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FINAL PERFORMANCE REPORT



FEDERAL AID GRANT NO. E-22-14

MANAGEMENT AND CAVE PROTECTION FOR THE OZARK BIG-EARED BAT AND GRAY BAT

OKLAHOMA DEPARTMENT OF WILDLIFE CONSERVATION

October 1, 2007 through September 30, 2008

FINAL PERFORMANCE REPORT

STATE: Oklahoma PROJECT NUMBER: E-22-14

PROJECT PERIOD: 1 October 2006 – 30 September 2008

PROJECT TITLE: Management and Cave Protection for the Ozark Big-eared Bat

(Corynorhinus townsendii ingens) and Gray Bat (Myotis grisescens) in Oklahoma

PRINCIPLE INVESTIGATORS: Keith W. Martin, Ph.D. and William L. Puckette

A. Abstract:

Cave protection and management was carried out in the Ozark Region of Oklahoma for the benefit and recovery of endangered and threatened cave-dependent wildlife species, in particular the endangered Gray Bat and the endangered Ozark Big-eared Bat. During the grant period, new gate/grill structures were constructed at two caves that are important to the conservation of endangered bats. Cave AD-220 is located in Adair County and has been used historically by a population of Ozark Big-eared Bats. Cave DL-4 is located in Delaware County and has been used historically as a roost for both the Gray Bat and a small population of Ozark Big-eared Bats. Repairs were made to gate/grill systems at three caves (AD-220, DL-8 and CZ-18) where there structures had been constructed in previous years of this project. Population monitoring surveys were conducted at six Gray Bat maternity colonies (AD-7, AD-8, DL-1, DL-2, DL-91, and OT-13) during the summer months to estimate colony size and verify colony composition (e.g. continued use as maternity caves). Surveys were conducted at an additional 32 cave entrances to determine their occupancy by bats and their importance to the conservation of endangered bats.

B. INTRODUCTION:

All North American bats that are endangered or threatened can be classified as cave-dwelling species or subspecies (McCracken 1989, Harvey et al. 1999, Pierson 1999), and 13 are obligate cave-dwellers year-round (McCracken 1989). Two cave-dwelling species, the Gray Bat (Myotis grisescens) and Indiana Bat (Myotis sodalis), and one subspecies, the Ozark Big-eared Bat (Corynorhinus townsendii ingens), are of particular concern to recovery biologists because each is federally listed as endangered (U.S. Fish and Wildlife Service 1982, 1983, 1995).

Human disturbance at caves has caused population declines of many cave-obligate bats (Barbour and Davis 1969, Humphrey and Kunz 1976, Tuttle 1979, American Society Mammalogists 1992, Johnson et al. 1998, Wegiel and Wegiel 1998). As a result, cave gating has been used widely by governmental and private organizations to protect these sensitive ecosystems. Such management activities are immediate and long-term deterrents to human access at critical bat roosts and have become necessary to minimize ongoing human impacts.

Populations of bats presently are protected with internal gate systems throughout the United States including > 31 entrances to caves in northeastern Oklahoma (Martin et al. 2006). Seven of those caves have been inhabited historically by colonies of endangered Gray Bats (Martin et al. 2003). The remaining caves are inhabited by populations of endangered Ozark Big-eared Bats (Corynorhinus townsendii ingens), Big Brown Bats (Eptesicus fuscus), Eastern Pipistrelles (Pipistrellus subflavus), Northern Long-eared Bats (Myotis septentrionalis), and a single hibernaculum of endangered Indiana Bats (Myotis sodalis). Four caves that contain populations of either Ozark Cavefish (Amblyopsis rosae) and/or Oklahoma Cave Crayfish (Cambarus tartarus) also are protected from human entry by internal gates. Population estimates of bats at each of these caves prior to installation of gates beginning in 1981 and post-installation estimates from 1999 and 2000 show that each cave continues to be used by stable populations of resident bats (Grigsby et al. 1993, Martin et al. 2000, 2003, 2006; Puckette 2000).

In other parts of their ranges, populations of Gray Bats and endangered Virginia Bigeared Bats (*C. t. virginianus*) do not respond favorably to gated cave passages with prolonged, stable populations like those in Oklahoma; in fact, gating cave passages often is discouraged or prohibited (Pierson 1999). Nevertheless, little empirical evidence exists to suggest that these species will not accept fully gated cave passages, and experiments elsewhere have shown that appropriately placed gates within cave passages will not impede flight (White and Seginak 1989, Martin et al. 2003).

Recent studies have shown that relative to flight, populations of cave-dwelling bats are not adversely affected by appropriately placed gates in twilight or "dark zones" within cave passages, which are intended to restrict human access to bat roosts and colonies (White and Seginak 1988, Martin et al. 2000, 2003, 2006). Minimal effects of appropriately manipulated passages and entrances are further substantiated by the presence of stable populations of Gray Bats and Ozark Big-eared Bats in such caves in Oklahoma (Grigsby et al. 1993, Puckette 2000, Martin et al. 2000, 2003, 2006).

Procedures during this project were conducted in Adair, Cherokee, Delaware, and Ottawa counties of northeastern Oklahoma in the western limit of the Boston Mountains of the Ozark Plateau. The Plateau covers about 103,000 km² (Huffman 1959) in the central United States; elevations are 260–460 m above mean sea level. The Plateau is comprised of alternating layers of limestone, flint (= chert) and sandstone that are conducive to cave formation (Blair and Hubbell 1938). Caves in this region may serve as refugia from severe winters for *C. t. ingens* and other cave-dwelling species (Humphrey and Kunz 1976). The vegetation on mountain slopes is predominantly blackjack oak (*Quercus marilandica*), post oak (*Quercus stellata*), black hickory (*Carya texana*), and winged elm (*Ulmus alata*). Coralberry (*Symphoricarpus orbiculatus*) and sassafras (*Sassafras albidum*) comprise the sparse shrubby understory. Riparian areas are dominated by silver maple (*Acer saccharium*), river birch (*Betula nigra*), American elm (*Ulmus americana*), cottonwood (*Populus deltoides*), sycamore (*Plantanus occidentalis*), and various oak species (*Quercus* spp.). Sporadic openings of managed grasslands were used for various types of agriculture (Blair and Hubbell 1938, Harvey et al. 1981).

The objectives of this project were to identify caves that were considered critical habitat for Ozark big-eared bat and gray bat colonies in northeastern Oklahoma. Management/protection plans for these caves were developed and implemented during the project year as funding and time allowed. These management/protection plans were coordinated with the landowners and included posting a warning sign at cave entrances, placing human restrictive structures at or within caves such as fencing around the cave entrance or a gate/grill structure within the cave's passage. Caves also were monitored to determine the effectiveness of restrictive management plans, particularly gated caves, to determine the impact of these structures or other protection measures implemented at the site. As problems were identified with the cave protection plans, they were corrected.

C. PROJECT OBJECTIVE:

Develop and implement management and protection plans for caves that are important to the conservation of Ozark big-eared bat and gray bat colonies in northeastern Oklahoma. Each cave will be monitored to determine the effectiveness of the management plan and to determine the impact of the structure or other protection measures implemented at the site. As problems are identified with the cave protection plans, they will be corrected.

D. PROCEDURES:

The activities described below were designed to accomplish tasks B 1.6 and 1.7 of the 1993 Revised Ozark Big-eared Bat and Virginia Big-eared Bat Recovery Plan, and objectives 1, 1.2, 1.3.1, 3, and 3.2 of the 1982 Gray Bat Recovery Plan.

Biological surveys and monitoring visits were made to caves in the Ozark Region of Oklahoma that fall within the geographic ranges of the Ozark Big-eared Bat and Gray Bat in order to identify and evaluate important caves for the conservation and recovery of endangered bats and other cave-dependent wildlife. Depending upon time and funding limitations, one to two caves were identified for protection plans each year. The current landowner of each site was identified, proposed plans for the specific site were discussed and permission was sought to implement that plan. In addition to the landowner, approval of the proposed management plan was sought by all pertinent agencies including the Oklahoma Department of Wildlife Conservation's Wildlife Diversity Program and the U.S. Fish and Wildlife Service. Implementation of individual management plans was determined on a priority basis that was based upon the ability to effectively utilize available funds, in conjunction with the amount of human disturbance each site was receiving and the status of the population of Ozark Big-eared Bats or Gray Bats inhabiting the site. Each site where a structure was placed for protection was monitored at least twice in the year after installation. One inspection was conducted during the uninhabited season to inspect the structure or structures for possible vandalism; the other monitoring visit took place while the bats were utilizing the site. At maternity sites, these surveys were conducted as exit counts using infrared lighting and night vision scopes. This type

of survey accurately determines the population of Big-eared Bats using the site and whether the newly constructed structures are inhibiting the flight of the bats into and out of the site. Repairs were made to previously constructed gating systems on an as-needed basis. Annual reports of progress were submitted to the Oklahoma Department of Wildlife Conservation's Wildlife Diversity Program and the U.S. Fish and Wildlife Service.

E. Results and Discussion:

Cave Management Activities during the 2007-2008 project year

Gate Installations:

Cave AD-221: This cave is located in close proximity and in a similar geological zone where three cave entrances have been gated during previous project years. These caves occur in succession along a west-facing limestone bluff near (< 0.5 km) the city of Stilwell in Adair County, Oklahoma. Before the current project year, two caves in this complex were ungated and allowing human entry to potential bat roosts - AD-211 and AD-221. During the previous grant period, a monitoring visit had been conducted to this site (June, 2007) and a solitary Ozark bigeared bat was noted inside the passage of AD-221. Additionally, scattered deposits of moth wings, which are indicative of Ozark big-eared Bat inhabitation, were noted in the passages of the cave. Landowner permission was sought and granted to install an internal gating system inside the entrance to cave AD-221, and a in July 2007 a fence was constructed around the sinkhole entrance to prevent danger of livestock falling into the pit. During this project year, the final excavation and installation of an internal gating system was completed inside the entrance to cave AD-221 in December 2007.

Gate Repair Project:

Cave CZ-18: A monitoring visit by project personnel to this cave in July 2008 indicated that the gate/grill system previously installed by the Tulsa Grotto of the National Speleological Society had been vandalized and was allowing human entry. The cave is located on private property and used by a small population of Gray Bats, mostly males, and a moderate population (<40) of Ozark Big-eared Bats in both summer and winter seasons. Project personnel visited the cave in July 2008 and repaired the gate/grill system so that human entry is again restricted.

Colony/Species Monitoring:

An important aspect of the long-term E-22 project is monitoring caves that have received past management and protection efforts. These monitoring visits establish continued use by target species, verify the integrity of installed structures intended to eliminate human entry, and are conducted at non-gated caves to determine a ranking hierarchy for need of future consideration of management procedures. Monitoring at hibernacula was conducted in between December 2007 and February 2008. Summer roost monitoring visits were conducted in June and July 2008 to selected caves to determine use patterns and if possible, population estimates (Table 1).

Summary of Cave Management Activities during the Preceding Project Year, October 1, 2006 – September 30, 2007:

Gate Installations: An internal gate/grill structure was constructed within the passage of cave DL-4 and preliminary work was conducted on a grill/gate system at cave AD-221. Cave DL-4 is located in Delaware County Oklahoma and has been used historically as a roost by both the endangered Gray Bat and a small number of the endangered Ozark Big-eared Bat. The Tulsa Regional Grotto of the National Speleological Society had constructed a gate previously in DL-4 in 2004; however this gate was vandalized and damaged repeatedly between 2004 and 2006. This gate was repaired and a more secure external grill was constructed over the cave entrance. Cave AD-221 is located in southern Adair County and is used as a roost by the endangered Ozark Big-eared Bat.

Gate Repair Projects: Repairs were made to previously constructed gates within the passages of caves DL-8 and AD-220. Cave DL-8 is located in central Delaware County and is used as a roost site by Gray Bats during the summer months. Cave AD-220 is located in southern Adair County and is used as a roost site by Ozark Big-eared Bats and as a hibernaculum by Eastern Pipistrelles.

Colony/Species Monitoring: Exit trapping was conducted during the summer at three caves that have historically supported Gray Bat maternity colonies. Trapping is conducted periodically to verify colony composition and to document the continued use of each cave as a maternity site. Ninety-four Gray Bats were trapped and released at cave DL-91. These included 48 adult lactating females, two adult females that were not lactating, 42 young of the year bats and two adult males. Seventy-three Gray Bats were trapped and released at cave DL-2; these were comprised of 55 lactating adult females and 18 young of the year. Exit trapping was conducted after the breeding season at cave AD-8 in northern Adair County. Sixty-three Gray Bats were trapped and released, 44 of which were adult or young of the year females and 19 were young of the year males. Because of the skewed sex ration in favor of females and the lack of adult males, it appears that this site continues to serve as a maternity cave for the Gray Bat.

Monitoring visits were conducted at 32 entrances at 21 cave systems (some cave systems have multiple entrances) in Delaware and Adair counties to help evaluate additional caves that are important to local populations of endangered bats. Gray Bats had used one cave system historically, both Gray and Ozark Big-eared bats had used five cave systems, and Ozark Big-eared Bats had used the remaining 15 systems historically. During these monitoring visits 877 bats were encountered: 408 Ozark Big-eared Bats, 446 Eastern Pipistrelles (*Pipistrellus subflavus*), four Gray Bats and 19 Northern Long-eared Myotis (*Myotis septentrionalis*).

F. SIGNIFICANT DEVIATIONS: None

G. Costs:

\$ 34,234.83

H. Report Prepared by:

Dr. Keith W. Martin Rogers State University Claremore, Oklahoma

I. Date:

3 December 2008

J. Approved by:

Wildlife Division Administration

Oklahoma Department of Wildlife Conservation

John Stafford, Federal Ald Coordinator

oklahoma Department of Wildlife Conservation

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Table 1. Results of site monitoring visits to selected entrances to caves in eastern Oklahoma during the 2007-2008 project year.

Date	County	Cave Number	Historical Bat Use	Gated	Results	
10-Nov-07	Delaware	DL-91	Gray Bat	Yes	21,369 M.g. Guano Measurement	
24-Dec-07	Adair	AD-15	Multiple Species	Yes	51 Pips;4 C.t.i.; 1 M.s.; 2 E. f.	
24-Dec-07	Delaware	DL-3	Multiple Species	Yes	1 Pipistrelle	
24-Dec-07	Delaware	DL-4	Multiple Species	Yes	5 Pipistrelles	
24-Dec-07	Delaware	DL-8	Multiple Species	Yes	1 Pipistelle, Minor Gray bat guano	
24-Dec-07	Delaware	DL-39	Gray Bat	No	1 Gray Bats; 2 Pipistrelles	
27-Dec-07	Adair	AD-14 (Sawney)	Ozark Big-eared Bat	Yes	15 Pips.; 20 M.septentrionalis	
27-Dec-07	Adair	AD-14 (Backdoor)	Ozark Big-eared Bat	Yes	52 Ozark Big-eared Bats; 3 Pips	
27-Dec-07	Adair	AD-14 (Unnamed)	Ozark Big-eared Bat	No	1 Ozark Big-eared Bat	
27-Dec-07	Adair	AD-14 (Cable Ladder)	Ozark Big-eared Bat	Yes	No bats encountered	
27-Dec-07	Adair	AD-14 (Sam's Pit-1)	Ozark Big-eared Bat	Yes	No bats encountered	
27-Dec-07	Adair	AD-14 (Copperhead)	Ozark Big-eared Bat	Yes	No bats encountered	
27-Dec-07	Adair	AD-14 (Unnamed)	Ozark Big-eared Bat	No	No bats encountered	
27-Dec-07	Adair	AD-14 (Third Cave)	Ozark Big-eared Bat	Yes	No bats encountered	
27-Dec-07	Adair	AD-14 (Sidedoor)	Multiple Species	Yes	No bats encountered	
27-Dec-07	Adair	AD-14 (Flatrock)	Ozark Big-eared Bat	Yes	No bats encountered	
27-Dec-07	Adair	AD-14 (Joens)	Ozark Big-eared Bat	No	No bats encountered	
27-Dec-07	Adair	AD-14 (Salamander)	Ozark Big-eared Bat	Yes	No bats encountered	
27-Dec-07	Adair	AD-125	Ozark Big-eared Bat	No	No bats encountered	
31-Dec-07	Adair	AD-13	Ozark Big-eared Bat	Yes	7 Pipistrelles	
31-Dec-07	Adair	AD-3	Ozark Big-eared Bat	No -	425 Ozark Big-eared Bats; 1 E.f.	
31-Dec-07	Adair	AD-7	Gray Bat	No	52 Pipistrelles	
31-Dec-07	Adair	AD-7	Gray Bat	No	19,431 M.g. Guano Measurement	
2-Jan-08	Adair	AD-10	Ozark Big-eared Bat	Yes	79 Pips; 1 E.f.; 3 C.t.i.	
20-Jan-08	Delaware	DL-1	Gray Bat	Yes	9,944 M.g. Guano Measurement	
1-Feb-08	Ottawa	OT-13	Gray Bat	Yes	19,760 M.g. Guano Measurement	
29-May-08	Adair	AD-125	Ozark Big-eared Bat	No	133 C.t.i. Emergence count	
3-June-08	Adair	AD-13	Ozark Big-eared Bat	Yes	67 C.t.i. Emergence count	
10-June-08	Adair	AD-17	Ozark Big-eared Bat	Yes	186 C.t.i. Emergence count	
10-June-08	Adair	AD-18	Ozark Big-eared Bat	Yes	18 C.t.i. Emergence count	
12-Jun-08	Delaware	DL-91	Gray Bat	Yes	3,440 Gray Bats Emergence count	
17-June-08	Adair	AD-10	Ozark Big-eared Bat	Yes	289 C.t.i. Emergence count	
23-June-08	Adair	AD-14 (Sam's Pit)	Ozark Big-eared Bat	Yes	5 C.t.i. Emergence count	
23-June-08	Adair	AD-14 (Third Cave)	Ozark Big-eared Bat	Yes	70 C.t.i. Emergence count	
23-June-08	Adair	AD-14 (Joen's)	Ozark Big-eared Bat	No	175 C.t.i. Emergence count	
23-June-08	Adair	AD-14 (Flat Rock)	Ozark Big-eared Bat	Yes	0 C.t.i. Emergence count	
29-Jul-08	Delaware	DL-91	Gray Bat	Yes	17,640 Gray Bats Emergence count	
6-August-08	Adair	AD-10	Ozark Big-eared Bat	Yes	423 C.t.i. Emergence count	

Table 1. Results of site mentioning visits to selected consumes to can on in custom O' Innoces.

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