



ABUNDANCE AND DISTRIBUTION OF STRIPPED GROUND SQUIRREL (*Xerus erythropus*) IN THE RANGES OF YOLA SOUTH LOCAL GOVERNMENT, ADAMAWA STATE, NIGERIA



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Received: March 20, 2022 Accepted: June 18, 2022

Abstract: The study focused on abundance and distribution of stripped ground squirrel (*Xerus erythropus*) in the ranges of Yola South local Government Area of Adamawa State, Nigeria. Understanding the distribution, abundance and habitats used by the biological species is pertinent for the proper understanding, development and management of any ecosystem, such had been very scarce on the species under study in the area. Three habitats (Farmland, mountainous area and stream valley) were purposely selected for data collection. Three transects of 1km length were established in each of the habitat for data collection on abundance and distribution of the squirrel species. Structured questionnaires were administered for data on socio-economic traits, crops planted by farmers and those damaged in the study area by stripped ground squirrel. Data collected were subjected to descriptive statistics. The result on socio-economic traits of respondents showed that majority were male (40%), married (86%), with family size of 6-10 individuals (78.67%), had secondary education (40%), within the age-group of 36-40 years (48.67%) and who are farmers by profession (80%). Result on habitat distribution of squirrel species showed that majority were sighted on the farmlands (56.67%), rated as being common (53%) and utilized farmland as preferred habitat (40%). The result equally revealed maize/sorghum as the major crop (30%) planted and mostly utilized (35%) by the species. Digging of planted seeds by the squirrel was the major damage (36%) done to crops in the study area. Dressing of seeds with appropriate pesticides before planting as well as monitoring the ecological activities of the species is recommended.

Keywords: Distribution, abundance, squirrel species, crops, damage

Introduction

Striped ground squirrel (*Xerus erythropus*) is a species of squirrel native to Africa. It was first described by Geoffroy in 1803 (Wilson and Reeder, 2005; Skurski and Waterman, 2005). There are about six or more sub-species. The species are moderately large with sandy-brown or dark-brown fur with a white lateral stripe and whitish underparts. Adults live alone or in pairs in a simple burrow with a central nest, foraging, mostly on the ground, for seeds, nuts and roots, and caching excess food under stones. This is a common species with a wide range and the International Union for Conservation of Nature (IUCN) has rated its conservation status as being of "least concern" (LC) because a least concern species is a species that has been categorized or evaluated as not being a focus of species conservation (IUCN, 2005).

Xerus erythropus is abundant in many parts of Africa (Skinner and Smithers, 1990). Sub-species include *Xerus erythropus chadensis*, *Xerus erythropus erythropus* and *Xerus erythropus chadensis* usually found in Chad, Kenya and Senegal, while *Xerus erythropus* is found in Northern Nigeria (Grubb *et al.*; 2008). Ground squirrels eat bulbs, fruits, grasses, herbs, insects, seeds especially seeds of some planted crops (of maize/sorghum, groundnut and millet) and shrubs (Skurski and Waterman, 2005). A ground squirrel's daily activities are made of around 70% feeding, 15-20% being vigilant and around 10% socializing. The squirrels use the position of the sun as an orientation marker to either hide or look out for food. (Steppan *et al.*, 2004)

Squirrels are wide habitat tolerance, occurring in forest (though more usually secondary forest than primary), swamp forest, mangroves and drier woodland formations. Typically found in cultivated lands in many parts of the range (e.g., Uganda, Morocco, Kenya and Liberia). (Nowak, 2004)). Striped ground squirrels (*Xerus erythropus*) are diurnal herbivores, and spend almost their entire lives on the ground, although are capable of climbing into bushes to reach food. They eat a range of seeds, nuts, and roots, and can be an agricultural pest, eating crops as Sorghum, groundnut, cassava, yams, cotton bolls, peanuts, and sweet potatoes among others (Steppan, 2004). They may occasionally supplement their diet with eggs, insects, and other small animals. Their predators include servals, jackals, birds

of prey, and common puff adders (Herron and waterman, 2004).

The squirrels spend the night in burrows, which they dig with their large claws. Their burrows are usually simple in structure, with a central nest less than a meter below the surface, a single entrance tunnel, and a few blind-ending tunnels that almost reach the surface. The latter are used as escape routes, allowing the squirrel to rapidly break through to the surface; the main entrance tunnel is often blocked with a temporary pile of dirt at night (Steppan *et al.*, 2004). Foods such as nuts and seeds are often stored around the burrows. (Nowak, 2004). Because squirrels cannot digest cellulose, they must rely on foods rich in protein, carbohydrates, and fats. In temperate regions, early spring is the hardest time of year for squirrels because the nuts they buried are beginning to sprout (and thus are no longer available to eat), while many of the usual food sources have not yet become available (Bradley, 2017). During these times, squirrels rely heavily on the buds of trees. Squirrels, being primarily herbivores, eat a wide variety of plants, as well as nuts, seeds, conifer cones, fruits, fungi, and green vegetation. Some squirrels, however, also consume meat, especially when faced with hunger. Squirrels have been known to eat small birds, young snakes, and smaller rodents, as well as bird eggs and insects. Some tropical squirrel species have shifted almost entirely to a diet of insects (Thorington *et al.*, 2012).

Most species of ground dwelling squirrels mate and reproduce year-round but mating occurs mostly in the dry season months. The ground squirrel is a typical seasonal breeder, with a short breeding season lasting from April to May and a long period of sexual dormancy from June to the following March. After copulation, males usually masturbate which serves to keep the genitals clean and reduce the risk of sexually transmitted infections (Waterman, 2010). In groups, only one female enters estrous at a time which lasts around three hours. Gestation period lasts around 48 days. Males reach sexual maturity at eight months while female mature at 10 months (Steppan *et al.*; 2004).

Longevity of *Xerus erythropus* is limited by predation. Human disruption of habitats may also limit the lifespan, which averages 2 years in the wild, under domestication (captivity) lives 6 years or more (Nowak, 2004). They establish colonies

that are usually occupied by females. A female's home range is much smaller than a male's at about 1.37 ha. A male's home range is more extensive per hectare. Most ground squirrels are territorial, but share their burrows with several other burrowing species. (Dobigny, *et al.*, 2000; Nowak, 2004)

There is increase in human/animal population consumption in Adamawa state and particularly in the study area which could limit the abundance and distribution of species in question. They are regarded as a pest in some parts of their range. The species is almost domesticated and is consumed as an intensive source of protein/food. Uncontrolled burning destroys ground cover and food-producing shrubs, as well as slowing of regeneration of timber stands and this could hamper the species production in the study area by destroying the home range and or territories. (Koprowski *et al.*; 2015).

Currently there are no relevant information on the abundance and distribution of Striped Ground Squirrel in the study area that could serve as a data base for research study. It is pertinent to note that isolated populations are highly susceptible to decline in areas with a high percentage of forested land managed for timber harvest. Understanding the distribution, abundance, habitat used and crops patronized by Striped Ground Squirrel is essential for the development of management plan and sustainability of both the species (crops patronized as well as the Striped Ground Squirrel) (Koprowski, 2015). Hence, the necessity of this study which is to assess the distribution and abundance of Striped Ground Squirrel in Yola south local government of Adamawa State.

Methodology

Study Area

The study was conducted in Yola-South Local Government Area of Adamawa State, northeastern Nigeria. Adamawa State is located in the North Eastern part of Nigeria and is divided into 21 local government areas. It lies between latitudes 7° and 11° N and Longitudes 11° and 11° E. It shares boundary with Taraba State in the south, Gombe State to the west and Borno state to the North. The State has an international boundary with the Cameroon Republic along its eastern side. It has a land area of about 38,741 km² (Adebayo, 1999) (Figure 1). Yola is a capital city of Adamawa State, Nigeria, located about 22 miles east of Jimeta with a human population of 336,648 (National Population Commission, 2010).

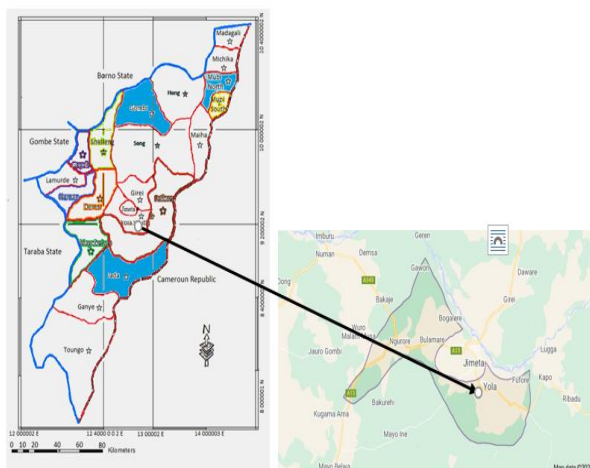


Figure 1: Map of Adamawa State Showing Yola South Local Government Area

(Source; National Population Commission of Nigeria (web site), National Bureau Statistics (2010).

Adamawa State has a tropical wet and dry climate. Dry season lasts for a minimum of five months (November-March) while the wet season commences from April to October. Mean annual

rainfall ranges from 700mm in the North-west, to 1600mm in the extreme southern part of the state. The maximum annual temperature ranges between 17 °C to 40 °C during January-December dry season and 26.44 °C to 32.2 °C during wet season respectively (Kwaga *et al.*, 2020)

Adamawa is inhabited by the Mumuye, Higi, Kapsiki, Chamba, Margi (Marghi), Hausa, Kilba, Gude, Wurkum, Jukun, and Bata peoples with few Fulanis scattered all over the State. All these groups are primarily engaged in farming and herding (cattle, goats, sheep), but fishing and trading are also important within the state and along the riverbanks. Peanuts (groundnuts), cotton, sorghum, millet, rice and maize) are the main crops. Peanuts and cotton are exported, as are cattle, dyed skins, and gum arabic. (Adebayo, 1997)

The dominant woody plant species consists of *Anogeissus leiocarpus* (African birch), *Kigelia africana*, (sausage tree), *Acacia seyal* (red acacia or shittah tree) Combretum species (bushwillows or combretums), and *Prosopis africana* (African mesquite, iron tree) species. Grass species consists of *Cenchrus purpureum*, *Tridax procumbens*, *Cenchrus species*, *Sida acuta*, *Sena obtusifolia*, *Croton lobatus* and *Portulaca quadrifida* among other species (Ikusemoran *et al.*, 2013; Kwaga *et al.*, 2020)

Study Design and Data Collection

A preliminary survey was conducted prior to the detailed study in order to assess the nature of habitats of the study area. The area was divided into three locations (farmland, mountainous and riverine areas) based on the preliminary survey carried out.

i. For data on abundance and distribution of species, Three transects of 1 kilometer length were established along each habitat selected in the morning (6:30 – 10:30am) and afternoon (3:30 – 5:30pm) following Bradley (2017) and Kwaga *et al.*, (2020). This was followed by counting species/nests/burrows spotted along each transect (Appendix I, Plate I).

ii. Data on preferred habitat by the species was obtained through the administration of 150 structured questionnaires and participatory appraisal techniques on the respondents, (farmers, hunters, traders, applicants) following (Richard *et al.*, 2006).

iii. Information on the crops eaten by the species was sourced through administration of questionnaires based on the population of the community using Conchran allocation method as adopted by Kwaga *et al.*, (2020) on the respondents. This is illustrated as follows:

$$n_h = N_h \times \frac{n}{N}, \text{ where}$$

n_h = number of questionnaire administered in each community
 N_h = Estimated population of the people in each community,
 n = Total number of questionnaires administered and
 N = Total number of people in all the communities.

Statistical Analysis of Data

Data collected were subjected to descriptive statistics (frequency table, percentages and charts) following Kwaga *et al.*, (2019).

Results and Discussion

Socio-economic Characteristics of the Respondents

The result of socioeconomic characteristics of the respondents in the study area are presented in the Table 1. The result revealed that 60% of the respondents were male while 40% are female. Majority of the respondents were married (86%), while 10% and 4% were single and divorced with family size of 6-10 individuals (78.67 %). Majority of the respondents have secondary school certificate (40%), followed by those without formal education (38%). The age-bracket of most of the respondents were within 36-40 years (48.67%). The result also shows farming (80%) as the major occupation of the

respondents. Although female were involved in crop farming, it is mostly undertaken by the male gender, thus agreeing with the finding of Ndaghu *et al.*, (2009) and Robert *et al.*, (2013) who reported that males are the most household heads and are responsible for major production of crops and decision in most of the communities. This finding however, disagrees with

Zubairu and Maurice (2014) during their study on “analysis of household food security among crop farmers in Ardo-Kola local government of Taraba State, Nigeria”. Hadebe and Mpofu (2013) equally reported that women are mostly involved in food crop production which ensures food security.

Table 1. Socioeconomic Characteristics of respondents in the study area.

Respondent	Frequency	Percentage (%)
Gender		
Male	90	60
Female	60	40
Total	150	100
Marital Status		
Single	15	10
Married	129	86
Divorced	6	4
Total	150	100
Family Size		
1-5 members	20	13.33
6-10 members	118	78.67
11-15 members	12	8
Total	150	100
Education Qualifications		
Primary	25	16.67
Secondary	60	40
Tertiary	8	5.33
No formal education	57	38
Total	150	100
Age Group/bracket		
21-25	5	3.33
26-30	7	4.67
31-35	52	34.67
36-40	73	48.67
Above 40	13	8.66
Total		
Occupation		
Hunter	16	10.67
Farmer	120	80
Herder	14	9.33
Total	150	100

Table 2: Habitat Distribution of the species in the study area

Species Distribution/habitat	Transects Number/frequency				Total	Percentage (%)
	I	II	III	IV		
Anthills	10	11	12		33	22
Valley	2	2	6		10	6.67
Stream/river bank	5	2	3		10	6.67
Mountains	4	3	5		12	8
Farmlands	20	25	35		85	56.67
Total	41	43	61		150	100

The findings of the study shows that majority of the respondents were married, while few were single and others divorced. This explains the significance of farming labor to agricultural production in a typical or normal rural community in Nigeria. Most rural dwellers and or farmers will prefer to marry in order to have cheap labour for agricultural activities to enable their household to be food secured (Kirwan and Maye, 2013). The distribution of the respondents by number of family size shows that most of the respondents have up to 6–10 individuals. Larger number of children can serve as source of

family labour even though dependency ratio could be high.. The finding shows in general that majority of the respondents in the study area were literate. The level of education of household is an indication that knowledge could be imparted easily either on wildlife conservation or crop improvement techniques.

Habitat distribution of stripped ground squirrel across the study Area

The result of habitat distribution and abundance of squirrels in the study area is presented in Table 2. The result indicated that

majority of the species (56.67%) were sighted on farmlands, while only few were found on mountains (8%). From the findings of the study, it shows that there are many squirrels in the study area that will cause some damage to the planted crops. This findings is in agreement with Torington (2012) who reported that the ground diversity of squirrel species are social, often living in well-developed colonies, while the dwelling species are solitary.

Habitat abundance of squirrel across the Study Area

Table 3: Species Abundance by respondents in the study area

Species Status	Frequency	Percentage (%)
Common	80	53.33
Rare	30	20
Abundant	40	26.67
Total	150	100

Table 3 shows the result of habitat abundance of species in the study area. The results indicates that 20%, 26.67% and 53.33% of the respondents reported rare, abundant and common respectively. This finding reveals that the species under study are very common and could be sighted easily in the study area. It is in agreement with Bradley (2017), who reported that ground squirrel could be available once there is good forage or related environment.

Habitat Explored/ most preferred by the Species in the Study Area

Figure 2 shows the result of the habitat explored or preferred by the species in the study area. The result indicated that farmland contained most of the species (40%) while valley or stream had the least (4%). The abundance/preference of species on farmlands/cultivated area is in slight agreement with Krebs (1994) who observed that ground squirrel prefer open savannah-wet habitats, especially with cover/hide-out and grasslands in which they could burrow easily. This could be attributed to the open nature of the farmland with more abundant crop plants found along than anthills and valleys. The reason could as well be ascribed to the open nature of the farmland, accompanied by the available seedlings or seeds derived by the species. Nowak (2004) made similar observation on cultivated land in many parts of the range in Uganda, with wider habitat tolerances occurring around the forest areas.

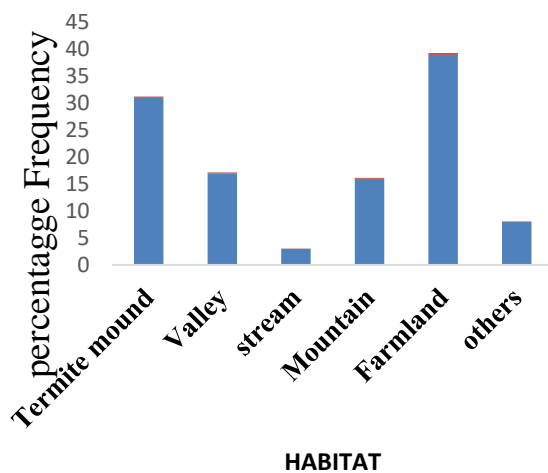


Figure 2. : Preferred Habitats by the Species in the study area

Types of Crops Planted in the Study Area

The result on the type of crops/plant planted in the study area is presented in Table 3. The result shows that six (6) different crops are planted, Maize, sorghum, Groundnut, rice, cowpea, and vegetables. The result further showed that maize/sorghum is mostly planted (24.67%) among other crops while vegetable is of least concern (7.33%). The result is in correspondence with the land use pattern observed by Adebayo (1997) that ecological condition of the state permits the cultivation of

cereal and root crops and live stocks rearing. This could probably be one of the reasons why squirrels are found mostly sighted near anthills and on the farmlands in the study area.

Crops mostly preferred by stripped ground squirrel in the study area.

The results of crop planted mostly preferred by the stripped ground squirrel is presented in Figure 3. The result indicated that maize and sorghum are most (35% and 25%) utilized while cowpea were less utilized by the species (6%). This could be ascribed to the fact that most of the soil are conducive for most cereal crops as observed by Ikusemoran *et al.*, (2013) that the vegetation and soil in an area permits the growth and development of most cereal crops. The finding of this study is in agreement with Ikuseroran *et al.*,(2013) observation.

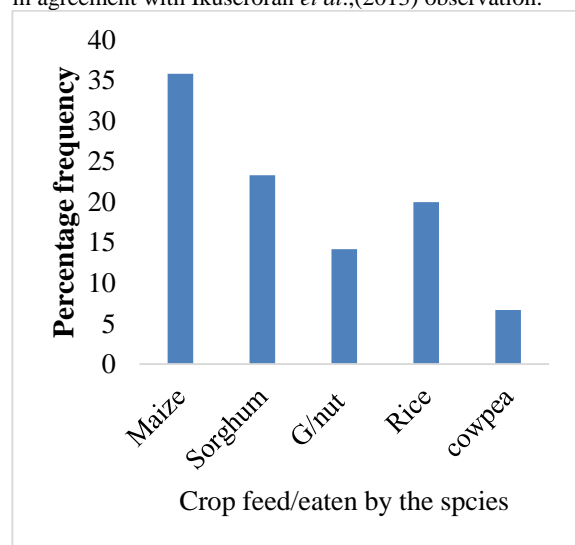


Fig.3: Preferred Crop Feed/Eaten by The Species Field Survey, 2021

Damage done to Crops by Species in the Study Area

The result of the damage done to crops by squirrel in the study area is shown in Table 4. The result indicated that most of the damage by the species is digging of the planted seeds (36%) with little or no destruction at harvest (14%). The findings of this study is in agreement with Dobigny *et al.*, (2000) and Nowak (2004) that the work range of most ground male squirrel starts between 1.37 to 7.00 hectares and gives them opportunities to exploit many farmlands. Borrowing and uprooting are equally other damage but is not as severely done compared to digging of planted seeds. Steppan (2004) made similar observation that squirrel have been using scent found

- Ndaghu, A.A., Maurice, D.C., and Zubairu, E. (2009). Adoption of the New Rice for Africa (NERICA) Rice Variety among Small Scale Farmers in Taraba State. *Nigerian Journal of Tropical Agriculture* 11:259-265.
- Nowak, R. 2004. "Walker's Mammals of the World" (On-line). African Ground Squirrels. Accessed April 27, 2004 at http://www.press.jhu.edu/books/walkers_mammals_of_the_world/rodentia/rodentia.sciuridae.xerus.html
- Richard W. Thorington, *Katie Ferrell – Squirrels: the animal answer guide*, JHU Press, 2006, ISBN 0-8018-8402-0, ISBN 978-0-8018-8402-3, p. 75.
- Skinner J.D., Smithers R.H. (1990). *The mammals of southern African sub-region*: University of Pretoria 391-423
- Skurski D, Waterman J (2005). "Xerus erythropus", *Mammalian Species* 781: 1-4.
- Steppan SJ, Scorz BL, Hoffmann RS (2004) Nuclear DNA phylogeny of the Squirrels (Mammalia: Rodentia) and the evolution of arboreality from C-myc and RA 91 *Molecular Phylogenetic and Evolution* 30: 703-719.
- Thorington, Richard W.; Koprowski, John L.; Steele, Michael A.; Whatton, James F. (2012). *Squirrels of the World*. Johns Hopkins University Press. p. 8. ISBN 978-1421404691.
- Waterman JM (2010) The Adaptive Function of Masturbation in a Promiscuous African Ground Squirrel. *Plos one* 5: e13060..
- Wilson, D.E.; Reeder, D.M. (2011). "Class Mammalia Linnaeus, 1758. In: Zhang, Z.-Q. (Ed.) *Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness*"(PDF). *Zootaxa*. 3148: 56–60.
- Zubairu, E.A., and Maurice, D.C. (2014). Analysis of Household Food Insecurity among Food Crop Farmers in Ardo-Kola Local Government Area of Taraba State, Nigeria. *Taraba Journal of Agricultural Research*, 2 (2): 20-25



Plate I: Diagram Showing Ground Striped Squirrel (*Xerus erythropus*) in the Study Area (Termite mound/anthill) (Field Survey, 2021)