PERFORMANCE REPORT

SECTION 6

ENDANGERED SPECIES ACT

FEDERAL AID PROJECT E-22-6

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

OCTOBER 1, 1998 - SEPTEMBER 30, 1999

PROJECT REPORT

STATE: Oklahoma PROJECT NUMBER: E-22-6

PROJECT PERIOD: 1 October 1998 – 30 September 1999

PROJECT TITLE:

Management and Cave Protection for the Ozark Big-eared Bat (*Corynorhinus townsendii ingens*) and Gray Bat (*Myotis grisescens*) in Oklahoma

PROJECT OBJECTIVE:

To locate, determine ownership and develop and implement cave protection management plans for Ozark Big-eared and/or gray bat caves in Oklahoma.

INTRODUCTION:

Of the 39 species of bats found in North America, about 18 rely substantially on caves throughout the year. Thirteen of these species utilize caves year-round. These caves are utilized as winter hibernacula, stop-over roost sites during migration, summer roost sites, or maternity sites where adult females give birth to their young. All North American bats listed as endangered or threatened by the U.S. Fish and Wildlife Service are cave dwelling species (McCracken 1989). Human disturbance at maternity and hibernacula caves has been implicated as a major cause for the decline in population of many cave dwelling bats (Tuttle 1979; Humphrey and Kunz 1976). Low reproductive rates, long generation times, and concentrations of populations in localized roosts contribute to the difficulty in developing management objectives for protecting and recovering bat populations. These populations cannot sustain elevated mortality rates or poor recruitment as a result of disturbance (McCracken 1989; Am. Soc. Mamm. 1992). Conservation efforts concentrating on protecting these caves and the various

types of colonies of bats that they house is quite possibly the most important contemporary issue in bat conservation in the United States (Am. Soc. Mamm. 1992). Efforts to restrict disturbance by human entry to these caves include construction of gates and grills at cave entrances, fencing of cave entrances, placing warning signs at entrances, and maintaining a close and positive rapport with private landowners.

The karst region of the Ozark Plateau extends into northeastern Oklahoma. This region represents the westernmost expansion in Ozark big-eared bat (*Corynorhinus townsendii ingens*) and gray bat (*Myotis grisescens*) ranges. Both species are obligate cave dwelling species and listed as endangered by the U.S. Fish and Wildlife Service. There are nine known caves in eastern Oklahoma considered essential to the Ozark big-eared bat's existence. The present population of Ozark big-eared bats range-wide including Arkansas and eastern Oklahoma, is estimated to be 1,600 to 2,300 bats (U.S. Fish and Wildlife Service 1993). Grigsby and Puckette (1982) identified six caves in this region that were inhabited by maternity colonies of gray bats. These essential caves and as many as an additional 20 caves in northeastern Oklahoma that serve as habitat for the Ozark big-eared bat and gray bat, need protection from human disturbance to maintain and enhance the population of bats in each cave (Grigsby and Puckette 1982). The construction of gate/grill systems and fences are needed at cave openings to serve as deterrents to human entry while allowing bats to enter and leave their roosts inside the cave (U.S. Fish and Wildlife Service 1982).

Construction of restrictive structures at cave entrances has evolved considerably over the past 25 years. Original designs were constructed in cage-like fashion exterior to the cave entrance. This placement resulted in the abandonment of some caves by bats (Tuttle 1977; 1979; Clark et al. 1996). In 1980 and 1982, two maternity caves inhabited by the gray bat in northeastern Oklahoma were gated. The exterior features of those cave entrances, however, precipitated the placement of gates 9-15m inside the cave passage. Each cave continues to be used by maternity populations of gray bats numbering an estimated 5,400 and 14,000 bats. A third maternity cave in Oklahoma was gated using the same type of placement with similar results in 1991 (Grigsby et al. 1993). Although the general design of gate construction continues to evolve (White and Seginak 1987), placement of structures within a cave passage is now a generally accepted protocol for cave gating throughout the United States.

Fifteen caves in northeastern Oklahoma presently are protected using the internal gate design. Six of those caves are inhabited by colonies of the endangered gray bat. The endangered Ozark big-eared bat is the target species in 8 additional caves. Both species are obligate cave dwelling bats throughout the year. A single cave that contains populations of the Ozark blind cavefish (*Amblyopsis rosae*) and the Ozark blind crayfish (*Cambarus* sp.) is protected from human entry and vandalism by an internal gating system.

Conspicuously missing during the installation of gate systems in caves throughout Oklahoma has been a systematic assessment of their impacts on the microclimate of the cave interiors, and ultimately on bat populations. It is likely that the distribution of caves containing appropriate internal ambient conditions plays an important role in distribution and ranges of cave-dwelling bat species (Tutttle and Stevenson 1977). There are references in scientific literature of cave entrance

characteristics that affect internal ambient conditions. These factors include: number of entrances, size of entrances, passage size, presence of water flow, air flow, and annual range of temperatures outside the cave (Tuttle and Stevenson 1977). It is suspected that cave gates alter airflow in cave passages (Humphrey 1978; U.S. Fish and Wildl. Serv. 1984; Richter et al. 1993). In some instances, improper gating of caves has contributed to reduced bat use by altering necessary airflow for maintenance of appropriate ambient conditions (Tuttle 1977; Tuttle and Stevenson 1977). Roost substrate temperatures influence body temperature and ultimately metabolic rates of hibernating bats (McNab 1974; Humphrey 1978). Fetal and neonatal growth rates are affected directly by sub-optimal temperatures of pregnant females and juveniles. Poor thermoregulation in these bats may result in slow maturation, thus reducing survival and natality (Studier and O'Farrell 1972; Humphrey 1975). It also is suspected that cave gates interrupt or impede the exit of large colonies of bats from roost caves. An increase in swarming activity before exiting or entering a cave that is gated may increase the risk of predation (Tuttle 1977; 1979; White and Seginak 1987).

Although placement of gates in entrances of caves is the most effective method to deter human access to critical bat roosts, their effects on resident bat populations have been poorly measured. One aspect of this project is to determine effects that cave gates have on the ambient microclimate of cave interiors and selected bat behavior. Results from this study will contribute to both the theory and methodology influencing conservation efforts of bat researchers and wildlife managers in Oklahoma, and ultimately the United States.

The primary objectives are the identification of caves that are considered critical habitat for Ozark big-eared bat and gray bat colonies in northeastern Oklahoma. Management/protection plans for one to three of these caves are developed and implemented during the project year as funding and time allow. These management/protection plans are coordinated with the appropriate landowners and may include posting a warning sign at the cave entrance, placing human restrictive structures at or within the cave such as fencing around cave entrance or constructing a gate/grill structure within the cave. Each cave is monitored to determine the effectiveness of the management plan, particularly gated caves, 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. In an attempt to address effects of cave gates on bat populations in northeastern Oklahoma, a component of this project is to monitor and compare internal ambient temperature, relative humidity, substrate temperature, and emergence times of bat flight between gated and non-gated caves. Internal ambient temperature, relative humidity, substrate temperature, and emergence times of bat flight.

APPROACH:

Procedures listed below are designed to accomplish task 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.

1. The current landowner of each site will be identified, and after determined, proposed plans for the specific site will be discussed and permission to implement those plans will be sought.
2. Determine the projected cost for the implementation of the recommended management plan.
3. Obtain approval of the proposed maintenance plan from all pertinent agencies including the Oklahoma Department of Wildlife Conservation Wildlife Diversity Program, the U.S. Fish and Wildlife Service and individual landowners of each site.
4. Upon approval of the maintenance plan for each site, the plan will then be implemented. Implementation of individual management plans will be determined on a priority basis. This priority will depend on the ability to effectively utilize available funds, in conjunction with the amount of human disturbance each site is receiving and the status of the population of Ozark big-eared bats or gray bats inhabiting the site.
5. Each site where structures are placed for protection will be monitored twice annually after installation. One inspection will be conducted during the uninhabited season to inspect the structure or structures for possible vandalism. An additional monitoring visit will take place while the bats are utilizing the site. These surveys will be conducted as exit counts at maternity sites using infra-red lighting and night vision scopes. This type of survey accurately determines the population of Big-eared bats using the site and if the newly constructed structures are inhibiting the flight of the bats into and out of the site.
6. Reports of the progress of each management plan will be submitted to the Oklahoma Department of Wildlife Conservation Wildlife Diversity Program and the U.S. Fish and Wildlife Service. A final report will be submitted after the fifth project year. An annual performance report will be submitted at the end of each segment year.

EXPECTED RESULTS/BENEFITS:

In northeastern Oklahoma, endangered gray bat and Ozark big-eared bat populations have been protected by gate/grill systems in 15 caves. These caves are located in Adair, Delaware and Cherokee counties. The continuation of this project is intended to assist in stabilizing and increasing the Ozark big-eared bat and gray bat populations in northeastern Oklahoma. This may ultimately allow for recolonization of previously known caves that were inhabited by these species (Grigsby and Puckette, 1984).

PROCEDURES:

The following is a description of caves and procedures that were involved in the project during the 1998-1999 project year.

- Site CZ-9: This cave is presently used as a maternity site for the gray bat. A gate/grill structure was placed within this cave in 1991 but had since been vandalized. Even though human entry into the cave was adequately impeded, the lock system was vulnerable to additional vandalism. In December 1998 the lock system was reconstructed and other damaged portions of the grill were repaired.

- Site DL-34: This cave contains past guano remains from gray bat usage but is not currently being utilized by the species. It presently is inhabited by Ozark Blind Cavefish and Ozark Blind Crayfish (*Cambarus* sp.). An internal gating project for this cave was completed during the 1997 project year. Vandals had since damaged the mechanism that protects the lock system. The lock protection system was repaired in August 1999.

- Ambient Cave Climatic Data: During the project year, ambient surface (temperature and relative humidity) and internal cave conditions (temperature, relative humidity, and substrate temperature) were monitored at three gated and three non-gated caves. Gray bat populations utilize four of these caves. The remaining two caves are used by small numbers of Ozark Big-eared bats. Conditions at each cave were monitored for 7 consecutive days each between 9 July and 9 August 1999. These same methods will be repeated during November-December 1999 and again during the summer 2000.

- Exit Data: Three gated and three non-gated caves were monitored to determine emergence times of respective gray bat populations. Exit data were recorded on three occasions for each cave between 15 June and 17 July 1999. These same caves will be monitored during the maternity season 2000.

- Population Estimates: Population estimates were obtained for Ozark Big-eared bats (Figure 1) at three caves through direct exit counts using infra-red lighting and night vision. Estimates of gray bat colony sizes (Figure 2) were obtained at five caves presently protected with internal gate/grill systems. These estimates were established by measuring surface area of guano deposited during summer 1981, and 1999 as described by Tuttle (1979).

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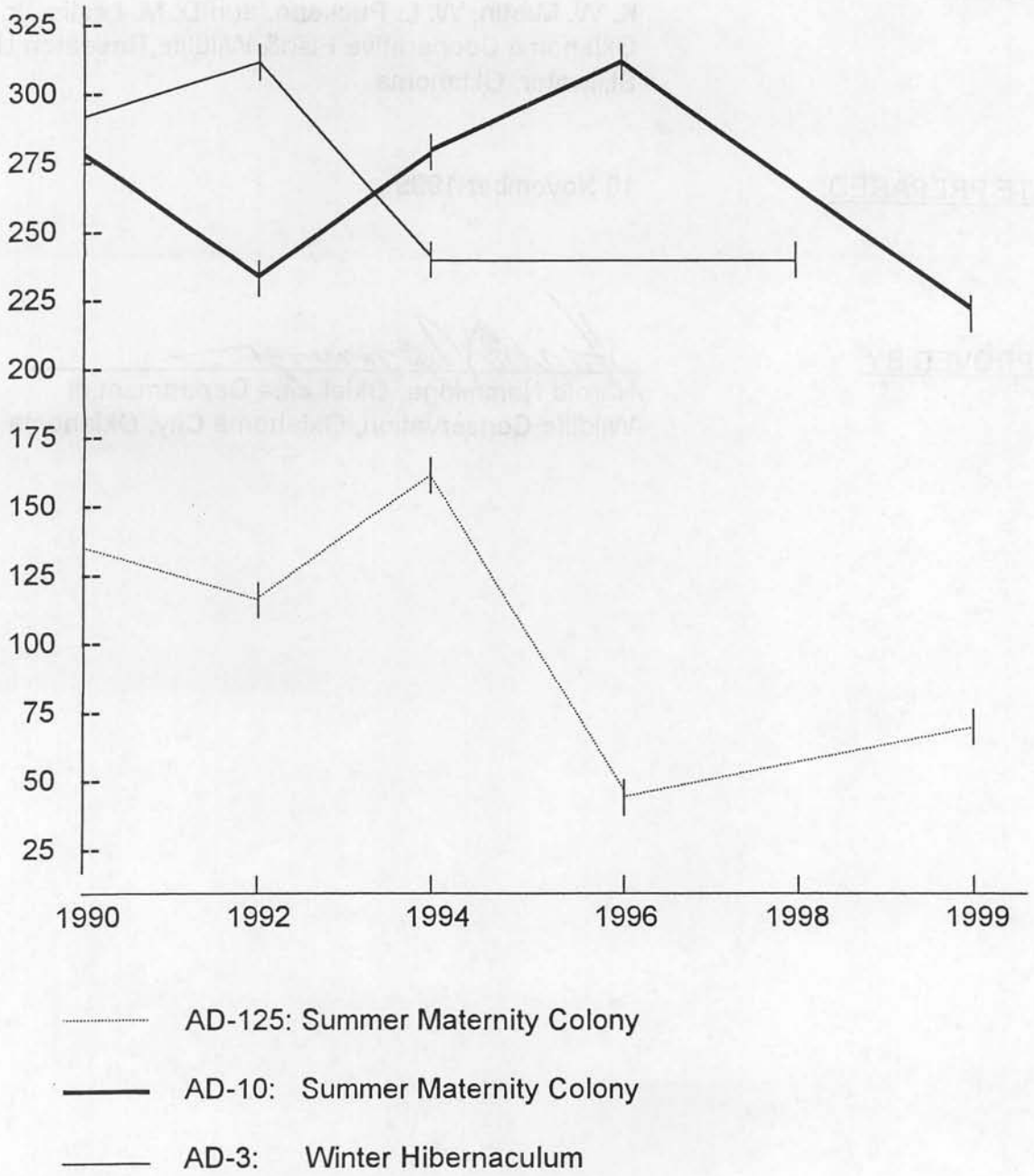

Figure 1. Bi-ennial population estimates at three Ozark big-eared bat caves following the 1990-1998 winter hibernations, and 1990-1999 summer maternity seasons. Vertical bars represent data points for actual estimates.

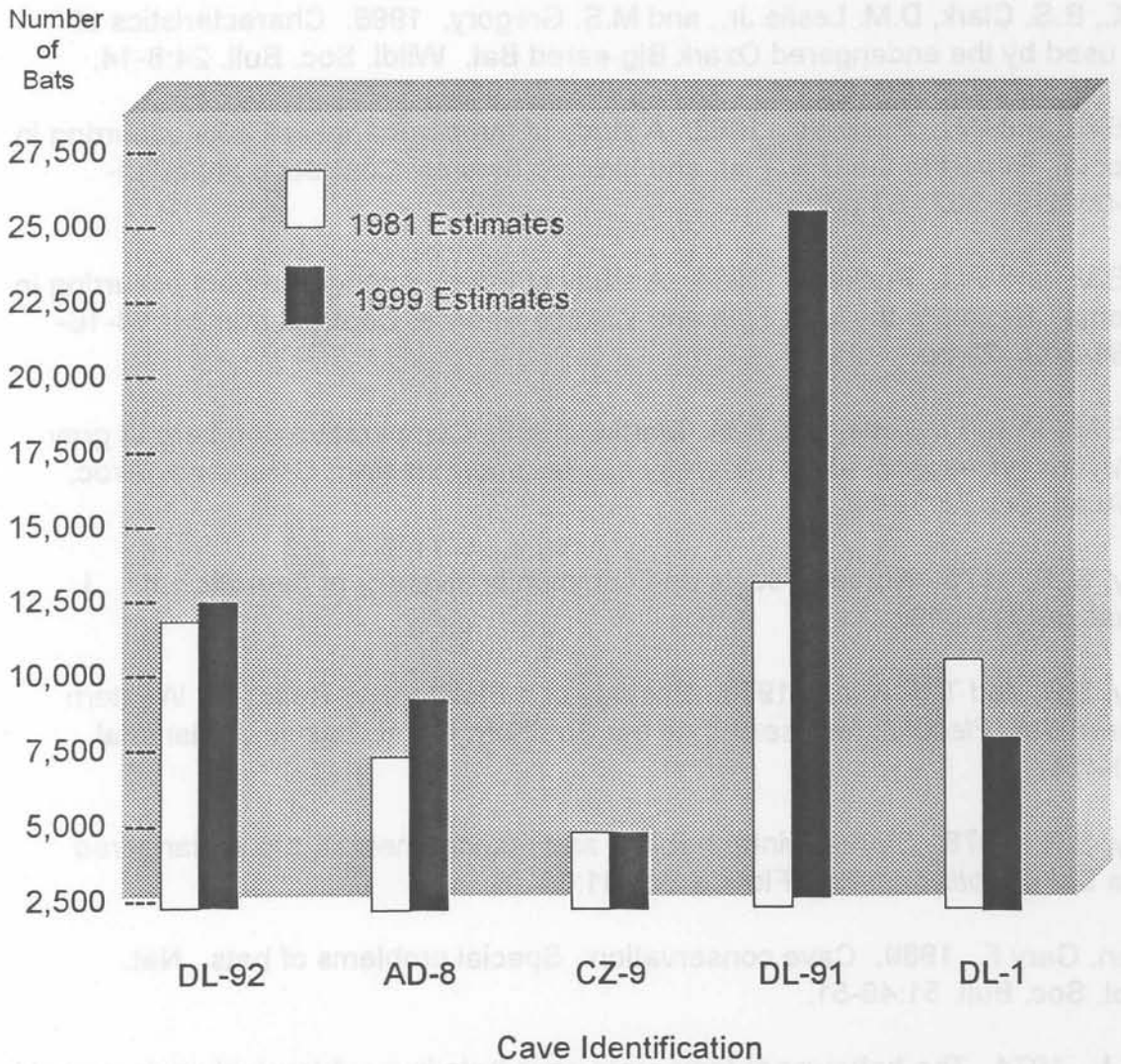

Figure 2. Population estimates at five gray bat caves protected by internal gate/grill systems in Oklahoma. Earlier estimates are from Grigsby and Puckett (1982). Cave DL-1 is inhabited by a bachelor colony. The remaining caves are inhabited by maternity colonies.

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