

FINAL REPORT
SECTION 6
ENDANGERED SPECIES ACT



FEDERAL AID PROJECT E-9

Gray Bat (Myotis grisescens) Population and
Protection System Monitoring

SEPTEMBER 22, 1989 - SEPTEMBER 21, 1995

FINAL REPORT

STATE: Oklahoma

PROJECT NUMBER: E-9

PROJECT TITLE:

Gray Bat (Myotis grisescens) Population and
Protection System Monitoring

FORMER TITLE:

Gray Bat (Myotis grisescens) and Ozark Big-eared Bat
(Plecotus townsendii ingens) Cave Protection

SEGMENT DATES: 22 September 1989 - 21 September 1995

PROJECT OBJECTIVES:

Locate, determine ownership and develop a protection/management/monitoring plan for gray bat and Ozark big-eared bat caves in northeast Oklahoma and implement this protection/management/monitoring plan, monitor protective structure usage, population trends, evaluate current protection/management, make recommendations for protection, supervise design and construction of protection systems, determine colony type and present and/or submit for publication the results of any studies connected with this project.

ABSTRACT:

Thirteen caves inhabited by the gray bat (Myotis grisescens) and/or the Ozark big-eared bat (Plecotus townsendii ingens) in four northeast Oklahoma counties (Adair, Cherokee, Delaware and Ottawa) were considered during this project. Landowner relations were established and maintained at all sites and all sites were monitored for bat populations and human activity. One site (CZ-9) was protected with an internal protection system and one site (DL-21) was protected with a fence and the fence was painted, maintained and improved. The protection system at one site (AD-8) was repaired. Maternity colonies of M. grisescens were monitored using a video camera with an infrared scope to confirm bats usage pattern of the grid system. Colony composition determination were made at 3 sites (AD-8, CZ-9 and DL-91). This was done by capturing a small number of emerging bats using a Tuttle Trap and determining sex, age, reproductive condition, weight and forearm length. Bats from 2 of those sites were fitted with transmitters for a telemetry study. Population estimates were made at 7 sites (AD-8, CZ-9, DL-1, DL-91, DL-92, OT-4 and OT-13).

INTRODUCTION:

Gray and Ozark big-eared bats are limited in their distribution to areas of the southeastern United States that are dominated by limestone formations (Barbour and Davis, 1969). In Oklahoma, the ranges of these two species are thus limited mainly to the extreme northeast counties of the state. Seventeen caves located in Adair, Cherokee, Delaware and Ottawa counties are known to be inhabited by the gray bat (Grigsby and Puckette, 1984 and Bagley, 1986). At least seven other caves in northeast Oklahoma are known to be inhabited by Ozark big-eared bats (Skeen et. al., 1991).

Declines in the populations of cave dwelling bats have been drastic (Barbour and Davis, 1969). However, there is no reason this trend cannot be reversed by taking adequate protection and management steps. Recovery plans developed by the U.S. Fish and Wildlife Service (1982 and 1986) for both gray bats and Ozark big-eared Bats are designed to return these species populations to self sustaining levels.

Protection of maternity sites is an essential step in halting the population decline of gray and Ozark big-eared bats. This can be effectively done by gating or fencing the cave entrance to preclude human entry during crucial periods of their life cycle. When properly constructed, the protection systems should promote growth of the population to an optimum level for the site. Continued population growth beyond the optimum should force the population to branch out into other caves in the area (Grigsby and Puckette, 1984). During the ten year period of 1981 through 1991, populations at protected sites remained stable or showed marked increase (Grigsby, Puckette and martin, 1993).

After the sites have been protected, they must be monitored to determine effectiveness of the protection system, both as a barrier to humans and as an acceptable flyway for the bats. Research is also needed to confirm colony composition at the sites which are believed to be maternity sites and to determine the flight corridors between the cave site and the feeding areas so these crucial flyways may be preserved.

Portions of the recovery plan for the gray bat in Oklahoma that have been implemented include construction of internal grid systems at two maternity caves, AD-8 and DL-92, (Grigsby and Puckette, 1984), the construction of a fence around the entrance of a former maternity cave, DL-91 (Skeen, et al., 1990), and more recently, construction of a second type of internal grid at site CZ-9, (Skeen et al., 1991) and a fence around the entrance of site DL-21.

I. PROCEDURE:

1. Land ownership was established at sites where it was unknown. Plans for each specific site were discussed and permission to implement those plans was obtained from the landowners.
2. Projected costs for the implementation of the recommended plans for each site were determined.
3. Upon approval of the plans for each site, the plan was implemented according to the priority given to that plan. The priority listings below are as stated by Grigsby and Puckette (1982 and 1984).

Priority 1. All actions that are absolutely essential to prevent extinction of the species.

Priority 2. All actions necessary to maintain the species current population status.

Priority 3. All other actions necessary to provide for full recovery of the species.

4. Colony composition at each inhabited site was determined by capturing a representative number of bats using a Tuttle Trap.
5. Each site with a protective grid system was monitored throughout the year. Evening emergence flights were monitored using an infrared scope and video camera at sites known to be inhabited by maternity colonies. Population estimates were determined using the stain and guano measurement technique in mid-July after the

bats had departed from the site.

6. Sites AD-8 and CZ-9 was monitored using radio telemetry to determine flight corridors.
7. Results of research will be presented at meetings and/or submitted for publication.

II. SUMMARY OF PROGRESS:

A. Colony Protection For AD-7:

1. Site: Site AD-7 serves as a maternity site for Myotis grisescens and also serves as a feeding roost for Plecotus townsendii ingens.
2. Status During Study: This site was visited once during the study period. Though population estimates were not made due to the inaccessibility, there was evidence of a relatively large colony. At that time, Plecotus townsendii ingens activity was evidenced by the presence of moth wings inside the cave.
3. Cave Management Schedule: During the course of this study, the following activities occurred.

Site monitored July 1993.

4. Recommendations: This site should be monitored regularly and careful consideration should be given to protection due to the dual species usage status of this site.

B. Colony Protection For AD-8:

1. Site: Site AD-8 serves as a maternity site for Myotis grisescens. A protective grid system was installed at this site in 1980 and remains to the present. However,

a portion of the upper horizontal bar was removed by vandals prior to this study allowing human entry.

2. Status During Study: During this study, repairs were made to the vandalized grid. This did not completely prevent human entry but did serve to drastically curb such activity. The entry door was damaged by vandals but entry was not achieved at that location. Population fluctuations and roost site movement during this study seemed to show about a one year lag behind instances of human disturbance.

Populations during the study fluctuated markedly but showed an overall upward trend.

3. Cave Management Schedule: During the course of this study, the following activities occurred.

Landowner relations re-established May 1990.

Grid measured for repairs March 1991.

Protective system monitored March and November 1991, May and June 1992 and January 1994.

Protective system repaired March 1993.

Video of emergence flight through protective system May, June and July 1993, May 1994 and June 1995.

Measurements made for replacement of entry door January 1994.

Videos viewed and data recorded February 1994

Bats trapped for colony composition determination July 1994.

Bats trapped for confirmation of colony composition and fitting of transmitters June 1995.

Population estimates made July 1990, 1991, 1992, 1993, 1994 and 1995.

4. Summary of Results: Results of colony composition and radio telemetry studies are as follows.
 - a. During colony composition studies, thirty gray bats were captured using a Tuttle Trap. Of those captured, nineteen were adult lactating females and the remaining eleven bats were young of the year. This confirmed conclusively that this site serves as a maternity site for Myotis grisescens.
 - b. All six adult lactating female bats which were fitted with transmitters were tracked during the ten day telemetry study. Results of the telemetry study seem to indicate that the bats in this colony follow the valley to Highway 10 where they then cross the highway and follow wooded canyons across the hill to reach the Illinois river. After reaching the river, they appear to forage along cliffs and wooded areas near the Illinois river.

5. Recommendations: Replacement of the entry gate at this site is needed and an upgrade of the current protective system should be considered. Monitoring should continue, possibly in conjunction with the OSRC or the local Game Warden. As important as the cave is to the continued survival of this colony, further work should be done to more precisely identify and to protect the flight corridors and foraging area.

C. Colony Protection For AD-15:

1. Site: Site AD-15 serves as a minor roost for Plecotus townsendii ingens. The spring flowing from the cave serves as water supply for the landowner. An internal grid protection system was installed at this site by other researchers in 1994.
2. Status During Study: During this study, an internal grid protection was installed at this site by other researchers in 1994.
3. Cave Management Schedule: During the course of this

study the following activities occurred.

Landowner relations established March 1992.

Location of proposed protection system discussed and site monitored March 1992.

Protection system discussed with landowner April 1992.

Site measured for protection system June 1992.

4. Recommendations: Monitoring should continue at this site and the protection system should be observed carefully for usage by bats.

D. Colony Protection For CZ-9:

1. Site: Site CZ-9 serves as a maternity colony for Myotis grisescens. Cave amphipods have also been found in the small stream in one of the passages at this site. A protective grid system was installed at this site in 1991 and an entry door was installed the following year. Chain ladders were also installed in following years to make population estimates possible in difficult areas of the cave.
2. Status During Study: During this study, evidence of past human activity within the cave prompted the installation of a protection system to prevent human access while allowing the bats to use the cave. This site was used as a maternity site each year throughout the study and after the completion of the protective system, no evidence of human entry was found. Populations during this study showed an increase.
3. Cave Management Schedule: During the course of this study, the following activities occurred.

Landowner relations established October 1989.

Population estimates visual August 1990, partial estimate August 1991 and complete estimates July 1992 and July 1993.

Preliminary measurements and location determinations for protection system August 1990.

Final measurements for protection system and footing for protection system dug and poured February 1991.

Protection system grid installed and coated with primer March 1991.

Entry gate installed in protection system March 1992.

Protection system monitored May, June, September and October 1991, March 1992, May 1993 and June 1995.

Emergence flight videos July 1991, May 1992, May and June 1993, May and June 1994 and June 1995.

Videos viewed and data recorded February 1994.

Bats trapped for colony composition determination June 1994.

Bats trapped for colony composition confirmation and to fit bats with transmitters for telemetry July 1995.

4. Summary of Results: Results of colony composition and radio telemetry studies are as follows.
 - a. During colony composition studies, twenty eight gray bats were captured using a Tuttle Trap. Of the bats captured, thirteen were adult lactating females, five were adult males and the remaining ten were young of the year. This confirmed conclusively that this site serves as a maternity site for Myotis grisescens.
 - b. All six adult lactating female bats which were fitted with transmitters were tracked during the 10 day telemetry study. Results of telemetry seem to indicate that the bats in this colony followed the small stream in front of the cave down to the creek then followed the creek down to the river. After reaching the river, data indicate that the bats foraged primarily along the west side of the river and lake. However, instances were recorded of bats foraging up to one half mile west of the river, over open lake and in Sequoyah State Park.
5. Recommendations: Monitoring of the protection system at this site should be continued, possibly in conjunction with the Army Corps of Engineers or the local Game Warden. Further work should be done to more precisely identify and protect the flight corridors and foraging area.

E. Colony Protection For DL-1:

1. Site: Site DL-1 has served as a night roost during the maternity season and as a spring and fall roost site for Myotis grisescens in the past. Current usage is unknown. An internal grid protection system was installed at this site by other researchers in 1995.
2. Status During Study: During this study, an internal grid protection system was installed at this site by other researchers in 1995.
3. Cave Management Schedule: During the course of this study the following activities occurred.
 - Land owner relations established May 1992.
 - Site monitored May 1992.
 - Population estimates made August 1992.
4. Recommendations: Monitoring at this site should continue and the protection system should be carefully observed for usage by bats.

F. Colony Protection For DL-2:

1. Site: Site DL-2 has served as an alternate Myotis grisescens maternity site for DL-91 in the past. However, no evidence of a population has been found during this study. A vulture nest with one offspring was found inside the entrance during the 1992 season.
2. Status During Study: Flooding during high water levels on Grand Lake decreases the usefulness of this site for Myotis grisescens. The protective nature of the land owner serves to adequately protect this site for the

present.

3. Cave Management Schedule: During the course of this study, the following activities occurred.

Landowner relations established August 1992.

Site monitored August 1992.

Site monitored July 1993.

4. Recommendations: This site should continue to be monitored and land owner relations should be maintained. Unless changes occur in ownership or cave usage status, management of this site should be left to the landowner.

G. Colony Protection For DL-8:

1. Site: Site DL-8 has served as a transient and bachelor site for Myotis grisescens in the past. However no evidence of a colony was found during this study.
2. Status During Study: During this study, this site has shown a continuing high level of human activity which is sufficient to prevent usage of by Myotis grisescens.
3. Cave Management Schedule: During the course of this study, the following activities occurred.

Site monitored November 1991 and June 1992.

4. The nature trail which leads near the cave entrance should be closed due to the exposure it gives this site. Monitoring should continue at this site and consideration should be given to protection.

H. Colony Protection For DL-15:

1. Site: Site DL-15 serves as an alternate Myotis grisescens maternity site for DL-92. This site is

located in close proximity to a county road and has no protection.

2. Status During Study: During this study and in the past, this site was subjected to heavy human activity. This seems to be due to its location near a road, its reputation as a site for Native American artifacts and its lack of protection.

3. Cave Management schedule: During the course of this study, the following activities occurred.

Site monitored June 1993.

4. Recommendations: Due to its status as alternate maternity site for DL-92 during high water, this site should be further evaluated and considered for protection.

I. Colony Protection For DL-21:

1. Site: Site DL-21 formerly served as a minor hibernaculum and currently serves as a night roost for Plecotus townsendii ingens. This site was protected with a fence around the entrance in 1990. The fence was later painted with brown and green camouflage paint to make it less visible from the road.

2. Status During Study: During this study, vandalism to the fence occurred and other evidence of human activity was found. Repairs were made to the vandalized portion of the fence and other improvements were made to the fence.

3. Cave Management Schedule: During the course of this study, the following activities occurred.

Landowner relations established 1989.

Protective fence constructed 1990.

Protective fence painted with camouflage 1991.

Site monitored and vandalism repaired August 1992.

Site monitored January and May 1993.

Protective fence improved May 1993.

4. Recommendations: Monitoring should continue at this site and the fence should be maintained. Maintenance should include repair of any damage to the fence, trimming of tree branches above fence and cutting of brush growing up in the fence wire.

J. Colony Protection For DL-91:

1. Site: Site DL-91 serves as a maternity site and alternate maternity site with DL-2 for Myotis grisescens.

This site was protected in 1983 with a grid system at the entrance. The protection system was later locked open due to abandonment and a fence was constructed around the entrance in 1989. A colony of Myotis grisescens subsequently returned to this site in 1992.

This site is also inhabited by cave fish and cave crayfish.

2. Status During Study: During this study, vandalized portions of the fence were repaired. Usage of this site by Myotis grisescens during the study varied with

human activity.

3. Cave Management Schedule: During the course of this study, the following activities occurred.

Landowner relations established 1991.

Monitoring and population estimates August 1992.

Emergence flight videos May and June 1993 and July 1994.

Population estimate July 1993.

Site monitored and possible site of internal grid discussed August 1993.

Bats trapped for colony composition determination July 1994.

4. Summary of Results: Results of colony composition studies are as follows.

During colony composition studies, thirty eight gray bats were captured using a Tuttle Trap. Of the bats captured, nine were adult females, six of which were lactating, two were adult males and the remaining twenty seven were young of the year. This data combined with the previous lack of bat emergence seems to indicate that this site serves as a day roost for volant Myotis grisescens young of the year.

5. Recommendations: Monitoring at this site should continue and an internal grid protection system should be installed as previously discussed.

K. Colony Protection For DL-92:

1. Site: Site DL-92 serves as a maternity site for Myotis grisescens. An internal grid protection system was installed at the site in 1983.
2. Status During Study: Human entry was evident at this site during this study, but was infrequent and seemed confined to areas just inside the grid. Population during the study fluctuated but showed an overall

upward trend.

3. Cave Management Schedule: During the course of this study, the following activities occurred.

Land owner relations established 1990.

Site monitored June 1991, May and June 1993, June 1994 and June 1995.

Emergence flight videos taken July 1991.

Population estimates taken August 1990, July 1991, 1992 and 1993.

4. Recommendations: Monitoring at this site should continue and the protective system should be improved to preclude human entry.

L. Colony Protection For OT-4:

1. Site: Site OT-4 served as a maternity site for Myotis grisescens until the apparently abandoned the site during the 1994 maternity season.

2. Status During Study: During this study, a history of human disturbance continued. The Myotis grisescens population at this site fluctuated but the overall trend was a marked decrease until abandonment occurred.

3. Cave Management Schedule: During the course of this study, the following activities occurred.

Landowner relations established 1989.

Population estimates were taken July 1990, 1991, 1992 and 1993.

Internal grid protection system discussed with land owner and measurements taken June 1992.

Site monitored December 1992 and 1993.

Emergence flight videos taken May 1992, May and June 1993 and May and June 1994.

4. Recommendations: Monitoring should continue at this site. Due to the high level of human activity and the recent status as a Myotis grisescens maternity site, an internal grid protection system should be installed.

M. Colony Protection For OT-13:

1. Site: Site OT-13 has served as a Myotis grisescens maternity site. However, usage as a maternity site has become questionable.

This site has seen an increase in human activity during this study. A vulture nest was present in the cave entrance and two offspring were raised during the 1993 maternity season.

2. Status During Study: During this study, the sign at the cave entrance was destroyed, cave formations from inside the cave were found outside the entrance and other evidence of human activity were noted.

The Myotis grisescens population at this site has decreased dramatically during this study and the previous status as maternity site is in questionable.

3. Cave Management Schedule: During the course of this study, the following activities occurred.

Landowner relations established 1990.

Population estimates taken August 1992 and July 1993 and 1995.

Site monitored and possible site for protection system measured August 1992.

Site monitored December 1992 and June 1995.

Emergence flight videos taken May 1993, and June 1994.

4. Recommendations: Monitoring at this site should continue. This site should also be protected with an internal grid protection system to prevent human entry.

III. DISCUSSION:

Internal grid type protection systems have shown a good measure of success at Myotis grisescens maternity sites as indicated by increased populations at protected sites. These population increases are, however, offset by decreases at unprotected sites. Overall population trends state wide are difficult to determine as currently unknown caves undoubtedly exist which may be suited for gray bat habitation and therefore, unknown colonies may exist.

Colony composition studies at sites where data were gathered indicated that all three sites were maternity sites as shown by the high proportion of lactating females and juveniles. An almost complete lack of adult males confirms this conclusion.

Telemetry studies at AD-8 and CZ-9, though not conclusive, seem to indicate the need for protection of wooded flight corridors between gray bat maternity sites and their foraging areas near waterways.

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Appendix 1

Myotis grisescens Populations in Caves Monitored

| CAVE | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|--------|--------|--------|--------|--------|--------|-------|
| AD-7** | "-" | "-" | "-" | "-" | "-" | "-" |
| AD-8 | 6,000 | 9,800 | 13,100 | 12,100 | 10,400 | "-" |
| AD-15* | "-" | "-" | "-" | "-" | "-" | "-" |
| CZ-9 | "-" | "-" | 51,900 | 54,400 | "-" | "-" |
| DL-1 | "-" | "-" | 9,200 | "-" | "-" | "-" |
| DL-2 | "0" | "-" | "0" | "0" | "-" | "0" |
| DL-8 | "-" | "0" | "0" | "0" | "-" | "-" |
| DL-15 | "-" | "-" | "-" | "0" | "-" | "-" |
| DL-21* | "-" | "-" | "-" | "-" | "-" | "-" |
| DL-91 | "-" | "-" | 21,000 | 32,900 | "-" | "-" |
| DL-92 | 21,900 | 22,700 | 56,600 | 30,700 | "-" | "-" |
| OT-4 | "-" | 8,300 | 1,200 | 1,500 | "-" | "-" |
| OT-13 | "-" | "-" | 24,600 | 5,200 | "-" | 6,200 |

* Site serves Plecotus townsendii ingens

** Site serves both Myotis grisescens and Plecotus townsendii ingens

"-" Population estimates not taken

"0" Site not inhabited by bats

Appendix 2

Past Work Done on Gray Bat and Ozark Big-eared Bat Cave Sites

| Cave | Protection | Year Completed | Results |
|-------|--------------------|----------------|---------------------------|
| AD-8 | Grid/Gate | 1980 | Population Up |
| AD-15 | Grid/Gate | 1994 | Unknown |
| CZ-9 | Grid/Gate | 1992 | Population Up |
| DL-1 | Grid/Gate | 1995 | Unknown |
| DL-91 | Grid/Gate Fence | 1983 | Colony Returned 1992 * |
| DL-92 | Grid/Gate | 1983 | Population Up |

* Based on 30 July 1992 Population Estimate

Appendix 3

CONFIDENTIAL INFORMATION, DO NOT DISTRIBUTE

Code Numbers and Names of Key Cave

| Code Number | Cave Name |
|-------------|------------------|
| AD-6&7 | Charlie Owl |
| AD-8 | Adair Bat |
| AD-15 | Cave Springs |
| CZ-9 | Dressler |
| DL-1 | Anticline |
| DL-2 | Beaver Dam |
| DL-8 | Boulder/Bolton |
| DL-15 | Dick/Wolf Hollow |
| DL-21 | Unknown |
| DL-91 | Twin/Dunaway |
| DL-92 | Spavinaw Bat |
| OT-4 | Shiflet |
| OT-13 | Boy Scout |

Appendix 4

CONFIDENTIAL INFORMATION, DO NOT DISTRIBUTE

Site Locations

- Site AD-7:
This site is located southwest of Stilwell, Adair County, Oklahoma.
- Site AD-8:
This site is located five miles south of Kansas, Adair County, Oklahoma, at Cookson Hills Christian School.
- Site AD-15:
This site is located near Cave Springs, Adair County, Oklahoma.
- Site CZ-9:
This site is located in extreme southwestern Cherokee County, near Fort Gibson, Oklahoma.
- Site DL-1:
This site is located about 6 miles southeast of Jay, Delaware County, Oklahoma.
- Site DL-2:
This site is located northwest of Jay, Delaware County, Oklahoma.
- Site DL-8:
This site is located 1/4 mile north of Lake Eucha in Delaware County, Oklahoma and is owned by the City of Tulsa.
- Site DL-15:
This site is located on private property near the Spavinaw Hills Game Management Area southwest of Eucha, Delaware County, Oklahoma.
- Site DL-21:
This site is located about 6 miles east of Kenwood, Delaware County, Oklahoma.
- Site DL-91:
This site is located near the Drowning Creek arm of Grand Lake in Delaware County, Oklahoma and is owned by the Nature Conservancy.
- Site DL-92:
This site is located on property adjacent to the Spavinaw Hills Game Management Area southwest of Eucha, Delaware County, Oklahoma and is owned by the Claremore Club.

Appendix 4 (continued)

Site OT-4:

This site is located approximately seven miles north of Grove, Ottawa County, Oklahoma.

Site OT-13:

This site is located near Grove, Ottawa County, Oklahoma.

