



- Anthony, N. M., Bantz, R., Garland, T. Jr., & Ribic, C. A. (2005). Comparative Effectiveness of Longworth and Sherman Live Traps. *Wildlife Society Bulletin*, 33(3), 1018-1026.
- Brooks, R. T., & Doyle, K. L. (2001). Shrew Species Richness and Abundance in Relation to Vernal Pond Habitat in Southern New England. *Northeastern Naturalist*, 8(2), 137-148.
- Conner, P. F. (1971, July). The Mammals of Long Island, New York. *New York State Museum & Science Service*, 416, 26-59.
- Flowerdew, J. R., Shore, R. F., Poulton, Simon, M. C., & Sparks, T. H. (2004). Live Trapping to Monitor Small Mammals in Britain. *Marine Review*, 3, 31-50.
- Rodda, G. H., Wiewel, A. S., & Yackel-Adams, A. A. (2009). Evaluating Abundance Estimate Precision and the Assumptions of a Count-Based Index for Small Mammals. *Journal of Wildlife Management*, 75(5), 761-771.

ABSTRACT

An area of 170 acres encompassing a variety of vegetation types was surveyed at Brookhaven National Laboratory (BNL) to discover the population levels of small mammals. Using a Geographic Information System (GIS) 30 locations were chosen in various vegetation types. During the first 3 weeks, 30 Sherman traps were used in a grid formation. In the remaining 5 weeks, 25 traps were placed in either a grid or transect formation for three consecutive nights for a total of 2,327 trap nights. The data revealed that the species diversity among small mammals is low, as only 5 species were found: *Mus domesticus* (House Mouse), *Peromyscus leucopus* (White Footed Mouse), *Zapus hudsonsius* (Meadow Jumping Mouse), *Glaucomys volans* (Southern Flying Squirrel), *Tamias striatus* (Eastern Chipmunk). Any other species were classified as "Other" in the results. Based on the data from the mice and chipmunk captures, the ideal locations for traps appeared to be in places with little to no vegetation and a decrease access to a food source as their food supply increased, there were less captures. While the vegetation combination of either grass/greenbrier or huckleberry/blueberry for the under-story with an over-story mix of oak/maple/pine was the preferred area for the flying squirrels. No small mammals were captured in the grassy fields. Considering the lack of complex small mammalian species observed within the ecosystem at BNL, further investigation into this dearth of diversity in the mammalian population should be conducted. Different capturing methods can be used, including pitfalls along with the Sherman traps, to increase the variety of species captured. Upcoming studies should be conducted to look at the full 5265 acres that encompasses all of BNL.

history of Brookhaven National Laboratory (BNL) was once the Army's Camp Upton during two separate periods, World Wars I (1917-1920) and II (1940-1946). In order to build the army base all of the area was cleared of any vegetation. The time between the army's usage, the Civilian Conservation Corps planted many of the trees that are remnants here today.

The field of science has been focusing on new technologies in the past two decades and humankind has lost sight in the natural history of living things. Science requires that the natural world be studied to ensure development and human progress is not negatively impacting it.

The small mammalian population is an important aspect to the ecosystem. They are distributors of seeds as well as a food source for larger predators. The small mammals range from different breeds of mice, shrews, moles, and voles, including chipmunks and flying squirrels too (Conner 1971). A survey is an informative way to increase knowledge on the ecosystem's wellbeing. The data on the small mammal population levels are reliant upon proper evaluation and it being utilized for management and preservation purposes (Adams *et al.* 2009, Flowerdew *et al.* 2004). Since most of these small mammal species are nocturnal, overnight trapping methods are required to document them. The trapping techniques used are to insure that the small mammals be released back into the wild once data is obtained from them. It is suspected that the levels of the small mammal population is low with few diversities of species. This ecosystem has to be a balanced environment, for it concerns all fauna and flora to coexist and thrive. The causes of what is suspected has to be investigated in order for the imbalances to be corrected.

An area of 170 acres, encompassing a variety of vegetation types, was surveyed at Brookhaven National Laboratory (BNL) to discover the population levels of small mammals. Using a Geographic Information System (GIS), 30 locations were chosen in various vegetation types. During the first three weeks, 30 Sherman traps were set in a grid formation. For the remaining 5 weeks, 25 traps were placed in either a grid or transect formation for three consecutive nights for a total of 2,327 trap nights. The data revealed that the species diversity among small mammals is low, as only 5 species were found: *Mus domesticus* (House Mouse), *Peromyscus leucopus* (White Footed Mouse), *Zapus hudsonsius* (Meadow Jumping Mouse), *Glaucomys volans* (Southern Flying Squirrel), *Tamias striatus* (Eastern Chipmunk). Based on the data from the mice and chipmunk captures, the ideal locations for traps appeared to be in places with little to no vegetation and a decreased access to a food source. As food supplies increased, capture rates declined. The vegetation combination of either grass/greenbrier or huckleberry/blueberry for the under-story with an over-story mix of oak/maple/pine was the preferred area for the flying squirrels. No small mammals were captured in the grassy fields. Considering the lack of complex small mammalian species observed within the ecosystem at BNL, further investigation into this dearth of diversity in the small mammal population should be conducted. Different capture methods can be used, including pitfalls, to potentially increase the variety of species captured. Upcoming studies should be conducted to look at the full 5,265 acres that encompasses all of BNL..

Materials & Methods

Using Geographic Information System (GIS), 30 locations were selected for study in a 170-acre area at BNL for an eight-week small mammal survey. It was initiated on June 8th and concluded on July 30th, 2009. Each site varied in vegetation involving the under-story and over-story. Trapping was conducted three consecutive nights each week. Each trap was baited with a combination of peanut butter, rolled oats, and birdseed that was rolled into a ball and placed in the back of each trap.

Weather conditions were recorded to see if weather had an affect on trapping. At each trapping location, a data logger was placed every Monday and removed the following Monday to be placed at a new site. The last week the data loggers were pulled on Friday. All weather conditions were recorded every morning before traps were checked at each site, making note of any extreme weather conditions that occurred the previous night.

Every site had a formation in which the traps were setup. The first week, two sites were set with 30 folding Sherman traps (H. B. Sherman Inc., Tallahassee, FL; 23.0 cm x 7.7 cm x 9.1 cm) that were placed in a grid configuration of 5 x 6 that were always positioned 5 m apart. When amounts of traps declined the grid arrangement was 5 x 5. There were different quantities of traps used at certain sites (Table 1). The setups of locations were alternated between grids and transect configurations. For this survey there was a total of 2,347 trapping nights.

By recording the position on GPS along with the headings at all sites other researchers can duplicate this study. After each site was setup the headings in degrees in two cardinal directions were recorded in grid configuration while only one heading was recorded for each transect. There were 29 locations where the headings were taken from trap # 1 with exception to site # 24, which was at the midpoint. In consideration to the small mammals during the warm weather months of June and July, the sites were initially setup on Mondays after 5 pm when temperatures were 65 degrees or higher, otherwise under 65 degrees they were setup between 3 and 5 pm. Every Tuesday through Thursday morning the traps were checked between 6:45-9:45 am and closed for the day to prevent small mammal from being trapped during the heat of the day. In the late afternoons each Tuesday and Wednesday, the traps were reopened and rebaited, if necessary. Every Thursday morning the traps were removed, after they were checked for captures.

Each capture was marked to identify recaptures in the future. Every individual creature caught were initially weighed, after which they were photographed. Each of the small mammals were sexed and shaven on the either the left or right hindquarters so they would be easily identifiable upon recapture. The exception was the Southern Flying Squirrel (*G. volans*). As part of a different study, flying squirrels were given a numbered ear tag.

There were only five different species caught, the three mice species are the House Mouse (*M. domesticus*), the White Footed Mouse (*P. leucopus*), Meadow Jumping Mouse (*Z. hudsonsius*), the other two species were the Southern Flying Squirrel (*G. volans*) and the Eastern Chipmunk (*T. striatus*). Two other species not categorized as small mammals that were captured were labeled as "Other" (Figure 7). All animals were captured in only 15 of the 30 sites visited (Figure1). There were a total of 22 captures throughout the study area at BNL's. There were no captures of shrews, voles or moles in the same area being studied.

Every capture of the House Mouse (*M. domesticus*) occurred in a location with a varied environment, different from the others. There were two adult males, one adult female and one unknown. The White Footed Mouse (*P. leucopus*) was all caught in areas with similar over-stories. Of the seven captured six were males, five adults and one juvenile, the last one was not known, but had the weight of a juvenile. There was only one Meadow Jumping Mouse (*Z. hudsonsius*) captured during this study, which escaped before being sexed, but according to its weight was a juvenile. The Southern Flying Squirrel (*G. volans*) captures were in diverse surroundings that all were on the edge of two different types of floras. Of those caught five were males, four adults and one juvenile, and two adult females. Only one Eastern Chipmunk (*T. striatus*) was captured throughout this study and escaped before being sexed. There were two other captures that were neither small mammal species caught in this study.

The only documented recaptures were that of the Southern Flying Squirrel (*G. volans*), ear tag #8 was caught three times in this study, while two others were only caught once each, ear tag # 9 and #11.

Weather conditions ranging from heavy rainfall to clear skies for the overnight had no affect on captures. The capture of three of the five species were caught in the worse of these conditions as well as one non small mammal specie.

There were raids on 10 sites by a bigger mammal of unknown species, presumably a raccoon, that stole bait from the traps. Sometimes only a part of a site had been hit, but most times all traps had been attacked, which happening 15 times. Of these 10 sites 5 were hit twice while the other 5 were attacked only once.

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Conclusion

The results show that the population is not as diverse as it should be. Considering that there is a wide range of vegetation types, including an array of under-story with over-story combinations, there should have been an assortment of moles, voles, and shrews caught in addition to the species that were captured. In a study done for the specific captures of shrews the trapping method used were pitfalls (Brooks and Doyle 2001). There were 3,880 trap nights in that study successfully capturing 2,124 small mammals of nine different species, but only 341 were actually shrews (Brooks and Doyle 2001). The percentage of captures, 55%, as compared to the results of this study of capturing 20 small mammals in 2,347 trap nights were less than 1% (0.85%).

In another study on four different methods of trapping; Longworth traps, large and small Sherman traps, and pitfalls, were tested to distinguish each technique (Anthony *et al.* 2005). Most captures were with the pitfalls with the majority being shrews, all of the other three had a greater species diversity and less captures (Anthony *et al.* 2005, Brooks, & Doyle 2001).

In the areas that consisted of a huckleberry and blueberry combination under-story had only Southern Flying Squirrel (*G. volans*) captures, this being one of their food sources (Conner 1971). All of the different species captured feed on a variety of material, including leaves, insects, seeds, nuts, and fruits when in season.

During this study it was revealed that the Southern Flying Squirrel (*G. volans*) exhibited new learned behaviors. Sherman traps were used in a different study, their bait lacking birdseed, had taken place at the same localities of this study resulting in five recaptures of the Southern Flying Squirrel (*G. volans*). Once these studies sites were separated the recaptures stopped.

Further research should be conducted to include all 5265 acres that encompasses BNL. There are different trapping methods that are required to effectively increase the species captured. These capturing techniques need to include the use of pitfalls in association with Sherman traps. The duration of any new research is supposed to continue at eight weeks with the extension to four or five nights of trapping at each location. With increasing both the nights per week of trapping and types of traps used would obtain greater information and the diversity of the small mammals species captured. Also it ought to be established what the population levels are during the three other seasons of the year, to obtain a full year of data that covers the fluctuation of food sources.