PENNSYLVANIA GAME COMMISSION
BUREAU OF WILDLIFE MANAGEMENT
PROJECT ANNUAL JOB REPORT

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TITLE: Special Concern Mammal Species Research/Management

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TITLE: Surveys of Terrestrial Mammal Species of Special Concern

PERIOD COVERED: 1 July 2016 to 30 June 2017

COOPERATING AGENCIES AND PARTNERS: Pennsylvania Department of Conservation and Natural Resources, Heritage Conservancy, Virginia Polytechnic Institute.

WORK LOCATION: Statewide

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ABSTRACT This report summarizes field work for terrestrial small mammals, including a novel acoustic survey for northern flying squirrels and West Virginia water shrew trapping surveys. Due to its difficulty of detection in the field by standard methods (due to low numbers, limited range, and possible hybridization with the southern flying squirrel), a pilot study began in the northeastern region surveying several high and several low quality habitats to determine habitat occupancy, and latency of detection, for northern flying squirrels (*Glaucomys sabrinus*). Two trapping surveys were completed by Pennsylvania Game Commission Diversity Division staff and the results were entered into the terrestrial mammal database. These surveys resulted in the collection and documentation of 2 water shrews (*Sorex palustris*). Due to their capture locations, they are believed to be West Virginia water shrews (*S. p. punculatus)*, a state-threatened species in Pennsylvania. As the gap between the 2 species shrinks, the validity of this distinction becomes questioned. Preservation of these specimens for future genetic and morphological analyses may help differentiate it from the northern water shrew (*S. p. albibarbis*).

OBJECTIVES

1. To assess and monitor the distribution and relative abundance of Pennsylvania's terrestrial mammal species of special concern.

2. To examine northern flying squirrel habitat occupancy and detection rates by testing a new technique using acoustic equipment at current and historical sites within Pennsylvania.

3. To reduce the size of the known gap between the existing home ranges of the northern water shrew (*Sorex palustris albibarbis*) and the state-threatened West Virginia water shrew (*S. p. punculatus*).

INTRODUCTION

Terrestrial small mammals

The Pennsylvania Game Commission has been permitting qualified researchers to trap terrestrial small mammals using a variety of techniques for decades. The majority of these efforts are focused on non-game species and typically from the family Rodentia. As a requirement of these permits, researchers must submit a final report including a summary of captures and trap site information. This data, combined with small mammal surveys conducted by the Pennsylvania Game Commission, are stored in a database for long-term preservation and future data needs. This database includes records dating back to 1984, which currently contains details for >600 site surveys and >10,300 individual capture records.

In recent years, the Pennsylvania Game Commission has focused on water shrews (*Sorex paulustis*). Two subspecies are currently recognized: the northern water shrew (*S. p. albibarbis*) and the West Virginia water shrew (*S. p. punculatus),* with the West Virginia shrew being listed as state-threatened species in Pennsylvania. This separate classification was originally based on the large gap between the 2 subspecies, and only a few locations of the threatened West Virginia water shrew are known. Many years of work by researchers and Pennsylvania Game Commission staff have documented numerous additional shrew captures to help narrow this gap. With a reduced gap and significant molecular advances, it is the objective of the Pennsylvania Game Commission to investigate the separate subspecies designation more.

Northern flying squirrels

The northern flying squirrel was listed as state-endangered and a species of Greatest Conservation Need in Pennsylvania's Wildlife Action Plan (Pennsylvania Game Commission 2015). Therefore, identification and management to protect and improve northern flying squirrel habitat is critical. All sites containing northern flying squirrels are also noted to have significant numbers of southern flying squirrels (*Glaucomys volans*). The northern is distinguished in the field by the combination of several key traits, including its larger mass, longer and wider tail, longer hind foot, and the coloration of hair located on both the tail and thoracic cavity (Whitaker and Hamilton 1998). Specifically, a northern's thoracic cavity hair is lead-colored at the base and white on the tip, and the hair located at the terminal end of the tail is often brown with a black tip. None of these traits alone are enough to distinguish species, as variation in the southern flying squirrel can account for similar traits. Furthermore, a minor amount of hybridization has led to confusing morphological conditions and field identification must be confirmed periodically by genetic analysis (Garroway et al. 2010; Steele et al. 2010).

Research and monitoring of northern flying squirrels was initiated in 2001 with a State Wildlife Grant awarded to Wilkes University and Penn State University. Completion of these and subsequent grant projects resulted in the listing of the squirrel as state- endangered and the establishment of a long-term monitoring program using nest boxes deployed across its historic

range. There are currently 742 boxes throughout northeastern Pennsylvania. The Pennsylvania Game Commission's goal was, formerly, to annually examine each of the established nest boxes. However, due to a number of factors, including: low detection rates using traditional methods such as these nest boxes and live-trapping efforts (Mahan et al. 1999), the increased need by Pennsylvania Game Commission Environmental Review to more definitively determine habitat occupancy for project compliance and review, and the northern flying squirrel's similar appearance (and potential hybridization) with southern flying squirrels, a new method of detection became overwhelmingly necessary. Therefore, the Pennsylvania Game Commission partnered with Virginia Polytechnic Institute (Virginia Tech) researchers to pilot a study aimed at comparing 2 models of detectors, the Pettersson D500x and the Song Meter SM2Bat+ (Wildlife Acoustics Inc., Concord, MA). Future work will also compare the AR125 detector (Binary Acoustic Technology).

In addition to providing nest boxes for northern flying squirrels, red spruce management and planting has traditionally been a primary emphasis for their management. Red spruce trees are associated with multiple genera of hypogenous fungi, and these fungi serve as a primary food source for northern flying squirrels. In previous years, diversity staff collected spruce cones when available, had the agency nursery grow the seedlings, and under-planted occupied habitat containing only hemlock, as a preventative measure against the Woolly Adelgid blight. Over 1,000 spruce seedlings have been planted at a number of important, active northern flying squirrel sites. However, due to a several year period of no cone production, no seedlings could be produced and planted during this reporting period.

METHODS

Northern flying squirrels

Northern flying squirrel data is largely collected during Pennsylvania Game Commission nest box checks, although some live trapping has occurred. Nest box checks are performed by placing a ladder against the tree and quickly plugging the entrance of the box with a rag. If animals are present, the box is removed from the tree and the animals are processed and released on the ground. The contents of each box (e.g., nest material, food) are recorded, and every box that does not contain a nest is cleaned out. This clean-out process allows the Pennsylvania Game Commission to examine general changes in box use over time. Again, however, due to the labor- and time-intensive nature of this process, it has become apparent that there is a need for an easier, more efficient, and more definitive way of surveying for the presence of this species.

Ultrasonic acoustic surveys have been shown, through past Virginia Tech research (Diggins *Accepted*) that local and temporal use across seasons and years relative to habitat condition can be determined for these squirrels. The recent discovery and characterization of ultrasonic vocalizations of North American flying squirrels (*Glaucomys* spp., Gilley 2013) has provided the necessary proof-of-concept for use of acoustics to survey flying squirrels.

The Pennsylvania Game Commission and collaborators have conducted the detector comparison study in Carbon County from May-July 2017 at 3 low and 3 high probability of occupancy sites. Detectors were paired at each of these sites and deployed for two 6-day periods.

Virginia Tech then analyzed these data by calculating the probability of detection (POD) between High and Low occupancy sites and the latency of detection (LTD; i.e., the number of survey nights until the initial detection at that site; Gommper et al. 2006). Latency of detection between detectors to determine which detectors recorded squirrels. Additionally, we looked at call quality to determine which detectors recorded calls clearly enough for identification to species. The results of this pilot study are currently being analyzed and will be completed by January 2018.

Water shrews

Due to the water shrew's very high metabolism, propensity for undercut banks or logs along and within primary rushing mountain streams, the only suitable trapping method is via Museum Special snap traps. Standard protocol is to trap with 75-100 traps baited with chewed oats for 3 nights or until a single individual is captured. In 2016, 75 Museum Special traps were placed at three sites, Mill Creek, Right Fork Mill Creek, and Baldwin Creek. Traps were placed in pairs for the length of existing suitable habitat at both Baldwin and Mill Creek (Westmoreland Co.). Mill Creek and Baldwin Creek are medium gradient streams providing undercut banks preferred by water shrews. Due to the proximity and drainage connection, traps at Right Fork Mill Creek were pulled when a shrew was captured at Mill Creek.

RESULTS

Northern flying squirrels

In June, 2016 2 Pettersson acoustic detectors were placed at 6 locations within Luzerne, Carbon, Monroe, and Wayne Counties (Fig. 1). Three locations were grouped as low quality habitat and 3 were grouped as high quality habitat. Detectors were placed at each site for 9 consecutive nights. At the high quality sites, Pettersson DX500 detectors were paired with Song Meters to determine if potential detection differences occur between 2 different models of full-spectrum detectors. Analyses will focus on confirming species presence, determine if hybridization of the 2 species has altered distinctive calls recently confirmed between the species, and determining latency of detection by habitat quality. Analysis of calls is expected to be completed by January 2018. While the technique will be useful for diversity staff surveys in the future, this technique will be developed into an environmental review survey protocol which has been lacking since the species became listed.

Water Shrews

The Pennsylvania Game Commission trapped three locations within Westmorland County for water shrews during 19-21 Sept 2016 capturing 2 individuals and producing 2 new occurrences for the species. These were both located within State Game Land 42, at Mill Creek and Baldwin Creek (Fig. 2). In addition, the Western Pennsylvania Conservancy (WPC), also captured water shrews at 2 new locations within Potter and Clinton counties (Fig. 2). Due to its capture location, both shrews are currently labeled as West Virginia water shrew (*S. p. punculatus)*, a state-threatened species in Pennsylvania. Specimens were preserved for future genetic and morphological analyses against the northern water shrew (*S. p. albibarbis*).

RECOMMENDATIONS

1. Continue to compare the calls recorded by ultrasonic detectors deployed in the field

to confirm the Pennsylvania Game Commission's current acoustic equipment can be used for northern flying squirrel surveys.

2. Conduct a fall 2017 Pennsylvania Game Commission BioBlitz to narrow the existing gap between northern water shrews and West Virginia water shrews.

LITERATURE CITED

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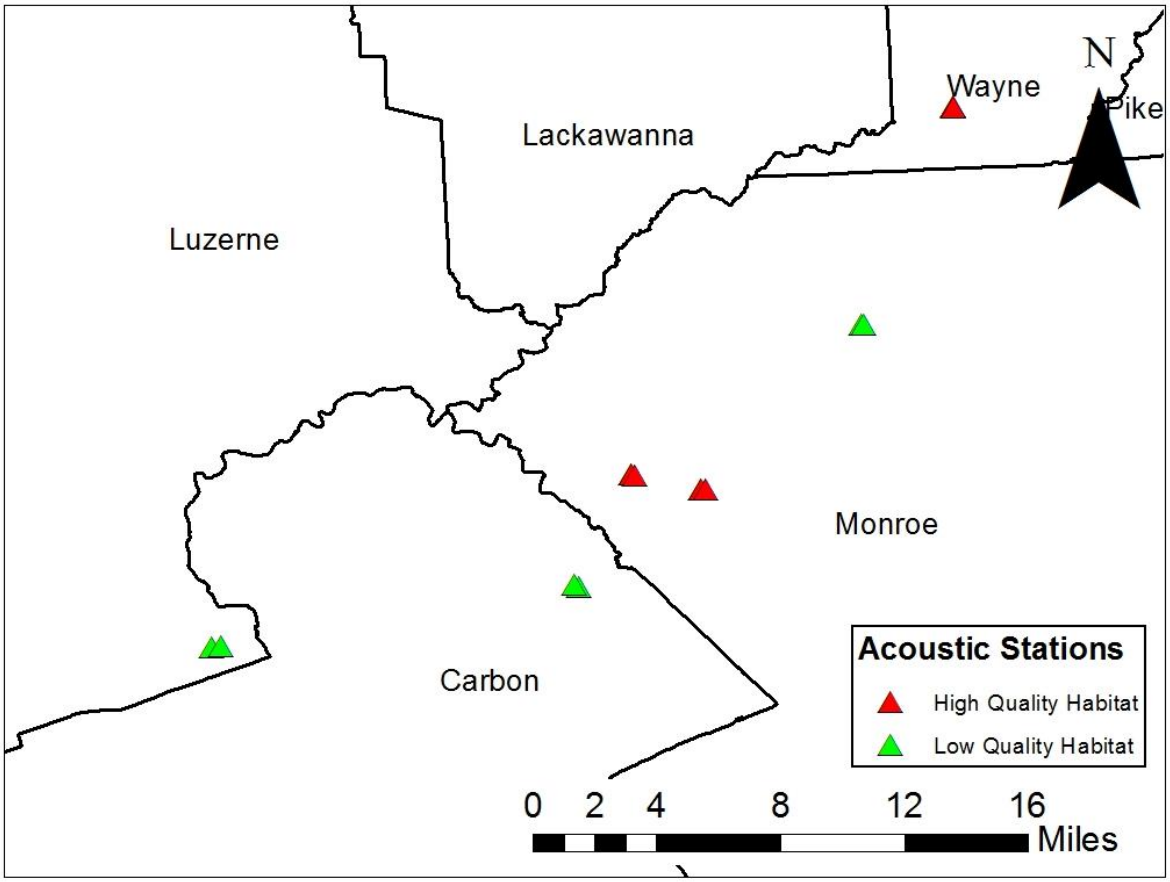

Figure 1. Paired northern flying squirrel acoustic stations (*n* = 12) at 6 separate sites across Luzerne, Carbon, Monroe, and Wayne Counties.

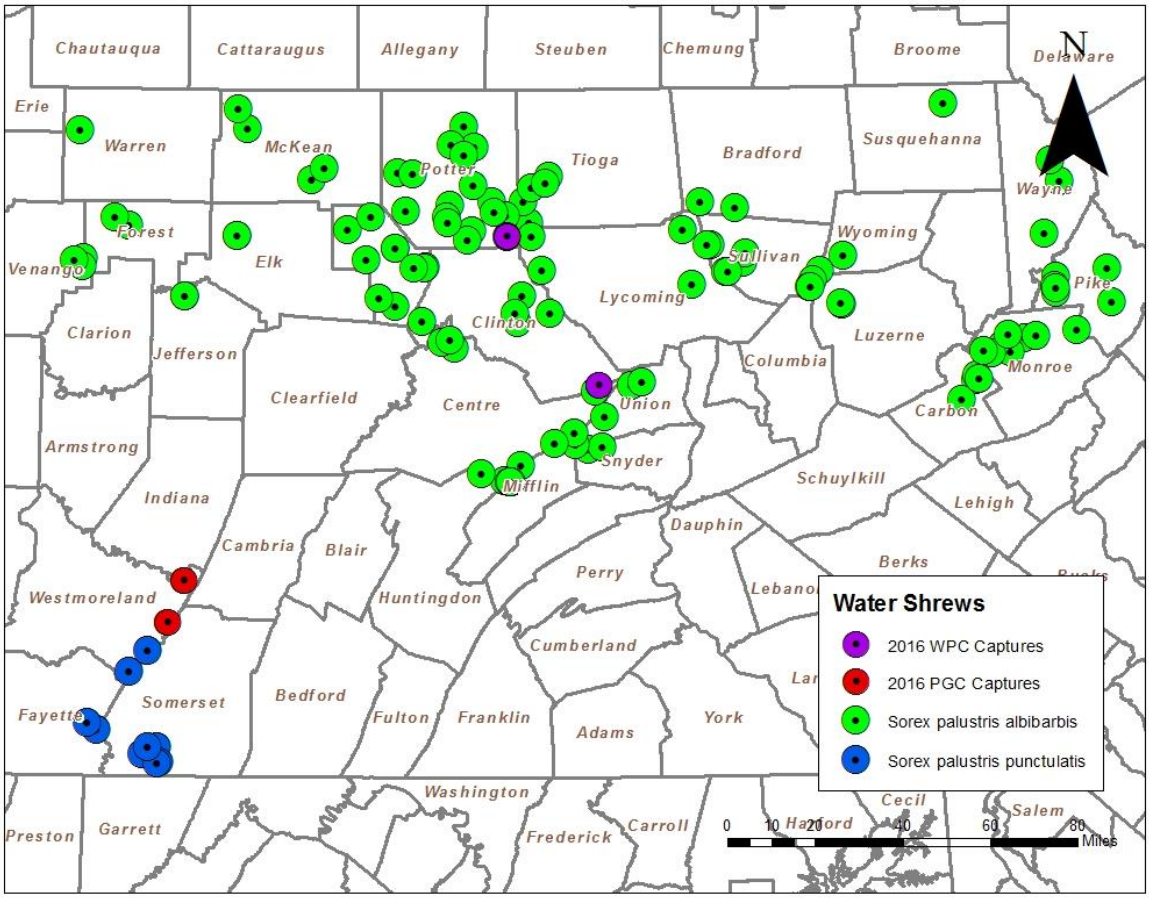

Figure 2. Capture locations of all water shrews *Sorex palustris* statewide in Pennsylvania, including those caught by Pennsylvania Game Commission (n = 2) within Westmoreland County and those caught by Western Pennsylvania Conservancy (n = 2) within Potter and Clinton County in 2016.