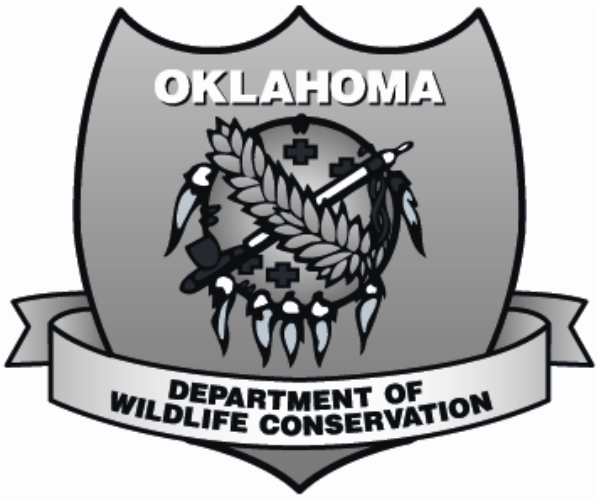
FINAL PERFORMANCE REPORT



FEDERAL AID GRANT NO. F13AP00783 (E-22-19)

MANAGEMENT AND PROTECTION FOR THE OZARK BIG-EARED BAT, GRAY BAT, AND STYGOBITIC FAUNA IN OKLAHOMA

OKLAHOMA DEPARTMENT OF WILDLIFE CONSERVATION

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Final Performance Report

State: Oklahoma **Project Number:** F13AP00783 (E-22-19)

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Project Title: Management and Protection for the Ozark Big-eared Bat, Gray Bat, and Stygobitic Fauna in Oklahoma

A. Abstract:

Unique characteristics common to North American subterranean fauna render them vulnerable to anthropogenic activities and underscore the importance of monitoring and protecting sensitive populations. Within the United States, subterranean fauna constitute more than 50% of the G1-G2 species recorded in the Natural Heritage Program; however, less than 4% have received federal protection. Procedures implemented during this project were intended to 1) maintain the bat population in targeted caves by preventing unnecessary human entry and disturbance to critical roosts; and 2) survey stygobitic fauna in Oklahoma and delineate biologically important subterranean systems. Management procedures, including gate/grill construction at one cave, and population monitoring efforts were completed at 27 caves that have received past management and protection efforts. Stygobitic bioinventory surveys were conducted at 10 caves and focused on population counts of Ozark Cavefish and both state endemic cave crayfish. Future management recommendations follow the results of these project activities.

B. Need:

The cave-producing karst ecosystem of the Ozark Highlands harbors a diversity of unique and sensitive organisms, many of which are cave obligates. Unique characteristics common to North American subterranean fauna render them vulnerable to anthropogenic activities and underscore the importance of monitoring sensitive populations. Subsurface habitats typically display decreased diversity in community complexity and reduced species abundance relative to above ground ecosystems translating to fewer species and individuals in subterranean habitats than in surface habitats (Holsinger, 1988). Processes that isolate subterranean populations of organisms, and evolutionary adaptation of those species to their environments, can produce extreme patterns of endemism (Barr and Holsinger, 1985; Culver et al, 2000).

Human disturbance at caves is a persistent problem internationally and has been implicated as a cause for decline in several cave-dependent bats (Barbour and Davis, 1969; Humphrey and Kunz, 1976; Tuttle, 1979; American Society of Mammalogists, 1992). About 18 of the 45 species of North American bats rely substantially on caves throughout the year (McCracken, 1989) and all of the North American bats that are listed as endangered or threatened by the United States Fish and Wildlife Service are cave-dependent species or subspecies (McCracken, 1989; Harvey et al., 1999; Pierson, 1999). In the central United

States, two obligate cave-dependent 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 because each is federally listed as endangered (United States Fish and Wildlife Service 1982, 1983, 1995).

Anthropogenic activities threaten groundwater quality and quantity and consequently the communities of organisms living within groundwater habitats. The combined ranges of over 50% of the described species and subspecies of groundwater-dwelling fauna (stygobites) in the continental United States are estimated to constitute less than 1% of the total surface area of the country (Culver et al, 2000). These phenomena render groundwater species vulnerable to anthropogenic activities and necessitate monitoring of vulnerable species and populations.

Cave gating has been used widely by government and private entities to protect these sensitive ecosystems from direct human impacts. Communities of cave fauna presently are protected with internal gate systems throughout the United States including more than 34 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, as well as big brown bats (*Eptesicus fuscus*), tri-colored bat (*Perimyotis subflavus*), and northern long-eared bats (*Myotis septentrionalis*). Four caves that contain populations of either the Ozark cavefish (*Amblyopsis rosae*), Oklahoma cave crayfish (*Cambarus tartarus*) and/or Delaware County cave crayfish (*Cambarus subterraneus*) also are protected from human entry by internal gate/grill systems.

Procedures during this project were conducted in the Ozark Highlands in northeastern Oklahoma. The Ozarks Highlands cover about 103,000 km^2 (Huffman 1959) in the central United States at elevations of 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). The caves in this region serve as refugia from severe winters and hot summers for many cave-dwelling species (Humphrey and Kunz 1976, Fenolio et al. 2005).

C. Purpose:

The purpose of this project was to assist in the recovery of the Gray Bat, Ozark Big-eared Bat and Ozark Cavefish by working with cave owners and constructing internal gate and grill systems within those caves that support populations of one or more of these species. The internal gate/grill systems prevent unauthorized human entry into those caves and protect bats and cavefish from human disturbance which is especially important for bat populations during hibernation and pup rearing. This project also supported biological inventories of Ozark caves to identify and prioritize caves based upon their importance to the three federally listed species and other Ozark cave-endemic species that are similarly affected by human disturbance within their cave environments. These biological data improve the effectiveness of the overall cave gating project by ensuring the resources are directed to the most important caves. These data also assist in the monitoring and status assessment of cave-dependent species so that future management decisions can be based on better information.

D. Objectives:

1) Maintain the bat population in targeted caves by preventing unnecessary human entry and disturbance to critical roosts.

2) Survey the stygobitic fauna in the Oklahoma Ozarks and identify biologically important subterranean systems that include but are not limited to historic localities for *Amblyopsis rosae* and the species of groundwater crayfish that are endemic to Oklahoma.

E. Results:

Cave Management—Population estimates of bats at caves prior to installation of gates (beginning in 1981) and post-installation estimates show that each cave continues to be used by stable, or increasing populations of resident bats (Grigsby et al. 1993, Martin et al. 2000, 2003, 2006; Puckette 2000). Procedures in this project assist in stabilizing sensitive populations of cave fauna in northeastern Oklahoma. The following is a description of caves and management procedures that were conducted during the project.

Long-term Management Plan: Cave AD-7

This cave is located in T15N R24E, Adair County, OK. The site annually serves as a maternity cave for a colony of gray bats. It is the only maternity colony of gray bats in the state that is not protected from human entry by a gate/grill system. During the winter season of 2014-15, a visit was conducted and permission was obtained from private landowners to access the site with vehicles and equipment. Project personnel are confident that the Oklahoma Chapter of the Nature Conservancy is the landowner on which the main entrance is located. All landowners have been contacted in 2014-15 and granted vehicular access to the site, and materials for the initial fabrication of the internal gate/grill system have been secured and will begin during the next grant segment.

Gate Removal and Re-installation: Cave DL-39

There are two entrances to this cave system that has 5,550 feet of mapped passage. The cave contains an active stream that flows its entire length, and though it is subject to flooding in extreme rain events, it does house a colony of gray bats with as many as 11 roost sites within the passage. The colony that uses the cave has never been identified as a maternity colony because typically males, young of the year, and non-lactating females have been historically trapped at the entrance. The largest entrance to the cave is located on the Mary Looney Unit of the Ozark Plateau National Wildlife Refuge. Though the entrance/passage is not gated, the refuge's headquarters is located on the property and provides adequate protection from human entry and potential disturbance to roost sites. However, a second entrance is located on private property in T21N R24E, Delaware County, OK. This smaller entrance joins the main passage and was gated with a solid iron door in the 1960's (*William Puckette, pers. comm.*). The design of the historical gate system prohibited any bat flight through the entrance, and potentially disrupted airflow into and out of the cave subsequently altering the internal climate of the passage. During the 2013 summer season, management efforts were

initiated to inspect access, develop a management plan, and gain permission from the landowner to begin an excavation of the current gate and replace it with a larger gate that permits both ingress/egress by bats and airflow. Excavation and removal of the existing gate structure began in December 2013 and continued though the current project cycle and will be completed in 2016.

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 from December 2014 through March 2015. Summer roost monitoring was conducted from May through August 2014 at selected caves to determine use patterns and if possible, population estimates (Table 1).

Pre-White-Nose Syndrome Surveys

For the second consecutive year, pre-white-nose syndrome surveys were conducted in five caves in northeastern Oklahoma. Beginning in January 2015, ten torpid *Perimyotis subflavus* from five different caves and surrounding substrates were sampled for the presence of *Pseudogymnoascus destructans*. Personnel in this project were invited to participate in the monitoring program that assists in the early detection of the causative fungus *P. destructans*, on bat specimens from caves in eastern Oklahoma. Protocols exist for both the cultivation of *P. destructans* and the cultivation-independent detection of this organism based on growth cultivation. Early detection is essential to provide resource managers the time and data necessary to implement a management or containment plan. During the hibernation season 2014-15, project personnel sampled live-caught specimens of *P. subflavus* retrieved from torpid populations in five specific caves in eastern Oklahoma (AD-7; DL-8; DL-21; DL-91: OT-13). These monitoring efforts were in collaboration with the Ecological Services Office of the U.S. Fish and Wildlife Service in Tulsa, Oklahoma. Colony cultivation and identification of microfauna will be conducted by the Center for Microbial Genetics and Genomics at Northern Arizona University's Keim Genetics Lab in Flagstaff, AZ. Results from the 50 live specimens and on nearby substrates will be available in summer 2015.

Additionally, soil samples were collected at three different locations in the passages of each of the five caves above. Protocols have been developed in the laboratories of the University of Central Oklahoma for the cultivation and detection of *P. destructans*. Results from the 15 samples will be available in summer 2015.

Table 1. Population estimates and species richness at select caves in eastern Oklahoma during the project period.

Date	County	Cave Number	Gated	Monitoring Results
2-June-14	Adair	AD-125	No	105 COTO
5-June-14	Adair	AD-10	Yes	320 COTO
9-June-14	Adair	AD-13	Yes	63 COTO
12-June-14	Adair	AD-17	Yes	72 COTO
12-June-14	Adair	AD-18	Yes	170 COTO
16-June-14	Delaware	DL-91	Yes	9,140 MYGR (Emergence)
16-June-14	Delaware	DL-2	No	9,385 MYGR (Emergence)
11-Sep-14	Delaware	DL-91	Yes	18,015 MYGR (Emergence)
11-Sep-14	Delaware	DL-2	No	0
17-Dec-14	Adair	AD-13	Yes	2 PESU;
17-Dec-14	Adair	AD-17	Yes	38 PESU
17-Dec-14	Adair	AD-18	Yes	83 PESU; 1 EPFU; 1 MYSE
17-Dec-14	Adair	AD-15	Yes	24 PESU; 2 MYSE; 5 COTO
17-Dec-14	Adair	AD-21	Yes	1 COTO
19-Jan-15	Adair	AD-7	No	5 EPFU; 2 MYGR; 130 PESU
15-Jan-15	Cherokee	CZ-18	Yes	198 PESU; 2 MYSE
24-Jan-15	Adair	AD-10	Yes	315 COTO; 51 PESU
22-Jan-15	Adair	AD-14	Yes	165 PESU; 10 MYGR: 37 MYSE; 2 EPFU
21-Mar-15	Adair	AD-29	Yes	1 COTO; 1 PESU
21-Mar-15	Adair	AD-30	Yes	16 PESU
21-Mar-15	Adair	AD-54	Yes	30 PESU
21-Mar-15	Adair	AD-211	Yes	1 COTO; 4 PESU
21-Mar-15	Adair	AD-221	Yes	70 PESU; 9COTO
4-Feb-15	Adair	AD-8	Yes	98 PESU; 1 MYGR
25-Feb-15	Ottawa	OT-13	Yes	16 PESU
3-Mar-15	Delaware	DL-91	Yes	35 PESU
27-Jan-15	Delaware	DL-21	No	21 PESU; 1 MYSE

MYGR: *Myotis grisescens*
MYSE: *Myotis septentrionalis*
EPFU: *Eptesicus fuscus*
COTO: *Corynorhinus townsendii ingens*
PESU: *Perimyotis subflavus*

Stygobitic Bioinventories— Dr. Fenolio has been assisting the USFWS Tulsa Field Office with subterranean surveys and bioinventory work since 2001. In particular, regular counts of subterranean habitats containing populations of Ozark Cavefish, and both state endemic cave crayfish, Oklahoma Cave Crayfish and Delaware County Cave Crayfish, have been a focus of these surveys. Examining caves where historical records of Ozark Cavefish exist, but where they have not been seen in recent years, is a goal. Trapping in caves with historical reports of cave crayfish, and where the identification of those populations has not been determined, has also

been a focus. Of note during these surveys are other important subterranean species such as the Grotto Salamander (*Eurycea spelaea*), groundwater amphipods (*Stygobromus* spp.), and range-limited groundwater isopods, such as Mackin's Cave Isopod (*Caecidotea mackini*). Data collected from these surveys have always been provided to the Subterranean Biodiversity Project database, originally maintained by Dr. G.O. Graening and now by Michael E. Slay of the Nature Conservancy in Fayetteville, Arkansas. Species descriptions, conservation updates, and biological observations are being published every year (Graening et al., 2012).

Ozark aquatic surveys in spring 2014 lasted three days and included subterranean biologists Drs. M. Niemiller (University of Kentucky) and D. Soares (University of Maryland), who drove to the site and participated in bioinventories. William Puckette and Keith "Andy" Harris also participated in some of the inventories. USFWS biologists Richard Stark and Shea Hammond participated via organization. At the end of the day, all gear was washed with appropriate disinfectants and decontaminated prior to use the following day in a new system.

Surveys were also conducted in December 2014 by subterranean biologists Dr. Dante Fenolio, Dr. D. Soares (University of Maryland), Nature Conservancy karst biologist, Michael Slay, and UFWS agents Richard Stark and Shea Hammond. Each day of this trip, only one cave, or cluster of caves in close proximity, were surveyed. At the end of the day, all gear was washed with appropriate disinfectants and decontaminated prior to use the following day in a new system.

Cave AD-8: 24 May 2014
Surveyors: Dr. Danté Fenolio and *Keith Andy Harris*

This cave serves as a significant Gray Bat maternity site and has substantial guano deposits approximately 250 meters into the system. The entrance is a low and tight crawlway and the gate lock can be difficult to unlock and open. A stream issues through the cave, exiting the natural entrance. The stream harbors significant guano deposits. This cave is home to an endemic groundwater isopod, *Caecodotea macropropoda*. The system is biologically diverse and accommodates Grotto Salamanders (*Eurycea spelaea),* Tri-colored Bats, and groundwater flatworms (*Dendrocoelopsis americana).* A small group of clustered Gray Bats (roughly 40 individuals) were roosting on the ceiling near the natural entrance to the cave. They were not disturbed and care was taken to pass by that area quietly and move deeper into the system. Nine dead Tri-colored Bats were found along the cave stream in various states of decomposition. None of the live *P. subflavus* displayed obvious signs of White Nose Syndrome.

Table 2. Faunal inventory for cave AD-8 in Delaware County, Oklahoma

25+	Cave Crickets	*Ceuthophilus* sp.
40+	Hothouse Millipedes	*Oxidus gracilis*
50+	Cave Dung Flies	*Spelobia* sp.
50+	Heleomyzid Flies	
5	aquatic subterranean flatworms	*Dendrocoelopsis americana*
50+	endemic aquatic isopods	*Caecodotea macropropoda*
25+	larval Grotto Salamanders	*Eurycea spelaea*

40+	Gray Bats	*Myotis grisescens*
20+	Tri-colored Bats	*Periomyotis subflavus*
9	dead Tri-colored Bats	*Periomyotis subflavus*

Cave DL-33: 25 May 2014
Surveyors: Dr. Danté Fenolio, Dr. Matthew Niemiller, Dr. Daphne Soares, and W. Puckette

This cave has a low entrance that is elevated approximately two or three meters from the stream that cuts through the floor of the hollow. The clearance of the entrance is low, requiring surveyors to crouch and crawl; however, it eventually opens to a passage that allows for upright walking. We encountered several isolated pools at the mouth of the cave upon visitation. A stream issues through the system with numerous slow flowing pools. There are a couple of tight squeezes in the system when following the waterway. Approximately 300 meters into the system, the cave turns into a low crawl in the water.

Table 3: Faunal Inventory for Hampton Cave

34	Cave Crickets	*Ceuthophilus* sp.
16	Hothouse Millipedes	*Oxidus gracilis*
50+	Cave Dung Flies	*Spelobia* sp.
2	Cave Beetles	*Platinus* sp.
50+	Mosquitoes	
7	Cave Isopods	*Caecidotea* sp.
2	Cave Amphipod	*Stygobromus* sp.
2	Cave Fungus Gnat larvae	*Macrocera nobilis*
25+	Heleomyzid Flies	
12	Meshweaver Spiders	*Cicurina* sp.
2	Cave Harvestmen	*Crosbyella* sp.
17	Collembola	
2	aquatic subterranean flatworms	*Dendrocoelopsis americana*
1	aquatic blind cave snail	
17	Tri-colored Bats	*Periomyotis subflavus*
19	Grotto Salamander larvae	*Eurycea spelaea*
1	Grotto Salamander adult	*Eurycea spelaea*
3	Cave Salamander larvae	*Eurycea lucifuga*
3	Cave Salamanders	*Eurycea lucifuga*
1	Virginia Opossum carcass	*Didelphis virginiana*

Cave DL-40: 25 May 2014
Surveyors: Dr. Danté Fenolio, Dr. Matthew Niemiller, Dr. Daphne Soares, and W. Puckette.

The cave has a mouth at the floor of a hollow. A perennial stream issues from the cave mouth. The entire cave is a crawl which gets progressively lower and lower. Our team crawled back some 400 meters; W. Puckette was able to crawl the furthest back into the narrow passage. The banks of the system are washed chert cobble and there is one secondary entrance approximately 200 meters into the system and on the right bank. The crawl through

this secondary entrance appears to have experienced some cave in and has the risk of being unsafe to surveyors. This would be a dangerous system to explore during or after a rain as there are clear signs that the cave completely fills during high-flow events.

Table 4: Faunal Inventory for Jumper Springs Cave

10+	Mosquitoes	
10	Cave Isopods	*Caecidotea* sp.
11	aquatic leeches	
7	Ringed Crayfish	*Orconectes neglectus*
39	Grotto Salamanders larvae,	E*urycea spelaea*
20+	larval Salamanders	*Eurycea* sp. (likely *E. lucifuga* or *E. melanopleura*)
500+	larval fishes	

Cave DL-83: 26 May 2014
Surveyors: Dr. Danté Fenolio, Dr. Matthew Niemiller, Dr. Daphne Soares.

The system is located in the front yard of a private landowner. The cave is too small for surveyors to enter; however, two distinct springs issue from a limestone feature in the landowner's yard. The spring run issuing from the subterranean systems was inventoried. Landowners are friendly and interested in the cave life on their property.

Table 5: Faunal Inventory for Twin Spring Cave

4	Cave Crickets	*Ceuthophilus* sp.
5+	Heleomyzid Flies	
2	Ringed Crayfish	*Orconectes neglectus*
3	Odonate larvae	
1	Grotto Salamander adult	*Eurycea spelaea*
5	Cave Salamander larvae	*Eurycea lucifuga*
1	Cave Salamander adult	*Eurycea lucifuga*
1	Pickerel Frog	*Rana palustris*

Cave DL-148: 2 December 2014
Surveyors: Dr. Danté Fenolio, Mike Slay, Richard Stark

We performed the biannual count of both the Oklahoma Cave Crayfish and the Ozark Cavefish within this system. The water level in Long's Cave was as low as has ever been seen by the surveyors. The low water crawl near the entrance was passed through without difficulty. We made it all the way to the sump at the back of the cave. Survey time within this system was approximately one hour, with an ambient temperature of 30° F. We took video of the survey as we moved through the "keyhole" passageway that characterizes this system. Thick tree roots have remained hanging from the ceiling and extending down into the water; in fact, a juvenile Ozark Cavefish was spotted at this location among the tree root mass to the right of the entrance. No cave crayfish were observed.

Table 6: Faunal Inventory for Long's Cave

23	Pickerel Frogs	*Lithobates palustris*
7	Cave Salamanders	*Eurycea lucifuga*
1	YOY Ozark Cavefish	*Amblyopsis rosae*

Cave DL-119: 2 December 2014
Surveyors: Dr. Danté Fenolio, Mike Slay, Richard Stark

We performed the biannual count of both the Oklahoma Cave Crayfish and the Ozark Cavefish within this system. As observed in previous surveys of Long's and McGee's Caves, we had greater success detecting these species in McGee's Cave as compared to Long's. The water level was normal and the cave was warmer than Long's Cave (McGee's Cave is a heat trap). A fin clip was taken from a subadult Ozark Cavefish before being released. The fin clip is to be used for an e-DNA project funded by USFWS and conducted through the Oklahoma Cooperative Fish and Wildlife Research Unit at Oklahoma State University. Richard Stark was present for the fin clip collection and reported the collection of the fin clip when he turned in reports for his permit. For accuracy, I am including the event here but do not consider the fin clip as something collected on my permit to do so. Two walking legs were collected from adult Oklahoma Cave Crayfish (one leg from each adult) for the same e-DNA project. Richard Stark took all of the genetic materials and delivered them to the Cooperative Fish and Wildlife Research Unit. We were in the system for approximately 45 minutes. Care was taken not to step on some chert piles where juvenile Ozark Cavefish have been observed in previous surveys.

Table 7: Faunal Inventory for McGee's Cave

7	Pickerel Frogs	*Lithobates palustris*
1	Cave Salamander	*Eurycea lucifuga*
3	Ozark Cavefish (2 YOY & 1 subadult)	*Amblyopsis rosae*
3	Oklahoma Cave Crayfish	*Cambarus tartarus*
5	Cave Crickets	*Ceuthophilus* sp.

Cave DL-92: 3 December 2014
Surveyors: Dr. Danté Fenolio, Mike Slay, Dr. Daphne Soares, and W. Puckette

The cave was surveyed on 3 December 2014. We had trouble with the lock on the cave gate and recommend that it be replaced within the next grant segment. We made it to the back of the cave to a point where it is a difficult crawl in the water and in the cave stream, at which point we ceased our survey. As we entered the system, we observed copious amounts of bat guano approximately 2/3rd of the way into the cave. The back 1/3rd of this cave is a beautiful cherty cave stream with abundant and diverse invertebrate assemblages.

Table 8: Faunal Inventory for Cave DL-92

3	Surface Catfish near mouth of cave	
3	larval Grotto Salamanders	*Eurycea spelaea*
5	Tri-colored Bats	*Periomyotis subflavus*
1	Gray Bat	*Myotis grisescens*
14	Ozark Cave Amphipods	*Stygobromus ozarkensis*
50+	Groundwater isopods	*Caecidotea stiladactyla*
3	Groundwater isopods	*Caecidotea antricola*
25	Ringed Crayfish	*Orconectes neglectus*
10	small blue crayfish	*O. neglectus*
100+	Dung Flies	*Speliobia* sp.
20+	beetles	*Platinus* sp.
1	beetle	
3	"Moth Flies,"	Psycodidae
6	Psocopterans	
25+	unidentified springtails on surface of drip pools	
25+	Hothouse Millipedes	*Oxidus gracilis*
20+	spiders	*Cicurina* sp.
1	Fishing Spider	

Cave DL-91: 4 December 2014
Surveyors: Dr. Danté Fenolio, Mike Slay, Dr. Daphne Soares, and W. Puckette

The cave was surveyed on 4 December 2014. We performed the biannual count of the Delaware County Cave Crayfish in this system. Due to an injury upon initial entry to the system, Dr. Fenolio was unable to further participate in the survey efforts; however, the rest of the surveyors performed the survey. Richard Stark recommended that we establish pitfall traps in this system to better understand the invertebrate community in this biodiverse system. Walking legs were collected from 6 individual cave crayfish for eDNA analysis. The total survey time was approximately 3 hours.

Table 9: Faunal Inventory for cave DL-91

12	Delaware County Cave Crayfish	*Cambarus subterraneus*
25+	Pseudoscorpions,	*Hesperchernes occidentalis*
20+	staphylinid beetles	
50+	Fungus Gnats	*Macrocera nobilis*
1	cave beetle	*Ptomophogus cavernicola*
10+	cave beetles	*Platinus* sp.
10+	Psychodidae	
1	Onychiuridae springtail	
1	Arrhopalitidae springtail	

Cave DL-39: 4 December 2014
Surveyors: Dr. Danté Fenolio, Mike Slay, Dr. Daphne Soares, and Shea Hammond

On 5 December 2014 we performed the biannual count in this cave of the Oklahoma Cave Crayfish. This is the longest survey in the regular surveys we perform. In previous years, the survey has taken as long as 9 hours to reach the end of the walking passage. This trip took 6 hours. We entered the system from the Moonshine Room and used that entrance to assist in reducing the amount of required time to conduct the survey. The section of the cave from the Moonshine Room to the January-Stansbury entrance is not the habitat where we encounter *C. tartarus*; this portion of stream hosts abundant surface crayfish which undoubtedly compete with, and may prey on, the cave crayfish. The Oklahoma Cave Crayfish was photographed in-situ using an underwater camera rig. This year's count is the largest ever recorded for this species. We collected morphometric data for 40 cave crayfish (all that we could catch).

Table 10: Faunal Inventory for cave DL-39

27	Tri-colored Bats	*Periomyotis subflavus*
23	Pickerel Frogs	*Lithobates palustris*
8	Grotto Salamander larvae	*Eurycea spelaea*
1	Grotto Salamander adult	*Eurycea spelaea*
45	Oklahoma Cave Crayfish	*Cambarus tartarus*
14	Ringed Crayfish	*Orconectes neglectus*
2	Cave Amphipods	*Stygobromus* cf *ozarkensis*
10+	Cave Crickets	*Ceuthophilus* sp.
2	beetles	*Platinus*

Cave DL-14: 6 December 2014
Surveyors: Dr. Danté Fenolio, Mike Slay, Dr. Daphne Soares

This cave has a small aquatic system that flows through it which contains a diverse community of aquatic cave organisms. The crawl into the cave is filling with chert rubble and is getting more difficult to access. If a large storm passed though, there is a chance that the entrance would no longer be passable. A small stream issues from beneath a wall approximately 50 meters into the system and flows to the rubble pile at the front of the cave, where the stream is pirated and goes back below ground. The upper area of the stream, where a shallow cherty run exists, is the area where we have found aquatic blind cave snails. We revisited the system and took another count of snails (a bioinventory of the cave was performed earlier in the year) and recorded over 50 individuals in the same microhabitat; we are currently working on a species description.

F. Discussion and Recommendations:

1. Cave AD-7 in Adair County is the last known maternity colony of gray bats in Oklahoma that is currently unprotected from human entry and disturbance. Verifying landownership of the cave's two entrances and successfully securing access across private properties has been a crucial step in providing long-term protection to the critical bat roosts inside the cave. Now that they are established, planning has begun to install gate/grill systems inside the cave's respective entrance's and passages.

2. Construction on the gate to the private entrance to cave DL-39 will be finalized in 2015 and monitoring efforts will be used to determine if ingress/egress by bats has been improved with the installation of a bat-friendly structure.

3. Annual monitoring of caves that have received past management and protection efforts will continue. These 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.

4. Considerable emphasis by multiple government agencies is being placed on pre-WNS management and monitoring in states where the vector is likely to be detected in the near future. Oklahoma is considered one of those states. Monitoring torpid populations and surrounding substrate is an appropriate extension of this project if funding persists. Construction of gate/grill systems in cave passages effectively removes the threat of human transmission between caves in pre-WNS areas.

5. The federally threatened northern long-eared bat (*Myotis septentrionalis*) is classified as a tier II species of greatest conservation need (criteria 2 and 3) in Oklahoma's Comprehensive Wildlife Conservation Strategy (CWCS). More specifically, it is a SGCN in 9 of 11 Conservation Landscapes in the Ozark Region of the CWCS and is identified as having an unknown status and trend within each landscape. Northern long-eared bats in Oklahoma spend winter hibernating in caves and abandoned mines, and in the summer use caves as maternity and day and night foraging roosts (Caire et al. 1979; Caceres and Barclay 2000). More than 20 caves in Adair, Cherokee, Delaware, and LeFlore counties have been documented to house populations or individuals of northern long-eared bats (Stevenson 1986; Martin and Puckette pers. comm.). White-nose syndrome is currently the predominant threat to the northern long-eared bat, especially throughout the northeast portion if its range; certain hibernation sites have experienced declines of up to 99 percent from pre-white-nose syndrome levels. Although the disease has not yet spread throughout the northern long-eared bat's entire range, it is currently found in at least 22 of 39 states where the northern long-eared bat occurs. Other threats to the species include: wind energy development, habitat destruction or disturbance (e.g., vandalism to hibernacula, roost tree removal), and contaminants. Cave management efforts to protect cave-dwelling populations of the species from human activity, and management and containment of potential transmission of WNS should become a significant aspect of this project, if it continues (Caceres and Barclay 2000).

G. Significant Deviations:

There were no significant deviations from the stated objectives.

H. Literature Cited:

American Society of Mammalogists. 1992. Guidelines for the protection of bat roosts. Journal of Mammalogy 73:707-710.

Barbour, R.W. and W.H. Davis. 1969. Bats of America. University of Kentucky Press, Lexington, KY 286 pp.

Barr, T. C. and J. R. Holsinger. 1985. Speciation in cave faunas. Annual Review of Ecology and Systematics 16: 313–337.

Blair, W. F., and T. H. Hubbell. 1938. The biotic districts of Oklahoma. American Midland Naturalist 20: 425–454.

Caire, W. R., R.K. LaVal, M. L. LaVal, and R. Clawson. 1979. Notes on the ecology of *Myotis keeni* (Chiroptera, Vespertillionidae) in eastern Missouri. American Midland Naturalist 102:404-407.

Caseres, C. and R. M. R. Barclay. 2000. *Myoits septentrionalis*. Mammalian Species Account No. 634. American Society of Mammalogists. 4pp.

Culver, D. C., L. L. Master, M. C. Christman, and H. H. Hobbs III. 2000. Obligate cave fauna of the 48 contiguous United States. Conservation Biology 14: 386–401.

Fenolio, D.F., G.O. Graening and J.F. Stout. 2005. Seasonal movement patterns of pickerel frogs (*Rana palustris*) in an Ozark cave and trophic implications supported by stable isotope evidence. The Southwestern Naturalist 50: 385–389.

Graening, G.O., D.B. Fenolio, H.H. Hobbs, S. Jones, M.E. Slay, S.R. McGinnis, and J.F. Stout. 2006. Range extension and status update for the Oklahoma Cave Crayfish, *Cambarus tartarus* (Decapoda: Cambaridae). The Southwestern Naturalist 51: 94–99.

Graening, G.O., D.B. Fenolio, and M.E. Slay. 2012. Cave life of Oklahoma and Arkansas. University of Oklahoma Press. 248pp.

Grigsby E.M., W.L.Puckette, and K.W. Martin. 1993. Comparative numbers of gray bats (*Myotis grisescens*) at six maternity caves in northeastern Oklahoma. Proceedings of the Oklahoma Academy of Science 73:35-38.

Harvey, M.J., J.S. Altenbach, and T.L. Best. 1999. Bats of the United States. Arkansas Game and Fish Commission, Little Rock, AR 64 pp.

Holsinger, J.R. 1988. Troglobites: the evolution of cave dwelling organisms. American Scientist 76: 147–153.

Humphrey, S.R. and T.H. Kunz. 1976. Ecology of a Pleistocene Relic, the Western Big-eared Bat (*Plecotus townsendii*), in the Southern Great Plains. Journal of Mammalogy 57:470-494.

Martin, K. W., W.L. Puckette, S.L. Hensley and D.M. Leslie, Jr.. 2000. Internal cave gating

as a means of protecting cave-dwelling bat populations in eastern Oklahoma. Proceedings of the Oklahoma Academy of Science 80:133-137.

Martin, K. W., D.M. Leslie, Jr., M. E. Payton, W.L. Puckette, and S.L. Hensley. 2003. Internal cave gating for protection of colonies of the endangered gray bat (*Myotis grisescens*). Acta Chiropterologica 5:143-150.

Martin, K. W., D.M. Leslie, Jr., M. E. Payton, W.L. Puckette, and S.L. Hensley. 2006. Impacts of passage manipulation on cave climate: Conservation implications for cave-dwelling bats. Wildlife Society Bulletin 34:137-143.

McCracken, Gary F. 1989. Cave conservation: Special problems of bats. National Speleological Society Bulletin 51:49-51.

Pierson, E.D. 1999. Tall trees, deep holes, and scarred landscapes: conservation biology of North American bats. Kunz T.H., P. Racey, editors. Bat biology and conservation. Smithsonian Institution Press, Washington, D.C. p. 309-325.

Puckette, W. L. 2000. Annual report to the U.S. Fish and Wildlife Service FWS Agreement 1448-0002-95-0860. Ecological Services Office, Tulsa, Oklahoma, USA.

Stevenson, L.K. 1986. Some biological aspects of *Myotis keeni* in Oklahoma. M.S. Thesis Pittsburg State University, Pittsburg, KS. 82 pp.

Tuttle, M.D. 1979. Status; Causes of decline and management of endangered gray bats. Journal of Wildlife Management 43(1):1-17.

U.S. Fish and Wildlife Service. 1982. Gray Bat recovery plan. U.S. Fish and Wildlife Service, Washington, D.C. 94 Pp.

U.S. Fish and Wildlife Service. 1983. A recovery plan for the Ozark Big-eared Bat and the Virginia Big-eared Bat. Twin Cities, MN 61 Pp.

U.S. Fish and Wildlife Service. 1995. Ozark Big-eared Bat Recovery Plan, Revised. Albuquerque, NM 80 Pp.

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