



SPECIES COMPOSITION AND ABUNDANCE OF SMALL/MEDIUM SIZE MAMMALS IN FEDERAL COLLEGE OF WILDLIFE MANAGEMENT ESTATE, NEW BUSSA, NIGERIA.

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ABSTRACT

Understanding the area's potential for wildlife variety and composition will increase the region's value for creating refuges and conservation measures. This study focused on the abundance and distribution of small/medium size mammals in the Federal College of Wildlife Management Estate. The studies were undertaken to derive information on the types of small/medium size mammals found in the study region and determine the abundance, distribution, and diversity of small/medium size mammals species present in the study area. This study used a plot sample method, using three stratified habitat sites, each measuring 100m²: 1) residential area, 2) farmland region, and 3) woodland area. Data were evaluated using descriptive statistics (tables and charts). The result revealed that thirteen (13) small/medium size mammals are in FCWM estate belonging to nine (9) families. There are 3 species of bats that fall into 2 categories. Three of these bat species were caught using the chase and grip method during the survey, and they were quickly recognized and released. The other species were documented as observed species. Out of the 13 species- seven were rodents, two insectivores, two frugivores, one carnivore, and one omnivore. The species of bats and rodents were the two most commonly found ones. The biggest concentration of small animals is found in the residential area, which contains a total of 469 small mammals. The results show that the relative abundance in the farmland area ranged from 0.46 to 28.84%, the relative abundance in the residential area ranged from 0 to 32.62%, and the relative abundance in the woodland area ranged from 0 to 34.9%. The results also demonstrate that there was no discernible change in small mammal species abundance between study sites ($P>0.05$). The study concludes that small- and medium-sized mammal species were ecologically dispersed among all habitat types on FCWM land.

Keywords: composition, abundance, mammals, Nigeria.

Introduction

Small mammals comprise the highest proportion among the mammal species all over the world (Vaughan *et al.*, 2000). Small mammals include bats, rodents and insectivores, while the medium size mammals include the duiker, bushbuck (Earthwatch-Europe 2002). In Africa, small mammals are probably the most ubiquitous and numerous

(Skinner and Chimimba, 2005). For instance, one study on the community structure of small mammals (Rodentia and Soricomorpha) from the Gulf of Guinea region of West Africa found 45 species of soricomorphs and 101 of rodents (Amori and Luiselli, 2011). All groups are elusive and difficult to survey because, in order to avoid predators, they have evolved dull colouration, secretive



behaviour and, in many cases, nocturnal habits.

Due to these traits and their tiny size, field identification of African small mammal species is challenging. For instance, there are roughly 190 bat species and about 380 rodent species in Africa, only surveys and collecting carried out across various seasons will allow a more accurate estimate of the species present in a given forest (Nowak, 1999). Regional checklists and mammal lists of the world may serve to provide a general concept of the species present in an area. Small mammals are known to have ecological, economical, social and cultural values (Avenant 2011). They play an important role in natural communities and provide the main supply of fresh food for many predators (Earthwatch-Europe 2002). The effects of low abundance in small mammal numbers can also affect alternative prey species such as domestic fowl eggs. Faunal exploration is an important component of the study in a given protected area. Additionally, strengthening scientific knowledge on mammal populations will increase the region's value for creating refuges and protected areas (Habtamu and Bekele, 2008).

Very little is known about these groups, either in terms of where they are found, or their ecology and population biology, most work having been done in temperate zones (Vaughan *et al.*, 2000).

The information on small mammals' abundance provides further information on the basic population status of small mammals as well as, identifies the various disturbance-sensitive to small mammals' species, in Federal College of Wildlife Management Estate (FCWM), environment and suggested management strategies for the small

mammals' species in FCWM. The objectives of the study include identifying the different kinds of small and medium-sized mammals that are present in the research area, as well as their number, distribution, and diversity.

Materials and Methods

The Study Area

Federal college of wildlife management is in New Bussa, the administrative headquarters of Borgu Local Government Area of Niger state, it covers a total land mass of about 16,200km² and it is situated between latitudes 9°N and 11°N and longitude 2°E and 4°E, (Child, 1974).

The length of the rainy season is from about 175 to 190 days (5 – 6 months) during which 1000mm -1250mm rainy is recorder annually. The rainy season normally comes in April accompanied by strong wind and thunderstorm reaching its peak in July to August and declines in September. Generally, the temperature is high during dry season just before the rain. It declines during the rainy season from June to October and rises again in November and drop slightly in December and January due to Harmattan in the dry season. The mean maximum temperature is 35°C – 40°C but minimum temperature ranges between 14°C – 15°C in the Harmattan (Child, 1974).

The vegetation may be described broadly as wooded guinea savanna with legumes accounting for 55.7% of trees and almost an equal mixture of legumes and combretaceae plants making up shrubs and small trees while grasses dominates the herbaceous layers. The vegetation has a lot of flora species which are found all over the area which includes: *Annona senegalensis*, *Boswellia dalselli*, *Combretum molle*, *Combretum nigricans*,



Terminalia glaucoescens, *Terminalia mollis*, *Terminalia macroptera*, *Anogeissus leiocarpus*, *Afzella africana*, *Daniella oliverii* and so on.

While the fauna species found in the study area includes: Civet cat *Nandinia dinotata*, Bats *Eidolon helvum*, Squirrels *Xerus erythropus*, Snails, Duikers *Sylvicapra grimmia*, Monkeys *Erythrocebus patas*, Baboons *Papio anubis*, Snakes *Python sebae*, Skink *Panaspis togoensis*, Lizard *Agama agama*, Crocodiles *Crocodilus spp.*, Hawks, Stone partridge, Guinea fowls, Green parrots, Grey-horn bill and so on (Child, 1974). The terrain is gentle undulating with widely scattered small hills. The highest elevations occur near the western boundary between 300m -350m above sea level. The lowest area around the Kainji Lake with an elevation of about 142m above Sea Level. The River drains with other seasonal stream before emptying into the River Niger (Child, 1974).

Study Design

Plot sampling method was used for this study. A total of three stratified habitat sites, each measuring 100 meters square were mapped out in FCWM estate landscape: 1. Woodland area (reserved area with thick bushes), 2. Farmland area (with habitat patches, fencerows, and scattered trees), and 3. Residential areas (scattered trees, gardens, and buildings). Each of the sites was subdivided into two plots then, small and medium size mammals were inventorized by walking along already-built paths and tracks. During the dry and early rainy seasons of 2019, small and medium size mammal species were identified and counted at each study site for a period of 5 months. Information was gathered from March to July. Three times a

week, plots were visited at 9:00 am and 6:00 pm.

Data Collection Techniques

For bats, counting was carried out in the dusk-time by checking roosting sites (caves, hollow trees and fallen logs) and fruiting/flowering trees.

The emergence points from caves, and roost points for easy counting, were located, and observers stationed at each point, to count how many bats emerge at dusk. A binocular was also use to aid identification and counting.

For rodents and insectivores, searching was carried out under fallen logs for runs, where tiny feet have left a distinct path, as well as for signs of discarded food remains or faecal pellets, this help identify sites that was sampled later. Spherical nests of grassy material in the leaf-litter, as well as runs, are indicative of their presence.

Other indirect signs of small mammal presence include their teeth, skulls, and other skeletal remains. Scats and skulls from carnivores may also be discovered and used for identification. They use these locations for gathering, food storage and consumption, and shelter. Places small mammal used to assemble, store food, consume food, and shelter is also used for identification. All specimens were identified with field guides as recommended by (Kingdon 1997).

Data Analysis:

Data was achieved using descriptive statistics (tables and charts).

$$\text{Relative abundance } A = \frac{n}{N} \times 100$$

(eq 1)

Where A = Relative abundance



n = Quantity of each species present
 N = Quantity of all species present.
 Diversity of species was achieved using Simpson's (1949) diversity index.
 The index is mathematically stated thus:

$$D_s = \sum_{t=1}^s \frac{n_1(n_1-1)}{N(N-1)} \quad (\text{eq 2})$$

Where

- D_s = Simpson's diversity index
- n_1 = Total number of individuals in each species
- N = Total number of individuals in all species
- s = Number of species present
- \sum = Summation sign.

Analysis of Variance [ANOVA] was used to test if species distribution differed between 1) a residential area, 2) a farmland region, and 3) a woodland area of the study sites.

Results

From this study, table 1 indicates the ecological distribution of small and medium size mammal species in three different plot sites, each measuring 100m²: 1) a residential

area, 2) a farmland region, and 3) a woodland area of FCWM estate landscape. A total of thirteen (13) different species were recorded in the farmland corridors; the majorities were *Epomophorus gambianus* (62) followed by *Eidolon helvum* (57) then *Tadarida brasiliensis* (45). Ten species were recorded in the residential areas; the highest occurrence was still the bat families and eleven species were recorded in the thicket woodland corridors.

The 13 small/medium size mammals' species present belong to 9 families. Out of which 7 species were rodents, 2- insectivores, 2- frugivores, 1- carnivores and 1- omnivore. The most abundant species was the bat species followed by the rodents' species. The findings of the study further shows that the family *Muridae*, *Sciuridae*, *Leporidae*, and *Pteropodidae* has the highest number which represented by (2) individual species while *Soricidae*, *Cercopithecidae*, *Erinaceidae*, *Viverridae*, and *Molossidae* has the lowest number of representation with each recording (1) frequency respectively (Figure 1).

Table 1: Presence and Distribution of small/medium size mammal's species utilizing FCWM area.

S/No	Family	Common Name	Scientific Name	Farmland	Residential	Woodland
1.	Muridae	Brown Rat	<i>Rattus norvegicus</i>	X	X	X
2.		House Rat	<i>Rattus rattus</i>	X	X	X
3.	Soricidae	Shrew Rat	<i>Chrotomys gonzalesi</i>	X	X	0
4.	Sciuridae	Gray Squirrel	<i>Sciurus carolinensis</i>	X	X	X
5.		Tree Squirrel	<i>Sciurus spermophilus</i>	X	X	X



6	Leporidae	Hare	<i>Oryctolagus cuniculus</i>	X	X	X
7.		Giant Rat	<i>Cricetomy gabianus</i>	X	0	X
8	Cercopithecidae	Patas Monkey	<i>Erythrocebus patas</i>	X	0	0
9	Erinaceidae	Hedgehog	<i>Atelerit frontalis</i>	X	0	X
10	Viverridae.	Civet Cat	<i>Paradoxurus hermaphroditus</i>	X	X	X
11	Pteropodidae	Straw colored fruit bat	<i>Eidolon helvum</i>	X	X	X
12		Gambian fruit bat	<i>Epomophorus gabianus</i>	X	X	X
13	Molossidae	Free tail bat	<i>Tadarida brasiliensis</i>	X	X	X
	Total			13	10	11

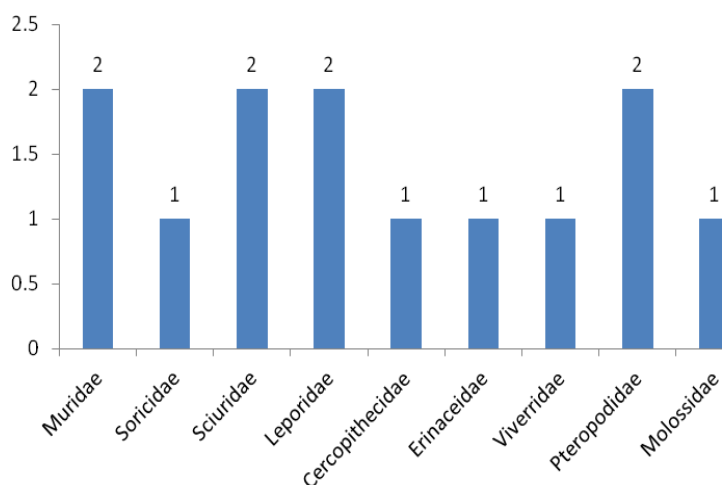


Figure 1 Types of small mammal's families in FCWM

The result in Table 2 shows the relative abundance of small mammal's species utilizing the study area. The result shows that

Farmland area had a relative abundance which ranges from 0.46 - 28.84%, *Epomophorus gabianus* have the highest



28.84%, Residential area had a relative abundance which ranges from 0 - 32.62% with *Epomophorus gambianus* having the highest 32.62%, while Woodland had a

relative abundance of 0- 34.90%, with *Tadarida brasiliensis* having the highest 34.90%,

Table 2: Relative abundance of small/medium size mammal's species utilizing FCWM area.

S/No	Family	Common Name	Scientific Name	Farmland	Residential	Woodland
1.	Muridae	Brown Rat	<i>Rattus norvegicus</i>	4.19	0.85	1.57
2.		House Rat	<i>Rattus rattus</i>	4.65	2.77	4.31
3.	Soricidae	Shrew Rat	<i>Chrotomys gonzalesi</i>	0.93	0.85	0
4.	Sciuridae	Gray Squirrel	<i>Sciurus carolinensis</i>	6.05	1.28	4.71
5.		Tree Squirrel	<i>Sciurus spermophilus</i>	2.33	4.48	3.14
6	Leporidae	Hare	<i>Oryctolagus cuniculus</i>	0.46	0	0.39
7.		Giant Rat	<i>Cricetomy gabianus</i>	0.93	0	0
8	Cercopithecidae	Patas Monkey	<i>Erythrocebus patas</i>	1.39	0	1.96
9	Erinaceidae	Hedgehog	<i>Atelerit frontalis</i>	0.46	0.21	0.39
10	Viverridae.	Civet Cat	<i>Paradoxurus hermaphroditus</i>	2.33	1.07	1.18
11	Pteropodidae	Straw colored fruit bat	<i>Eidolon helvum</i>	26.51	25.59	19.21
12		Gambian fruit bat	<i>Epomophorus gambianus</i>	28.84	32.62	28.23
13	Molossidae	Free tail bat	<i>Tadarida brasiliensis</i>	20.93	30.28	34.90
Total				100	100	99.99

The total number of small mammals presents in Table 3 shows that the species diversity was higher in the open farmland (Simpson's

index of diversity, 0.79) than in the thicket woodland (0.75) and the residential areas (0.73).



Table 3: Species composition, richness and diversity (Simpson’s index) within habitats in the study area.

Parameters	Farmland	Residential	Woodland
Total number of individuals	215	469	255
Species richness	13	10	11
Species diversity S.Index1-D	0.79	0.73	0.75

The result in Table 4 shows the Analysis of Variance of small mammal’s species utilizing the study area. The result shows that the differences in small mammal’s abundance between study sites are not significant.

Table 4: Analysis of Variance of small mammal’s population abundance between study sites

Factor	Sum of Squares	DF	Mean Square	F-cal	Sig.
Between Groups	2869.538	2	1434.769	0.88107	0.42NS
Within Groups	58623.230	36	1628.423		
Total	61492.769	38			

Figure 2 shows the similarity in the distribution and composition of small mammals present in the study area. The result shows that Farmland area and Woodland area are similar in the types of small mammals associated with the habitat type and their composition, while Residential areas differs in small mammal’s composition.

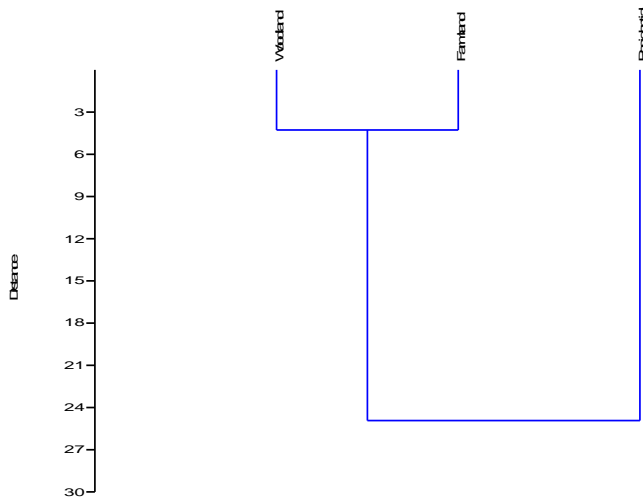


Figure 2. Similarity in the distribution and composition of small/medium size mammals present in the study area



Discussion

From this study a total number of 13 small- to medium-sized mammal species from 9 families are identified from this investigation. Adam, *et al.* (2021) reported a similar outcome, stating that nine (9) different species of small mammals from seven (7) different families had been discovered in Federal University Gashua, Yobe State, Northeast Nigeria. The species of bats and rats were the two most prevalent ones. Small animals are most likely the most pervasive and numerous in Africa (Skinner and Chimimba, 2005). Hence the significance of studying mammal communities' number and distribution is a result of the significant ecological function that these species serve. Through land isolation or fragmentation, wildlife species diversity, particularly that of small mammals, is reduced. This has a negative impact on seed production and slows down vegetation regeneration in an area. Study on the community structure of small mammals from the Gulf of Guinea region of West Africa found 45 species of soricomorphs and 101 of rodents (Amori and Luiselli, 2011). Consequently, almost all of the small mammal species were distributed ecologically, virtually in every type of habitat in the West African region. They carry out a variety of ecological services along broad environmental gradients. They provide food and pollination services for other creatures that pose a greater threat to conservation, like snakes, preying birds, and other carnivores.

Compared to other places, farmland had a higher population of rodents and insectivores, particularly those from the families Muridae, Sciuridae, Pteropodidae, Viverridae, and Molossidae. This implies that farmlands is rich in food resource and if the ' borders,

where the majority of these animals are found, are properly maintained, the population of small mammals in the region will continue to rise. This finding concurs with that of Gebresilassie *et al.* (2004) who found that farms provide small mammals with vital supplies (essential foods; grains, nut and plants) more effectively than grasslands do before harvest. The small mammals - *Eidolon helvum*, *Epomophorus gambianus*, and *Tadarida brasiliensis* were the most frequent flying mammals observed in the three habitat types, followed by *Rattus rattus*, *Sciurus spermophilus*, and *Sciurus carolinensis*. This was anticipated because the abundance of fruit trees and abandoned buildings should provide these animals with a suitable home. As food and cover availability are significant determinants of rodent distribution overall (Avenant and Cavallini, 2008), so too is habitat complexity. While research has shown that small mammals' migratory patterns are also influenced by the resources' availability (both in terms of quality and quantity) (Kasso *et al.*, 2010; Kilgore *et al.*, 2010). For instance, the absence of enough shelter, such as that seen in open farmland, may have exposed the animals to predators, forcing them to move to environments that were more conducive to their needs (Hansson, 1999).

The finding demonstrate that there was no significant variation ($P>0.05$) across sampling sites in the abundance of small mammal species. Similarity in the distribution of small mammals present in the study area- shows that farmland area and woodland area are similar in the types of small mammals associated with the habitat type. As a result, most small mammal species preferred habitats that were densely covered and had a wide variety of plant species. Similar result was found in Arbaminch forest (Datiko *et al.*,



2007). The majority of small mammals' species, such as juvenile *Rattus rattus*, were spotted in the region's early rainy season. This demonstrates that most species of small mammals breed during the rainy season. The availability of more nutrient-rich food during the rainy season may encourage animal reproduction (Jackson and Aarde 2004; Marcello *et al.*, 2008).

According to observations made during the study on the impact of the small mammal species in the study area, bats are frequently seen perched atop tall trees like neem trees and mango trees. As a result, the trees in the study area always appear to be flourishing because the bats aid in pollinating the flowers and dispersing the seeds of the plants.

The study's findings also show that some of the problems that small mammal species populations experience is brought on by human activity, such as farming in and around the estate, frequent and careless bushfires within the estate, and the destruction of small mammal nests due to deforestation. Avenant and Cavallini (2008) contend that fire may even be advantageous since it promotes the growth of more nutrient-dense plants and hastens the recovery of the population of small mammals. When fires were highly common, this might have a serious negative impact on populations of tiny mammals. It is essential to research the mammal communities because of the important ecological roles that these species play especially for the sake of conservation.

Conclusion

The finding of this study shows that small mammal species were ecologically distributed across practically all types of habitats on the FCWM estate. The study region's residential area is where the majority of small animals

are found, so constant monitoring of these animals is necessary. To assess the condition of the small mammal population and inform efficient conservation management methods, this monitoring should be conducted on a regular basis..

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