BAT SURVEY OF THE PRINCE WILLIAM FOREST PARK

Final Report to:
Prince William Forest Park

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II. Introduction

Most survey efforts in Virginia have been conducted with cave bats usually with emphasis on endangered species. Several reasons for the lack of extensive surveys include the difficulty in capturing bats, inability to identify bats in flight, few researchers studying bats, a lack of money to promote surveys, and until recently a lack of priority with land managers. A second source of records comes from Health Departments where animals are tested for rabies. While exact locations are generally not recorded, county occurrences are noted.

In a search of existing bat data for Prince William County we found no survey efforts or county records from the Health Department or independent researchers. This survey of Prince William Forest Park constitutes the first known effort to survey for bats in the Prince William Forest Park and Prince William County.

Many bat species have shown declines over the past 30 or more years. Most of these declines have been noted with cave bats where consistent effort has been conducted to monitor populations over time. Tree bats, due to their solitary nature, represent a difficult group of bats for which to gather population trend data.

In order for land managers to better plan and manage wildlife within their area, a knowledge of the species and their habitat requirements is of paramount importance. This survey provides the groundwork for the knowledge Prince William Forest Park needs for the

management of bats. It must be recognized that this is an initial effort and that further work will undoubtedly add to this effort. A notable gap in this survey effort was the lack of captures of several species we expected to find in the Park. This is most likely a reflection of the sampling intensity and difficult nature of capturing bats. This report summarizes the efforts, observations, collections, and management recommendations of this survey.

III. Survey Methods, Results and Discussion

1. Building Surveys

1a. Methods: Attics, crawl spaces, chimneys, and crevices of buildings in the five cabin camps were searched with high powered head lamps and flashlights for the presence or signs of bat use. Searches were conducted throughout the year in order to determine seasonal use. Data gathered at each cabin camp included date, percent cloud cover, rain, wind, temperature, building number, time of search, species, number observed, and comments (Appendix A; copies of data sheets).

1b. Results and Discussion: Two hundred and forty-nine buildings were searched between October 28, 1993 and June 23, 1994 for the presence of bats. No bats were detected and no sign (appearance of guano, staining, or carcasses) of bat use was present in the buildings surveyed. This indicates that bats were not utilizing the cabin camp buildings as either major summer or winter roosts during this period. However, during one summer survey period a bat was found in a cabin in Cabin Camp #3 by one of the campers. This bat most likely flew into the cabin during the evening, perhaps in pursuit of a prey item, when the door was open. The bat subsequently left and was not found utilizing the cabin after this incident.

The selection of a roost site is dependent upon temperature, relative humidity, and air flow. In addition, different species require slightly different conditions of temperature, relative humidity, and air flow for both winter and summer roosts. The absence of bats observed during this

survey does not preclude future use of the buildings as roosts, maternity sites or hibernacula. Selection of a site is in part based on availability of sites. The natural roosting, maternity or hibernating habitat for cave bats is either caves, rocky crevices or trees. The natural roosting, maternity or hibernating habitat for tree bats is trees. Bats that utilize trees will use the cavities, crevices, or sloughing bark of the tree for roosting, rearing young or hibernating. With the maturing of the forests and the presence of the gypsy moth in Prince William Forest Park, there are ample roosting, maternity and hibernating sites for bats to select. However, both cave and tree bats have adapted to using man-made structures for roosting, rearing young and hibernating. This in part may be a response to a loss or changes in availability of natural sites. As conditions in the Park change, the availability of roosting, maternity and hibernating sites will change along with the probability of bats utilizing the buildings in the camps.

2. Summer Mist Netting

2a. Methods: Mist nets were used to capture bats at selected sites in the Park (Appendix B, Figures 1-7). Nets were erected to either canopy height or to a maximum height of 25 feet when the canopy was greater than 25 feet. Net length was dictated by the width of the stream or corridor and varied between 18 to 42 feet in length. Nets were checked a minimum of every 15 minutes. Bats captured in nets were removed and placed in cotton bags to be transported to a processing station. Data collected included site, date, temperature, wind, rain, moon, observers, capture time, species, height in net, sex, age, reproductive condition, right forearm length, weight, and presence of parasites. Bats were then marked with a small drop of non-toxic eye lash

glue placed on the posterior portion of the head. This allowed identification of bats that flew back into the net and prevented the processing of a previously captured individual.

2b. Results and Discussion:

Effort, Species, and Numbers Captured: A total netting effort of 39 hours and 40 minutes was conducted at nine different sites on fifteen different nights in the Park (Appendix A; copies of data sheets). Sites were surveyed between one and three times. Bats were captured at four of the ten sites with a capture ratio of 0.52 bats/hour. A total of 21 bats was captured including 12 *Eptesicus fuscus*, seven *Lasiurus borealis*, and two *Pipistrelles subflavus* (Table 1). Several species of bats we expected to capture were not netted. The silver haired bat (*Lasionycterus noctivagans*), little brown bat (*Myotis lucifugus*), evening bat (*Nycticeius humeralis*), and northern long-eared bat (*Myotis septentrionalis*) are all common bats we expected to capture. The lack of captures for these species does not necessarily exclude their presence, but may indicate low abundance or difficulty in mist netting these species.

Sex Ratios: Of the 21 bats captured, nine were males and 12 were females giving a sex ratio of 1.3 females per male (Table 2). The male to female sex ratios for each species included 1:1 ratio for *Eptesicus fuscus*, 1:1 ratio for *Pipistrellus subflavus*, and 1:2.5 ratio for *Lasiurus borealis*. Downing (1980) indicated that sex ratios can provide information on whether a population is within the range needed for normal reproductive performance, but cautioned that data could be biased due to sampling methods. Our low sample size does not allow inferences on the sex ratio,

but does provide the start of a data set that may be utilized as more data are gathered.

Juvenile to Adult Female Ratios: Of the 21 bats captured, 9 were adult females and three were juveniles (0.3 young per adult female). The juvenile to adult female ratio for each species included 1.5:1 ratio for *Lasiurus borealis*, 1:1 ratio for *Pipistrellus subflavus*, and 0:6 ratio for *Eptesicus fuscus*. Measures of natality (number of young per adult female) and rearing success (number fledged or weaned) can be indicators of population health (Downing 1980). A decline in the percentage of young in the population may indicate low natality or high juvenile mortality. Our low sample size does not allow inferences on the juvenile to adult female ratio, but does provide the start of a data set that may be utilized as more data are gathered. Another factor affecting this age ratio is the time of year sampling occurs. Identification of juveniles is only possible during a short period in mid to late summer and fall. If sampling efforts are not concentrated during this period then a bias in the juvenile to adult female ratio is likely. The lack of juvenile *E. fuscus* in this survey may be a reflection of sampling effort as opposed to a true reflection of the juvenile to adult female ratio. This is supported in part by the capture of lactating adult females at one site (Mawavi Road) indicating presence of juvenile *E. fuscus*.

Reproductive Condition: Reproductive condition for males is not easy to determine in Vespertilionidae bats as testes are descended at birth and a distinct scrotal pouch is not always evident (Racey 1988). Therefore we do not report on the reproductive condition of males. Reproductive condition in females was determined by either palpitation or evidence of lactation. Of the nine adult females captured, four (44.4%) were reproductively active (Table 2). High

reproductive activity has been noted in several species of bats (Racey 1988). The low percentage of reproductively active females observed in this survey is likely a reflection of sample size and may not represent the true ratio of reproductively active females.

Mass: Measurements of mass were obtained for adult and juvenile *Lasiurus borealis* and adult *Eptesicus fuscus* (Table 2). The mean body mass for adult *L. borealis* is 12.8 grams ($n = 4$, SE = 2.35, Range = 10.0 - 15.0 g). The mean body mass for juvenile *L. borealis* is 9.6 grams ($n = 3$, SE = 1.5, Range = 8.0-11.0 g). The mean body mass for adult *E. fuscus* is 16.8 g ($n = 12$, SE = 1.6, Range = 14.3 - 20.0 g).

3. Anabat Recordings

3a. Methods: Anabat detectors with delay switches and tape recorders were placed near water sources (rivers and ponds) to provide additional information for species identification. Anabats were placed at six different sites for six nights of sampling (Appendix B, Figures 8-11). Voice prints were compared with known prints of bat species for possible species identification (Krusic 1995).

3b. Results and Discussion: Bat activity is often concentrated over water sources (Hayes and Adam 1996, Parker et al. 1996, and personal observation). Therefore we placed Anabat detectors at most of the major ponds and along the South Fork Quantico Creek near the Liming Lane Fire Road. This increased our potential to record additional bat species that were not captured

through the use of mist nets. Tapes were analyzed using the Analook software program and visually compared with known voice prints (Krusic 1995). Species identification was confirmed for *Lasiurus borealis*, *Pipistrellus subflavus*, and *Eptesicus fuscus*. Identification of *Myotis* species was not confirmed with the Anabat detectors.

Several species of bats including *Lasionycterus noctivagans* (silver haired bat), *Nycticeius humeralis* (evening bat), *Myotis lucifugus* (little brown bat), and *Myotis septentrionalis* (Northern long-eared bat) considered abundant and ubiquitous in Virginia were not identified through Anabat recordings. The absence of these bats is most likely a reflection of the limitations of the sampling techniques and intensities. All bat species can detect and avoid mist nets, however, the use of the Anabat system is considered an unobtrusive means of identifying bat species. A limitation to the Anabat system is the need to have good quality calls for identification. Several factors affect call quality including position of bat in relation to the Anabat detector, distance from the detector, and signal obscurance. A few calls we analyzed appeared to belong to the genus *Myotis*, however, the call quality was not sufficient for positive identification. We feel further sampling efforts at Prince William Forest Park will reveal the presence of most of the species we were unable to identify.

IV. Management Recommendations

Management for bats requires several key parameters including sites for hibernating, rearing young and roosting, foraging areas and a source of water. Sites for hibernating, rearing young and roosting in Eastern Virginia are predominately dictated by either natural cavities, sloughing bark on trees or man-made structures. There are few mines, caves, or portals for bats to use in the eastern half of Virginia. Several studies have been conducted on roost tree preference for different species (Kunz 1982, Kurta et al. 1993, Betts 1996, and Sasse and Pekins 1996). These studies show a variety of tree species and conditions utilized by bats, however, mature older "wildlife trees" predominate in these studies. With the aging forests in Prince William Forest Park and the presence of gypsy moths, natural roost sites should not be a limiting factor. The gypsy moth has caused damage to several areas in the park and evidence of potential roost trees can be found in these areas. With this trend, active management to create snags or roost trees is not necessary. However, when roost sites are identified, they should be made know to appropriate personnel and protected from disturbance. Because these trees are likely to be in a decaying nature, they may be marked as hazard trees depending on their location. In these situations, alternatives to protect the roost tree should be considered.

Studies have shown that bats use a variety of habitats for foraging (Krusic 1995, Parker et al. 1996). Edges and riparian zones (Hayes and Adams 1996, Parker et al. 1996) are areas of high bat activity as well as older forested stands (Krusic 1995, Erickson and West 1996). While most of Prince William Forest Park is comprised of maturing forests, there are several open areas

including roads, fields, and regeneration caused by gypsy moths. In addition, the drainages and ponds in the park provide habitat for aquatic insects and add to the diversity of foraging sites. With these options, active management of foraging areas is not recommended.

However, an issue of concern may be the active control of gypsy moths through the use of insecticides. The chemicals used for control of gypsy moth not only affect the development of gypsy moth larvae, but also affect at a minimum other lepidoptera. A second issue to consider in gypsy moth control is the alternative of no action. This also affects insect diversity and availability as the vegetation composition and structure changes after gypsy moths have infested an area. With the Park's policy of limited intervention in gypsy moth control, we feel that active gypsy moth control will have little effect on the bats within the Park.

Lastly, sources of water are important for the management and preservation of bat species. With the many drainages and ponds that exist in the park, water is not a limiting factor. Therefore, active management of water sources is not recommended.

Table 1. Site code and name, number of visits, number of bats and species captured, and habitat type for each mist net site.

Site Code and Name	# Sample Nights	# Bats Captured and Species Code	Habitat Type
SFQC (South Fork Quantico Creek)	3	---	Riparian (Hardwood)
CAPO (Carter Pond)	2	---	Pond (Hardwood)
ORCA (Oak Ridge Campground)	3	2 (LABO*)	Mature Hardwood
MARD (Mawavi Road)	2	12 (EPFU*)	Corridor (Hardwood)
BURD(Burma Road)	1	1 (LABO*)	Riparian (Hardwood)
LLFR (Liming Lane Fire Road)	1	---	Corridor (Hardwood)
HIME (High Meadows)	1	---	Corridor (Hardwood/Conifer)
CC03 (Cabin Camp #3)	1	---	Corridor (Hardwood)
CBPM (Cabin Branch Pyrite Mine)	1	6 (LABO, PISU*)	Riparian (Hardwood)

* LABO = *Lasiurus borealis*, EPFU = *Eptesicus fuscus*, PISU = *Pipistrelles subflavus*

Table 2. Species, number caught, sex and age, reproductive condition, mean weight, and mean right forearm length (RFA) for all bats captured.

Species	# Caught	Sex & Age				# Repro. Active Adult Females	Mean Body Mass (g) (By Age)		RFA (mm) (Mean)
		Male		Female					
		AD	JU	AD	JU		AD	JU	
Lasiurus borealis	7	2	---	2	3	0	12.8	9.6	41.77
Eptesicus fuscus	12	6	---	6	---	4	16.8	---	45.42
Pipistrelles subflavus	2	---	1	1	---	0	---	---	33.2

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