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Katie E. Gillies
Department of Fish and Wildlife Resources
University of Idaho
Moscow, ID 83843

RH: Emergence Surveys and Central Idaho Bats • *Gillies*

Emergence Surveys and Foraging Activity of Central Idaho Bats

Katie E. Gillies, Department of Fish and Wildlife Resources, University of Idaho, Moscow, ID 83843 USA

Abstract: The Frank Church River of No Return Wilderness in Central Idaho had not been surveyed for bat populations prior to this study. Emergence surveys at abandoned mines and caves were conducted and additional nights of sampling were recorded during the summer of 2002. I taped vocalizations using an audio recorder and the ANABAT II echolocation device; I analyzed files to determine species composition. I used a population mean equation to calculate the proportion of bat calls made per species and to determine the proportion of occupied to unoccupied caves and mines in the study area. Using SYSTAT, I determined there is no statistical difference among foraging activity in burned and unburned locations two years after a wildfire. These results are pertinent to understanding the distribution and roosting locations of Idaho bat species for conservation purposes.

INTRODUCTION

Bats' nocturnal lifestyles and elusive habits have made modern scientific data collection difficult to obtain. Until the recent development of echolocation devices, researchers were unable to develop practical field studies. This lack of data is alarming because bat populations around the world are declining at an unprecedented rate

(www.batcon.org). Bat Conservation International recently announced a need for research to be conducted in central Idaho. Prior to 2002, there had not been a survey for bat species in the Frank Church River of No Return Wilderness. Therefore, there is no current data available on the composition of bat species, the location of roosting sites, or the status of populations.

There has been a significant amount of research collected on the use of abandoned mines and caves as bat roosts (Altenbach & Pierson 1995, Brown 1998, Navo 1995, Rainey 1995). Of the 45 species of North American bats, 28 are known to roost in old mines (Pierson et al. 1991). Most survey studies focus on roosts because colony roosts are convenient to study for a number of reasons (Thomas 1998). Consequently, standardized protocols are available for conducting external surveys of mines. This is an important tool in documenting species use and colony sizes of roosts.

In the summer of 2002, the Diamond Point fire burned much of the Big Creek drainage. This fire allowed for the opportunity to study the post-fire habitat use of bats in the drainage. Although there is a large amount of research studying the effects of fire on other organisms, there is virtually no research available on post-fire habitat use by bats. This project focused on these two important aspects of bat ecology: roosting sites and post-fire habitat use. Six objectives guided the research:

Objective 1: Determine which abandoned mines and caves are used as roosting sites in the Big Creek drainage.

Objective 2: Conduct emergence surveys of bats in occupied mines and caves to determine the colony size of the roosts.

Objective 3: Determine which species are present in roosts and sampling locations with the use of the ANABAT II echolocation device.

Objective 4: Determine proportion of occupied to unoccupied caves and mines.

Objective 5: Determine proportion of species present at each cave, mine and sampling location.

Objective 6: Select burned and unburned vegetation sites to monitor for bat foraging activity and compare frequency of use.

STUDY AREA

The Taylor Ranch Wilderness Research Station is located in the 2.35 million ha Frank Church River of No Return Wilderness, Idaho. The ranch is located on the south side of Big Creek, a major tributary to the Middle Fork of the Salmon River. The ranch is 3,900 feet in elevation and receives approximately 15 inches in precipitation per year with average temperatures ranging from -25° F in the winter to 100° F in the summer (www.uidaho.edu/cnr/facilities). Elevations at study sites ranged from 3149-5781 feet. Vegetation types in this area are highly variable ranging from landscapes dominated by sagebrush to Ponderosa Pine to Douglas fir with some landscapes burned more severely than others. This project encompassed the Big Creek drainage and its associated tributaries to include a wide range of vegetative habitats.

METHODOLOGY

Numerous studies have examined mines and caves for bat colonies. The abundance of bat emergence survey research created a need for a protocol to standardize this procedure; Brown (1998) developed a highly applicable protocol. I used this to guide this aspect of the study.

First, I located potential roost sites using a United States Forest Service map of the north section of the Frank Church River of No Return Wilderness. This identified known mines in the drainage and displayed some of the known natural caves in the area. Unmapped caves were identified on a topographical map by Jim and Holly Akenson, Taylor Ranch managers. Once a potential roosting site had been located, an external survey was conducted (Navo 1994). This included: recording a GPS location, entrance dimensions, entrance obstructions, distance to standing water and stream channels, temperature at mine/cave entrance, entrance stability, degree of human disturbance and any visual signs of bats (i.e. guano, bats, insect parts, etc.).

Next, I conducted an external mine emergence survey. According to Brown's protocol, observers arrived at the site at least one hour before dark to conduct the external survey. The entrance was approached quietly and the observer was positioned at least 20 feet from the entrance. The observations were conducted using ambient or green-filter light to illuminate an entrance. The count use two tallies: one for emerging bats and one for returning bats. This data was used to determine the size of the colony in the mine or cave.

To determine species composition, I used an ANABAT II echolocation device (Titley Electronics, Ballina, New South Wales, Australia). The ANABAT II is a broadband high frequency detection device designed specifically for bat research studies. O'Farrell and Gannon (1999) found the ANABAT to be more successful at detecting the presence of all bat species present in a study area when compared to mist-netting and harp traps. I determined species composition by recording bat calls at roosts and other sampling locations. These recorded vocalizations were analyzed using the ANABAT 6

mini-ZCA Interface Module and Software system, also from Titley Electronics. This program created a sonogram of the call and I compared it to a vocalization library to delineate between the calls of different species. There is, however, a concern that the ANABAT II is not sensitive enough to differentiate between *Myotis* species (Rita Dixon, personal communication 2002). In this case, the presence of the *Myotis* genera was recorded without the distinction of species.

To determine the proportion of occupied to unoccupied caves and mines, I calculated a population proportion. Jim Akenson obtained a total count of 48 caves and mines for Big Creek and Crooked Creek. A subset of 9 caves and mines were surveyed. The population proportion was calculated using the following equation:

$$\text{p-hat} = \frac{\sum_{n} y_i}{n}$$

Where n= the total number of sites surveyed, and y= the number of bats counted at each site (Mendenhall 1971). This enabled us to extrapolate a total number of occupied caves and mines in the area.

The same equation was used to determine the proportion of species recorded at each cave or mine and sampling location. Additionally, the variance of p-hat (V-hat) was estimated using the following equation:

$$\text{V-hat} = \frac{pq \quad (N-n)}{(n-1)\ (N)}$$

Where q-hat = 1-p-hat

And where N = the total number of bats (calls) obtained in 34 nights of sampling and n = the total number of bats (calls) for a specific species obtained. This was calculated for each species identified.

The bound of error on this estimation was calculated using the following equation:

$$2\sqrt{V(p)} = 2\sqrt{\frac{pq(N-n)}{(n-1)(N)}}$$

This enabled us to "draw inferences based on a population based on information contained in a sample" (Mendenhall 1971).

Due to the lack of data assessing the relationship between post-fire habitat use and bat foraging activities, the methods for this aspect of the study were guided by Rita Dixon (Idaho Department of Fish and Game) and Dr. Kerry Reese (Department of Fish and Wildlife Resources, University of Idaho). Burned and unburned sites of riparian, field, forest and sagebrush vegetation types were selected and UTMs were recorded with a GPS. These sites were monitored for bat activity. I sat at each location from 2200 to 2300 hours and recorded the number of "fly-bys" in that hour. A "fly-by" was a bat vocalization detected by the ANABAT II. The collected data was analyzed by SYSTAT which calculated a 2-way analysis of variance of the data using two strata: habitat and burned/unburned. This determined if there was a statistical difference in foraging levels at each site and overall.

RESULTS

The study was conducted over a ten week period in the summer of 2002. In that time, nine caves or mines were surveyed and a total of 34 nights of ANABAT sampling was obtained. Table 1 displays the number of bats found emerging and returning at each site. The roost size was determined by taking the lower of the two counts (Rita Dixon,

personal communication 2002). We were unable to determine the roost size at Jensen Cabin Mine due to poor weather conditions on two separate survey attempts.

Name	UTM	Number Emerging	Number Returning	Estimated Roost Size
Snowshoe Mine	651489/5006435	67	59	59
Cave Creek Cave	660923/4995290	56	64	56
Dunce Creek Cave	674509/4997061	15	7	7
Garden Creek Cave	659449/4999278	15	12	12
Cabin Creek Overhang	662062/5002606	2	0	0
Cabin Creek Cave	662356/5003605	6	11	6
Acorn Mine	650393/5000885	0	0	0
Big Creek Cave	662459/5003561	1	0	0
Jensen Cabin Mine	650081/5006474			unknown

Table 1

Six species of bats were identified using the ANABAT II: *Lasionycteris noctivagans, Myotis thysanodes, Eptisicus fuscus, Myotis evotis, Myotis yumanensis,* and *Lasiurus cinerius*. A seventh species of bat, *Euderma maculatum*, was acoustically identified by observers at two separate sites. Sonograms of each of the species identified with the ANABAT II are provided in the appendix. Numerous calls of unidentifiable *Myotis* species were also obtained. These calls were recorded, but not used in statistical analysis.

To determine the proportion of species present, the total number of bat calls for each identified species was used. T2 displays the population proportion, the variance around the estimate, and the bound of error of the estimate.

Species	# Calls	P-hat	Q-hat	Variance	Bound of error
LANO	47	0.0819	0.9181	0.0015	0.0775
MYTH	109	0.1899	0.8101	0.0012	0.0693
EPFU	103	0.1794	0.8206	0.0012	0.0693
MYEV	203	0.3537	0.6463	0.00073	0.05404
MYYU	92	0.1603	0.8397	0.0012	0.0693
LACI	15	0.0261	0.9739	0.0018	0.0849
EUMA	5	0.0087	0.9913	0.00213	0.0923
TOTAL	574	1			

Table 2

The total number of calls was highest for MYEV and lowest for EUMA (Figure 1).

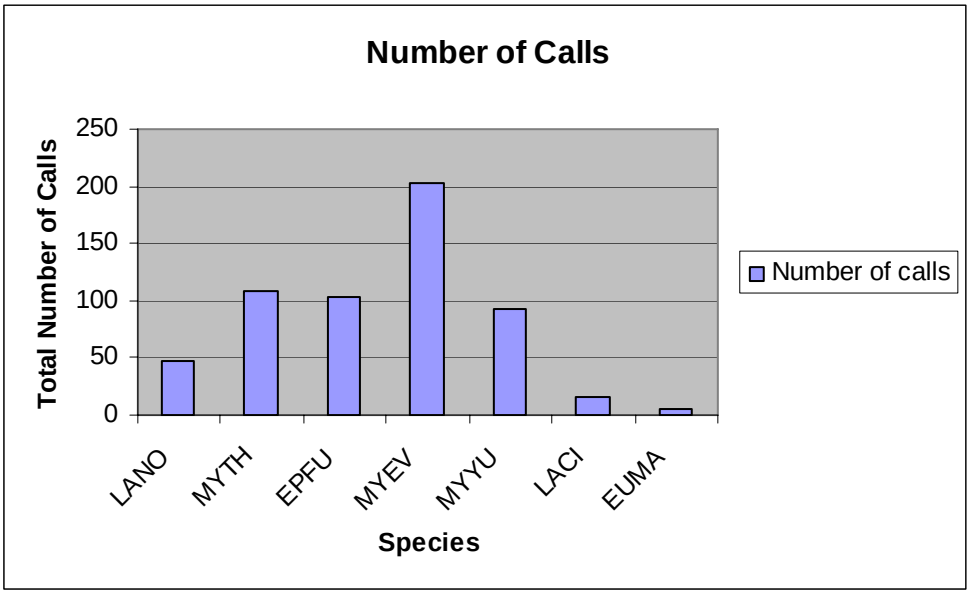

Figure 1

A total number of 48 caves and mines were identified in the Big Creek and Crooked Creek drainages. From the 48 caves and mines, nine were surveyed for emergences; bats were present at seven of these sites. The estimated proportion of the total number of caves and mines in the study area occupied by bats is 0.777 (37 of 48) with an estimated variance of 0.01817. The estimated proportion of unoccupied caves

and mines was 0.222 (11 of 48) with an estimated variance of 0.01754. The bound of error of the estimation for both occupied and unoccupied caves and mines is 0.264.

I sampled eight locations to monitor foraging activity between burned (1) and unburned (0) habitats. The data in Table 3 was analyzed by SYSTAT which calculated a 2-way analysis of variance of the data using two strata: habitat and burned/unburned.

Date	Location	Passes per Hour	Status	Dominant Vegetation	Type
6/11/02	Mineral Lick	35	Unburned (0)	Big Sage	Sage
6/13/02	Sage Flat	44	Burned (1)	Various grasses	Sage
7/31/02	Pioneer Creek	57	Unburned (0)	Currants, Water birch	Riparian
7/7/02	Cliff Creek	43	Burned (1)	Douglas Fir	Riparian
7/21/02	Cabin Creek	12	Unburned (0)	Ponderosa Pine	Forest
8/2/02	Big Creek slope	8	Burned (1)	Ponderosa Pine	Forest
8/1/02	Main pasture	21	Unburned (0)	Various grasses	Field
7/22/02	Cabin Creek flat	83	Burned (1)	Various grasses	Field

Table 3

Figure 2 shows the least squares means between the two strata. There is no statistical correlation between burned and unburned sites (P-value = 0.491).

Figure 3 displays the least squares means between the four habitat types. There is no statistical significance to which habitat type was chosen (P-value = 0.414).

DISCUSSION

Based on the collected data, it is apparent that a bat community was present and abundant in the Frank Church River of No Return Wilderness. Snowshoe mine and Cave Creek, with 59-64 bats in each colony, may be important roosting sites. Other locations appear to be used to a lesser extent. Due to the low degree of human disturbance in this area, protective gates are probably not necessary. Informational signs may be beneficial in educating the public on the distinctiveness of these locations as prominent bat roosts.

The results of the species composition are unique in that four Idaho Species of Special Concern were identified: *Myotis thysanodes, Myotis evotis, Myotis yumanensis,* and *Euderma maculatum*. The validity of these findings is debatable. Murrey et al. (2001) have argued that acoustic identification using an ANABAT II is only 80% reliable. This is due primarily to the inability of the ANABAT to differentiate between some *Myotis* species. Also, Barclay (1999) has cautioned bat biologists to recognize the limitations of this technique. However, O'Farrell and Gannon (1999) argue that acoustic sampling detects more species present than mist-nets and harp traps. In order to fully verify these results, extensive mist-netting should be conducted in the region. Since there were no previous studies on the bat community in this region, this basic information on species composition will be useful to wildlife managers.

The proportion of species present also provided unique results. I found the proportionately highest species to be *Myotis evotis*, followed by *Myotis thysanodes*. These are both Idaho Species of Special Concern. This indicates healthy populations of both species were present in the study area. Additionally, the majority of calls obtained at Snowshoe Mine (73%) were from *Myotis yumanensis*, another Idaho Species of Special Concern. This presents the possibility of the presence of a maternity colony at this site. Mist-netting at Snowshoe Mine in May and June should be conducted to determine whether females are lactating to verify this possibility.

Results from this study are consistent with previous studies done on the use of abandoned mines and caves as bat roosts (Altenbach & Pierson 1995, Brown 1998, Navo 1995, Rainey 1995). This study verifies that bats use abandoned mines and caves as roosting sites in the study area. Calculations show that 77.7% of all caves and mines in

the study area are occupied by bats, while 22.2% are unoccupied. According to Pierson et al. (1991), 28 of 45 North American bat species roost in old mines. Of the three mines sampled in our survey, one mine had bat activity. I was, however, unable to determine the presence of bats at the Jensen Cabin Mine due to rainy and cool weather conditions on two separate survey attempts. All caves in this study had bat activity. This agrees with Pierson (1991) that natural caves are the most important roosting sites for bats.

The calculations from SYSTAT appear to show a strong favor in foraging activity in burned habitats rather than unburned habitats. These results, however, are not statistically significant. A trend appears to favor field and riparian habitat types for foraging activity, but, again, these results are not statistically significant. This lack of significance can be attributed to the lack of repetition. This study could be repeated at each location to increase sample size. An increase in sample size may allow me to determine a statistical difference. However, I feel that two years after the fire, the insect community has recovered enough to support bat communities without favoring any particular habitat. A similar study conducted the year following a fire could be beneficial in resolving these questions.

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