235					235			5		5	240
1989	242	1	1			244		140	8		148	392
1990	289			0		289		160	19		179	468
1991	182	0		0	1	183		140	39		179	362
1992	316	2				318		150	63		213	531
1993	323	0	0	0	12	335		120	43		163	498
1994	230	1	0	0	0	231						

# Figure 4. Ozark big-eared bat summer counts

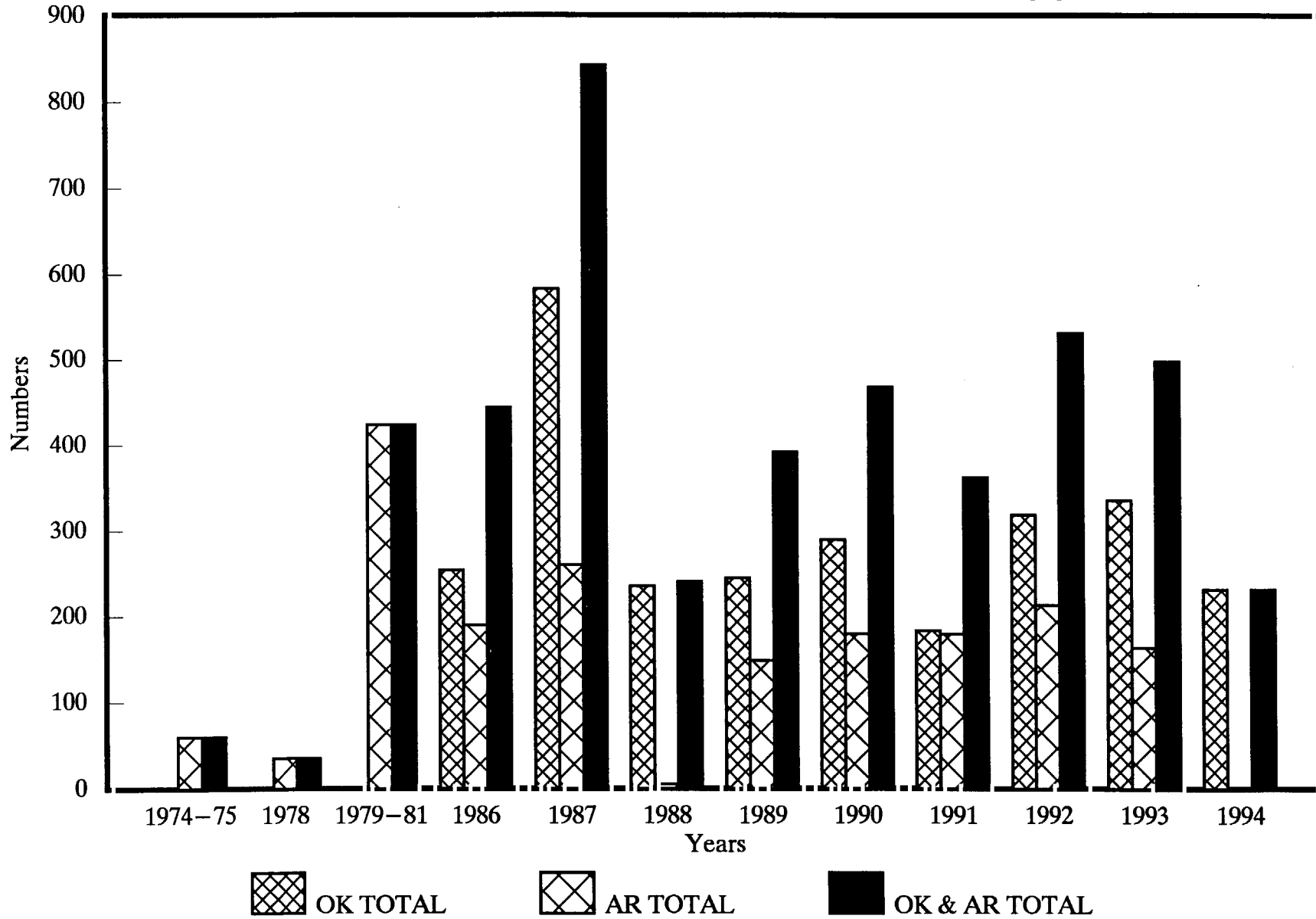
Not all sites were surveyed each year so this is not a true representation of the population level.





# Figure 5. Ozark big-eared bat winter counts

Not all sites were surveyed each year so this is not a true representation of the population level.



between occupied and unoccupied caves, based on macrohabitat characteristics, are:

- o The scale of the analysis was insufficient,
- o Vegetation surrounding cave entrances may be more important than land-use,
- o Not all suitable caves are being used due to the small population, or
- o Cave use may be influenced more by internal than external parameters.

Wethington (1994) re-evaluated land-use patterns surrounding occupied and unoccupied caves using a finer resolution of data than that of Clark et al. (1991) and was still unable to ascertain differences. Wethington (1994) also evaluated the vegetational structure of the habitat immediately surrounding used, sporadically used, and unused caves finding few differences between cave classes for the vegetative parameters measured.

Clark et al. (1991) found that Ozark big-eared bats selected specific microsites in caves, apparently in response to temperature. During summer, maternity colonies were located in areas with cooler temperatures than those temperatures found at random points in the caves or near solitary individuals. This is unusual because most cave bats prefer sites where heat is easily trapped. Previous disturbance also may have affected their site selection. Solitary bats usually occurred near cave entrances at microsites with warmer temperatures than those at random points in the caves. Hibernating clusters of Ozark big-eared bats were found in the coldest caves and at the coldest locations in those caves during winter months. Relative humidity was not correlated to patterns of cave use by bats during summer or winter.

According to Puckette (pers. comm. 1994), in the Ozark National Forest area of Washington, Crawford, and Franklin Counties of Arkansas, the Ozark big-eared bat has been found in both limestone and sandstone habitat. In Crawford and Washington Counties, both the Pitkin Formation and limestones within the Hale Formation (Prairie Grove Member) have caves used by the Ozark big-eared bat. Most of the caves are short and many contain multiple entrances. Entrance size and configuration are extremely variable, therefore any enterable entrance should be checked for use by Ozark big-eared bats. Sandstone within the Atoka Formation produce usable habitat in Crawford, Franklin, and Washington Counties, Arkansas as well as Adair County, Oklahoma. Talus sites also occur in the Weddington Sandstone Member of the Fayetteville Formation near the Lake Weddington area in Washington County, Arkansas. The thicker ledge forming layers are usually involved. Other factors such as the inclination of the layers and amount of topographic relief are factors in the formation of talus. The Ozark big-eared bats use sites that are nothing more than a pile of large sandstone slabs with a partially darkened area under them. Because of this, deep valley areas with multiple sandstone benches potentially could produce sites at several elevations therefore increasing the complexity of site searches.

Puckette (pers. comm. 1994) found that the occurrence of guano associated with insect remains (moth wings) at locations within a site is the best and most consistent indicator of Ozark big-eared bat use of a cave. It is important to identify guano associated with the moth remains because birds (Phoebe) and mice will also leave moth remains in cave entrances. The season also is important. In summer, most all sites used by Ozark big-eared bats have signs or bat presents. In winter, the bats only will be present in the cold air trap sites suitable for hibernation.

#### D. Life History/Ecology

Ozark big-eared bats do not migrate and banded bats have seldom been recovered more than 32 km (20 miles) from the banding site (Harvey 1992). Like a number of other bats, Ozark big-eared bats generally return year after year to the same maternity site and hibernaculum.

Build-up of maternity colonies varies between years, typically occurring from late April to early June (Clark 1991). Solitary males have been found during the maternity period, but little is known about the summer habitat of males. Clark (1991) observed individual males in various caves, talus cracks, and cliff overhangs during the summer, autumn, and occasionally winter. Both sexes sometimes use the same summer roost although not usually clustering together. It was thought that Ozark big-eared bats prefer an area with dim light near the zone of total darkness in a cave, but maternity colonies and some hibernating clusters have been found some distance from the entrance in total darkness. Not all individuals go into daily torpor and human disturbance may cause the entire group to move to a remote location or to abandon the cave entirely.

Ozark big-eared bats mate from autumn into winter, with females mating their first autumn. Sperm is stored during winter, and fertilization occurs shortly after arousal from hibernation. A single young, weighing nearly 1/4 as much as its mother, is born in June. The young can fly in 14 to 21 days and are weaned by six weeks. Based on band recovery, maximum life span is about 16 years (Harvey 1992).

Ozark big-eared bats emerge from their cave later in the day than most bats, usually after dark (Harvey 1992). Clark et al. (1993) found that they begin to depart an average of 45 minutes after sunset, with the departure not affected by brightness of the sky (Clark 1991). During Clark's (1991) study, the bats circled inside the cave entrance prior to sunset, coming closer to the entrance as the amount of light decreased. Bats flying near the cave entrance flew in and out several times before leaving, but once one left, three or four others soon followed. Another subspecies (*P. t. pallescens*), as well as other species of cave bats, exhibit a light sampling behavior as evening approaches. They fly to the entrance, turn back into the cave, and then hang for a few minutes before sampling the light again (Twente 1955). Because of their late departure, big-eared bats are rarely seen foraging in the evening, even in areas where they are relatively common (Barbour and Davis 1969). Although most return before midnight, bats may leave and return throughout the night (Harvey 1992). Shifts in foraging activity of females at maternity sites, as reflected by Clark's (1991) emergence/return data, appear to be related to parturition and lactation (Clark et al. 1993). During May, bats left the cave after sunset to forage and did not return until sunrise. After colony formation in early June, activity became bimodal, attributed to near-term or postpartum females. By the second week in June, activity was trimodal, continuing for about three weeks during early lactation. During early July, activity shifted back to bimodal for around two weeks and after mid-July, the bats again left at sunset with some not returning until sunrise.

Ozark big-eared bats appear to forage mainly on moths, primarily near trees. Based on an analysis of fecal pellets, Clark (1991) found that although lepidopterans comprised only 21.5 percent of the available prey (63.7 percent of available prey  $\geq$  5mm), they occurred in more than 90 percent of the pellets and accounted for more than 85 percent of the volume of prey consumed. Clark (1991) also discovered that edge habitat, between forested and open areas, appeared to be the preferred foraging area. Forested habitat provides cover for both bats and

moths. Open areas allow for easy foraging because bats are not obstructed by branches while pursuing prey and are able to discriminate insects at greater distances. However, open areas provide no structural protection from predators. As the maternity period progressed, the average foraging distance from the cave increased, probably due to fewer trips back to the cave to nurse the young (Clark et al. 1993). During early lactation, the median distance to the center of foraging areas was 1.0 km, increasing to 1.9 km in mid-lactation, and to 4.2 km by late lactation. The maximum foraging distance from caves was 7.3 km.

Wethington (1994) found that after maternity colony breakup and prior to hibernation females used smaller foraging areas and traveled shorter distances to foraging sites than females studied during maternity season (Clark 1991). In addition, Wethington (1994) found no differences in foraging areas size or distance traveled to foraging sites between males and females. However, differences in these foraging parameters may exist between males and females during the maternity season, when the energy demands on the females are the greatest.

The Ozark big-eared bat hibernates in locations with moderate to high humidity (60-97 percent) (Clark 1991; Clark et al. 1991) and relatively cold temperatures of 13° C (56° F) or less but generally above freezing (Clark 1991, Harvey 1992). Clark (1991) found hibernating bats in both twilight areas and in total darkness some distance from cave entrances. If temperatures near entrances become too extreme, bats moved to more thermally stable parts of the cave and to other caves. Ozark big-eared bats usually hibernate in tight clusters of up to a hundred or more individuals (Harvey et al. 1981), but they have been found hibernating singly and in small groups (Clark et al. 1991). Sex ratios from Arkansas hibernacula indicate that there are about an equal number of males and females (Harvey et al. 1981). During hibernation, the long ears may be erect or coiled. When disturbed the bat is alerted and the ears become erect. If approached too closely or a light shone on the cluster for more than a few seconds, the entire group is likely to take flight.

Clark (1991) found that Ozark big-eared bats awaken throughout the winter and move among caves. Some bats were active, emerging from one hibernaculum 14 of 15 nights surveyed, with most winter activity confined to the first two hours after sunset. On December 22, 1987, Clark (1991) estimated that 268 torpid bats were present in a hibernaculum, and 40 bats (14.9 percent of the bats present) emerged that night. When external ambient temperatures were below freezing, more bats entered the cave than left. When temperatures were above freezing, bats were observed leaving the cave and did not return prior to morning. Breakup of hibernating clusters was gradual and incomplete, as several males were found in the hibernaculum during the summer (Clark 1991).

#### E. Reason for Listing/Threats

The Ozark big-eared bat was listed as endangered because of its small population size, reduced distribution, and vulnerability to human disturbance. Habitat loss and increased human disturbance at maternity caves and hibernacula are likely causes of its decline (Harvey 1975, Humphrey and Kunz 1976). Predation, reduced food supply, and disease may have some effect, but human disturbance at maternity and hibernation sites remains the major concern. A large segment of the population is concentrated in a small number of maternity caves during spring and summer and hibernacula during winter, making the Ozark big-eared bat very susceptible to

disturbance. Disturbance has increased in recent years due to growing interest in cave-related research and sport spelunking. The vulnerability of big-eared bats is increased further by their habit of congregating near cave entrances, their apparent low tolerance to disturbance, and their exotic appearance, which makes them targets of collection and intensive observation.

Any disturbance of Ozark big-eared bat roosts is harmful. However, disturbance of maternity colonies during April and May risks the abandonment of the sites. Disturbance later in the maternity season (June, July and early August) results in the additional risk of a high mortality of the young bats. Even a single disturbance, from late May through mid-July at maternity caves is especially detrimental, because flightless young are on the roosts and many may be dropped by their mothers or abandoned and die. Therefore, any disturbance of a maternity cave should be avoided between the first of April and the middle of August. Disturbance of hibernacula should be avoided from mid-August through April. During August and September, the hibernacula are forming and disturbance may discourage the site's use. In April hibernacula are breaking up, but bats still may be present. Each disturbance of hibernating bats may cause them to arouse partially or completely from hibernation. A limited number of arousals is natural but each episode uses stored energy that cannot be replaced before spring emergence.

A number of cave adapted bat species seem to be abandoning more caves each year, apparently as a result of the ever-increasing human disturbance as spelunking becomes more popular (Barbour and Davis 1969). Graham (1966) suggested that Townsend's big-eared bats abandoned six maternity roosts in California due to human disturbance. He chronicled the shifting of one colony to ever more inaccessible regions of the cave until the cave was finally abandoned. Humphrey and Kunz (1976) had similar experiences with colonies of P. t. pallescens in northern Oklahoma and Kansas. They commented: "Clearly handling and simply the presence of people cause this subspecies to desert preferred roosts as well as alternate roosts. It is unknown whether reduction results from direct loss of embryos or young, delayed development followed by failure to overwinter or failure of females to occupy the nursery the next year. Whatever the mechanism, nursery populations decline after disturbance and do not recover in the following year."

There has been a loss of Ozark big-eared bat caves and forested foraging habitat due to residential, agricultural, and timber development and reservoir and right-of-way construction. The potential for additional habitat loss is rapidly increasing because of ongoing and predicted future human population growth in the Ozarks. Over the last 10 years, the area has grown at nearly twice the national average, with continued growth predicted for the future (Howard Needles Tammen & Bergendoff et al. 1991). The population of Adair and Delaware counties, Oklahoma, and Crawford and Washington counties, Arkansas, has increased an average of 2.3% or by 37,300 people since 1982. This growth will probably result in increased human disturbance in essential caves, due to more people in the area and the cave locations becoming less remote.

Probable predators on Ozark big-eared bats include raccoons, bobcats, house cats, skunks, owls, and snakes. There is too little information available on predation, disease, and reduced food supply to determine their significance as limiting factors. With industrial and agricultural operations expanding throughout Ozark big-eared bat habitat, contaminants, especially waste and pesticides associated with chicken houses and other agricultural activities, may have an effect on the bats' continuing existence. The only known evaluation of the effects of contaminants on Ozark big-eared bats is an initial study of contaminants in guano by Martin

(1992). This study indicated that Oklahoma bats are being exposed to a variety of environmental contaminants but chronic exposure was not identified.

#### F. Conservation Measures

The objective of the 1984 Recovery Plan was to prevent the extinction of the Ozark big-eared bat. At that time, recovery was not addressed. Since 1984, substantial progress has been made on a number of the tasks presented in the Plan. This progress has been in the areas of research, land and easement acquisition, and landowner agreements to protect caves on private land. The following is a summary of efforts since 1984, by the various cooperating organizations and agencies involved in recovery efforts for the Ozark big-eared bat.

Oklahoma Cave Team The Oklahoma Cave Team was established to coordinate cave research, protection, and management among individual cave specialists from different organizations and agencies in Oklahoma and adjacent States. The team includes representatives from the Central Oklahoma Grotto, Tulsa Regional Oklahoma Grotto, The Nature Conservancy, Oklahoma Natural Heritage Inventory, Oklahoma Department of Wildlife Conservation, Rogers State College, University of Central Oklahoma, Northeastern State University, Southeastern Oklahoma State University, Oklahoma State University, University of Arkansas, U.S. Forest Service, and U.S. Fish and Wildlife Service. Research, protection, and management efforts for the Ozark big-eared bat have been suggested by and coordinated with this team at its yearly meetings.

Oklahoma and Arkansas Nature Conservancy New acquisitions, protection, and management strategies are being coordinated with the Oklahoma and Arkansas Chapters of The Nature Conservancy. The Oklahoma Nature Conservancy has been instrumental in preservation of important caves in eastern Oklahoma. They have:

- o Acquired land containing caves on Gittin Down Mountain.
- o Actively pursued other acquisitions including two additional essential Ozark big-eared bat caves (AD-14 and AD-125) in Adair County, Oklahoma.
- o Registered approximately 900 acres in 4 tracts under the State of Oklahoma Natural Area Registry Program. These tracts, adjacent to and near the Oklahoma Bat Caves National Wildlife Refuge, provide important cave and foraging habitat for Ozark big-eared bats and gray bats.

The Arkansas Nature Conservancy has a cooperative management agreement with the landowner of the major Ozark big-eared bat maternity cave (MR-9702) in Marion County, Arkansas. This cave was recently gated through a combined effort of the Arkansas Nature Conservancy, Arkansas Game and Fish Commission, and U.S. Fish and Wildlife Service. The Arkansas Natural Heritage Commission, a State agency, has registered the cave. Registered tracts are voluntarily protected by private landowners for the benefit of bats and other cave species. The landowners have agreed to notify the Oklahoma or Arkansas Nature Conservancy prior to any land use or ownership changes.

National Speleological Society Important caves in Adair County have recently been donated by

a private landowner to the National Speleological Society. There is a nationwide memorandum of agreement between the National Speleological Society and the Fish and Wildlife Service concerning cave protection and management. This agreement should be used to coordinate Ozark big-eared bat recovery activities with the National Speleological Society and representatives of local grottos.

Arkansas Game and Fish Commission, Arkansas Department of Parks and Tourism, and Arkansas Natural Heritage Commission These agencies have been instrumental in protecting essential Ozark big-eared bat caves in Arkansas. Two hibernacula (MR-0702 and Devil's Den State Park) are owned by the State. They have coordinated their protection efforts with the Arkansas Nature Conservancy and the Fish and Wildlife Service's Jackson, Mississippi Endangered Species Office and the Oklahoma Ecological Services Field Office.

Oklahoma Department of Wildlife Conservation The Oklahoma Department of Wildlife Conservation has coordinated Ozark big-eared bat projects cooperatively funded through Section 6 of the Endangered Species Act. These projects have been conducted by the Cooperative Fish and Wildlife Research Unit at Oklahoma State University (Clark et al. 1991, Puckette 1991, Puckette and Leslie 1993, Wethington 1994) and by Northeastern State University (Grigsby 1992). The objectives of the projects were to:

- o Search for essential maternity caves and hibernacula and monitor population trends and management effectiveness.
- o Investigate influence of cave characteristics and surrounding land-use patterns on cave use.
- o Use telemetry to identify movement and habitat preference between maternity colony break up and hibernation.
- o Develop and implement cave protection plans and landowner agreements, including fencing and cave gating, for essential caves on private land.

U.S. Fish and Wildlife Service The Oklahoma Ecological Services Field Office is responsible for coordinating all recovery efforts for the Ozark big-eared bat. This includes recovery efforts conducted by conservation organizations; the States of Arkansas, Oklahoma, and Missouri; and the Fish and Wildlife Service's Regions 2, 3, and 4. The Fish and Wildlife Service, through the Oklahoma Ecological Services Field Office, has:

- o Funded the Oklahoma Cooperative Fish and Wildlife Research Unit to study seasonal changes in roost use, nightly activity patterns, and food habits of Ozark big-eared bats at maternity colonies and hibernacula (Clark 1991).
- o Coordinated projects with the Oklahoma Department of Wildlife Conservation, cooperatively funded through Section 6 of the Endangered Species Act, to search for essential Ozark big-eared bat caves, monitor population levels, evaluate habitat preferences, and develop plans with landowners to protect essential caves on private land.

- o Assisted with the transfer of 255 acres, containing caves and foraging habitat, from the Farmers Home Administration to the Oklahoma Bat Caves National Wildlife Refuge.
- o Initiated a preliminary study of contaminant levels in endangered bats and guano to develop a baseline and identify possible problems.
- o Revised the Ozark Big-Eared Bat Recovery Plan, with the assistance of species experts.
- o Assisted the Oklahoma Nature Conservancy in acquiring an essential Ozark big-eared bat maternity cave and hibernaculum and adjacent foraging area.

and is currently:

- o Consulting with Federal agencies on Federal funded or permitted projects to avoid adverse impacts on the Ozark big-eared bat.
- o Administering a 3-year contract to monitor populations and search for essential Ozark big-eared bat caves in eastern Oklahoma and western Arkansas.
- o Assisting the Fish and Wildlife Service's Realty Division in identifying and acquiring caves and foraging areas essential to the Ozark big-eared bat's continuing existence.
- o Working with the Oklahoma Bat Caves National Wildlife Refuge to implement tasks presented in the Ozark Big-Eared Bat Revised Recovery Plan.

Research conducted by the Cooperative Fish and Wildlife Research Unit at Oklahoma State University has obtained information on the distribution, abundance, life history, and ecology of the Ozark big-eared bat. The following is a brief summary of the areas where research provided additional information:

- o Dr. Brenda Clark's study (Clark 1991; Clark et al. 1993) of summer maternity caves identified female Ozark big-eared bat's:
  - Foraging distance of up to 7 km from the maternity cave
  - Preference for forest edges as foraging habitat
  - Food preference for moths
  - Changes in nightly foraging activity attributed to development of the young bats
- o Dr. Bryon Clark's study (Clark et al. 1991) found:
  - Ozark big-eared bats selected roost sites in maternity caves and hibernacula based on temperature, with humidity having no apparent effect
  - No difference in surrounding land use between used and non-used caves
  - Frequent movement among hibernacula during winter
- o Ms. Traci Wethington's study (1994) found:
  - Females used smaller foraging areas and traveled shorter distances to foraging



- sites after maternity season
  - Females use habitats in proportion to availability after maternity season
  - No differences in foraging area size and distance traveled to foraging areas between males and females
  - Little difference in the vegetational structure of the habitat surrounding used, sporadically used, and unused caves
  - No difference in surrounding land-use between used and unused caves (using a finer resolution of data than that of Clark et al. 1991)
  - Found 2 limited-use, and 1 possible-use Ozark big-eared bat caves in Oklahoma.
- o Mr. Bill Puckette has:
- Found 10 essential, 38 limited-use, and 5 possible-use Ozark big-eared bat caves in Oklahoma and 13 limited-use and 12 possible-use caves in Arkansas.
  - Monitored the Ozark big-eared bat population for the past 7 years and identified population trends.
  - Assisted in gate design and construction.
  - Provided management recommendations.

The Oklahoma Bat Caves National Wildlife Refuge was established in 1985, by the Fish and Wildlife Service, to protect the endangered Ozark big-eared bat and gray bat and their habitat. The Oklahoma Bat Caves National Wildlife Refuge consists of 7 tracts of land totalling 865 acres. All 7 areas, whether in fee ownership, a management easement, or management agreement with a private landowner, are under management and law enforcement authority of the Oklahoma Bat Caves National Wildlife Refuge. These areas are summarized as follows:

- o Three areas in fee title
  - 90 acres including AD-10
  - 130 acres adjoining the Oklahoma Nature Conservancy land
  - 255 acres recently transferred from the Farmers Home Administration, also adjoining the Oklahoma Nature Conservancy land
- o Two areas in purchased management easements
  - 90 acres with AD-7 from the Oklahoma Nature Conservancy.
  - 60 acres with AD-18 from a private landowner.
- o Two areas in management agreements with landowners
  - 130 acres containing DL-3 and DL-4 with the City of Tulsa
  - 120 acres surrounding AD-10 with the Cherokee Nation

The easements with Oklahoma Nature Conservancy (AD-7) and the private landowner (AD-18) and the management agreement with the City of Tulsa (DL-3/4) allow the Fish and Wildlife Service to:

- o Access the property for the purpose of administration, law enforcement, research, and inspection.
- o Control access by constructing signs, gates, fences, or other structures where needed.
- o Mark boundaries as protected area.
- o Modify land surface and habitat with the approval of the landowner.
- o Approve alteration of topography or vegetation; construction of roads, trails, buildings, fences, or other structures; and monitor application of insecticide, herbicide, or other chemicals.

The agreement with the Cherokee Nation is not as binding and can be terminated with a 30-day written notice by either party. It is still considered part of the Oklahoma Bat Caves National Wildlife Refuge and allows the Fish and Wildlife Service to:

- o Access the property for administration, protection of wildlife, law enforcement, research, and inspection.
- o Construct signs, gates, fences, or other structures where needed to control access.
- o Maintain the road right-of-way.

Management recommendations have been developed as part of an Action Plan for the Oklahoma Bat Caves National Wildlife Refuge (Swanson 1991) and are provided in Appendix I. The Refuge has started a public outreach program by developing an informational brochure and display used during presentations to schools and organizations to inform the public of the importance of cave resources. A name change has been suggested for the Refuge, to one encompassing the entire Ozarks, such as the Ozark Caves National Wildlife Refuge or Ozark National Wildlife Refuge. With the number of other Federally listed caves species in the Ozarks, such a central management authority would benefit a number of species.

#### G. Strategy of Recovery

The most important factor in assuring the continuing existence, upgrading to threatened status, and eventual delisting of the Ozark big-eared bat is limiting human disturbance at essential maternity caves and hibernacula. It is also critical to protect these caves and their surrounding foraging areas from habitat loss due to residential, agricultural, and timber development and reservoir and right-of-way construction. The potential for additional habitat loss is increasing because of the rapid human population growth in the Ozarks. The continuing existence of the Ozark big-eared bat and its eventual recovery can be assured when:

- o Long-term protection of essential maternity caves, hibernacula, and surrounding surface foraging habitat is provided by implementing protection and management plans on private, State, and Federal land. This also involves acquisition of essential caves in fee or easement and developing management agreements with private land owners. Acquisition of essential caves, such as AD-125, is extremely important; however, without

management (e.g. gating, fencing, monitoring, and law enforcement), acquisition alone will not provide necessary protection.

- o Management is assured through a full-time position, such as manager of the Oklahoma Bat Caves National Wildlife Refuge, an Ozark big-eared bat coordinator, or an Ozark cave coordinator. The position should have responsibility for coordinating the preparation and implementation of the management plan, both on public and private land and across State and Fish and Wildlife Service Regional boundaries, for the recovery of the Ozark big-eared bat.
- o The Fish and Wildlife Service's Divisions of Law Enforcement and Refuges and Wildlife assures that protection and management measures are successful, by enforcing trespass and harassment provisions of the Endangered Species Act on all areas and the Wildlife Refuge Administration Act on fee, easement, or agreement areas considered parts of the National Wildlife Refuge System.
- o Monitoring of the Ozark big-eared bat population is continued to determine if the protection and management efforts are effective. This is accomplished by using minimal disturbing census techniques to annually monitor population status at maternity colonies and censusing hibernacula no more than once per winter and preferably only once every 2 years.
- o Search is conducted for unknown essential Ozark big-eared bat maternity caves and hibernacula is continued for the next 10 years or until potential sites have been exhausted. Because of the disparity between summer and winter population estimates, it would appear undiscovered essential caves, especially hibernacula have yet to be discovered.
- o A population viability analysis is conducted to determine a self-sustaining population level. Results obtained should help provide valuable insight needed to upgrade or delist the species.
- o Landowner and public support for protecting Ozark big-eared bat caves and other cave resources is developed. This effort can best be accomplished by educating landowners, organizations, and schools on the importance of these resources.
- o The Ozark big-eared bat is reestablished at remaining available caves throughout its known historic range in Oklahoma, Arkansas, and Missouri.
- o A means to continue protection of the Ozark big-eared bat is assured after delisting.

## PART II. RECOVERY

### A. Objectives and Criteria

The **initial objective** of the recovery plan is to assure the continuing existence of the Ozark big-eared bat. This objective should be achieved when:

- o Stable or increasing populations are maintained, over a 10-year period, and secure habitat is provided at all 14 essential caves listed in Table 1. This effort will require providing each cave and its foraging area long-term protection from human disturbance and habitat loss and continued population monitoring.
- o The Oklahoma Bat Caves National Wildlife Refuge becomes fully operational with sufficient funds and manpower to manage Refuge caves and properties, construct required cave gates and fences, monitor populations, and deter human disturbance through appropriate law enforcement.

For this to occur the following tasks should be implemented:

<u>Initial Tasks</u>	
<u>To assure the Ozark big-eared bat's continuing existence</u>	
<u>Task No.</u>	<u>Task</u>
1.1	Obtain long-term authority to manage and protect colony sites.
1.2	Enhance Management of the Oklahoma Bat Caves National Wildlife Refuge.
1.3	Expand approved acquisition area for the Oklahoma Bat Caves National Wildlife Refuge
1.5	Manage Ozark big-eared bat caves by other agencies and groups
1.6	Construct, manage, and monitor cave gates and fences
2.1	Use minimal disturbing census techniques to annually monitor population status at maternity colonies
2.2	Census all known hibernacula
3.1	Search for additional maternity colonies
3.2	Search for additional hibernacula
4.1	Prevent adverse modification to cave habitat, including entrances
4.2	Identify and protect essential surface foraging habitat and movement corridors used by maternity and hibernating colonies
6.1	Develop and maintain landowner support

### Upgrading to Threatened Criteria

The **short term (10-year) objective** is to upgrade the Ozark big-eared bat to threatened status. The following reclassification objectives are preliminary and may be revised on the basis of new information, including research identified in this recovery plan.

After the tasks required to assure the Ozark big-eared bat's continuing existence have been accomplished, the bat may be considered for upgrading to threatened when:

- o Stable or increasing populations are maintained, over a 10-year period, at all essential Ozark big-eared bat sites, the 14 essential caves listed in Table 1 and those discovered during the next 10 years. This effort will require implementing measures to assure long-term protection of caves and foraging areas from human disturbance and habitat loss.
- o The Oklahoma Bat Caves National Wildlife Refuge authority is expanded to ensure development and implementation of management agreements with private landowners essential for the recovery of the Ozark big-eared bat and coordinate recovery efforts across State and Fish and Wildlife Service Regional boundaries.

Upgrading to threatened may be considered by 2005, through implementation of the recovery tasks presented below.

<b><u>Short Term (10-year) Tasks</u></b> <b><u>To upgrade the Ozark big-eared bat to threatened</u></b> <b><u>after assuring continuing existence</u></b>	
<b><u>Task No.</u></b>	<b><u>Task</u></b>
1.4	Add new approved areas for land acquisition in eastern OK, western and north central AR, and southern MO.
1.7	Place warning/interpretive signs at cave entrances
1.8	Use law enforcement agencies to protect Ozark big-eared bat caves
6.2	Develop and maintain caver support

### Interim Delisting Criteria

**Delisting objectives** for the Ozark big-eared bat are considered interim because the opportunity and potential locations for reestablishment of additional populations is uncertain. A number of historic sites have been closed, commercialized, or heavily disturbed (Figg and Lister 1989). For these reasons, a date to delist the Ozark big-eared bat cannot be accurately determined at this time. However, after the Ozark big-eared bat has been upgraded to threatened, it may be possible to delist it when:

- o All existing essential and limited-use caves in the three State area have been identified.
- o All known limited-use sites have been protected from human disturbance and habitat loss.
- o Stable or increasing populations have been reestablished at all available caves once used by the Ozark big-eared bat throughout its known historic range in Oklahoma, Arkansas, and Missouri. A population can be considered reestablished after its numbers have remained stable or increased for 10 consecutive years. Protection of caves identified for expansion of the Ozark big-eared bat and reestablishment of populations in Missouri are key elements to delisting.
- o A population viability analysis is conducted to determine the self sustaining population level, which should be used to refine delisting tasks.
- o A plan is developed to provide long-term protection after delisting.

Delisting may be initiated when the following tasks are successfully completed.

<b><u>Interim Delisting Tasks</u></b> <b><u>To delist the Ozark big-eared bat</u></b> <b><u>after upgrading to threatened</u></b>	
<b><u>Task No.</u></b>	<b><u>Task</u></b>
2.3	Conduct a population viability analysis
3.3	Search for caves and other structures providing limited-use Ozark big-eared bat habitat
4.3	Essential roost sites and surface habitat locations are made available only to agencies able to assist in protection
4.4	Map essential Ozark big-eared bat caves
5.0	Evaluate contaminant effects on Ozark big-eared bats
6.3	Develop and maintain public support
7.0	Conduct possible future research
8.0	Protect all known limited-use sites from human disturbance and habitat loss
9.0	Reestablish stable or increasing populations at all available historic caves in Oklahoma, Arkansas, and Missouri
10.0	Provide long-term protection for Ozark big-eared bat habitat after delisting

It is not necessary to accomplish the above tasks in the order they are presented, but the tasks to assure continuing existence of the Ozark big-eared bat are definitely the highest priority and should be accomplished first.

This recovery plan should be utilized by the Fish and Wildlife Service, individuals, organizations, and agencies working with the Ozark big-eared bat to coordinate recovery activities. As the Plan is implemented, it should be understood that revision likely will be necessary. Sound management of the resource and close coordination between management agencies should provide more stable habitat for the Ozark big-eared bat and restore it to a less endangered status.

The tasks presented in the Revised Ozark Big-Eared Bat Recovery Plan provide an excellent example of an ecosystem approach to recovering the Ozark big-eared bat. In addition to assuring the continuing existence of the Ozark big-eared bat, the tasks will protect areas of high quality Ozark forests and watersheds, including ground water and streams important for:

- o Maintaining bio-diversity,
- o Preventing forest fragmentation,
- o Conserving neotropical migratory songbird habitat,
- o Protecting other cave, stream, and interior forest resources
- o Preserving additional fish and wildlife resources including other federally listed and candidate species.

#### B. Narrative Outline for Recovery Actions Addressing Threats

The tasks necessary to recover the Ozark big-eared bat are summarized in Table 3 and discussed as follows:

1. Protect essential Ozark big-eared bat caves from human disturbance and habitat loss due to future development. Constructing appropriately designed cave gates is the most effective barrier available for limiting human access to caves. Purchasing caves and surrounding foraging habitat in fee title and then implementing an appropriate protection and management plan is the best means of providing long-term protection from habitat loss. Known Ozark big-eared bat caves in the greatest need of the following protective measures are identified in Table 1.
  - 1.1 Obtain long-term authority to manage and protect colony sites. The Fish and Wildlife Service and other appropriate conservation organizations and agencies should obtain long-term authority to manage essential Ozark big-eared bat caves. Other organizations and agencies with interests in Ozark big-eared bats include the following:
    - o Oklahoma Nature Conservancy has registered Ozark big-eared caves and foraging habitat in Oklahoma and worked closely with State and Federal conservation agencies.
    - o National Speleological Society and their local grottos owns caves in Oklahoma that may provide Ozark big-eared bat habitat.
    - o Oklahoma Department of Wildlife Conservation owns three limited-use caves and possibly other undiscovered caves.

**Table 3. Summary of Recovery Tasks**

1. Protect essential Ozark big-eared bat caves from human disturbance and habitat loss due to future development.
  - 1.1 Obtain long-term authority to manage and protect colony sites.
  - 1.2 Enhance Management of the Oklahoma Bat Caves National Wildlife Refuge.
  - 1.3 Expand approved acquisition area for the Oklahoma Bat Caves National Wildlife Refuge.
  - 1.4 Add new approved areas for land acquisition in eastern Oklahoma, western and north central Arkansas, and southern Missouri.
  - 1.5 Management by other agencies and groups.
  - 1.6 Construct, manage, and monitor cave gating and fencing.
  - 1.7 Place warning/interpretive signs at cave entrances.
  - 1.8 Use law enforcement agencies to protect Ozark big-eared bat sites.
2. Monitor population trends.
  - 2.1 Use minimal disturbing census techniques to annually monitor population status at maternity colonies.
  - 2.2 Census all known hibernacula.
  - 2.3 Conduct a population viability analysis.
3. Search for undocumented caves of importance to Ozark big-eared bats.
  - 3.1 Maternity colonies.
  - 3.2 Hibernacula.
  - 3.3 Caves and other features and structures providing limited use habitat for Ozark big-eared bats.
4. Prevent adverse modification of essential habitat.
  - 4.1 Prevent adverse modification to cave habitat, including entrances.
  - 4.2 Identify and protect essential surface foraging habitat and movement corridors used by maternity and hibernating colonies.
  - 4.3 Make essential roost sites and surface habitat locations available only to agencies able to assist in protection.
  - 4.4 Map essential Ozark big-eared bat caves.
5. Evaluate contaminant effects on Ozark big-eared bats.
6. Develop and maintain public support for Ozark big-eared bat protection.
  - 6.1 Landowner support.
  - 6.2 Caver support.
  - 6.3 Public support.
7. Possible Future Research.
8. Protect all known limited use sites from human disturbance and habitat loss.
9. Reestablish stable or increasing populations at all available historic caves in Oklahoma, Arkansas, and Missouri.
10. Provide long-term protection for Ozark big-eared bat habitat after delisting.



- o Oklahoma Tourism and Recreation Department owns caves in Oklahoma. At this time none are known to contain Ozark big-eared bats, but they may be found in caves on their property in the future.
- o Arkansas Nature Conservancy has registered Ozark big-eared bat caves in Arkansas and worked closely with State and Federal conservation agencies.
- o Arkansas Game and Fish Commission administers the State endangered species program and may have unknown sites on land that they manage.
- o Arkansas Department of Parks and Tourism owns an essential Ozark big-eared bat site and may have other unknown sites.
- o Arkansas Natural Heritage Commission administers an essential Ozark big-eared bat cave through a cooperative agreement with a private landowner.
- o Forest Service has limited-use Ozark big-eared bat caves and possibly others.
- o National Park Service owns caves along the Buffalo River in Arkansas, including a gray bat cave. A solitary Ozark big-eared bat has been found in a cave and one in a mine on Park Service land and others could be found in the future.

These organizations and agencies should develop means to restrict human access and manage essential Ozark big-eared bat caves. These include essential caves listed in Table 1 plus any essential colony sites discovered in the future. Protection can be accomplished through fee title acquisition, conservation easements, land exchange, donations, and cooperative agreements.

To fulfill the recovery objective, the mechanism chosen for colony site protection should provide long-term protection that will not be affected by changes in landowner attitudes or sale of property. The most effective method of providing the needed protection is fee title acquisition. Where fee title acquisition is not possible, conservation easements should be considered. Although acquisition of these essential areas is extremely important, acquisition without management will not provide the necessary protection. The present priorities for acquisition of known essential Ozark big-eared bat caves in Oklahoma are (in order of priority):

<u>Priority</u>	<u>Cave</u>	<u>County</u>	<u>Comments</u>
1	AD-125	Adair	Largest known population of Ozark big-eared bats not under protection.
2	AD-17	Adair	Extremely important maternity cave adjoining the Oklahoma Bat Caves National Wildlife Refuge.
3	AD-14	Adair	Essential large Ozark big-eared bat cave near AD-125
4	AD-3	Adair	Extremely important hibernaculum adjoining the Oklahoma Bat Caves National Wildlife Refuge.
5	AD-13	Adair	Important maternity site.
6	AD-16	Adair	Important transient roost for Ozark big-eared bats, currently undergoing degradation.
7	AD-15	Adair	Ozark big-eared bat hibernaculum and gray bat roost site.

This priority may change based on the results of the ongoing cave search. When new and more essential caves are found, they will be added to the list.

Three of the essential Ozark big-eared bat caves in Arkansas have some form of protection. MR-0702 and Devil's Den (both hibernacula) are owned by the State. MR-9702 (a maternity site) is a privately owned cave registered by the Arkansas Natural Heritage Commission with a cooperative management agreement with the Arkansas Nature Conservancy. MR979A is an alternate maternity and bachelor cave and is in need of protection. There is the potential for a number of unknown Ozark big-eared bat caves to exist in Arkansas and additional work is needed to identify these sites and prioritize them for protection.

Cooperative agreements have functioned well in providing short-term authority to protect and manage important caves. However, these agreements do not provide the long-term protection necessary to insure continued existence of the Ozark big-eared bat, because agreements may be easily cancelled by the land owner. They are temporary measures and should only be used after attempts such as fee title acquisition and easement purchase have failed or as interim measures prior to obtaining more permanent protection. All existing cooperative agreements should be reviewed to determine if they provide adequate long-term protection. If these agreements are inadequate in providing necessary long-term protection, they should be replaced, preferably by fee title acquisition or easement purchase. This long-term protection should provide management and law enforcement authority

by the management organization or agency, such as the Oklahoma Bat Caves National Wildlife Refuge.

Where agreements with private landowners are being developed, the Fish and Wildlife Service's Partners for Wildlife program is a possible means of accomplishing the task. The program is designed to assist private landowners in protecting fish and wildlife resources on their land through habitat restoration and coordination with other individuals, organizations, agencies, and the Fish and Wildlife Service. Voluntary registration of forested foraging habitat surrounding caves and serving to buffer them from human disturbance can, in some cases, provide adequate protection as long as there is regular communication and a good working relationship with the landowner.

For any type of landowner agreements to be successful, a long-term management presence in the area is necessary. The Service should work regularly with the landowners to keep them informed and to coordinate long-term recovery efforts from year to year. These activities are needed to maintain landowner relations and assure that a true interest exists in recovering the Ozark big-eared bat and that these efforts will continue over the years. Such a presence should be in the form of a full-time Fish and Wildlife Service position.

Whether through acquisition, easements, or landowner agreements, the Fish and Wildlife Service should expand its activities for managing caves on private, State, and Federal land. To assure long-term protection throughout the Ozark big-eared bat's range, it will be necessary to coordinate recovery efforts that cross State and Fish and Wildlife Service Regional boundaries.

- 1.2 Enhance Management of the Oklahoma Bat Caves National Wildlife Refuge. The Oklahoma Bat Caves National Wildlife Refuge was established in 1985 to provide long-term protection for the Ozark big-eared and gray bats. Management of the Ozark big-eared bat habitat by this refuge is a key element in the recovery of this endangered bat, but low funding and manpower have made management difficult. Although a relatively small area is currently involved (865 acres), the special management requirements of the Ozark big-eared bat's cave and forested foraging habitat demand innovative funding and manpower. The area under refuge management is expected to increase as new caves identified in Task 3.1, 3.2, and 3.3 are acquired. Because purchase of all areas needed for recovery may be impossible, the authority to work on private land will be essential. Management recommendations have been developed as part of an action plan for the Oklahoma Bat Caves National Wildlife Refuge (Swanson 1991) and are provided in Appendix I.

To coordinate recovery efforts across State and Fish and Wildlife Service Regional boundaries and provide a long-term cave management presence in the Ozarks, a central cave management program should be established. This will require a full-time refuge manager or biologist and expansion of the Oklahoma Bat Caves National Wildlife Refuge to work across Regional boundaries and on private land. A name change may be required for the Refuge, to one

encompassing the entire Ozarks, such as Ozark Caves National Wildlife Refuge or Ozark National Wildlife Refuge. Also, with the number of other Federally listed caves species in the Ozarks, such central management will benefit a number of species.

- 1.3 Expand approved acquisition area for the Oklahoma Bat Caves National Wildlife Refuge. To assist in the acquisition of essential caves identified in Task 3.1, 3.2, and 3.3, the approved area of acquisition for the refuge should be expanded. Since 1985, several essential caves have been found outside the original approved area. Two of the most important areas for acquisition, where populations of Ozark big-eared bats have most recently been found (AD-14 and AD-125 and surrounding foraging areas) are near the Arkansas border, some distance from existing refuge land. Both Ozark big-eared bats and gray bats have been reported from AD-14 and it may serve as an alternate site for AD-125. AD-125 is number one and AD-14 is number three on the Service's acquisition list. They are included in the new proposed approved area identified in Figure 6. It encompasses about 10,000 acres, and extends eastward to the Arkansas border where it adjoins the Ozark National Forest. Besides AD-14 and AD-125, numerous other caves also are found in the area. Ozark big-eared bats have been reported from several of these caves and there is a strong possibility that an undiscovered major hibernaculum occurs in the area.
- 1.4 Add new approved areas for land acquisition in eastern Oklahoma, western and north central Arkansas, and southern Missouri. It would be extremely helpful for protection and acquisition efforts to be able to identify the specific amount and location of habitat required by the Ozark big-eared bat. However, there is the possibility of finding new essential Ozark big-eared bat maternity caves and hibernacula anywhere in the Ozark area of eastern Oklahoma, western and north central Arkansas, and possibly southern Missouri. This makes it difficult to predetermine the size or location of a proposed approved area for acquisition. Because of the possibility of finding caves and foraging habitat essential for assuring the Ozark big-eared bat's continuing existence and recovery anywhere within their range, the new approved acquisition area should cover the entire 27 county area in Arkansas, Missouri, and Oklahoma (Figure 7).

The Fish and Wildlife Service's Region 2 Realty Division should be responsible for establishing a new approved area for acquisition and coordinating with the Service's Regions 3 and 4 Realty Divisions, that are responsible for Missouri and Arkansas. Also the cave acquisition and management efforts of the Oklahoma, Arkansas, and Missouri State resource agencies should be considered. This coordination will assist in assuring an ecosystem approach to cave acquisition and management in the Ozarks. With the number of Federally listed caves species in the Ozarks, a central management authority would benefit a number of species. For example Region 2's acquisition of the Oklahoma Bat Caves National Wildlife Refuge, Region 3's recent acquisition of an Ozark cavefish cave in Missouri to establish the Ozark Cavefish National Wildlife Refuge, and Region 4's acquisition of Logan Cave as part of the National Wildlife Refuge system in Arkansas complements the cave protection efforts throughout the Ozarks. Also changing

Figure 6. Location of New Approved Area for Immediate Acquisition

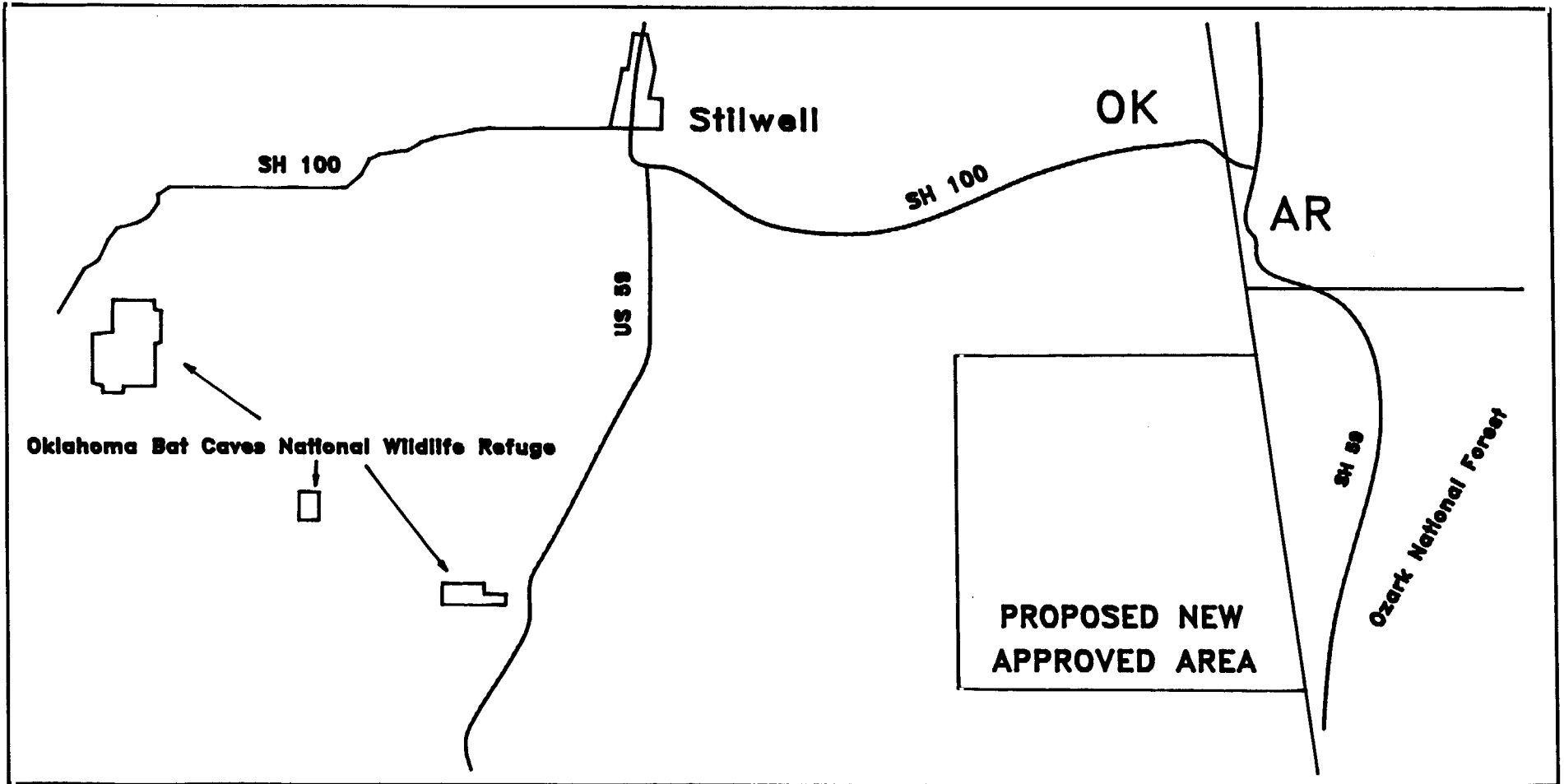
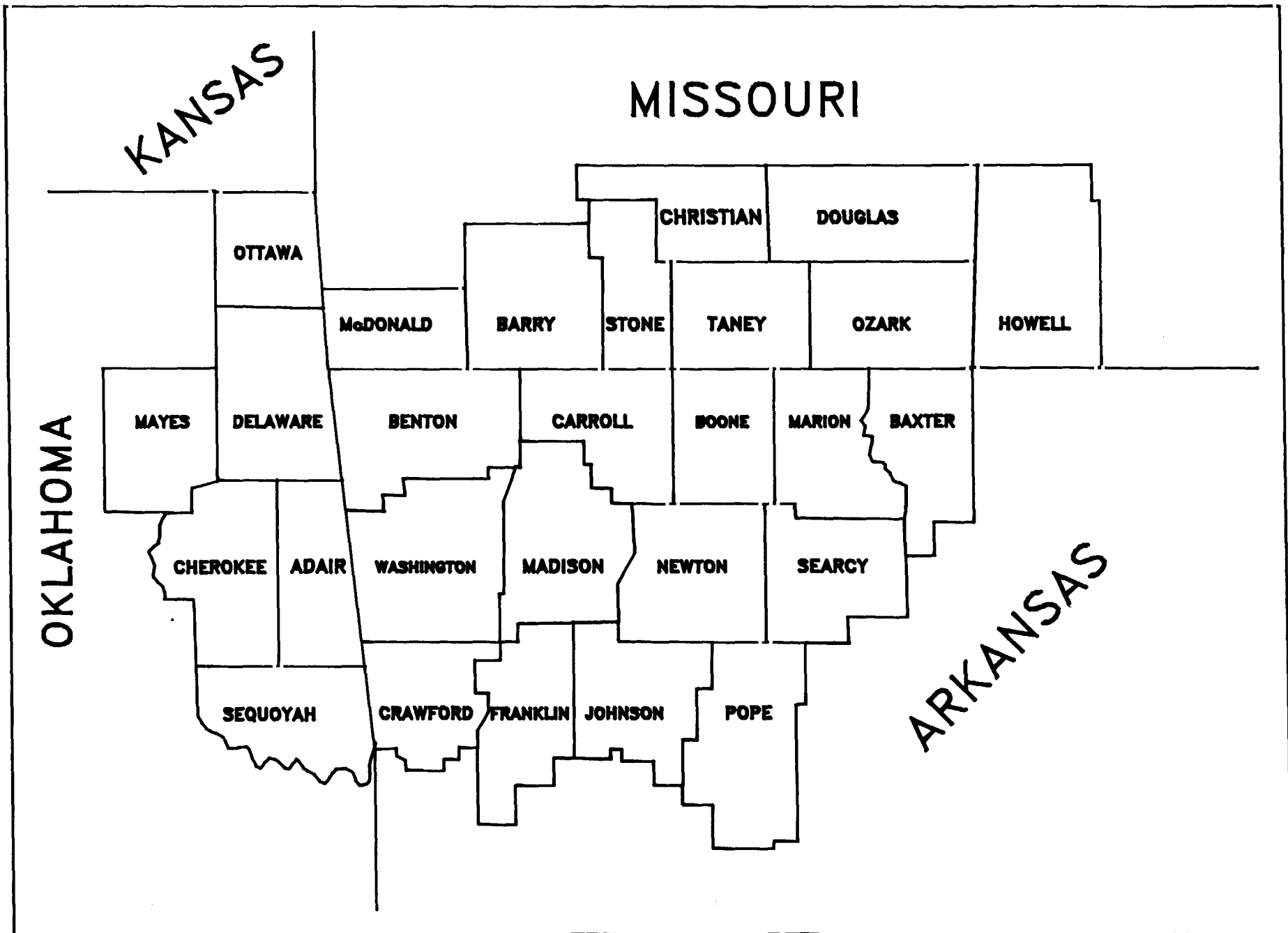


Figure 7. Area where essential Ozark big-eared bat habitat may be found and added to the proposed new approved area for acquisition



the name of the Oklahoma Bat Caves National Wildlife Refuge to the Ozark Caves National Wildlife Refuge or Ozark National Wildlife Refuge may facilitate acquisition and management of caves by one unit of the Fish and Wildlife Service in coordination with Regions 2, 3, and 4. This will make the process more efficient and help in recovery actions for the Ozark big-eared bat and other endangered Ozark cave species (e.g. gray bat and Ozark cavefish, as well as a number of candidate species) that cross regional boundaries.

- 1.5 Management by other agencies and groups. The Ozark big-eared bat is listed as a State endangered species in Oklahoma by the Oklahoma Department of Wildlife Conservation, in Arkansas by the Arkansas Game and Fish Commission, and in Missouri by the Missouri Department of Conservation. In Arkansas an important hibernaculum is owned and managed by the Arkansas Department of Parks and Tourism. Therefore, the Fish and Wildlife Service should coordinate all management efforts with these agencies. The Oklahoma and Arkansas Nature Conservancy own and manage important caves in both States. The Fish and Wildlife Service cooperatively manages a cave owned by the Oklahoma Nature Conservancy on Gittin Down Mountain as part of the Oklahoma Bat Caves National Wildlife Refuge. Other important caves on Gittin Down Mountain also have been donated to the National Speleological Society. The National Speleological Society and Fish and Wildlife Service have cooperated in cave management in other areas of the country and there is a nationwide memorandum of agreement between the two that should facilitate future cave management. There are limited-use Ozark big-eared bat caves on Forest Service land in Arkansas and other possible sites. The National Park Service owns gray bat caves along the Buffalo River, in Arkansas. Only two Ozark big-eared bats, one from a cave and one from a mine, have been recorded from Park Service land, but it is possible that more could be found in the future. Any of these private groups or State or Federal agencies could own and manage caves, but any effort to manage Federally endangered bats should be coordinate with the Fish and Wildlife Service.
- 1.6 Construct, manage, and monitor cave gates, fences, and other cave protective devices where needed. Some remote, little known caves may not require gating or fencing to protect them from human disturbance. It may be sufficient only to keep their locations confidential. But frequently cave locations are well known, especially by local residents, and some form of protection is required. It is necessary to take a cautious approach to gating or fencing cave entrances to insure the bats' acceptance of the structures. Poorly designed gates may caused bats to abandon caves, by adversely affecting bat flights and internal cave characteristics. They also take away from the naturalness of an area. Based on successes with gating MR-9702 in Arkansas (Harvey pers. comm. 1992) and western big-eared bat and Virginia big-eared bat caves (White 1987), construction of an appropriately designed steel gate at the cave entrance appears to be a viable means of protecting Ozark big-eared bats from human disturbance. Where gating is not possible, fencing should be considered. Adversely affecting a cave's Ozark big-eared bat population by gating or fencing can be avoided by:

- o Using appropriate gate designs similar to those provided by White and Seginak (1987),
- o Building structures during periods when bats are not using the cave,
- o Possibly constructing only a portion of the gate at a time to allow the bats to acclimate to the structure,
- o Maintaining existing temperature and humidity at occupied roost sites by not impeding air flow,
- o Monitoring flight patterns before and after construction to identify any adverse impacts,
- o Continuing periodic monitoring to insure that the bats are not suffering long-term adverse effects from the gate, such as increased predation or loss of significant energy reserves due to increased circling during swarming,
- o Comparing population trends in gated caves versus ungated caves with low human disturbance and ungated caves with high human disturbance.
- o Where gates are not possible or successful, fencing cave openings far enough back from the entrance to provide adequate flight space,
- o Establishing a system for inspection, maintenance, and repair of any structures.
- o Using information gained in post-construction observations to modify future gate designs,
- o Removing gates or fences if any adverse effects are recognized,

The Arkansas Department of Parks and Tourism maintains a cave alarm on the Devil's Den hibernaculum. The system has proved effective on a number of occasions. Other cave protective devices, such as alarm systems may be effective on other caves and should be considered, especially where enforcement personnel are nearby.

- 1.7 Place warning/interpretive signs at cave entrances. Gates and fences should be accompanied by warning/interpretive signs. Appropriately worded signs (Appendix II) should restrict access by informing the public of the importance of not disturbing Federally listed endangered bats and possible consequences should harm occur. These signs are necessary to aid the Fish and Wildlife Service's Law Enforcement Division and other law enforcement agencies in prosecuting trespass cases. Placement of such signs at ungated or unfenced caves should be considered carefully because their presence could draw attention to the cave and increase human disturbance. However, a sign placed to avoid attracting undue



attention, such as inside the cave and not visible from outside, should be a positive measure in protecting bat colonies.

- 1.8 Use law enforcement agencies to protect Ozark big-eared bat sites. The local, State, and Federal law enforcement agency most capable of responding to cave trespass and vandalism at each essential Ozark big-eared bat cave should be identified. In most cases, this will be the county sheriff's office, State conservation department game ranger, Fish and Wildlife Service Federal Law Enforcement Agent or Refuge personnel. Law enforcement agencies need to be informed of conservation efforts, site locations where assistance may be required, and names of the landowner so an appropriate response can be made to complaints regarding cave trespass and vandalism. Where there are little known essential caves, with remote locations that are less likely to be disturbed, it may be more beneficial to keep the locations confidential.

Landowners with essential caves on their property will be asked to notify the appropriate law enforcement agency of cave trespass and cave-related vandalism. Any easements or conservation agreements should be worded to allow law enforcement access necessary to control trespass and Endangered Species Act violations. The Fish and Wildlife Service's Law Enforcement Division should help assure these measures are successful by prosecuting trespass and harassment violations under the Endangered Species Act on all areas and the Wildlife Refuge Administration Act on fee, easement, or agreement areas considered parts of the National Wildlife Refuge system. Any action that affects or may affect Federally listed endangered or threatened species should be immediately reported to the U.S. Fish and Wildlife Service's Law Enforcement Special Agent at:

Special Agent  
U.S. Fish and Wildlife Service  
P. O. Box 3685  
Tulsa, Oklahoma 74101-3685  
Phone 918-581-7469  
FAX 918-581-7467

Special Agent  
U.S. Fish and Wildlife Service  
53 Post Office Bldg.  
Little Rock, Arkansas 72201  
Phone 501-378-5643  
FAX 501-378-6493

Special Agent  
U.S. Fish and Wildlife Service  
1103-A Southwest Blvd.  
Jefferson City, Missouri 65109  
Phone 314-636-7815  
FAX 314-634-6045

2. Monitor population trends. The size of the extant Ozark big-eared bat population level is still being determined and there is the possibility of finding additional caves with major populations. It is important to continue monitoring the population to identify and prioritize essential areas to protect. Monitoring also allows documentation of population trends and response to recovery efforts.

- 2.1 Use minimal disturbing census techniques to annually monitor population status at maternity colonies. A night vision scope with an infrared light source should be used to annually census populations at each maternity colony for at least 5 consecutive years in order to identify trends. After the initial 5 years, a decision should be made to continue annual monitoring or change monitoring to every other year, possibly alternating sites every year. However, because of small population size and susceptibility to disturbance, monitoring frequency may need to be further modified based on the results of the initial monitoring.
- 2.2 Census all known hibernacula. Censusing will document the continued use of presently known hibernacula and those discovered in the future. The American Society of Mammalogists (1992), in its "Guidelines for the Protection of Bat Roosts", recommends that disturbance from monitoring declining bat populations be as brief as possible and occur no more than once per winter and preferably only once every 2 years. The census party should be limited to no more than three people and attempt to limit its total time in the immediate vicinity of the hibernating bats to 5 minutes or less. The bat cluster size should be estimated and no living bats should be handled, nor should they be disturbed other than by the observers' presence.
- 2.3 Conduct a population viability analysis. A population viability analysis should be conducted to determine a self-sustaining population level. The information from the analysis will be used to refine future recovery tasks, including tasks needed to delist the bat. The analysis should be accomplished within the next 10 years.
3. Search for undocumented caves of importance to Ozark big-eared bats. Because numbers of bats estimated from summer maternity counts are larger than those found during winter hibernacula counts, apparently Ozark big-eared bats are using caves, or sites within caves, that have not been found. Based on maternity counts, Clark (1991) estimated the Oklahoma Ozark big-eared bat population to be roughly 1,700 bats in 1990, but she only found 622 bats during a winter census of known hibernacula. Evidently there are major hibernacula that have not yet been located. The apparent fluctuation in numbers from year to year are possibly the result of bat movement among caves. Some maternity colonies occupy alternate sites in different years, such as AD-17 and AD-18. In Oklahoma, the search for new maternity caves and hibernacula should be continued throughout Adair, Delaware, Cherokee, and Sequoyah counties and adjacent Mayes and Ottawa counties for the next 10 years.

In Arkansas, only four sites presently are known to be regularly inhabited by Ozark big-eared bats, a maternity cave (MR-9702), a possible alternate maternity and bachelor cave (MR-979A), and two hibernacula (MR-0702 and Devil's Den State Park) (Harvey et al. 1981). However, recent findings of a number of single bats and one small group in caves and talus cracks in western and north central Arkansas (Harvey pers. comm. 1993 and Puckette pers. comm. 1992) indicate that there may be other caves in the area essential to the Ozark big-eared bat's recovery. Because of these findings, the search should continue over the next 10 years in western and north central Arkansas, especially in Crawford, Franklin, Marion, and Washington counties but also in Baxter, Benton,

Boone, Carroll, Johnson, Madison, Newton, Pope, and Searcy, counties.

The Ozark big-eared bat once lived in southern Missouri, with records from Barry and Stone counties, but a number of its historic sites have been closed, commercialized or heavily disturbed. Figg and Lister (1989) searched 81 caves in Barry, Stone, Taney, and Ozark counties, but was denied permission to search the cave where the last known Ozark big-eared bat population was found in Missouri. No active sites were found. If populations in Arkansas and Oklahoma increase, Ozark big-eared bats may expand back into their historic range. The likelihood of expansion could increase if some of the historic caves could be protected,. Periodic searches, especially of historic locations in Barry and Stone counties, should be continued. If Ozark big-eared bats are found in Missouri, the search effort will need to be intensified.

Region 2 of The Fish and Wildlife Service has lead for recovering the Ozark big-eared bat and should coordinate the search for essential caves. Because Missouri is in Region 3 and Arkansas is in Region 4, both Regions should assist with the searches, due to their familiarity with each State and the involved agencies.

- 3.1 Maternity colonies. Caves suspected of containing undocumented Ozark big-eared bat maternity colonies should be examined only by qualified personnel. The initial search may require investigators to enter the roost area to verify the presence of bats. After a new colony has been located, all subsequent surveys should be conducted by a non-intrusive census technique.
- 3.2 Hibernacula. The search for hibernacula is of particular importance because there are considerably more bats counted from maternity caves than from known hibernacula. Therefore, there are apparently hibernacula that have yet to be identified. When a suspected hibernaculum is investigated it should be censused as described in 2.2.
- 3.3 Caves and other features and structures providing limited-use habitat for Ozark big-eared bats. While searching for maternity caves and hibernacula, data should be collected on caves, talus cracks, trees, buildings, bridges, and any other structures providing habitat for solitary Ozark big-eared bats. These may include summer sites for males and non-reproducing females, winter sites for solitary males and females, and sites used by transient bats. Townsend's big-eared bats have been found to use man-made structures (Barbour and Davis 1969; Harvey 1992), as have Virginia big-eared bats light tagged by Virginia Dalton; however, there is only one record of Ozark big-eared bats from a mine near the Buffalo National Scenic River in Arkansas (Harvey pers. comm. 1993). The importance of these limited-use caves and other structures is not fully understood and should be investigated to determine if they should be protected. Additional information on the summer habitat of male Ozark big-eared bats could affect management and recovery strategy.
4. Prevent adverse modification of essential habitat. Remaining essential subsurface and surface habitat should be maintained to insure the continued existence and recovery of the Ozark big-eared bat. Numerous caves and considerable upland and riparian forest

used for foraging habitat have been lost to urban and industrial development; agricultural expansion; cave commercialization; and reservoir, highway, powerline, and pipeline right-of-way construction.

- 4.1 Prevent adverse modification to cave habitat, including entrances. Adverse modifications to caves that would alter their suitability for Ozark big-eared bats should be identified and prevented or eliminated. Acquisition in fee title or easements, along with implementation of appropriate management, is the most secure and long-term means of protecting essential Ozark big-eared bat caves, but these actions are not always possible. Where acquisition and management is not possible, adverse impacts of Federally funded or permitted projects can be prevented through Section 7 of the Endangered Species Act, that requires Federal agencies to consult with the Fish and Wildlife Service.

Protection from private actions can best be accomplished through working with the public and developing private landowner support. The Fish and Wildlife Service's Partners for Wildlife initiative is an ideal means of accomplishing this task. The program is designed to assist landowners in protecting fish and wildlife resources on private land through alliances among individuals, organizations, agencies, and the Fish and Wildlife Service. The Oklahoma Natural Areas Registry Program of the Oklahoma Nature Conservancy has successfully developed relationships with private and public landowners at Gittin Down Mountain, four of whom have signed voluntary cooperative agreements to protect about 900 acres of forested foraging habitat.

Protection from private development is provided under the taking provisions of Section 9 of the Endangered Species Act. Impacts of private actions on the bat also may need to be addressed under the incidental take permit conditions of Section 10 of the Act. Public information and education on the importance of protecting the endangered Ozark big-eared bat, its habitat, and other unique cave biota is also important.

- 4.2 Identify and protect essential surface foraging habitat and movement corridors used by maternity and hibernating colonies. Surface habitat surrounding each essential Ozark big-eared bat cave should be conserved to assure maintenance and expansion of each colony. Studies by Clark (1991) and Clark et al. (1991) provided valuable information on habitat requirements of the Ozark big-eared bat. Using radio telemetry, Clark et al. (1993) found that female Ozark big-eared bats foraged along wooded edges up to 7.3 km from the maternity cave. In another radio telemetry study, Wethington (1994) found that both females and males during the late summer and fall pre-hibernation period foraged shorter distances from used caves than females previously studied during maternity season. Based on this information, forested foraging areas and movement corridors within 7 km of each essential cave should be monitored for potential threats.

Most of the methods mentioned for protecting cave habitat, including acquisition and management, can also be used to preserve surface foraging habitat and movement corridors. Ozark big-eared bat surface habitat encompasses a

relatively large area, but as much of it as possible should be protected to assure a continuing food supply. Because the area used by Ozark big-eared bats is large and most is in private ownership, a program to work with landowners such as the Fish and Wildlife Service's Partners for Wildlife and The Nature Conservancy's Natural Area Registry is of great importance. Other types of cooperative agreements with landowners also can provide protection and is encouraged.

- 4.3 Make essential roost sites and surface habitat locations available only to agencies able to assist in protection. Because of the susceptibility of Ozark big-eared bats to human disturbance, colony site locations should be considered confidential. Essential cave locations should be restricted to only those who will protect or manage the sites. Such actions will help protect essential caves, especially little known or remote caves, from unauthorized entry without the need for fences or gates. As the human population in an area expands and the likelihood of an essential cave being discovered increases, it will be necessary to provide more secure protection, such as fencing and gating.
  - 4.4 Map essential Ozark big-eared bat caves. Essential caves should be mapped when the bats are not present to identify their extent, other possible openings, and overlying land use and drainage patterns. Members of local grottos, associated with the National Speleological Society in Arkansas, Missouri, and Oklahoma, and the Cave Research Foundation can provide valuable assistance with such mapping.
5. Evaluate contaminant effects on Ozark big-eared bats. An initial investigation of Ozark big-eared bats and gray bats by Martin (1992) indicated that:
    - o Careful consideration should be given to selecting a surrogate species to be used to monitor exposure to organochlorine pesticides, their metabolites, and polynuclear aromatic hydrocarbons. If reliable surrogates can be identified, they should be used in a monitoring program. Opportunistic analysis of dead endangered bats should continue as they are encountered.
    - o An in-depth literature survey should be conducted to determine the significance of aliphatic hydrocarbon residues in bats. If it is determined that there is need for information regarding these residues, guano should be monitored from various locations.
    - o Trace elements contained in guano should be monitored from various locations with results correlated with known prey species and feeding areas to identify "hot spots" and temporal trends.
  6. Develop and maintain public support for Ozark big-eared bat protection. The ultimate fate of endangered Ozark big-eared bats depends in large part on increasing the level of public support and cooperation. During this effort care should be taken not to increase disturbance of colony sites by curious individuals.

- 6.1 Landowner support. The purchase of all caves and foraging habitat essential to Ozark big-eared bat protection will not be practical. Therefore, it is extremely important to develop other means to work with landowners to protect these areas on private land. All landowners of Ozark big-eared bat habitat should be informed of the value of their property to the protection of bats and the contribution of their property to endangered bats and what the landowner can do voluntarily to protect them. These contacts should be maintained over the years to assure continued landowner support. For agreements to be successful with private landowners, a long-term management presence by private conservation organizations, State wildlife agencies, or the Fish and Wildlife Service is necessary in the area. Someone should regularly work with the landowners and let them know the interest to protect and recover the Ozark big-eared bat continues over the years. Such a presence should be in the form of a full-time Fish and Wildlife Service position, such as an Oklahoma Bat Caves National Wildlife Refuge Manager, Ozark Caves National Wildlife Refuge Manager, or Ozark Cave Coordinator. This position will need the authority to work on private land and across State and Fish and Wildlife Service Regional boundaries.

Presently an endangered bat cave protection project that includes developing management plans and fencing and gating essential privately owned maternity caves and hibernacula is being funded through Section 6 of the Endangered Species Act. The project currently is being conducted by Rogers State College and Northeastern State University and coordinated through the Oklahoma Department of Wildlife Conservation. Because Section 6 funding can not be assured indefinitely, a more secure funding source is needed to provide protection of privately owned caves. The Fish and Wildlife Service's Partners for Wildlife program provides a means of continuing cave protection and management on private land. This program is designed to help private landowners improve fish and wildlife resources on their land, through funding and technical assistance. Partners for Wildlife private land management strategies can be developed through the Fish and Wildlife Service's Oklahoma Bat Caves National Wildlife Refuge or Oklahoma Ecological Services Field Office and may incorporate assistance from other conservation organizations and agencies. Protection of foraging habitat on private land can be implemented through landowner contact programs such as The Nature Conservancy's Natural Areas Registry.

- 6.2 Caver support. The cooperation of caving groups should be sought in educating members on the need to avoid disturbing Ozark big-eared bat colonies. Contacts should be established and maintained with the American Cave Conservation Association, National Speleological Society, and Missouri Speleological Survey and local grottos, such as the Tulsa Regional Oklahoma Grotto, Central Oklahoma Grotto, Buffalo River Grotto, Little Rock Grotto, Lower Ozark Sub-Terrestrials, Ozark Highland Grotto, and Heart of the Ozarks Grotto. The national memorandum of agreement between the National Speleological Society and the Fish and Wildlife Service will be helpful. Coordination with local grottos can be initiated through slide presentations, pamphlets, and articles in the organizations' newsletters. Whenever possible, local caving groups should be involved in efforts to protect Ozark big-eared bats in order to foster a commitment to bat

conservation. Local grottos can provide valuable assistance with cave gating and other protection and management projects. The Tulsa Regional Oklahoma Grotto and Central Oklahoma Grotto have assisted the Oklahoma Nature Conservancy with such projects. Local grotto also may act as cooperators in Partners for Wildlife projects on privately owned caves.

6.3 Public support. Fish and wildlife management, if it is to be successful, should involve the public. The major reason for the Ozark big-eared bat's decline is human disturbance. The people responsible probably are not aware that they are creating a problem or of the value of the cave resources being affected. The public should be informed of the value of caves and bats in general, the value of Ozark big-eared bats, their endangered status, and the major problems for their survival through:

- o Newspaper articles (An example is presented in Appendix III),
- o Radio and television broadcasts,
- o Distribution of pamphlets,
- o Presentations to schools and organizations, and
- o Public relation programs of National Wildlife Refuges and Ecological Service Field Offices with cave protection and management responsibility in Oklahoma, Arkansas, and Missouri

These actions should be concentrated in the cave areas of the Ozarks and done in a professional manner that will not divulge specific cave locations.

7. Possible Future Research. Since the original Recovery Plan was published in 1984, research has obtained information on the distribution, abundance, life history, and ecology of the Ozark big-eared bat (Clark 1991, Clark et al. 1991, Clark et al 1993, Puckette and Leslie 1993, Wethington 1994). Much of this Revised Recovery Plan is based on this information. The following is a brief summary of the areas where future research could provide useful additional information:

- o Locations of unknown essential maternity caves, hibernacula and limited-use caves, especially in Arkansas. The Ozark big-eared bat cannot be protected successfully or the total population monitored unless all essential cave locations are known.
- o Winter Ozark big-eared bat movement among hibernacula to identify possible alternative hibernacula or roost sites that may be essential to protect. This should also include activity patterns of hibernating bats and times and patterns of arrival at and departure from hibernacula.
- o Summer male Ozark big-eared bat habitat use. Solitary males have been found

in crevices, overhangs, and some caves, but may use other habitat such as trees, buildings, and bridges. Identification of habitat preferences and biological importance of these sites is necessary to determine which areas should be protected and develop appropriate management strategies.

- o The importance of limited-use sites, to identify additional areas possibly in need of protection.
  - o Prey species used. An understanding of the predator/prey relationship may reveal links between population declines and declines in prey species availability and assist in understanding the significance of surface habitat and possibly the implication of chemical contamination.
8. Protect all known limited-use sites from human disturbance and habitat loss. If limited-use caves are found to be necessary to assure the continuing existence of the Ozark big-eared bat, they should be protected in the same manner as maternity caves and hibernacula. If talus cracks, trees, buildings, bridges, and other structures are found to provide essential habitat for solitary Ozark big-eared bats they also should be protected.
  9. Reestablish stable or increasing populations at all available historic caves in Oklahoma, Arkansas, and Missouri. A number of historic Ozark big-eared bat caves have been closed, commercialized, or are heavily disturbed (Figg and Lister 1989). For this reason it probably will be impossible to reestablish populations at all historic sites. It may be feasible, however, to reestablish the Ozark big-eared bat at suitable remaining caves over its historic range, including Missouri. Reestablishment should occur naturally through expansion of the present range into previously used areas as existing populations increase because of improved protection. A population can be considered reestablished after its numbers have remained stable or increased for 10 years. Expanding the Ozark big-eared bat's range is important because a broader range and more widely distributed population may result in a more stable overall population. With increased distribution and numbers, the Ozark big-eared bat will be less susceptible to catastrophes such as the loss of a colony to vandalism or natural disaster.
  10. Provide long-term protection for Ozark big-eared bat habitat after delisting. To provide long-term protection after delisting, a central authority to protect and manage the Ozark big-eared bat throughout the Ozarks should be maintained. This will require continued coordination across State and Fish and Wildlife Service Regional boundaries and management of caves on private, State, and Federal land. The central authority, whether the Oklahoma Bat Caves National Wildlife Refuge, Ozark Caves National Wildlife Refuge, or an Ozark Cave Coordinator, should be funded and staffed appropriately after delisting.



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### PART III. IMPLEMENTATION SCHEDULE

The following table is a summary of actions and estimated costs for implementing the Ozark big-eared bat recovery plan. It is a guide for meeting the objective discussed in Part II of this Plan. This table indicates task priorities, task numbers, task descriptions, duration of tasks, the responsible agencies, and lastly, estimated costs. These actions, when accomplished, should prevent the extinction of the Ozark big-eared bat and result in it being upgraded to threatened and eventually delisted. It should be noted that the estimated monetary needs for recovery are identified and, therefore, Part III reflects the total estimated financial requirements for the recovery of this species.

#### A. Definitions

Priorities in column 1 of the following implementation schedule are assigned as follows:

- |            |   |   |
|------------|---|---|
| Priority 1 | - | An action that <u>must</u> be taken to prevent extinction or to prevent the species from <u>declining</u> irreversibly in the <u>foreseeable</u> future.                |
| Priority 2 | - | An action that must be taken to prevent a significant decline in the species population/habitat quality, or some other significant negative impact short of extinction. |
| Priority 3 | - | All other actions necessary to meet the recovery objectives.  |

#### B. Key to Acronyms used in Implementation Schedule

- |        |  |
|--------|--|
| AGFC   | - Arkansas Game and Fish Commission            |
| ANC    | - Arkansas Nature Conservancy                  |
| ANHC   | - Arkansas Natural Heritage Commission         |
| ADPT   | - Arkansas Department of Parks and Tourism     |
| AU     | - University of Arkansas                       |
| CFWRU  | - Cooperative Fish and Wildlife Research Unit  |
| FS     | - Forest Service                               |
| FWS    | - Fish and Wildlife Service                    |
| EC     | - Environmental Contaminants                   |
| ES     | - Ecological Services                          |
| LE     | - Law Enforcement                              |
| OBCNWR | - Oklahoma Bat Caves National Wildlife Refuge  |
| REL    | - Realty                                       |
| R&W    | - Refuges and Wildlife                         |
| OESFO  | - Oklahoma Ecological Services Field Office    |
| MDC    | - Missouri Department of Conservation          |
| NPS    | - National Park Service                        |
| NSS    | - National Speleological Society               |
| NSU    | - Northeastern State University                |
| ONC    | - Oklahoma Nature Conservancy                  |
| ODWC   | - Oklahoma Department of Wildlife Conservation |
| ONHI   | - Oklahoma Natural Heritage Inventory          |

OSU	- Oklahoma State University
OBEB	- Ozark big-eared bat
RSC	- Rogers State College
TROG	- Tulsa Regional Oklahoma Grotto

## RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRI-ORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (yrs)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)				COMMENTS
				FWS		Other	FY96	FY97	FY98	FY99	
				Reg.	Pro-gram						
1	1.1	Obtain long-term authority to manage and protect colony sites	10	2 3 4	REL R&W ES	ANC ONC NSS ODWC AGFC ANHC MDC	116 5	116 5	116 5	116 5	Use existing program funding plus \$300,000 to acquire AD-14&AD-125. An additional \$384,000 is estimated to be needed over the next 10 years to acquire new essential caves expected to be found. \$5,000/yr. for cooperative agreements by R&W with landowners.
1	1.2	Enhance Management of the Okla-Bat Caves National Wildlife Refuge	10	2	R&W		127	127	118	102	With full-time manager. After the initial 4 years annual funding should be \$85,000.
1	1.3	Expand approved acquisition area for Oklahoma Bat Caves National Wildlife Refuge	10	2 3 4	REL R&W	ANC ONC ODWC AGFC ANHC MDC					Use existing program funding
1	1.5	Manage Ozark big-eared bat caves by other agencies and groups	10	2 3 4	R&W ES	ONC ANC NSS ODWC AGFC ADPT ANHC MDC FS NPS	15 15	15 15	15 15	15 15	Costs for managing areas by other groups or agencies depends on the number and size of the areas.
1	1.6	Construct, manage, and monitor cave gates, fences, and other cave protective devices where needed	10	2 3 4	R&W ES	ANC ONC NSS ODWC AGFC ADPT ANHC MDC FS	9	9	9	9	To construct at newly found sites, and replace, repair, and maintain existing structures on private land will require annual funding of \$9,000 from a source such as Partners for Wildlife.
1	2.1	Use minimal disturbing census techniques to annually monitor population status at maternity colonies	10	2 3 4	R&W ES	ODWC AGFC ANHC MDC OSU AU	1	1	1	1	2.1, 2.2, 3.1, 3.2, and 3.3 are now being contracted by the OBCNWR and DESFO. Approximately \$8,000 will be required annually to continue these tasks and monitoring and the search should continue for the next 10 years.

PRI-ORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (yrs)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)				COMMENTS
				FWS		Other	FY96	FY97	FY98	FY99	
				Reg.	Program						
1	2.2	Annually census all known hibernacula	10	2 3 4	R&W ES	ODWC AGFC ANHC MDC OSU AU	1	1	1	1	
1	3.1	Search for undocumented maternity colonies	10	2 3 4	R&W ES	ODWC AGFC ANHC MDC OSU AU	2	2	2	2	
1	3.2	Search for undocumented hibernacula	10	2 3 4	R&W ES	ODWC AGFC ANHC MDC OSU AU	2	2	2	2	
1	4.1	Prevent adverse modification to cave habitat, including entrances	10	2 3 4	R&W ES LE	ANC ONC NSS ODWC AGFC ANHC MDC	2 2 2	2 2 2	2 2 2	2 2 2	Some funding to ES for Sec. 7 review and to LE for enforcement. Private land protection can come from a program such as Partners for Wildlife.
1	4.2	Identify and Protect essential surface foraging habitat and movement corridors used by maternity and hibernating colonies	10	2 3 4	R&W ES LE	ANC ONC NSS ODWC AGFC ANHC MDC	2 2 2	2 2 2	2 2 2	2 2 2	Same as 4.1
1	6.1	Develop and maintain land-owner support	10	2 3 4	R&W ES	ANC ONC NSS ODWC AGFC ANHC MDC	2	2	2	2	Possibly from a program such as Partners for Wildlife.
2	1.4	Add new approved areas for land acquisition in eastern OK, western AR, and southern MO	10	2 3 4	R&W REL		2	2	2	2	Funding needs will depend on the number and size of new important areas found to need protection as a result of 3.1, 3.2, and 3.3.

PRI-ORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (yrs)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)				COMMENTS
				FWS		Other	FY96	FY97	FY98	FY99	
				Reg.	Program						
2	1.7	Place warning/interpretive signs at cave entrances	10	2 3 4	R&W ES	ANC ONC NSS ODWC AGFC ADPT ANHC MDC	1	1	1	1	Annual funding of \$1000 will be required for new sites and repair and replacement of existing signs.
2	1.8	Use law enforcement agencies to protect OBEB caves	10	2 3 4	LE R&W	ODWC AGFC MDC					Use existing program funding. Some additional funding may be necessary
2	6.2	Develop and maintain cover support	10	2 3 4	R&W ES	ANC ONC NSS ODWC AGFC ANHC MDC					Use existing program funding
3	2.3	Conduct a population viability analysis	3	2	R&W CFWRU ES	AU OSU	20	20	10		
3	3.3	Search for caves and other structures providing limited-use OBEB habitat	10	2 3 4	R&W ES	ODWC AGFC ANHC MDC OSU AU	2	2	2	2	
3	4.3	Make essential roost sites and surface habitat locations available only to agencies able to assist in protection	10	2 3 4	R&W ES	ODWC AGFC ANHC MDC					Use existing program funding
3	4.4	Map essential OBEB caves	5	2 3 4	R&W ES	COG TROG NSS	2	2	2	2	Local NSS grottos in OK, AR, and MO can assist with this.
3	5.0	Evaluate contaminant effects on OBEB	4	2	EC R&W ES		25	25	25	25	Includes three studies. One on organochlorines, one on aliphatic hydrocarbons, and one on trace elements.
3	6.3	Develop and maintain public support	10	2 3 4	R&W ES	ANC ONC NSS ODWC AGFC ADPT ANHC MDC	2	2	2	2	Use existing program funding

PRI-ORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (yrs)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)				COMMENTS
				FWS		Other	FY96	FY97	FY98	FY99	
				Reg.	Program						
3	7.0	Possible future research	3	2	R&W CFWRU ES	AU OSU	40 40	40 40	40 40	20 20	
3	8.0	Protect all known limited-use sites	10	2 3 4	R&W ES	ANC ONC NSS ODWC AGFC ANHC MDC	20	20	20	20	Cost will depend on the number and size of areas requiring protection
3	9.0	Reestablish stable or increasing populations at available historic caves	10	2 3 4	R&W ES	ANC ONC NSS ODWC AGFC ANHC MDC	140	140	50	45	The cost of managing historic caves will be similar to managing existing essential caves and will vary depending on the number of caves.
3	10.0	Provide long-term protection after delisting	10	2 3 4	R&W ES	ANC ONC NSS ODWC AGFC ANHC MDC					This will require continued funding for the Refuge after delisting of <u>\$85,000/yr.</u>



**APPENDIX I**

**ACTION PLAN FOR MANAGEMENT**

**AT**

**OKLAHOMA BAT CAVES**

**NATIONAL WILDLIFE REFUGE**

**Action Plan for Management**  
**at**  
**Oklahoma Bat Caves National Wildlife Refuge**

**Prepared by**  
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**MAY 23 1991**

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To assist in this review, a team of people knowledgeable in the management of the Refuge, current research and recovery actions for the Ozark big-eared and gray bats, and cave protection and management was convened to help identify the important issues and evaluate recommended actions. The author wishes to recognize the assistance of Ron Sullivan, Refuge Manager, Sequoyah NWR; Steve Hensley, FWS Fish and Wildlife Biologist, Tulsa, OK; Bill Puckette, private citizen, teacher, and spelunker; John Skeen, Non-game Biologist, Oklahoma Department of Wildlife Conservation; Dr. David Leslie, Unit Leader, Oklahoma Cooperative Fish and Wildlife Research Unit; and Nora Jones, The Nature Conservancy as review team members.

Mr. Roy Powers of the American Cave Conservation Association toured the most sensitive refuge caves to assess cave security and safety and offer technical advice on protective structures. His report appears as Appendix 4.

Without the knowledge, experience and ideas of these individuals, this report could not have been completed.

## EXECUTIVE SUMMARY

A number of actions are needed to secure protection of the Ozark big-eared bat (Plecotus townsendii ingens) and gray bat (Myotis grisescens), both endangered species, at the U.S. Fish and Wildlife Service (Service) Oklahoma Bat Caves National Wildlife Refuge (Refuge). Needed immediately are structural security measures at cave AD-10 (Adair County) to minimize human visitation that has the potential to eliminate the most important Plecotus maternity and hibernacula cave on the Refuge. First, a substantial pipe gate with vandal-resistant lock and appropriate signage is needed to minimize vehicle access to the site. Second, a steel cage covering the entire sink hole is recommended to preclude human entry. Prompt and frequent follow-up monitoring will then be required to maintain the structures, assess the effectiveness of the security measures, and determine any necessary corrective actions.

A conventional gate/grill should be constructed to seal off access to cave DL-4 in Delaware County. This action may encourage the return of Plecotus, which has all but abandoned the cave due to human disturbance.

With cave security addressed, the Refuge should initiate an aggressive program of cave management that would include irregular (unpredictable) law enforcement patrolling, a semi-annual (hibernation and maternity populations) bat census, and a vigorous public outreach program extending to all adjacent landowners, the spelunking (caving) community and key bat/cave scientific research entities for the purpose of securing cooperation and assistance in land management and cave protection. Additional Refuge personnel and specialty equipment purchases will be required to accomplish these tasks.

Continued support from the Realty Division is necessary to pursue promising acquisitions that will protect existing and newly discovered Plecotus/Myotis populations and other listed and candidate cave species. Fee acquisition, conservation easements, and Cooperative Agreements have been used in the past. These and other creative instruments are all appropriate protection methodologies and should be considered as circumstances warrant. A revised list of realty actions, in priority order, is provided.

Scientific research is needed to address practical questions relating to surface land use management and bat use, ecological aspects of the cave environment, and bat life history. The evaluation of environmental contaminants entering the caves that may adversely affect bats should be expanded from the initial sampling already conducted. The scope of analysis should include tissues (carcasses), if available, prey species (moths), surrogate (non-listed) bat species and groundwater sampling. Results should be correlated with the application of pesticides and other potential contaminants in the vicinity of the Refuge.

The Service should design, fund, conduct, or otherwise facilitate other research pertinent to management and protection of bats and bat caves. Most important at this time is a better understanding of surface habitat characteristics surrounding caves that favor use by bats. Such information would lead us toward land use prescriptions advantageous to bat conservation. Survey field work to identify other important caves in Missouri, Arkansas, and Oklahoma supporting Plecotus, Myotis, the threatened Ozark cavefish (Amblyopsis rosae), or candidate species has only started and must continue.

Finally, an information and education thrust should be focused on the development of portable materials for public presentations. Such materials should then be coordinated with the other public outreach initiatives in an active campaign to raise the overall profile of bat/cave conservation in eastern Oklahoma.

## INTRODUCTION

Oklahoma Bat Caves National Wildlife Refuge (Refuge) currently consists of five parcels of land under fee ownership or other management in Adair and Delaware Counties in northeastern Oklahoma. The Refuge was created in 1986 to protect the Ozark big-eared bat (Plecotus townsendii ingens) and gray bat (Myotis grisescens), both endangered species.

The Service holds fee title to two parcels of 80 and 110 acres. Conservation easements with The Nature Conservancy (TNC), Mr. Lloyd Cole, and the City of Tulsa encompass an additional 300 acres and grant surface land management protection for bat conservation. A Cooperative Agreement, and access easement, covering about 130 acres of land owned by the Cherokee Nation, adjacent to one fee parcel, will encourage compatibility of surface land use with Refuge objectives for bat conservation. Figure 1 shows the juxtaposition of Service properties. Considerable potential exists for further Realty actions to secure fee title, easement or other protection for caves in the area.

The Refuge contains important summer (maternity), and winter hibernation (hibernacula) caves for Plecotus (Appendix 1). To a lesser extent the Refuge provides habitat for Myotis, which is on the far western edge of its range in eastern Oklahoma. Along with the listed species, an entire ecosystem of cave creatures benefits from protection of the Refuge. The threatened Ozark cavefish (Amblyopsis rosae), candidate southern cavefish (Typhlichthys subterraneus), and candidate Ozark blind salamander (Typhlotriton spelaeus) are known to inhabit caves in the area, but have not been confirmed in current Refuge caves.

The Refuge is managed by the staff of Sequoyah National Wildlife Refuge at Vian, Oklahoma. The current management strategy for the Refuge is limited to cave protection due to the small size of the Refuge, the lack of management staff, and remoteness (approximately 40 miles to the nearest cave) from the Sequoyah Refuge headquarters. Public use is restricted on all Refuge lands, although hunting by permission of the Refuge Manager, is allowed. Annual funding has fluctuated between \$2,000 in FY 1986, and \$10,000 in FY 1991.

This Action Plan is intended to identify management actions mandatory for the conservation of the endangered bats and other listed and candidate species on the Refuge. The Ozark big-eared bat, in particular, is likely to be extirpated from the refuge in the very near future if protective actions are not implemented immediately. Recommendations herein will contribute to implementation of the approved Recovery Plans for the listed species and, most importantly, will assist the Region in supporting the appropriate management decisions affecting the Refuge.

## SPECIES ACCOUNTS

### **Ozark big-eared bat**

The Ozark big-eared bat is the largest of five subspecies of Townsend's big-eared bat. The subspecies is limited to eastern Oklahoma, northwestern Arkansas, and southwestern Missouri (Figure 2). The Ozark big-eared bat is an obligate cave inhabitant in both summer and winter. Maternity colonies form in late March to April when females segregate from males and congregate in warmer parts of selected caves from which they emerge nightly to feed on moths at the forest edges. Birth of a single young occurs in late spring or early summer. The young grow rapidly and are capable of flight in 3 weeks and attain adult size in 1 month. Plecotus exhibit a high degree of attachment to the maternity roosts, returning to the same cave year after year.

As winter approaches, the bats seek out cold cave environments where they enter an extended period of hibernation. During hibernation, the bats may utilize one-half their body fat. Periodic arousal, as from disturbance, may result in a serious depletion of fat reserves that cannot be replenished.

Within the range of the species there appears to be considerable unoccupied habitat. For instance, over 100 suitable caves exist in Adair and Delaware Counties, Oklahoma, yet only a few are occupied by Plecotus. Most recent counts indicate a population of about 860 females at maternity sites (Hensley, 1990). Males are unaccounted for in this estimate.

### **Gray bat**

The gray bat occupies a limited range in the southeastern United States from Tennessee to Eastern Oklahoma and south to Alabama (Figure 3). While there may be 1.5 million gray bats, about 95 percent of the known population hibernates in just 9 caves in winter with more than half in a single cave (USFWS, 1982). Fewer than 5 percent of available caves are suitable for gray bat occupation due to the species' unique habitat requirements (Tuttle, 1979). Winter caves must be deep and vertical with the lower levels acting as a cold air trap. A wider variety of caves is suitable in summer and are characteristically near water over which the bats forage for insect food (USFWS, 1982).

Upon arrival at hibernacula in the fall, adults mate and immediately enter hibernation. Females emerge from hibernation in March or April and give birth to a single young in May or June. Most young fly 20-25 days after birth and begin foraging over nearby water bodies.

Although gray bat numbers are comparatively high for an endangered species, the population has declined severely since cave exploitation began on a large scale. The rate of decline has increased in the past 30 years. At

Least three major hibernacula in Alabama and Tennessee have been abandoned in 50 years. Other hibernating populations have suffered a 50 percent decline (USFWS, 1982).

Reasons for the decline of gray bat populations can largely be attributed to human disturbance at critical caves. Commercialization of caves and the growing sport of spelunking (cave exploration) has disturbed bat populations and caused abandonment of many caves. Man-made impoundments for flood control, hydroelectric power, and agriculture have inundated caves. The influence of pesticides in the decline of the species has been documented (Clark et. al. 1978), but needs further study.

Finally, the installation of poorly designed cave gates, for bat conservation, has resulted in the abandonment of some gray bat maternity colonies. Gates that restrict bat movements, alter cave microclimates such as air flow, or facilitate predation should be avoided.

Bats play a vital role in the ecology of cave environments. Their guano (fecal material) fuels a complex subterranean food web that includes bacteria, invertebrates, and aquatic species. When bats are lost, the primary source of energy to the cave ecosystems is eliminated. Conversely, maintenance of bat populations may be the single most important element in preserving the entire cave ecosystem.

#### CAVE SECURITY

Deliberate or inadvertent disturbance to bats by human visitation to the caves is the single most significant threat to cave management and bat conservation at the Refuge. Congregations of bats in dense clusters for hibernation or in maternity colonies (1,828 per square meter for gray bats) (Tuttle 1975) render them particularly vulnerable to malicious vandalism. Plecotus roosts in small groups, preferring semi-light reaches usually near the cave entrance (Puckett pers. comm.). Thus, Plecotus is easily disturbed and readily takes flight by even a shallow penetration of the cave. In panic, pregnant females are stressed and newborn young, clinging to the mother, may be dropped to the cave floor and lost.

Cave AD-10 (Adair County) is the most frequently violated by unauthorized human intrusion. AD-10 is a 20-foot deep sink hole from which emanate 5 individual caves. Passages are small and there is considerable loose and fractured rock making the cave unsafe for entry by anyone not experienced with cave exploration (Powers, pers. comm.). The cave is the most important on the Refuge, supporting the largest population of Plecotus, and serving both as a hibernacula and maternity colony site. A cable barrier across the entrance road and "No Trespassing" signs at the barrier and in the vicinity of the cave have failed to halt unauthorized entry. The cable has been repeatedly cut and even disassembled by trespassers in the past (Sullivan, pers. comm.).



Options for structural protection have been identified, but each has disadvantages. Some measures fail to eliminate disturbance; others may have adverse effects on bats. Fences are easily breached and poorly designed and constructed gates will not stop the committed vandal. Due to the frequency of visitation and the remoteness of AD-10, fencing around the sink hole would not likely be successful. Given time and minimal assistance, a fence could be climbed or cut. Moreover, a fence represents the most expensive option. A combination of measures is needed to minimize disturbances at AD-10.

Approximately 150 steel gates have been installed on caves in the eastern United States, most to protect sensitive bat species from human disturbances. In virtually every case, caves with gates exhibited an increase in the resident bat population. Bats have even reinhabited abandoned caves after gates have been installed. Although we have no experience with P.t. ingens, empirical evidence indicates that other Plecotus subspecies will accept a gate structure, provided it is correctly installed (Powers, pers. comm.).

The cave geometry at AD-10 favors a low cage structure over the entire sinkhole, rather than individual gates on the separate cave entrances. A cage will probably require about the same amount of steel as individual gates, be less restrictive to bat populations, afford better public safety advantages, and generally represents a superior long-term solution (Powers, pers. comm.).

DL-4 in Delaware County is located in a public recreation area on an arm of Lake Eucha and is easily accessible. It is also well known by local spelunkers. Consequently, use of the cave by listed bats is now almost nonexistent. A protective structure on DL-4, sealing it off from intrusion, may encourage reestablishment of listed bats (Powers, pers. comm.)

Frequent follow-up monitoring (about once/week at first) will be necessary to assess the effectiveness of structures at AD-10 and DL-4, and determine the acceptability to Plecotus and Myotis. Night visits should be scheduled to observe bat flight patterns that might signal stress due to the new structures. With timely repair and good maintenance (i.e., rust control), the security structures should last many years.

### Actions

- o Install a pipe gate with vandal-resistant lock to replace the present cable across the entrance road to AD-10. Because the road is on Cherokee Nation land, appropriate signage that includes both the Service and Cherokee Nation logos should be placed at or on the gate to improve chances for compliance by local residents. The area should be designated a "Research Natural Area", closed to public entry, without mention of bats or caves.

- o Construct a cage over the entire sinkhole at AD-10 to prevent human entry. The cage should be designed and installed by someone experienced with such devices. Installation in early September will least disturb bats (Powers, pers. comm.).
- o Install a conventional cave gate at DL-4 to end further human disturbance. This gate should also be designed and installed by someone experienced in cave gating, and all work performed in early September.
- o Conduct irregular law enforcement patrols at AD-10 and DL-4, approximately once per week, until human visitation and vandalism abate, and then reduce visitation to once per month.

### CAVE MANAGEMENT

Perhaps the most important and complex issue is the long-term management of the Refuge to maximize conservation of endangered bats and other cave species of concern. This issue will remain significant long after security problems are resolved. Frequent, but irregular, monitoring of caves for protection is an important management action that has not received sufficient attention due to staff shortages and the scattered and remote nature of Refuge caves.

A regular assessment of Refuge bat populations is another critical objective that could be combined with law enforcement patrols. Population census work should be coordinated with the Oklahoma Cooperative Fish and Wildlife Research Unit which has conducted bat research for several years. Additional Refuge staff and equipment will be required to meet this challenge adequately.

Cave management includes not only consideration of the immediate Refuge property, but surface land use for a reasonable distance in all directions. Lactating female Plecotus may forage nightly out from the cave a maximum distance of about 7 kilometers (4.3 miles) (Leslie, pers. comm.).

The Nature Conservancy has secured cave property and is pursuing further acquisitions in eastern Oklahoma. They have expressed the desire that the Service manage TNC properties under appropriate agreements (Jones, pers. comm.). Such opportunities would broaden the scope of Refuge responsibilities in the year's ahead.

### Actions

- o Add at least one additional person to the Sequoyah Refuge staff with primary responsibility for Oklahoma Bat Caves Refuge management. The position should be in the GS-485 (Refuge Manage) or GS-486 (Wildlife Biologist) series at the discretion of the Refuge Manager and Regional Office. Recruitment should attempt to attract individuals with a

background in mammalogy (preferably bat biology) and an interest in cave conservation. The position should be rated high enough (and perhaps multiply-graded) to encourage extended tenure, allowing the incumbent to gain the trust of neighbors, researchers, and others active in cave protection.

- o Conduct irregular law enforcement patrols at all Refuge properties approximately once per month. Repairs and general maintenance of all security structures should be conducted when necessary.
- o Conduct a bat population census at all Refuge caves twice per year. A winter survey of hibernating populations and a summer (June-July) census of the maternity population are recommended. Census efforts should be coordinated with the Oklahoma Cooperative Fish and Wildlife Research Unit at Oklahoma State University, Stillwater, OK.
- o Purchase a night vision scope and infra-red lighting equipment to facilitate night census work.
- o Initiate a program of data collection on each cave on Refuge property. Parameters such as temperature, humidity, air flow, and physical structure of the cave (internal mapping) should be recorded.
- o Develop a MOU with TNC expressing the goals and objectives of each agency in protection and management of caves in eastern Oklahoma. An umbrella agreement should provide for subsidiary agreements addressing unique management requirements of selected caves.
- o No change is recommended in the current minimal surface land use of the Refuge. The Service should continue to allow public hunting access and other uses, by permission of the Refuge Manager, that are not incompatible with protection of the caves and bats.
- o Encourage minimal land use changes on private properties adjacent to the Refuge. Pursue conservation easements, cooperative agreements or other arrangements, as appropriate, to protect forage resources and minimize adverse effects of surface land uses on cave environments.
- o Participate in the interagency "cave working group" that has formed in Oklahoma. The group consists of Federal, State, and private individuals active in cave preservation.

#### REALTY SUPPORT

The Realty Division is already providing active support by pursuing acquisitions and conservation easements to secure newly discovered bat caves and to buffer existing Refuge properties. A Cooperative Agreement and access easement have recently been consummated with the Cherokee Nation at AD-10. The Realty staff is tracing land ownerships and boundaries in accordance with its current list of priority acquisitions. Action on 3 of

the 5 priority cave properties is underway. Realty actions currently in process are affirmed to be the most appropriate.

Appendix 2 provides a revised list of recommended cave sites requiring Realty action. This list should not replace the current Realty priorities, but is intended to guide future Realty actions.

The Nature Conservancy is actively identifying and securing sensitive bat caves. Their activities can be a valuable adjunct to Service realty efforts where land owners are reluctant to deal with the Government. The existing cooperative relationship with TNC on realty actions should be sustained in the best interests of program effectiveness.

The proximity of Oklahoma Bat Caves Refuge to Regions 3 and 4 suggests that efficient realty operations in Missouri (Region 3) and Arkansas (Region 4) could be coordinated with, if not conducted by, the Region 2 Division of Realty. Unfortunately, no Plecotus caves are currently known in Missouri, and Region 3 is only now assessing the occurrence of Myotis. Region 3 will not be ready to prioritize bat cave acquisitions in Missouri for some time (Refschneider, pers. comm.)

Similarly, we need more basic survey work in Arkansas before the Service can set priorities for Realty action in Region 4.

### Actions

- o Reaffirm/revise the priority list of Realty actions annually with the assistance of the "cave working group" to insure Service focus on the most important properties and to coordinate our efforts with other active parties.
- o Maintain our existing cooperative relationship with TNC, encouraging that organization to pursue conservation actions with owners of important properties who are reluctant to deal with the Service.
- o Maintain coordination with Region 3 and 4 to monitor their progress in identifying significant bat caves. Consider Realty assistance to those Regions in the future.

### RESEARCH

The primary focus of any research should be on Refuge management needs. Innovative research has only begun to explore bat/cave ecology on the Refuge. The State of Oklahoma is coordinating surveys for other caves that may support Plecotus and Myotis through Section 6 of the Endangered Species Act. The Nature Conservancy is conducting a status survey of eastern Oklahoma cave invertebrates.

The Service is in an excellent position to encourage, direct, and support bat/cave research through the Oklahoma Cooperative Fish and Wildlife Research Unit, Endangered Species Act (Section 6) funding, or direct contract. Research of greatest utility at this time would determine the microhabitat characteristics of hibernacula and maternity caves. A better understanding of the surface habitat (foraging) requirements that favor, or discourage, the use of particular caves by bats would allow more informed impact assessments of developments near caves and guide land use prescriptions that would advance bat conservation.

A particular area of research concern is that of contaminants in the cave environment. Fears are repeatedly expressed that groundwater contamination may threaten aquatic cave invertebrates and that bat populations may be accumulating pesticides either directly from exposure or secondarily through their insect food. However, little has been done to clarify the issue. Only recently has guano been collected and analyzed, but the results have not yet been assessed. However, it is not likely that a single sampling effort will reveal conclusive results. A more thorough contaminant survey effort should be conducted.

### Actions

- o Fund the Oklahoma Cooperative Fish and Wildlife Research Unit to conduct studies of the microhabitat of Refuge caves and nearby surface habitat characteristics that favor bats. Temperature, humidity, air flow, cave geometry, roost substrate availability in caves, and surface habitat use are all avenues of research useful to Refuge management.
- o Continue support for annual funding through the Endangered Species Act (Section 6) for surveys of other caves in Oklahoma, Missouri, and Arkansas to discover additional Plecotus and Myotis colonies.
- o Support TNC efforts to complete the eastern Oklahoma cave invertebrate status survey. Utilize the results in future decisions to list cave-obligate species as threatened or endangered.
- o Develop a new contract for additional contaminant surveys of Refuge caves. Include other caves as appropriate. Sampling should include guano, carcasses (tissues), prey species (moths), surrogate (non-listed) bats and groundwater. The results should be correlated with pesticide applications surrounding the Refuge or other known contaminant sources. The Division of Environmental Contaminants (soon to be the Division of Habitat Quality) in Fish and Wildlife Enhancement should be the lead on the contract and should interpret the results for the Refuge and make further recommendations as appropriate. The Oklahoma Cooperative Research Unit should also be solicited for support on this contract.

- o Encourage research into the importance of caves utilized by only one or a few bats. Such "solitary use" caves may be unique and potentially significant to bat conservation. Relative to other research needs, this effort would not be considered critical.
- o Bat/Cave research should be vigorously supported by the Regional Office in all in-Service forums that solicit Refuge research needs.

### PUBLIC OUTREACH

The Service owns or controls only a few bat caves despite considerable progress since our first acquisition in 1986. Until the importance of foraging habitat is clarified through research, we must assume that an insignificant amount of this undoubtedly critical component is protected on the Refuge itself. Thus, our ability to influence land use surrounding the Refuge is important and opportunities in this area should be pursued.

Public outreach means not only creating interpretive information and education materials for public distribution, but contact with specialized "publics" to foster protection and management on the Refuge. Interaction with neighboring landowners has already resulted in benefits as evidenced by several conservation easements that have expanded protection of Refuge caves. The cooperation and support of spelunking groups could materially advance Refuge objectives and produce secondary benefits. Because confidentiality is important, a sound trust relationship should be developed with any special interest group before revealing the locations of Refuge caves.

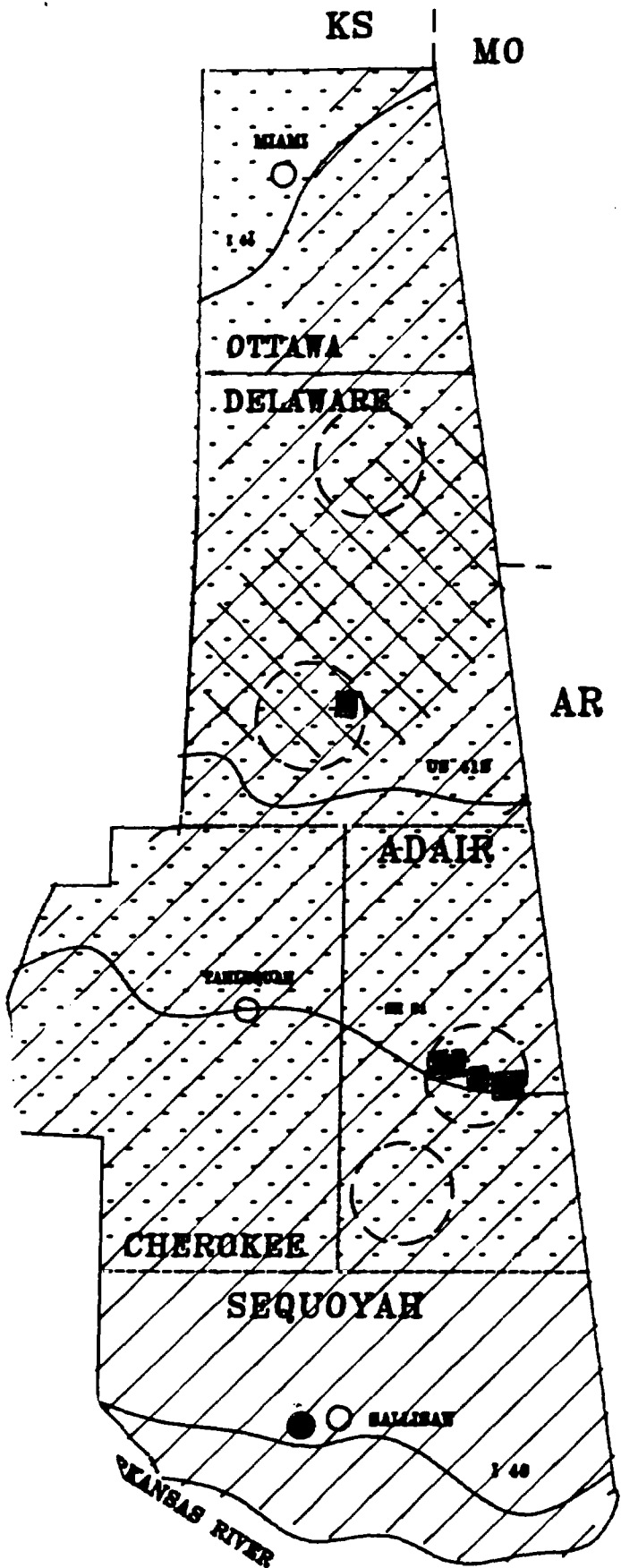
The new staff position at the Refuge (see Cave Management) will be key to making any public outreach effort succeed. Performance standards for the position should reflect the public outreach results desired.

### Actions

- o Develop an effective cooperative relationship with the Cherokee Nation, principally through their land manager and their Natural Resources Office. The purpose of contacts should be information exchange and coordination of land use proposals.
- o Develop an "umbrella" Memorandum of Understanding (MOU) with TNC regarding Realty efforts and cooperative cave management. The MOU should define the long-term goals of both the Service and TNC and reflect the current desire of TNC to transfer management of caves they acquire to the Service.
- o Pursue development of individual MOUs with selected local "grottos" (chapters) of the National Speleological Society. Such MOUs could result in assistance on mapping Refuge caves and the collection of physical data. These cooperative efforts also could encourage cave

security through a cooperative understanding of unique cave resources. In all such instances, confidentiality of cave locations should be protected.

- o Public information and education efforts should emphasize "portable" information such as slide/tape materials, video tape media, and public presentations. At the present time, the level of Refuge facilities and low visitation by the general public do not warrant expenditures for on-site interpretative materials.



OZARK BIG-EARED BAT DISTRIBUTION



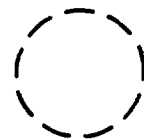
GRAY BAT DISTRIBUTION






OZARK CAVEFISH DISTRIBUTION



IMPORTANT CAVE AREAS

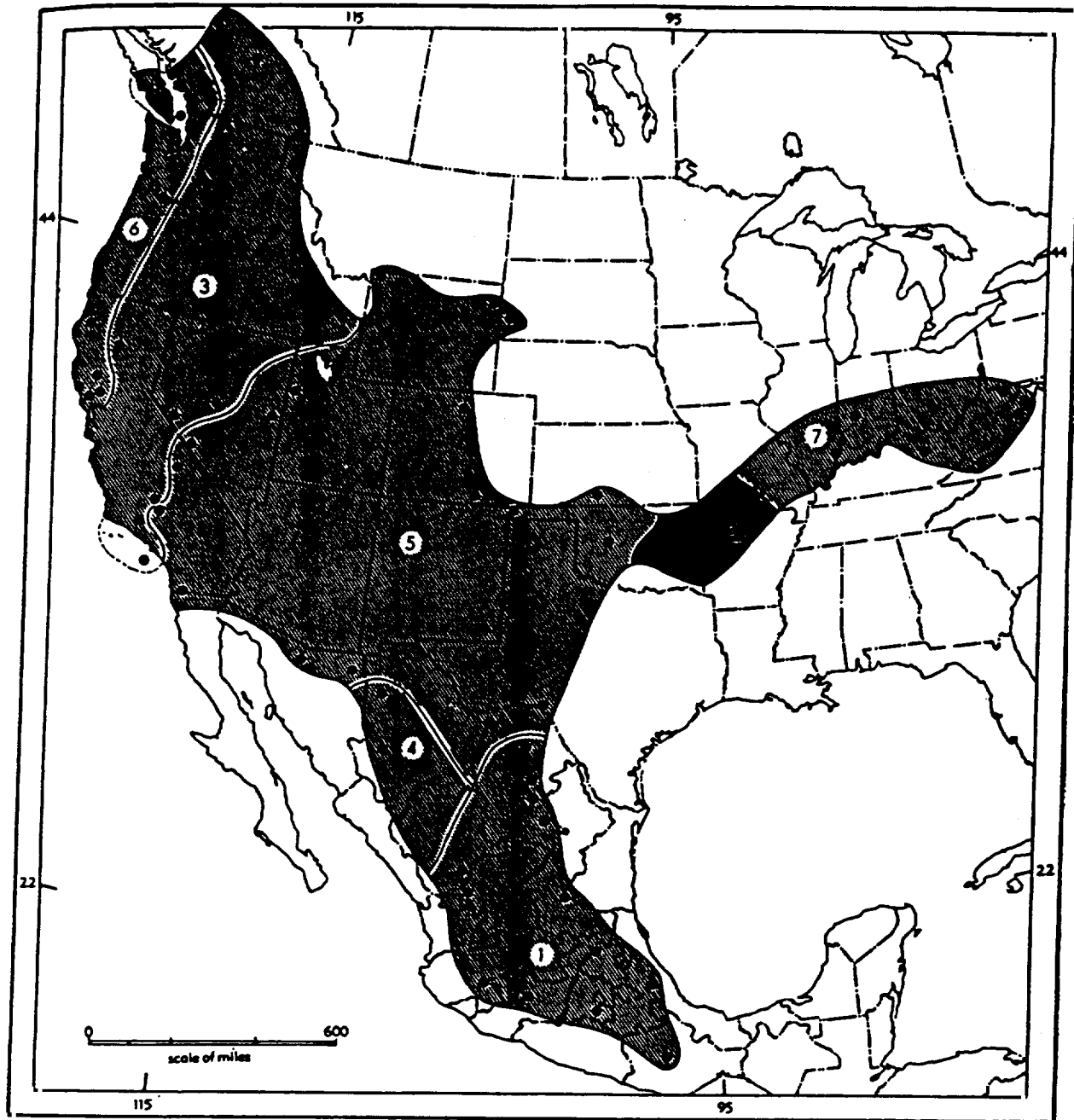


-  - Easement properties
-  - Fee Title properties
-  - Refuge Headquarters

**EASTERN  
OKLAHOMA  
CAVE RESOURCES**

**FIGURE 1**





Map 148. *Corynorhinus townsendii* and subspecies.

Guide to  
subspecies

1. *C. t. australis*

3. *C. t. intermedius*

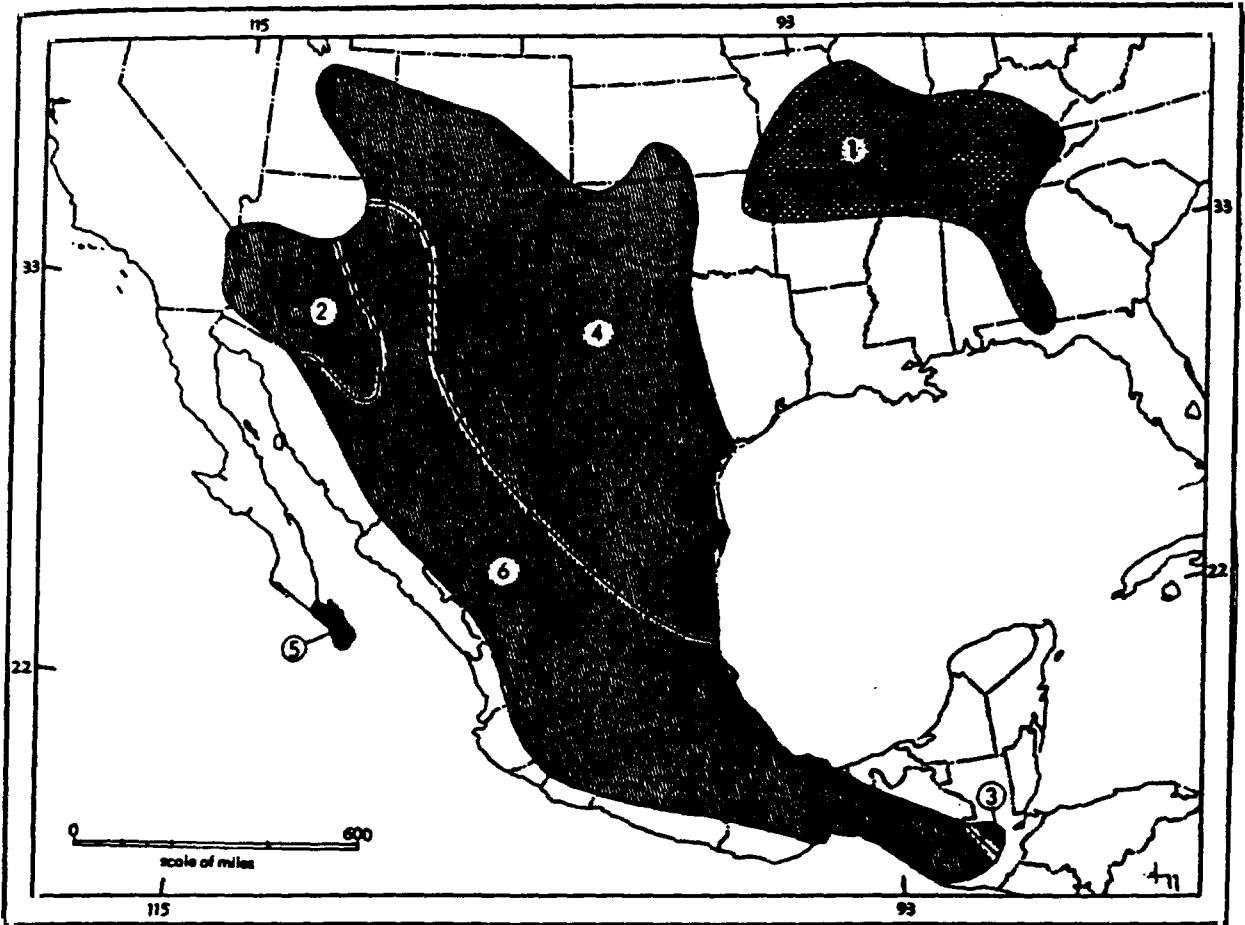
4. *C. t. mexicanus*

5. *C. t. pallescens*

6. *C. t. townsendii*

7. *C. t. virginianus*

Figure 2  
Range of Ozark Big-eared Bat  
(*Plecotus townsendii ingens*)



Map 121. *Myotis grisescens* and *Myotis velifer*.

- |                        |                            |                              |
|------------------------|----------------------------|------------------------------|
| 1. <i>M. o. brevis</i> | 3. <i>M. o. cobanensis</i> | 5. <i>M. o. peninsularis</i> |
| 2. <i>M. o. brevis</i> | 4. <i>M. o. incautus</i>   | 6. <i>M. o. velifer</i>      |

Figure 3  
Range of Gray Bat  
(*Myotis grisescens*)

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Appendix 1

Oklahoma Bat Caves National Wildlife Refuge  
 Caves Known to Support Ozark Big-eared and Gray Bats

<u>Designation</u>	<u>Status</u>	<u>County</u>	<u>Bat Use</u>	<u>Comments</u>
AD-10	Fee	Adair	Primary maternity; hibernacula	Human disturbance
AD-49	Fee	Adair	Hibernacula	Gittin Down Mtn. adjacent to TNC
AD-17/18	Easement	Adair	Maternity	Cole tract
DL-4	Easement	Delaware	Solitary use	Heavy disturbance; bats nearly extirpated
Charlie Owl	Easement	Adair	gray bats	TNC land adjacent to AD-49

## APPENDIX 2

### REALTY ACTIONS (in priority order)

<u>Cave Designation</u>	<u>County</u>	<u>Comments</u>
AD-125	Adair	Largest known population of <u>Plecotus</u> not under protection. A "must have."
AD-3	Adair	TNC currently pursuing.
AD-13	Adair	Coon Mountain Cave; maternity site.
AD-15	Adair	Cave Spring - <u>Plecotus</u> and <u>Myotis</u> habitation.
DL-92	Delaware	Largest gray bat colony in Oklahoma.
DL-15	Delaware	May be an alternative refugia from DL-92.
DL-38	Delaware	Ozark cavefish.
OT-4	Ottowa	Gray bat colony.

APPENDIX 3

Implementation Plan and Schedule

Priority I:

Purpose: To secure caves AD-10 and DL-4 from human intrusion.  
To increase protection immediately at two bat caves.

<u>ACTION</u>	<u>SCHEDULE</u>	<u>DIRECT COST (\$)</u>	<u>ANNUAL COST (\$)</u>
o Cave inspection and monitoring. Increase frequency of visits using existing staff.	3Q/91		5,000
o Install pipe gate with vandal-resistant lock across road to AD-10.	4Q/91 <u>1/</u>	800	M&R <u>2/</u>
o Signage for gate to AD-10.	4Q/91	300	M&R
o Cage over sinkhole at AD-10.	4Q/92	10,000	M&R
o Conventional gate at cave DL-4.	2Q/92	8,000	M&R
		<u>\$19,100</u>	<u>\$5,000</u>

Priority II:

Purpose: To improve management at all bat caves.

<u>ACTION</u>	<u>SCHEDULE</u>	<u>DIRECT COST (\$)</u>	<u>ANNUAL COST (\$)</u>
o Additional staff with management responsibility for OBC NWR.	4Q/91		45,000
o Vehicle fuel to support increased patrolling and increased management activity.			2,500
o Rappelling gear-includes lights and clothing.	4Q/91	1,500	
o Night vision scope and infra-red lighting.	1Q/92	7,000	
o Semi-annual bat census monitoring. Possibly in conjunction with OK Coop Unit.			5,000 <u>3/</u>
		<u>\$8,500</u>	<u>\$52,000</u>

Priority III:

Purpose: To encourage research on caves and resident species.

<u>ACTION</u>	<u>SCHEDULE</u>	<u>DIRECT COST (\$)</u>	<u>ANNUAL COST (\$)</u>
o Cave search and species surveys. Microhabitat studies in caves, surface habitat characteristics. Possible support by OK Coop Research Unit.			12,000
o Surveys for other bat populations.			(39,000) <sup>4/</sup>
o Contaminant monitoring in all OBC caves. Initial survey for one year. Additional work dependent on initial results.	1Q/92	10,000	
		<u>\$10,000</u>	<u>\$12,000</u>

Priority IV:

Purpose: To increase public awareness of cave conservation.  
To influence surrounding land use to benefit OBC NWR.

<u>ACTION</u>	<u>SCHEDULE</u>	<u>DIRECT COST (\$)</u>	<u>ANNUAL COST (\$)</u>
o Develop MOU with TNC regarding protection and management of eastern OK caves.	4Q/92		<u>5/</u>
o Investigate feasibility of MOUs with local "grottos" of Nat. Spel. Society to assist with cave mapping.	1Q/93		<u>5/</u>
o Public information and education materials.	4Q/93		<u>5/</u>
Slide/tape		1,000	
Video tape		10,000	
		<u>\$11,000</u>	

Footnotes

- 1/ Fiscal quarter/Fiscal year.
- 2/ Maintenance and repair expenses each year.
- 3/ Cost to vary depending on assistance provided by OK Coop Res. Unit.
- 4/ Endangered Species Act Section 6 funds to OK in FY91 for bat/cave survey work. Future expenses not attributable to NWR budget.
- 5/ Staff expenses included in salary and benefits for additional staff above.

APPENDIX 4  
**Inspection Report for AD - 10**

Inspection of AD-10 was made on March 30, 1991, and revealed the following. There are five passages radiating out from the floor of the sink. Because of the possibility of hibernating bats, these passage ways were not explored beyond the twilight zone. These passages probably interconnect as previously reported. The sides and ceiling of some of these passages are fractured and are unstable. The main passage, located on the east side, would require a gate approximately 12 x 14 feet. The remaining passage ways would require two more gates. Because of the number of gates that would have to be constructed and the degree of difficulty with construction, I recommend that a cage type gate be placed over the sink. The lip around the sink hole is stable except for one small area on the east side which may collapse in a few years but presents no danger to a properly engineered structure. The entire area surrounding the sink hole slopes inward and downward making possible the avoidance of an air dam. This cage must be properly engineered in order to prevent blockage of cold air. Because of the narrow time frame for installation which this gate must be installed, I would not be able to personally install or supervise the installation of this gate this year. I will however discuss AD-10 with Marion Vivittoe and see if he is interested and able to install the gate in late summer. If he is unable or unwilling, I can, with sufficient notice, fit this installation into next springs schedule.

DL-4 was also inspected on March 30, 1989. It was initially thought to have two separate entrances, but inspection revealed only one entrance. What was thought to be the entrance was a separate cave with two entrances. The geometry of DL-4 will permit the construction of a standard angle iron bat gate.

Due to its location the cave apparently receives heavy traffic. In addition to being a bat cave it potentially has archaeology possibilities. There is evidence of pot holeing. The gate at this site should be placed just inside the entrance and should be constructed with a steel skirt extending outward over the bluff covering the small area that is not bedrock. This will prevent tunneling.

Several gates have been placed on Plecotus maternity colonies in the east and the Plecotus population has increased in size. There is no reason to suspect that the western Plecotus would have any difficulties in using the gate.



**APPENDIX II**

**EXAMPLE OF APPROPRIATELY WORDED  
SIGNS RESTRICTING CAVE ACCESS**

**PLEASE NOTICE**

**DO NOT ENTER THIS CAVE  
BETWEEN**

**APRIL 1 AND SEPTEMBER 15**

The Ozark Big-Eared Bat, an Endangered Species, uses this cave for raising young during the summer and is sensitive to disturbance. If disturbed when newborn flightless young are present, the panicked parents may drop their young which they are unable to recover from the cave floor. The number of Ozark big-eared bats has declined drastically over the past several years and disturbance of nursery colonies has been a contributing factor. Insect eating bats such as the Ozark big-eared bat are beneficial to man and deserve protection.

The gate is to provide seclusion, for Ozark big-eared bats during a critical period of the year and is the property of the United States Government. Disturbance of the bats during the period of closure constitutes a violation of the Federal Endangered Species Act and is punishable by fines up to \$100,000 and/or imprisonment for up to one year.

**ATTENTION**

**DO NOT ENTER**

Endangered Bats may be living in the cave. Disturbance of endangered species is punishable by fines up to \$100,000. Bats Cannot tolerate disturbance. Do not enter this cave at any time. 16 U.S.C 1531-1543

**ATTENTION**

**DO NOT ENTER THIS CAVE  
BETWEEN**

**APRIL 1 AND OCTOBER 31.**

To do so when Ozark big-eared bats are present is a violation of the Federal Endangered Species Act, punishable by fines up to \$100,000 for each violation.

The Ozark big-eared bat, a highly beneficial endangered species that spends the summer here, is intolerant of disturbance, especially when flightless newborn young are present. Baby bats may be dropped to their deaths by panicked parents if disturbance occurs during this period, or may simply be abandoned.

**ATTENTION**

**CLOSED TO THE PUBLIC**

Do not enter this cave. The Ozark big-eared bat, an endangered species, has been known to use this cave. Disturbance of this endangered species is punishable by a fine up to \$100,000.

The highly beneficial Ozark big-eared bat is a mammal which cannot tolerate disturbance, especially when flightless newborn young are present. Young bats may be dropped or abandoned when disturbance occurs.

Example of warning signs used to protect endangered bat caves.

## **APPENDIX III**

### **EXAMPLE OF NEWSPAPER ARTICLE**

# Old Fears Haunt Bats' Reputation

By Mona Shoup  
World Staff Writer

Put aside fear and myths about bats, and you'll discover a fascinating and even cute little creature that benefits the environment and man.

Bats have gotten a bad rap because of movies and because people don't know much about them, said Steve Hensley, a biologist with the U.S. Fish and Wildlife Service.

"They're not evil animals, they're like any other mammal. They play their part in the big scheme of things in our ecology and environment," said Hensley.

"People tend to invent things about nocturnal animals — not just bats, but owls and other creatures that go bump in the night," said Chuck Rippey, Tulsa Zoo museum curator, who has done research on bats.

Around 18 species of bats are found in Oklahoma, which include residents and migrants. Three of those species, the Ozark big-eared bat, the gray bat and the Indiana bat, are federally endangered species, said Hensley.

All Oklahoma bats are insect-eaters, feeding on mosquitoes and moths in our back yards and along highways and on cutworms and grasshoppers on farmlands.

A major controller of night-flying insects and agriculture pests, bats would be sorely missed from the environment, said Hensley. One bat may eat as many as 100 insects nightly. The 20,000 gray bats from one cave in eastern Oklahoma eat about 250 pounds of insects a night.

Bat populations are declining. Their biggest threats are human intrusion, loss of habitat and pesticides.

Government and environmental groups are working together to protect major caves in Oklahoma. Cave locations aren't revealed because humans are destructive to caves and needlessly kill bats, said Nora Jones of The Nature Conservancy.

Cave conservation is important because a species' population could be greatly endangered by the loss of just one cave. For example, gray bats hibernate in only nine caves, but over half of the population hibernates in one



# Bat Rap

Photo by Merlin D. Tuttle

Isolated groups of Western big-eared bat, called the Ozark big-eared bat, occur in the Ozark mountains.

cave. And about half of the female Ozark big-eared bats form nursery colonies in one cave in Oklahoma, said Hensley and Jones.

"We really don't know that much about a lot of these species, but we do know that we need to protect their food supply in the place they reproduce and the place where they hibernate," said Jones.

Walking into a bat cave at the wrong time of year can be critical to the bats.

From late April to early July, some bat species form nursery colonies in caves when raising their young. If the bats are disturbed during this time, they're liable to drop or abandon their young, said Hensley. Many species have only one offspring per year.

During the winter, when bats hibernate, is another critical period. If they're disturbed, they may burn up too much energy and starve to death before spring, said Hensley.

"People who don't understand cave ecology and don't understand how delicate these systems are, can adversely impact the bats and other cave organisms," said Jones.

The whole cave habitat functions as a unit. Animal life in Twin Cave, a bat cave in northeast Oklahoma managed by The Nature Conservancy, includes rare Ozark cave fish, blind cave crayfish and cave salamanders that are all dependent on bat guano. If the bats are disturbed and move from the cave, then all these populations are going to crash, said Jones.

"Serious cavers understand this. They're committed to cave conservation and helping us maintain and restore these caves. It's people who really don't know what's going on who go in there and disrupt the system," said Jones.

Twin Cave was excessively vandalized and required major clean-up when the conservancy took it over in 1988. Since then, the number of bats in the cave has risen and the whole cave system's getting closer to normal, she said.

Even though researchers have gained more insight into the lives of bats, many myths still exist, said Rippey.

Rippey gives these explanations for some of the most common bat myths.

■ **Bats attack people.** People once mistook bats erratic flight patterns as trying to attract or attack humans, when in fact the bats were just trying to catch bugs. Bats use echolocation — so see Bats on C-2.

# Nature Lovers Going to Bat With Habitats for Bats

Some bats live in caves and buildings, some roost in trees in the summer and migrate in the winter — and some live in bat houses.

More people are putting up bat houses in their back yards, said Steve Hensley, a U.S. Fish and Wildlife Service biologist. "You can't attract a bat to a bat house, it's kind of like a bird house — if they need it, they will use it," said Hensley.

Bat houses are available where wild bird supplies are sold or you can build your own according to specifications from Bat Conservation International found in "The Bat in My Pocket: A Memorable Friendship" by Amanda Lollar (Capra Press, \$9.95) and "America's Neighborhood Bats," by Merlin D. Tuttle (University of Texas Press).

Species most likely to use a bat house in Oklahoma during

warm months are big brown bats, little brown bats and Mexican free-tailed bats, according to BCI.

Bat houses located near water and where pesticides aren't used are most likely to attract bats. It may take one to two years for a house to become occupied. If it's not occupied by the end of the second year, try moving it to a warmer or cooler location.

Europeans often put up four

bat houses at a time around a tree trunk and arrange them to face each direction to provide a variety of temperatures for the bats.

Fall, winter or early spring is the best time to put out a bat house. Houses should be hung 12-15 feet above the ground preferably on the sides of buildings and sheltered from the wind. Houses require no maintenance, since droppings fall

through the open bottom to the ground below.

Once bats have lived in your bat house for several months, they may be tolerant of having a flashlight shone on them occasionally. Do this only briefly and don't repeat more than once a week, or they may abandon the house and their young.

For more information, write Bat Conservation International Inc., PO Box 162603, Austin, TX 78716-2603.

---

## . . .Bats

Continued from C-1

phisticated ultrasonic signals — to hunt bugs, so if the bug is bobbing up and down, the bat is too.

■ **Blind as a bat.** Experiments have proven that bats can see and rely on sight for migration.

■ **Bats get tangled in women's hair as they fly past.** If a bat flies into you, it's usually by accident. Bats can sense something as fine as a strand of hair with echolocation. Sometimes bats don't echolocate, especially when they're in a familiar area.

■ **Bats are filthy.** Bats are clean animals and spend much time grooming themselves.

■ **Bats bite.** "A bat bite is a rare thing. Any animal will bite because that's the only defense that they have," said Rippey. Of the approximately 1 million bats that Rippey has handled while banding, he has been bitten only 30-40 times.

■ **Bats carry rabies.** The incidence of rabies in bats is less than one-half of one percent, according to Bat Conservation International, Austin, Texas. Rabid bats don't become enraged and attack people or animals. Rather, they usually become paralyzed and die quietly.

Bats, like any other wild animal, shouldn't be picked up or touched, said Hensley.

Occasionally bats might decide to roost in attics. The only effective way to get rid of them is screen them out after they've left for the evening. Be careful not to screen out bats during the spring when they might have young, said Rippey.

**To screen out:** For several days, hang nylon mesh at entry points so it extends at least two feet below and to each side, the bottom edge being allowed to hang loosely from one to several inches away from the side of the building. This allows emerging bats to crawl under and out, but returning bats are unable to find their way in.

If you're not sure bats are in your neighborhood, watch for them at dusk or around street lights at night.

**APPENDIX IV**

**COMMENTS ON THE REVISED**

**OZARK BIG-EARED BAT RECOVERY PLAN**

The notice of an opportunity to review and comment on the Ozark Big-Eared Bat Revised Recovery Plan was published in the Federal Register on September 21, 1993 (Vol. 58, No.181). Eight comment letters were received and copies of each are provided below. Editorial comments, corrections of factual errors, etc., were incorporated into the text of the plan and comments concerning contents of the plan were addressed in specific responses. Numbers occurring in the margins of the letters refer to the appropriate response for that comment.

1468 N. Westridge Ave.  
Tucson, AZ. 85745  
1 November 1993

Mr. Charles M. Scott  
Acting Field Supervisor  
Ecological Services  
U.S. Fish and Wildlife Service  
222 S. Houston, Suite A  
Tulsa, OK 74127

Dear Mr. Scott:

Thank you for giving me the opportunity to review the draft Ozark Big-Eared Bat Plan. Clearly it involved a lot of time and effort; it looks very good and quite complete. No wonder, when I see who was involved in preparing it -- you had a good crew. I have only a few comments.

1 First a few typos that the teacher part of my Id noticed and a spell-checker might not catch: P.t. virginianus (virginianis - p. 1), enter (inter - p. 7), pers. comm. (com. p. 8 ...), insight (incite - p. 30).

Next, a few specifics:

2 p. 3: As Mary K. Clark pointed out to me with a *P. rafinesquii* hanging onto my finger by its mouth, there is a behavioral difference between the species; *P. townsendii* is generally more docile than *P. rafinesquii*.

3 p. 3: *P.t. townsendii* is unlisted only if you do not want to mention that it is a Category 2 subspecies.

4 p. 3: *P.t. australis* does not occur in the U.S. (unless maybe one or two individuals have wandered across the U.S./Mexican border).

p. 7-8: Regarding bats hibernating in an inaccessible part of AD 125, would it be possible to install a beam-breaking device at the small hole to the inner chamber? A few years ago, my husband, Dave, designed and built a working prototype to count bats emerging through a small entrance at a cave here in Arizona. It was used to obtain nightly emergence counts. The modification it needed, that Dave did not have time to pursue then, was the ability to count bats going both ways to get net bat movement.

5 AD-125 sounds like a perfect place to use a beam breaker to obtain three basic pieces of information: 1. census of hibernating bats, 2. activity patterns of hibernating bats and 3. times and patterns of arrival at and departure from the hibernaculum. I think it is ultimately very important to determine particularly # 3, for which we have virtually no detailed information on any bat species.

To get the census, you would have to keep the beam breaker operating continuously from the time before the bats' arrival until some time period after you think they would have arrived. Of course, you run into the problem of the bats shifting sites during the winter, but you could still do the census with that caveat and refine the technique over the years of censusing. Or you could run it all winter and get some real good info on the whole shooting match: times and patterns of arrival at and departure from the hibernaculum, winter activity patterns and number of hibernating bats.

Beam breakers have a great enough current draw to be a potential problem if you want to operate them continuously unless you have easy access to the cave to change batteries.

6 p. 15: Light-sampling behavior is common among all species of cave bats. It's not really something special  
*P.t. pallescens* and *P.t. ingens*.

7 p. 15-16: There is an apparent contradiction between the statement that "most (bats) return before midnight" and two sentences later "bats...did not return until sunrise."



8 p. 18: Your dates for the maternity period seem to be much less conservative than your dates for the hibernation period. *P.t. virginianus* in the east begin arriving at maternity cave as early as mid- to late March. Since insects are not abundant until later in the spring, females arriving at the maternity cave just out of hibernation are probably undernourished and thus need protection from disturbance at that time to allow them to fully utilize a scarce resource to gain enough weight for normal development of their embryos. *P. t. virginianus* also use their maternity cave until late August/early September. Beginning in mid- to late July when the young first become volant until the time they ultimately enter hibernation, juveniles should be as free from disturbance as possible (whether they are still at the maternity cave or have gone to the hibernaculum). In learning first to fly and then to capture prey, they are probably the least efficient energetically in the first few months of their lives than they will ever be again. Recruitment of sufficient numbers of young is necessary for a stable population. Unless *P.t. ingens* occupies maternity caves for a far shorter time than *P.t. virginianus*, I would recommend extending the period of concern for *P.t. ingens* at the maternity roost.

9 p. 19: Your point about population growth related to formerly remote caves is important. A *P.t. pallescens* maternity colony here in Arizona is experiencing declines that seem to be the result of increased caver traffic since the road to the cave was paved, making access much easier. In addition, an outdoor recreation group takes people caving there for a fee.

10 p. 28-29: Regarding a potential change in name and management focus of the Refuge, I think someone should specifically be assigned to bats if management considerations are broadened. We've seen bats get lost in the shuffle when abiotic cave resources are included in cave management.

11 p. 32: The numbering system of the tasks is confusing to me.

12 p. 53: Regarding censuses, your recommendation in Task 2.2 is contrary to the recommendation of the American Society of Mammalogists preferably to conduct biennial censuses. Unless otherwise warranted, for at least the past ten years, the practice has been to census hibernating colonies of the other endangered species of bats biennially. It's easy enough to census a maternity colony annually because you do not have to enter the cave, but you do have to enter a hibernaculum.

13 p. 53: We have also observed maternity colonies occupying alternate sites in different years and perhaps during the same year. That is another aspect of this species' biology about which we know very little, yet is very important in management considerations. There is a maternity colony of *P.t. pallescens* here in Arizona that appears to be using two different caves in a pattern we have yet to figure out. Both caves are on Forest Service land. Currently both are receiving minimal protection of a sign restricting entry during the maternity season.

Finally, I must admit to cursory examination of some parts of the plan, mainly details of the narrative outline. And when I got to the schedule on pp. 73 -75, my brain balked and eyes glazed over.

I think, for the sake of the animals, that the energy you and the others have expended on this plan are well worth it. Thank you for that. Good luck with preparation of the final version. I would appreciate receiving a copy of the completed plan. Thank you.

Sincerely,

Virginia M. Dalton

Virginia M. Dalton

46 Cedar Drive  
Pacific, MO 63069  
Nov. 7, 1993

Mr. Charles M. Scott  
Acting Field Supervisor  
U.S. Fish & Wildlife Service  
Ecological Services  
222 S. Houston, Ste. A  
Tulsa OK 74127

Dear Mr. Scott:

After having read the Technical/Agency draft of the Ozark Big-Eared Bat Recovery plan I received, I have only a few comments.

The establishment of any Ozark Caves National Wildlife Refuge must be managed by an inter-regional Fish and Wildlife committee. Since these three states are in three different regions, some vehicle must be established to cut through management red tape in triplicate.

Such an authority should encompass managing endangered cave species ecosystems, not just bat caves, separate from Ozark cavefish caves, since there is a relationship between the viability of bat and cavefish populations.

Silent alarm systems, such as that at Devil's Den State Park, Arkansas, may prove more effective at actually catching trespassers with resulting convictions, than gates, which may be vandalized, with the damage being found only later. All the signs and warnings in the world will not do as much to protect the bats as a few well publicized convictions of violators.

It is important that cooperative efforts between US F&W and the NSS be more than just lip service. Cavers will not cooperate with government agencies by revealing additional Ozark Big-Eared Bat sites if the response of the agencies is to then put that cave off limits to all cavers. Cavers will respect and work with government agencies, even furnishing volunteer labor, expertise, and research, if their reward is to be allowed access to the cave during the course of their work. Annual or ongoing censusing of sites is something cavers can be trained and then given the responsibility to assist. In this way, closing the caves to recreational caving, but allowing caver access as part of the management will lessen animosity of cavers toward US F&W, and aid public relations of the Recovery Plan by involving cavers to educate and impress other cavers and the public with the seriousness of recovery efforts.

In this vein, the Missouri effort to locate and preserve Ozark Big-Eared Bat habitat for future restoration and management should take place through cooperation of the US F&W and its sub-contractors with the Missouri Speleological Survey (our state-wide internal organization of the NSS) in accordance with the terms of the NSS MOU, and private landowners.

Although such restoration is down the road many years, I

6  
feel such a reference should be placed into this document, just as reference has been made to Arkansas and Oklahoma NSS grottos and private landowners as cooperators. Though the Figg & Lister Missouri study determined the Ozark Big-Eared Bat to be extirpated from the state, as an active Missouri caver I have heard several unsubstantiated reports of its recent occurrence. Locations have not been forthcoming from the reporters because "the landowners don't want government people messing with their land." Clearly, any recovery plan for this bat in Missouri will have to take these two segments of the public into account, and they should be mentioned, even at this early stage.

That's about it. Overall, this document seems a workable plan for the near future. Thank you for giving me the opportunity to comment.

Sincerely,

*Jo Schaper*  
Jo Schaper  
NSS #27624

*Carbon to:*

*Dennis Figg  
Endangered Species Coordinator  
Mo. Dept. of Conservation*

# THE Nature Conservancy

ARKANSAS FIELD OFFICE

November 5, 1993

Charles M. Scott  
U.S. Fish & Wildlife Service  
Ecological Services  
222 S. Houston, Suite A  
Tulsa, OK 74127

Dear Mr. Scott:

The Nature Conservancy appreciates the opportunity to review and comment on the September 1993 draft revised Recovery Plan for the Ozark Big-eared Bat.

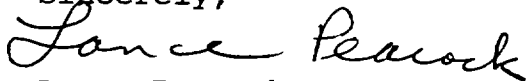
The Nature Conservancy is strongly supportive of the ecosystem level approach proposed by the U.S. Fish & Wildlife Service for achieving recovery of the Ozark Big-eared Bat. We support expanding the area within which the Service has approval for land acquisition for the purpose of conserving essential caves and foraging habitat. It is critical that acquisition and management through the National Wildlife Refuge system provide for implementation at priority caves in the Arkansas and Missouri Ozarks. The subspecies is of course known from northwest Arkansas and historically occurred in southwest Missouri.

An Ozark Caves National Wildlife Refuge should be created to enhance the recovery effort within the historic range of the Ozark Big-eared Bat across state lines and the Service's regional boundaries. The Refuge should be adequately staffed and funded, and would coordinate management planning and work with private lands and the general public. Other Ozark cave biota would greatly benefit from this approach.

The Conservancy also supports continued research on the Ozark Big-eared Bat, as outlined in the draft document. Particularly important is an intensified search in Arkansas and Missouri for caves of all usage categories.

The Nature Conservancy looks forward to working with all branches and regions of the U.S. Fish & Wildlife Service to further the tasks necessary for recovery of the Ozark Big-eared Bat.

Sincerely,



Lance Peacock

cc: Nora Jones  
Rod Miller



300 Spring Building, Suite 717 / Little Rock, Arkansas 72201 / (501) 372-2750 FAX (501) 376-8836

International Headquarters / 1815 Lynn Street / Arlington, Virginia 22209

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# The Nature Conservancy

Oklahoma Chapter

320 South Boston, Suite 1700 / Tulsa, Oklahoma 74103-4706 / (918) 585-1117 / FAX 585-2383

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November 5, 1993

Mr. Charles M. Scott, Acting Field Supervisor  
United States Department of the Interior  
Fish and Wildlife Service, Ecological Services  
222 South Houston, Suite A  
Tulsa, Oklahoma 74127

Dear Charlie:

Thank you for the opportunity to review the Technical/Agency draft of the Ozark Big-Eared Bat (*Plecotus townsendii ingens*) Recovery Plan. Your staff and their technical advisors have done a fine job with this plan, and you all should be commended for your thoughtful and careful work. Your attention to the partnership aspects of this recovery process is especially well done.

As noted in the report, protection of Ozark Big-Eared Bat habitat is the requisite first step in recovery. The Oklahoma Chapter of The Nature Conservancy has recently acquired 390 acres in Adair County containing AD-14 plus foraging habitat. We are in the process of negotiating acquisition of AD-125 (located on property adjacent to AD-14), plus buffer lands, totalling approximately 1100 acres. We will continue to work with U. S. Fish and Wildlife on long-term protection strategies in this important area.

As shown in the report, AD-14 and AD-125 rank high in the long-term protection priorities of U. S. Fish and Wildlife Service for recovery of the Ozark Big-Eared Bat. Such long-term protection may include transfer of fee title of these important lands from the Conservancy to U. S. Fish and Wildlife Service. We are eager to continue discussions of these long-term protection strategies with your regional realty staff.

We plan to continue cooperating with U. S. Fish and Wildlife Service on management and monitoring issues related to Ozark caves. As noted in the report, management following protection is fundamental to recovery of this species. We concur with the Recovery Plan that a full-time manager for Ozark cave resources on public and private lands in Oklahoma, Arkansas and Missouri is essential to the long-term survival of the Ozark Big-Eared Bat and other Ozark cave species. We strongly recommend that U. S. Fish and Wildlife Service fund and fill an Ozark cave manager position at the earliest possible date. This manager would develop and implement management plans, interact with private



Charles M. Scott  
U. S. Fish and Wildlife Service  
November 5, 1993  
Page Two

landowners, and coordinate cave management and monitoring. We concur that such a position should continue after any future delisting of the Ozark Big-Eared Bat.

Charlie, congratulations on a fine report. I look forward to working with your staff and our mutual partners on this important issue. Please let me know if you have any questions or need further information.

Sincerely,



Nora Jones  
Director of Science and Stewardship

cc: Herb Beattie  
Rod Miller  
Mike Andrews  
Lance Peacock  
Melissa Nagel

DEPARTMENT  
OF PARKS &  
TOURISM  
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501-682-7777  
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501-682-1364

# Arkansas

THE NATURAL STATE

November 1, 1993

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GOVERNOR

Richard W. Davies  
EXECUTIVE  
DIRECTOR

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RECREATION,  
& TRAVEL  
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COMMISSION

AN EQUAL  
OPPORTUNITY/  
AFFIRMATIVE  
ACTION  
EMPLOYER

Stephen W. Forsythe  
USDI Fish and Wildlife Service  
Ecological Services  
222 S. Houston, Suite A  
Tulsa, Oklahoma 74127

Dear Mr. Forsythe:

1 Thank you for the opportunity to review the Draft Ozark Big-Eared Bat Revised Recovery Plan. Arkansas Department of Parks and Tourism, Division of State Parks is interested in cooperating in activities which will facilitate implementation of the plan. The Draft Recovery Plan does not identify specific tasks for which this Department could be responsible. We hope the following comments will provide greater detail as to this Agency's potential role in protecting this species.

1) Task 1.5 - Manage Ozark big-eared bat caves by other agencies and groups:

2 As the owner of an essential Ozark big-eared bat site, the Department will cooperate with the various state and federal agencies in their work to monitor and enhance the population of this species.

2) Task 1.6 - Construct, manage, and monitor cave gates and fences:

3 The Department currently maintains a cave alarm on the Devil's Den hibernaculum. Park staff are able to respond to unauthorized entry to this site in a matter of minutes. This alarm system has proved effective on a number of occasions since it was installed. The language under this task should be expanded to include other "cave protective devices" such as that employed at Devil's Den. The Department will consider installation of protective devices on additional caves subject to determination of need and availability of funding.

3) Task 1.7 - Place warning / interpretive signs at cave entrances:

4 The Department currently maintains warning / interpretive signs at the Devil's Den site. The Department will be willing to install additional / replacement signs should it appear to be necessary.

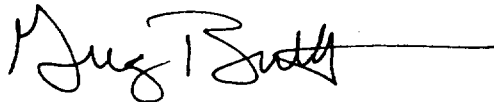
4) Task 6.3 - Develop and Maintain Public Support:

5 The Department currently provides professional interpretative programs to the public to increase awareness of the value of caves and cave resources. Special emphasis is placed on the status and survival problems of many bat species including the Ozark big-eared bat. Continuation and enhancement of this effort is expected to increase support for protective measures, and decrease disturbances to maternity and hibernaculum sites.

Stephen W. Forsythe  
October 29, 1993  
Page 2

Arkansas Department of Parks and Tourism, Division of State Parks is committed to protecting and facilitating the recovery of the Ozark big-eared bat. Please keep us informed as the Recovery Plan is developed and implemented. If you have any questions, please contact Randy Roberson, Resource Management Specialist, at 682-6938.

Sincerely,

A handwritten signature in black ink, appearing to read "Greg Butts", with a long horizontal line extending to the right.

Greg Butts, Director  
Arkansas State Parks

GB:rr

cc: Richard Davies  
Stan Graves  
Bill Sullivan  
Randy Roberson



STATE OF ARKANSAS  
DEPARTMENT OF POLLUTION CONTROL AND ECOLOGY  
8001 NATIONAL DRIVE, P.O. BOX 8913  
LITTLE ROCK, ARKANSAS 72219-8913  
PHONE: (501)562-7444  
FAX: (501)562-9297

October 20, 1993

Mr. Charles M. Scott  
Fish and Wildlife Service  
222 S. Houston, Suite A  
Tulsa, Oklahoma 74127

Dear Mr. Scott:

1 We have reviewed the draft recovery plan for the Ozark Big-Eared  
Bat and concur with it in its entirety.

Thank you for the opportunity to review the recovery plan.

Sincerely,



John Giese, Chief  
Environmental Preservation Division

JG:or19

STATE OF MISSOURI  
DEPARTMENT OF NATURAL RESOURCES

McL Canahan, Governor • David A. Shorr, Director

DIVISION OF GEOLOGY AND LAND SURVEY

P.O. Box 250 111 Fairgrounds Rd. Rolla, MO 65401-0250

FAX (314)368-2111

December 2, 1993

Charles M. Scott  
U.S. Fish & Wildlife Service  
Ecological Services  
222 S. Houston, Suite A  
Tulsa, OK 74127

Dear Mr. Scott:

Thank you for the opportunity to review the draft recovery plan for the Ozark Big-Eared Bat.

Noting that eight counties in Missouri are potential habitat for the Big-Eared Bat, yet it is not now known from any Missouri caves, suggests that provision should be made for potential refugia in Missouri as well as in Arkansas and Oklahoma.

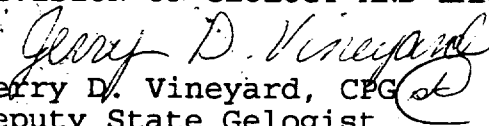
1 Involvement with Gray Bat and Ozark Cavefish recovery proposals prompts me to suggest that it might be prudent to establish an Ozark Cave Fauna National Wildlife Refuge, consisting of a series of caves that harbor one or more threatened or endangered species. This would be an alternative to setting up a separate refuge system for each species, and would trend more toward an ecosystem approach to the problem.

Such an effort might well be pursued through a consortium of land management agencies, private conservation groups such as the Missouri Chapter, The Nature Conservancy, the Missouri Speleological Survey, Inc., and the Missouri Cave Conservancy.

2 On the topic of caver support (p. 61-62), the Missouri Speleological Survey, Inc., should be listed, as well as several local grottos operating in southwestern Missouri, including Lower Ozark Sub-Terrestrials, Ozark Highlands Grotto, and Heart of the Ozarks Grotto.

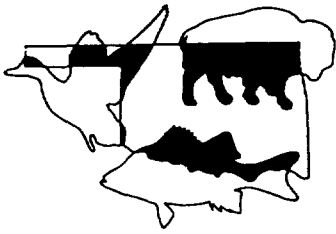
Sincerely,

DIVISION OF GEOLOGY AND LAND SURVEY

  
Jerry D. Vineyard, CPG  
Deputy State Geologist

JDV/sk

c: Ken Thomson



## OKLAHOMA COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT

404 Life Sciences West  
Oklahoma State University  
Stillwater, Oklahoma 74078  
(405) 744-6342

**Cooperating Agencies:**

U.S. Fish and Wildlife Service • Oklahoma Department of Wildlife Conservation  
Oklahoma State University • Wildlife Management Institute

29 October 1993

Mr. Charles M. Scott, Acting Supervisor  
Office of Ecological Services  
U.S. FISH AND WILDLIFE SERVICE  
222 S. Houston, Suite A  
Tulsa, OK 74127

Dear Charlie:

I have had the opportunity to review the draft (Sep 1993) of the Ozark big-eared bat Recovery Plan. Overall, your office did an *outstanding* job with it, and I am confident that it will provide the necessary template for successful recovery efforts. Steve Hensley should be commended for a fine Job!

As you well know, successful recovery of the Ozark big-eared bat will depend almost entirely on funding priorities at the FWS regional and national levels. I sure hope that Region 2 finally gets behind the appropriate and much-needed staffing of the Oklahoma Bat Caves NWR sometime in the near future.

1 I have enclosed a marked-up of the draft that contains a variety of questions, corrections, and editorial suggestions. This is a well-written document and requires very little editing. The most potentially contentious issue concerns cave gating. Clearly, gating has been used with great success elsewhere, and a cautious approach is carefully outlined in the Recovery Plan. As I read the relevant sections, however, it sounds as if all caves are in need of gating. Clearly, some may need such attention  
2 more than others (e.g., AD-3). I am most concerned with altered air flow and microhabitat changes that may result from cave gating. If great care is followed to avoid such alterations, gating should enhance recovery efforts at certain caves where it is clearly needed. On a more philosophical note, we sacrifice a degree of "wildness" with such a remedy. It is my hope that the other steps outlined in the Plan (e.g., staffing the Refuge, public education and involvement, etc.) will someday negate the necessity for such extreme management options.

Again, my congratulations on a job well done. I will look forward to continuing our work with your office on research-related objectives of the Recovery Plan. I will keep my fingers crossed on funding for this important effort.

Best Regards,

David M. Leslie, Jr.  
Unit Leader and Adjunct Professor

Enc.  
xc: J. G. Rogers, FWS-R2



# United States Department of the Interior

FISH AND WILDLIFE SERVICE  
Post Office Box 1306  
Albuquerque, N.M 87103



In Reply Refer To:  
R2/RE

LA-Oklahoma  
Oklahoma Bat Caves  
NWR (PA)

November 15, 1993

## Memorandum

To: Field Supervisor, Oklahoma Ecological Services, Tulsa, Oklahoma  
From: Chief, Land Acquisition Planning, Division of Realty, Region 2  
Subject: Review of the Draft Ozark Big-Eared Bat Revised Recovery Plan

Thank you for the opportunity to review the Draft Ozark Big-Eared Bat Revised Recovery Plan (Plan). The Plan is very thorough overall; it appears to cover all the necessary actions to ensure the continued existence of the bats. We have only a few comments as follows:

1. It would be helpful if Figure 2 showed the counties covered by the historic and present range of the bats.
2. Executive Summary, page 2, number 2, under *Delisting Actions Needed*; "Protect . . ." is vague. Does it mean acquire and manage, monitor and enforce, fencing, or all of the above?
3. What is the basis for estimated cost figures for land acquisition--known land sales in the area?
4. Does the geology of the area consist of karst formations? Do we have to protect surface sinkholes from being used as toxic waste dumps as they do on the Driftless Area National Wildlife Refuge in Region 3?
5. Figure 5 showing the proposed new approved area does not cite the county it overlays. This area appears too limited. A proposed protection area should encompass the historic range of the bats. The most inclusive list of counties should be made to account for any potential new discoveries of use sites. Add all the counties in Figure 6 now for the proposed new approved area for acquisition. This is much more efficient procedurally.

**We look forward to working with your office, other members of the recovery team, and other agencies, organizations, and individuals on this important resource protection initiative. Please coordinate with Jeannie Wagner-Greven, Ascertainment Biologist, Division of Realty, at (505) 766-2174.**

**cc: Refuge Manager, Sequoyah/Oklahoma Bat Caves National Wildlife Refuge  
Lena Marie, Realty Specialist**



# United States Department of the Interior



FISH AND WILDLIFE SERVICE  
Bishop Henry Whipple Federal Building  
1 Federal Drive  
Fort Snelling, MN 55111-4056

IN REPLY REFER TO:

FWS/AES-TE

NOV 18 1993

## Memorandum

To: Field Supervisor, Ecological Services Field Office,  
Tulsa, Oklahoma

From: Assistant Regional Director, Region 3

Subject: Review of the Technical/Agency Draft Ozark Big-Eared Bat Revised  
Recovery Plan

We appreciate the opportunity to review the technical/agency draft Ozark Big-Eared Bat Revised Recovery Plan. The Region 3, Division of Endangered Species, contracted for the development of the original Recovery Plan for this subspecies, and we retain a strong interest in its recovery. While we may no longer have any extant populations of this subspecies, we remain optimistic about the opportunities for the subspecies to return or be rediscovered in Missouri. We look forward to a close cooperation with Region 2 to bring about its reclassification and eventual delisting.

We are generally pleased with the revision of the Ozark Big-Eared Bat Recovery Plan. It does a fine job of incorporating the advances in our understanding of this subspecies, and provides a detailed update of the numerous important conservation steps that have been taken since the original 1984 Recovery Plan.

Attached you will find a few specific comments provided by Region 3, Division of Endangered Species. Additional comments are being prepared by our Columbia, Missouri, Ecological Services Field Office. If you have any questions concerning these comments, you may contact Mr. T. J. Miller, Acting Chief, Region 3 Division of Endangered Species, at (612) 725-3276.

Attachment

cc: Columbia, Missouri Field Office, with attachment

SPECIFIC COMMENTS ON SEPTEMBER 1993 DRAFT - OZARK BIG-EARED BAT REVISED RECOVERY PLAN

1 We find portions of the plan confusing due to the seemingly interchangeable use of the words "tasks", "criteria", and "objectives." We suspect other readers may have similar difficulty in understanding certain sections of the plan. For example, recovery tasks are shown in three boxes on pages 32, 34, and 36. In the first box they are called "initial objective tasks;" the second box lists them under the heading "Short Term (10-year) Objective;" while the third box is titled "Interim Delisting Criteria." In all cases the boxes contain lists of recovery tasks, not objectives or criteria. We suggest the boxes be relabeled accordingly and close attention be paid to the correct use of "tasks", "objectives", and "criteria." Parallel terminology should be used in the discussion on pages 31 through 37.

2 We assume that the three boxed task groupings represent the three priority levels of recovery tasks, as they correspond to the priority numbers assigned to the tasks in the implementation table. (However, task 4.2, shown as priority 1 in the implementation table, does not appear in any of the three boxes.) Tasks are also grouped by priority number in the implementation table. The only place where tasks are grouped with closely related tasks is in the lengthy recovery task narrative section which is 32 pages long. This organization makes it difficult to visualize closely related tasks that have different priority numbers. We suggest that this weakness be remedied either (1) by grouping related tasks in the implementation table rather than organizing it by priority number, or (2) by adding a stepdown recovery outline with related tasks grouped together.

3 Page ii, line three - This sentence mentions nine essential caves in Oklahoma and four in Arkansas, a total of 13 essential caves. In the sixth line from the bottom of the same page, 14 essential caves are mentioned. Table 1, page 6, and page 31 both list 13 essential caves, so we suspect the reference (page ii) to 14 essential caves is incorrect.

4 A similar discrepancy occurs with "limited use and transient caves" in Arkansas. Table 1, page 6 lists 14 of these caves, while page 8 says there are 13 such caves in Arkansas.

5 Page ii, item (1) under recovery criteria - The words "known active colony sites and" should be deleted to make this criterion agree with the wording in the first reclassification criterion as described on page 33. The latter criterion refers only to essential caves, while the wording in the former criterion encompasses all known active colony sites.

6 Page iv (showing table of upgrading and delisting costs) - Add the word "Additional" before "Cost for Delisting" to clarify that the total cost for delisting is the sum of the upgrading and the delisting costs that are shown, and not the \$983,000 that is currently indicated as the "Total Cost for Delisting."

8 Page 7, under "essential caves" - This definition is so vague as to be meaningless. Criteria for designating essential caves, or at least the factors that are considered in making such designations, need to be described here, as both reclassification and delisting criteria require the protection of these "essential" caves. With a such a vague definition the reclassification and a delisting criteria effectively are open-ended - it is impossible to have more than a general idea of how many caves need protection to achieve the criteria.

9 Page 7, first full paragraph, second line - Delete one of the uses of "presently" in this sentence.

10 Page 7 fourth line from the bottom of the page - This sentence appears to be incomplete. Additional wording should be added after the word "approximately."

11 Page 8, last line - This sentence ends by mentioning Harvey's discovery of several limited use and possible use caves in Marion county, Arkansas, yet Table 1 doesn't mention any Marion County caves in these categories. In contrast, Table 1 does appear to list all the limited use and possible use caves that have been located by Puckette (although the table lists 14, not 13, limited use caves).

Page 33, final sentence - Change "will" to "may" to avoid making the commitment to initiate reclassification based upon recovery tasks that are currently envisioned to be sufficient.

13 Page 35, final sentence - Change "initiated" to "considered" for the same reason.

14 Page 37, final sentence under point 1 - Contrary to the statement in this sentence, Table 1 does not indicate the caves that are "in the greatest need of these protective [gating] measures." Rather, the table merely shows the most important caves. Perhaps those caves that need gating could be indicated by asterisks.

15 Page 41, second paragraph, dealing with essential caves in Arkansas - This discussion neglects to mention cave MR-979A, which is listed as an essential cave in Table 1.

16 Page 46, second paragraph - Region 3 fully supports the expansion of the Oklahoma Bat Caves National Wildlife Refuge to additional areas, including Arkansas and Missouri. However, we recommend the deletion of all references to the changing of the refuge name to anything that would indicate that the Service is planning to acquire a large number of bat caves in Missouri. Region 3 has recently expended considerable effort to quiet fears within the Missouri Department of Conservation that we were embarking on a large-scale land acquisition project in the State with our purchase at Turnback Creek Cave. This parcel was our initial acquisition for the Ozark Cavefish National Wildlife Refuge. We would like to avoid a resurgence of those concerns at this time. It should be possible to expand the Oklahoma Bat Caves project



without changing the name to anything that would suggest a major expansion of Service acquisition efforts in Missouri. If there arises an opportunity to purchase an important Ozark big-eared bat cave in Missouri, Region 3 may be able to acquire it by an expansion of our existing cave acquisition program. We suggest a brief mention of the Ozark cavefish acquisition project in this section, as another existing Service acquisition effort which complements the Oklahoma bat cave acquisition project.

17 Page 52, final sentence under point 1.8 - Addresses and phone numbers should be provided for the nearest Service Law Enforcement agent for all three of the states, rather than refer all calls to the Tulsa Law Enforcement office.

18 Page 54, second paragraph - It is true that Figg and Lister conducted an extensive search in southwestern Missouri during 1988 and 1989 and failed to find Ozark big-eared bats. (Also see Figg 1987, which describes earlier unsuccessful surveys in adjacent areas of Missouri.) However, our understanding is that the surveyors were unable to gain permission to search the cave where the last known Ozark big-eared bat population was found in Missouri. We suggest wording be added to indicate that their exhaustive search was incomplete in this important respect.

19 Page 74 and 75, tasks 3.1, 3.2, 6.1, 1.7, 6.2, 2.3, 3.3, 4.4, 6.3, 7.0, 8.0, 9.0, and 10.0 - These tasks do not list Ecological Services as a responsible party, generally showing Refuges and Wildlife instead. Many of these activities must occur at caves that are located off refuge property. Thus, Ecological Services must be a full partner, and perhaps the lead player, in many of these tasks. We suggest that ES be added as a responsible program for all of these tasks.

## memorandum

DATE: November 17, 1993

REPLY TO  
ATTN OF: Chief, Division of Endangered Species, FWS, Atlanta, Georgia  
(AES/TE)

SUBJECT: Review of the Technical/Agency Draft Ozark Big-eared Bat  
Revised Recovery Plan

TO: Field Supervisor, FWS, Tulsa, Oklahoma  
Attn: Steve Hensley

We have reviewed the subject draft plan as requested and would like to commend the authors on an excellent product. We only have a few minor comments to offer and these are provided below.

1        General Comments - Suggest using the word "downlisting"  
2        ~~instead of "upgrading."~~ The words "Federal" and "State"  
3        should be capitalized. Action verbs such as will, will  
4        not, must, etc. should not be used in recovery plans.  
      Time and measurement are expressed in figures  
      (i.e., 10 years, four tracts).

Executive Summary - In "Estimated Cost" section, suggest  
      setting columns further apart so that the sets of  
      numbers can be lined up.

6        Page 1, first paragraph - Include citation at the end of  
      first sentence: (U.S. Fish and Wildlife Service 1979).

7        Page 7, last paragraph - The population number is  
      missing in the second sentence. In the fourth sentence,  
      the word should be "enter" instead of "inter."

8        Page 29, third paragraph - Recommend deleting section  
      beginning with ". . . and the Wildlife Refuge  
      Administration Act. . . ."

9        Page 30, third paragraph - Word should be "insight"  
      instead of "incite."

10       Page 33, fifth paragraph - Recommend rewording  
      "Upgrading to threatened will be initiated" to  
      "Downlisting to threatened may be initiated."

11       Page 35, fifth paragraph - Suggest changing "Delisting  
      will" to "Delisting may."

12       Page 42, third paragraph - We disagree with this  
      statement. The Fish and Wildlife Service may expand its  
      authority to manage caves on all lands; however, caves

could be managed also by State agencies and private conservation organizations.

Page 60, second paragraph - State agencies and private conservation organizations could also work with private landowners in the development of conservation agreements.

13

We appreciate the opportunity to review this recovery plan. If you have any questions regarding our comments, please contact Gloria Lee of my staff at 404/331-3580.

A handwritten signature in cursive script, reading "David P. Flemming". The signature is written in dark ink and is positioned in the lower right quadrant of the page.

**RESPONSE TO COMMENTS  
ON THE REVISED OZARK BIG-EARED BAT RECOVERY PLAN**

Ms. Virginia Dalton

1,2,3,4. Corrected in the Recovery Plan.

5. This is a good cave opening for use of a beam breaker to count bats, but its rather remote location would make changing batteries difficult. Your recommendations for obtaining information on activity patterns of hibernating bats and times and patterns of arrival at and departure from hibernacula have been added to the section on future research.
- 6,7. Corrected in the Recovery Plan.
8. The period to avoid disturbance of a maternity cave has been extended to between the first of April and the middle of August.
9. Comment noted
10. The purpose of the existing Oklahoma Bat Caves National Wildlife Refuge is to protect the Ozark big-eared bat and gray bat. Recommendations for improved management and expansion of the refuge in the Recovery Plan focus on the Ozark big-eared bat. However, many other species, both surface and subterranean, will benefit from these activities. The Recovery Plan provides an ideal opportunity for an ecosystem approach to management of Ozark resources.
11. A short summary table (Table 3) of recovery tasks has been added.
12. Wording in Task 2.2 has been changed to indicate that hibernacula should be monitored preferably only once every 2 years.
13. This is an important consideration with Ozark big-eared bats because they also have been found to alternate between maternity caves. There is a colony in Oklahoma that alternates between AD-17 and AD-18. It is essential to provide equal protection for both caves.

Mr. Jo Schaper

1. Inter-regional coordination within the Fish and Wildlife Service and among states is important to assure an ecosystem approach to cave protection and management in the Ozarks. Attempts are now being made to promote this type of coordination.
2. Although the plan is written to address recovery for a single species, the Ozark big-eared bat, it takes an ecosystem approach to recovery. Protection of Ozark caves and forests, through implementation of this plan's recovery strategy, will benefit a number of additional cave and surface species. Due to the number of other listed and candidate caves species in the Ozarks, a central management authority will be beneficial.
3. The Arkansas Department of Parks and Tourism has had success with a cave alarm. Alarms should be considered at other caves, especially where enforcement personnel are nearby. In addition, any easements or conservation agreements to protect caves will be worded to allow law enforcement access necessary to control trespass and Endangered Species Act violations. The Fish and Wildlife Service's Law Enforcement Division will

help assure these measures are successful by prosecuting trespass and harassment violations under the Endangered Species Act on all areas and the Wildlife Refuge Administration Act on fee, easement, or agreement areas considered parts of the National Wildlife Refuge system.

4. Working with local grottos is extremely important. The Tulsa Regional Oklahoma Grotto and Central Oklahoma Grotto have been very helpful in planning cave management strategies, cave gate construction, cave clean ups, cave mapping, and species monitoring. It is essential that this cooperation continue and expand to grottos in Arkansas and Missouri.
5. Any efforts to locate or manage Ozark big-eared bats in Missouri will be coordinated with the Missouri Speleological Survey in accordance with National Speleological Survey's Memorandum of Understanding.
6. A reference to coordination with the Missouri Speleological Survey and Missouri grotto has been added to the report.

#### Arkansas Field Office, The Nature Conservancy

- 1,2. The Nature Conservancy's Arkansas Field Office support in recovering the Ozark big-eared bat as well as all cave protection efforts is greatly appreciated. An ecosystem approach to any cave protection in the Ozarks is critical because of the number of unique species and the interdependency between surface and subterranean habitat. A central management presence that can work on private and public land and across state and Service Regional boundaries is needed.
3. The search for Ozark big-eared bat caves has been intensified in Arkansas. If there is some indication that Ozark big-eared bats may again be found in Missouri, efforts will be made to renew the search there.

#### Oklahoma Chapter, The Nature Conservancy

1. Comment noted
2. The Oklahoma Chapter of The Nature Conservancy has been very instrumental in efforts to recover the Ozark big-eared bat. The Service has identified AD-125 as its highest cave acquisition priority and AD-14 as its third highest. Because of the large number of Ozark big-eared bats and gray bats using the area, combined with the number of other caves in the immediate vicinity (some with endangered bats) the acquisition and protection of AD-14 and AD-125 is extremely important. In addition, the large continuous tract of forest surrounding AD-14 and AD-125 is ideal for interior forest species and includes a sizable portion of the Little Lee Creek and Lee Creek drainage. Acquiring this land is an excellent ecosystem approach to protecting a number of Ozark resources. In addition to helping recover the Ozark big-eared bat and gray bat, the acquisition of these tracts will:
  - o Help protect the Little Lee Creek and Lee Creek watersheds and the Category 2 longnose darter,
  - o Preserve habitat for an additional 5 candidate species,
  - o Conserve neotropical migratory songbird habitat,
  - o Prevent forest fragmentation,
  - o Promote bio-diversity,
  - o Protect other cave and interior forest resources.

The Oklahoma Chapter of The Nature Conservancy is to be commended for its outstanding efforts to protect these extremely important Ozark resources.

3. To satisfy the objectives of the Ozark Big-Eared Bat Recovery Plan, it will be necessary to ensure long-term protection of known colony sites (a priority 1 task) in order to maintain stable or increasing populations at all active maternity and hibernating sites. The Service will continue to work with The Nature Conservancy to develop these long-term protection strategies.
4. A long-term management presence by private conservation organizations, state wildlife agencies, or the Fish and Wildlife Service is necessary in the Ozarks. The Service must regularly work with the landowners, organizations, and state and federal agencies to let them know the interest to protect Ozark cave resources, including recovering the Ozark big-eared bat, continues over the years. Such a presence could be a full-time Fish and Wildlife Service position, such as an Oklahoma Bat Caves National Wildlife Refuge Manager, Ozark Caves National Wildlife Refuge Manager, or Ozark Cave Coordinator. This position will need the authority to work on public and private land and across state and Fish and Wildlife Service Regional boundaries.

#### Arkansas Department of Parks and Tourism. Division of State Parks

1. The Arkansas Department of Parks and Tourism has been added to the list of agencies in the Implementation Schedule responsible for recovery tasks:
  - 1.5 Manage Ozark big-eared bat cave by other agencies and groups,
  - 1.6 Construct, manage, monitor, cave gates, fences, and other cave protection devices,
  - 1.7 Place warning/interpretive signs at cave entrances,
  - 6.3 Develop and maintain public support.
2. The manager of Devil's Den State Park has been extremely helpful. The Service will assure that continuing recovery efforts are coordinated with the Arkansas Department of Parks and Tourism.
3. The use of other cave protective devices, such as alarm systems, has been added to Task 1.6 of the Recovery Plan.
- 4,5. Signs and interpretive programs will do much to inform the public of the importance of caves.

#### Arkansas Department of Pollution Control and Ecology

1. Comment noted

#### Missouri Department of Natural Resources

1. Consideration is being given to expanding cave protection throughout the Ozarks, including Missouri. For this to be truly successful, an ecosystem approach will be necessary, in which not only Ozark big-eared bats benefit, but numerous other Ozark species. Such a protection effort will have to be closely coordinated with the Missouri Chapter of The Nature Conservancy, Missouri Speleological Survey, Inc., Missouri Cave Conservation, Missouri Department of Natural Resources, Missouri Department of Conservation, and other state and federal agencies, including the Fish and Wildlife Service's own Region's 2, 3, and 4.

2. The Missouri Speleological Survey, Inc., Lower Ozark Sub-Terrestrials, Ozark Highland Grotto, and Heart of the Ozarks Grotto have been included under 6.2 Caver support.

#### Oklahoma Cooperative Fish and Wildlife Research Unit

1. The preferred means of cave protection, with the least chance of adversely affecting cave characteristics, bat use, and aesthetics is to keep essential cave locations confidential. This has been added to the text of the Recovery Plan. Some remote, little known caves may not require gating or fencing to protect them from human disturbance. However, when locations are well known, some form of protection may be required. If this is the case, it will be necessary to take a cautious approach to gating or fencing cave entrances to insure that the bats accept the structures.

#### Chief, Land Acquisition Planning, Division of Realty, U.S. Fish and Wildlife Service, Region 2, Albuquerque, New Mexico

1. Figure 2 is a general map of the present and probable historic Ozark big-eared bat distribution. Because of the lack of specific information on historic distribution, it is difficult to show specific counties on the map. However, Figure 3 was added to provide more detailed information on present distribution and possible areas where Ozark big-eared bats may be found.
2. The degree and type of protection needed by each limited use site may be different, so it may require some or all of the above.
3. The basis for estimated cost figures for land acquisition is known land sales in the area.
4. The Ozarks are a karst area and sinkholes do need to be protected from being used as toxic waste dumps. Most Ozark big-eared bat caves are in relatively sparsely populated areas with little industrial development. Therefore, there is little chance of contamination with industrial waste, but dumping of solid waste (trash) may occur. There also may be a threat of domestic sewage contamination from septic tanks and from land application of chicken house waste.
5. Figure 5 only shows an important portion recommended for immediate acquisition of the proposed new approved area presented in Figure 6.

#### Assistant Regional Director, U.S. Fish and Wildlife Service, Region 3, Fort Snelling, Minnesota

1. Corrected in the Recovery Plan.
2. Task 4.2 was added to the box with other priority 1 tasks.
3. Closely related tasks have been grouped in Table 3 at the beginning of Section B. Narrative Outline for Recovery Actions Addressing Threats.
- 4,5,6,7. Corrected in the Recovery Plan.
8. Several research projects have been conducted to determine specific physical and other characteristics of essential Ozark big-eared bat caves. These studies include:
  - o Clark et al. 1991 - Micro and Macrohabitat Characteristics of Caves within the Range of the Ozark Big-Eared Bat in Eastern Oklahoma
  - o Clark 1991 - Habitat Use, and Prey Selection by the Ozark Big-Eared Bat

- o Clark 1993 - Foraging Activity of Adult Female Ozark Big-Eared Bats in Summer
- o Wethington 1994 - Foraging Activity, Habitat Use, and Cave Selection by the Endangered Ozark Big-Eared Bat

These projects have identified habitat requirements useful in protecting and managing Ozark big-eared bats, but they have not been able to link specific characteristics to essential caves. At this time the best indication of a cave being essential to Ozark big-eared bats is that they use the cave as a maternity site or hibernaculum. This has been added to the definition of essential caves. Hopefully future research will discover more specific habitat requirements that can be used to identify essential caves by the time the Recovery Plan is revised again. At present, there are so few known maternity caves and hibernacula, all need protecting to assure the Ozark big-eared bat's continuing existence.

9,10,11,12,13,14,15. Corrected in the Recovery Plan.

16. A statement was added to indicate that coordination should be maintained with state resource agencies to assure that their acquisition objectives are considered. Also the acquisition of an Ozark cavefish cave in Missouri and how it complements Ozark cave protection was mentioned.

17,18,19. Corrected in the Recovery Plan.

Chief, Division of Endangered Species, U.S. Fish and Wildlife Service, Region 4, Atlanta, Georgia

1. We used the word upgrading, instead of downlisting, to more appropriately denote a positive accomplishment.

2,3,4,5. Corrected in the Recovery Plan.

6. The citation (Federal Register, Vol. 44, No. 232, Friday, November 30, 1979) was added to the end of the first sentence.

7. Corrected in the Recovery Plan.

8. This section was left in the Recovery Plan, but reference to the Division of Refuges Wildlife was added because of their authority to enforce laws on National Wildlife Refuges.

9. Corrected in the Recovery Plan.

10. Same as 1.

11. Corrected in the Recovery Plan.

12. As indicated in the Revised Recovery Plan, it is not necessary for the Fish and Wildlife Service to manage all endangered species caves. Private conservation organizations and state agencies already manage important caves and the number will probably increase. Because of its endangered species responsibility, it is important for the Service to have the authority to take the lead in managing caves or other habitat whether on private, state, or federal land and to coordinate this work across state and Service Regional boundaries.

13. Corrected in the Recovery Plan.