

AN EIGHT-WEEK SURVEY TO QUANTIFY THE SMALL MAMMAL POPULATION LEVELS AT BROOKHAVEN NATIONAL LABORATORY

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A House Mouse that was captured a site #13.

# ABSTRACT

An area of 170 acres was surveyed at Brookhaven National Laboratory (BNL) to discover the An area of 1/0 acres was surveyed at broomaven valuonal calonatory (brk) to discover time 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 Consecutive ingine for a total of 2,527 uap ingines. Ite data reveated in at the species investing among small mammals is low, as only 5 species were found. *Suis domesticus* (House Mouse), *Peromyscus leucopus* (White Footed Mouse), *Zapus hudsonsius* (Meadow Jumping Mouse), *Glaucomys volans* (Southern Flying Squirrel), and *Tamias striatus* (Eastern Chipmunk). Based on the data from the mice and chipmunk Squirel), and 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 lack 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 encompass all of BNL.

# Introduction

The small mammal population is an important aspect to the ecosystem. They are distributors of seeds and a food source for larger predators. The small mammals on Long Island range from different breeds of mice, shrews, moles, voles, chipmunks and flying squirrels (Conner 1971). A survey is an informative way to gather data on populations and diversity. The data on the small mammal population levels are reliant upon proper evaluation (Adams et al. 2009, Flowerdew et al. 2004). Since most of these small mammal applications are for the set of the nocturnal, overnight trapping methods are required to document them. The trapping techniques used are to insure that the small mammals will be released unharmed once data is obtained. It is estimated that the levels of the small mammal population are low with little species diversity

# Materials & Methods

Using a Geographic Information System (GIS), 30 locations were selected in a 170-acre area at BNL during an eight-week small mammal survey. The survey was initiated on June 8th and concluded on July 30th, 2009. Vegetation varied across all sites. 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 effect 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. 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 which determine how the traps were setup. Each week sites were se with Sherman traps (H. B. Sherman Inc., Tallahassee, Fl.; 23.0 cm x 7.7 cm x 9.1 cm.) that were placed i either a grid or transect configuration always positioned 5 m apart. For this survey there were a total of 2,347 trapping nights

The GPS point and headings were taken at each site, with the headings in degrees in two cardinal directions for the grid configuration and only one heading for a transect. In consideration to the small mammals during the warm weather months of June and July, the sites were deployed on Mondays after 5 pm when temperatures were 65 degrees or higher. Under 65 degrees, traps were setup between 3 pm 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 mammals from being trapped during the heat of the day. In the late afternoons, the traps were reopened and rebaited, if necessary. Every Thursday morning, the traps were removed after they were checked for capture

All animals were weighed and photographed. Most 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

Table 1 Sites, Week and Night Deployed, Trap Amounts, Trap Nights, and Sites Raided

Site	Week	Number of Traps	Nights Deployed	Number of Trap Nights	Number of Times Raided
1	1				
2					2
3	2	30			2
4	2	30	3	90	
5		30	3	90	a
6	2	30			
7	3	30			a
8					a
9	3	30	3	90	
10	3				a
11	4	25	3	75	0
12					
13	4	25	2*	50	0
14					
15	5	25	3	75	C
16	6	25	3	75	0
17	5				
18	5	25	3	75	i C
19	6	25	3	75	a
20	5	25	3	75	1
21	6				
22	6	25	3	75	
23	7	25	3	75	2
24	7	25	3	75	2
25	7	25	3	75	2
26				75	
27	8	25	3	75	. C
28	8	24	3	72	1
29	8	25	3	75	
30			3	75	1
			Total Trap Night	2 347	Total Raide 11

\*Batteries died in GPS and sites were located the following day



Marking White Footed Mouse caught at site #13.





Southern Flying Squirrel caught at site #16.



Placement of a trap at site #22.



climbing a Pitch Pine tree after being released



Traps setup in a transect configuration at site #25



A House Mouse that was captured at site # 13



Rebaiting Sherman traps at one of the sites

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There were only five different species caught. The three mice species were the House Mouse (M. domesticus), the White Footed Mouse (P. leucopus), and the Meadow Jumping Mouse (Z. hudsonsius). The other two species seen were the Southern Flying Souirrel (G. volans) and the Eastern Chipmunk (T. striatus). Two other species not categorized as small mammals, that were captured, were labeled as "Other". All animals were captured in 15 of the 30 sites sampled (see map below). There were a total of 22 captures throughout the study area at BNL. There were no instances of shrews, voles or moles.

Results

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 undetermined, which were caught at sites 5, 11, 13, and 20. The White Footed Mice (*P. leucopus*) were all caught in areas with similar over-story. Of the seven mice captured, six were males, five adults and one tangent in a deas with similar betressory to the sevent muce captured, six were mates, in e autors and outs juvenile, and one undetermined, but with the weight of a juvenile. These were caught at sites 4, 11, 13, 15, 17, and two at 25. There was only one Meadow Jumping Mouse (*Z. hudsonsius*) captured at site 4, which escaped before being sexed, but its weight was that of a juvenile. The Southern Flying Squirrel (*G. volans*) captures were in diverse surroundings that were on the edge of two different vegetation types. Five males, four adults and one juvenile, and two adult females were caught. At two sites, 2 and 21, one each were caught. Two were caught at site 16 and three were a site 19. Only one Eastern Chipmunk (*T. striatus*) was captured and escaped before being sexed at site 26. There were two other captures that were not classified as small mammals.

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

Weather conditions ranged from heavy rainfall to clear skies, and appeared to have no apparent weature conductors ranged from heavy rainfail to clear skies, and appeared to have no a effect on captures. The capture of three of the five species were caught in the worst weather condi-the survey period.

There were raids on 10 sites by a bigger mammal of unknown species, presumably a raccoon, that stole bait from the traps (Table 1). Sometimes only a part of a site had been disturbed, but most times, all traps had been raided, which happened 15 times. Of these 10 sites, 5 were raided twice while the other 5 were raided only once



#### Conclusion

The results show that the population is not as diverse as it should be. Considering that there is a wide The results show that the population is not as diverse as it should be. Considering that there is a value range of vegetation types, itcluding an array of under-story with over-story combinations, there should have been an assortment of moles, voles, and shrews in addition to the specific shut were captured. In a study done for the specific captures of shrews, the trapping method used was pitfalls (Brooks and Doyle 2001). There were 3,880 trap nights in that study, successfully capturing 2,124 small mannals 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, only Southern Flying Squirrel (G. volans) were 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

Further research should be conducted to include all 5,265 acres that encompass 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. By increasing both the nights per week of trapping and types of traps used, it would be expected that the diversity of the small mammals species captured would be increased. 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.

## Acknowledgements

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#### References

- Anthony, N. M., Bautz, R., Garland, T. Jr., & Ribie, 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). LiveTrapping to Monitor Small Mammals in Britain. Mammal Review, 34, 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 domesticate (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 S266 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 othipmunks and flying squirrels too (Comert 971). 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 mammals poperies 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 coxist and thrive. The causes of twait 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 trans 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 stratus* (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 Gak/maple/pine was the preferred area for the flying squirrels. No small mammals species observed within the ecosystem at BNL, further investigation into this dearth of diversity in the small mammalian species observed within the 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 8<sup>th</sup> and concluded on July 30<sup>th</sup>, 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., Tallahasse, 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  $3 \times 5$ . Three were different quantities of traps used at cratian 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 after thoors 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 (Figure 1). There were no 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 sever 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 uring this study, which escaped before being sexed, but according to its weight was a juvenile. The Southern Flying Squirel (*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 net 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, three 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 is 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.