

## Populations and Foraging Ecology of Some Mammals in AFI Mountain Wildlife Sanctuary, BOKI, Cross River State, Nigeria

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**Abstract:** A study was carried out to determine the population sizes and foraging ecology of some forest mammals by following transect routes and trails of animals. The sampling technique adopted was stratified random sampling done by the survey of 30 transect routes of 2000m in length and 100m in width in which accessibility was not made impossible by terrain forming a total sample area of 6.2km<sup>2</sup>. This represented sampling intensity of 6.2% of the total forest area of about 100km<sup>2</sup>. Ten surveys were carried out in all. Census was carried out by counting the animals that were sighted. Foraging habit of animals was studied by observing food residues of the animals along their trails. The result showed that Galago, *Galago senegalensis*, with a density per km<sup>2</sup> of 5.97 individuals and a total population of 597 animals had the highest population of all the primates found in this area. This was followed by Mona monkey, *Cercopithecus mona* with 1.12 individuals per km<sup>2</sup> and a total population of 112 animals. Putty nose monkey, *Cercopithecus nictitans* had a density per km<sup>2</sup> of 0.97 individuals and a total population of 97 animals. Also, Red eared monkey, *Cercopithecus erythrotis*, had a density per km<sup>2</sup> of 0.97 individuals and a total population of 97 animals. Drill monkey, *Mandrillus leucophaeus*, had a density per km<sup>2</sup> of 0.81 individuals and a total population of 81 animals. Cross River gorilla, *Gorilla gorilla diehli* had a density per km<sup>2</sup> of 0.48 individuals and a total population of 48 animals. Chimpanzee, *Pan troglodytes vellerosus* had a density per km<sup>2</sup> of 0.32 individuals and a total population of 32 animals. The study recorded the sighting of six herbivorous mammalian species including antelopes and wild pigs. Rock hyrax, *Procavia capensis*, had the highest density per km<sup>2</sup> of 8.06 individuals and a total population of 806 animals. Blue duiker, *Cephalophus monticola*, had the second highest density per km<sup>2</sup> of 6.94 individuals and a total population of 694 animals. This was followed by bay duiker, *Cephalophus dorsalis*, with a density per km<sup>2</sup> of 5.97 individuals and a total population of 597. Yellow backed duiker, *Cephalophus silvicultor* and red river hog, *Potamochoerus porcus*, had densities per km<sup>2</sup> of 5 individuals and a total population of 500 animals each. However, forest buffalo, *Syncerus caffer nanus*, had the lowest density per km<sup>2</sup> of 4.03 individuals and a total population of 403 animals. Improved conservation measures should be adopted.

**Keywords:** Afi Mountain, foraging ecology, mammals, population sizes, wildlife sanctuary.

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### I. Introduction

Many of the country's wildlife are endangered and facing the threat of extinction [1], the major threats are habitat destruction and over hunting [2][3]. Nigeria is one of the areas where tropical rain forests are being lost at the rate of over 405,000 hectares per annum [4][5]. This is a very serious threat to our tropical rain forest wildlife heritage. The decline in our animal numbers has been so rapid and apparent that many people are beginning to worry about their disappearance. Environmental pollution also threatens many of our wild fauna. The uncontrolled and illegal use of pesticides has often taken its toll on non-target organisms, especially those, which interact with aquatic ecosystem. Many local fish populations are threatened because of the illegal use of chemicals in fishing and habitat destruction by the oil industry[6].

On April 20, 1985, the Federal Government promulgated Decree Number 11 (The Endangered Species Decree) with the main aim of protecting endangered species in Nigeria in which chimpanzees, gorillas, and guenons are among the list of species totally protected from trade and traffic [6]. Although a major landmark in wildlife conservation in the country, some sections of the decree need to be reappraised, and a total revision of the decree may become necessary after determining the current level of abundance of our wildlife species. One of the weaknesses of the decree is the total protection of fairly common species such as kites and the permission to trade, under license, in endangered species such as cranes, secretary birds, and ostriches. Furthermore, the decree does not offer any protection to any of the country's amphibians although some rare ones are threatened by habitat destruction. The decree does not cover plants although some that are important food sources for wildlife may be threatened. This study was undertaken to estimate the population sizes and foraging behaviour of some mammals in the Afi Sanctuary.

## II. Survey and Sampling Techniques

The line transect survey method used by several researchers on the study of mammals especially primates in Africa was adopted for this study considering the nature of mammalian species and rugged topographic terrain of the mountainous study area [7][8] [9] [10][11] [12] [13] [14] [15][16] . This was done by following transect routes which were equally trails of animals which had already been created by both animals and humans activities with distances labeled with flagging by the protection staff with reference to cardinal points. The sampling technique adopted was stratified random sampling done by the survey of 30 transect routes of 2000m length and 100m width forming a total sample area of 6.2 km<sup>2</sup> in which accessibility was not made impossible by terrain. This represented approximately 6% sampling intensity of the total forest area. This technique was adopted in order to cover the entire home range of the species to make discovery of animals or their nests sites or hearing vocalizations and even direct observation of the animals while foraging where possible. Ten surveys were carried out in all.

Census was carried out by counting the animals that were sighted as well as counting nests particularly for chimpanzees and gorillas that have nests building behaviour. Foraging signs such as food residues and faecal droppings served as indirect counting methods or rather supportive evidences as to the existence and abundance of the animals. Foraging habits of animals were studied by observing food residues of the animals along their trails in order to identify the types of food materials they eat as well as direct observation of the animals as they were eating where possible. This was done to ascertain the species of plants and animals as well as the parts consumed by these animals.

## III. Method of Data Analysis

### 3.1 Estimate of Populations of Mammals in the Study Area

The objective of carrying out a census is to estimate the density of a sample population in a specific area so that the total population of a larger census area can be estimated. The basic methods of census data analysis for calculating population density, which is the number of animals per unit area, and total population were employed [17]. They are stated as follows:

$$\text{Estimated animal Population ,N} = \frac{\text{Number of animals Seen in sample area, n X Total census area ,A}}{\text{Sample area, a}} \dots\dots(1)$$

Total population of the species in the census area becomes:

$$N = \frac{n \times A}{a} \dots\dots(2)$$

Where, N is the total population; n is the sample population; A is the total area and a is the area of the sample area

$$\text{Density} = \frac{\text{Number of groups/individuals sighted}}{\text{Area census}} \dots\dots(3)$$

Binoculars, Photo Camera, Field note book, Field guide, Field manual, Sleeping tent and pad, Cutlass, Sunto clinometers.

## IV. Results

### 4.1 Mammalian Species Sighted in Afi Mountain Wildlife Sanctuary

Galago, Galago senegalensis, with a density per km<sup>2</sup> of 5.97 individuals and a total population of 597 animals had the highest population of all the primates found in this area . This was followed by Mona monkey, Cercopithecus mona with a density per km<sup>2</sup> of 1.12 individuals and a total population of 112 animals. Putty nose monkey, Cercopithecus nictitans, had a density per km<sup>2</sup> of 0.97 individuals and a total population of 97 animals. Also, Red eared monkey, Cercopithecus erythrotis, had a density per km<sup>2</sup> of 0.97 individuals and a total population of 97 animals .Drill monkey, Mandrillus leucophaeus, had a density per km<sup>2</sup> of 0.81 individuals and a total population of 81 animals. Cross River gorilla, Gorilla gorilla diehli had a density per km<sup>2</sup> of 0.48 individuals and a total population of 48 animals. Chimpanzee, Pan troglodytes vellerosus, had a density per km<sup>2</sup> of 0.32 individuals and a total population of 32 animals., as shown in fig. 1 below.

The study recorded the sighting of six herbivorous mammalian species including antelopes and wild pigs. Rock hyrax, Procavia capensis, had the highest density per km<sup>2</sup> of 8.03 individuals and a total population of 803 animals. Blue duiker, Cephalophus monticola, had the second highest density per km<sup>2</sup> of 6.94 individuals and a total population of 694 animals. This was followed by bay duiker, Cephalophus dorsalis, with a density per

km<sup>2</sup> of 5.97 individuals and a total population of 597. Yellow backed duiker, *Cephalophus silvicultor*, and red river hog, *Potamochoerus porcus*, had densities per km<sup>2</sup> of 5 individuals and a total population of 500 animals each. However, forest buffalo, *Syncerus caffer nanus*, had the lowest density per km<sup>2</sup> of 4.03 individuals and a total population of 403 animals as shown in fig. 2 below.

**4.2 Foraging Behaviour of Primate Species in the Study Area**

Residues of plants rhizomes, succulent stems, leaves, fruits, seeds, nuts and pulp or pith of some shoots of plants were found along the trails of these animals indicating their preferences for these food materials. The fruit types observed include that of False walnut, *Canarium schweinfurthii*; Achi, *Brachystegia eurycoma*; Guinea pepper, *Xylopia aethiopica*; Aidan tree, *Tetrapleura tetraptera*; African white oak, *Antiaris Africana*; miraculous plant, *Thaumatococcus danielli*; sand paper tree, *Ficus exasperata*, bush mango, *Irvingia gabonensis*, African star apple, *Gambeya albidum*; African breadfruit, *Treculia africana*; wild kola, *Cola argentea*; underground stem of *Icacinia trichanta*; wild berry, *Maesobotrya barteri*; African nutmeg, *Monodora myristica*, among others as shown in table 1 below. They supplemented their diet with eggs, larvae, nestlings, invertebrates, young and small animals which they collect from the ground or forest floor as well as tree crowns and branches as indicated by their food residues along their trails.

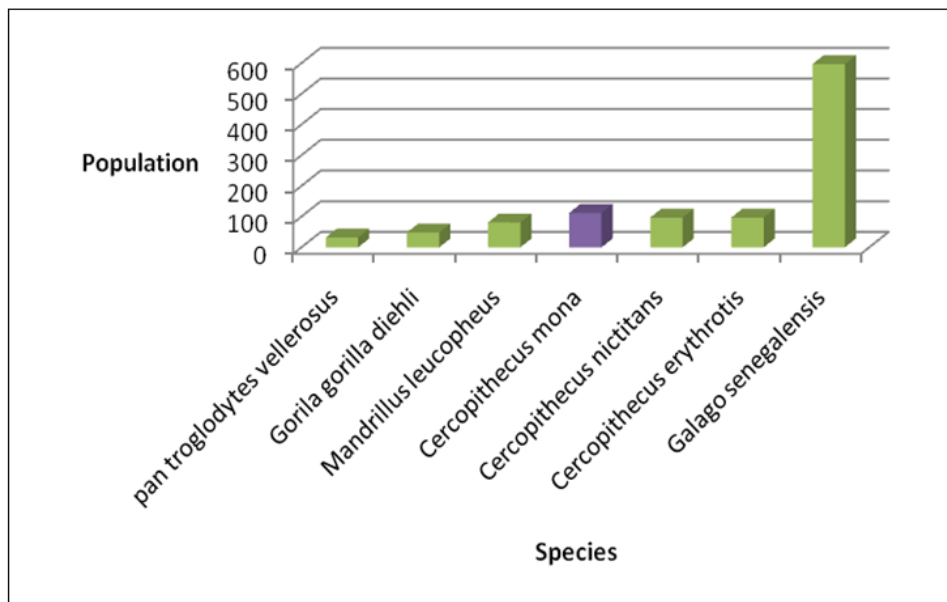


Figure 1: Primate Species Sighted in Afi Mountain Wildlife Sanctuary

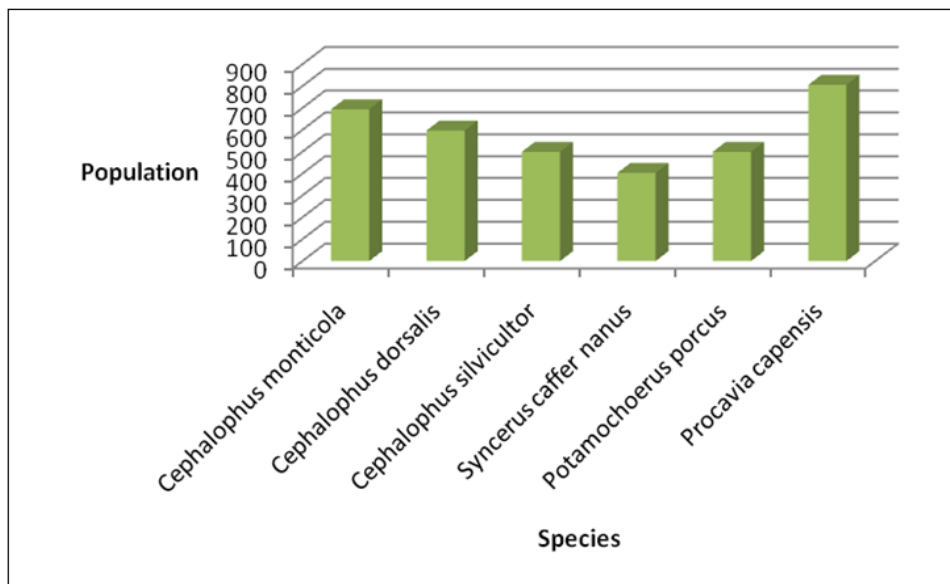


Figure 2: Artiodactyla Species Sighted in Afi Mountain Wildlife Sanctuary

**Table 1: Some Plant Species Foraged by Primates in the Area**

S/N	Common Name	Scientific Name
1	False walnut	Canarium schweinfurthii
2	Achi	Brachystegia eurycoma
3	Guinea pepper	Xylophia aethiopica
4	Aidan tree	Tetrapleura tetraptera
5	African white oak	Antiaris africana
6	Miraculous plant	Thaumatococcus daniellii
7	Sand paper tree	Ficus exasperata
8	Bush mango	Irvingia gabonensis
9	African star apple	Gambeya albidum
10	African breadfruit	Treculia africana
11	Wild cola	Cola argentea
12	Underground stem	Icacinia trichanta
13	Squirrel cherry	Maesobotrya barteri
14	African nutmeg	Monodora myristica
15	Alligator pepper	Aframomum melegueta

## V. Discussion

Some factors affecting the abundance of mammals in the Afi sanctuary include the following:

**Geographic isolation:** The chimpanzees, gorillas and drills which inhabit the eastern Nigeria and western Cameroon border region are geographically isolated from all other populations and represent the most north western populations of their geographic ranges. The Afi sanctuary's populations are equally isolated from the other populations of the Nigeria - Cameroon border populations which further limit the development of this important species. These highly threatened status of these species is due to their small populations which are fragmented by the dense human population of over 16,000 people in the surrounding villages (NPC, 2005)[18], making their heavy demands on the resources of this environment and even reinforced by the larger population of the nearby towns and cities. The Afi sanctuary sub-populations are even smaller than the other sub-populations with which it might have had no interchange of genetic materials for several decades. Small and fragmented populations are vulnerable to the detrimental effects of inbreeding, genetic drift and natural catastrophes which produce diminished genetic variation and demographic decline. The result is the production of a non-viable population with low ecological performance. However, despite the small numbers, isolation and threat facing the Afi sub-populations, they have persisted indicating that genetic reason alone is not potent enough a factor to extinguish a population.

**Habitat destruction:** Habitat destruction through indiscriminate logging, burning and farming had seriously affected the abundance of these animals. Some of the inhabitants still believed that the forests around them are the free gifts of nature as such they should not be prevented from exploitation of such resources. They equally believed that since this forest has become government property, they should not be prevented from exploitation because government property belongs to everyone, including them. The areas of the sanctuary most affected were the lowland areas since the exploitation of the highland was very difficult because of the terrain.

**Indiscriminate burning:** The indiscriminate burning carried out by poachers and farmers caused a lot of damages to the flora and fauna life forms in the area. For instance, the late burning carried out in some areas of the forests to permit logging operations or open up a farmland bring about total destruction of the vegetation and displacement of animals. Small animals like rodents and crawling animals, reptiles and insects are severely burnt as a result of sudden outbreak of fire in the reserve. Large mammals are forced to move out of their shelter and territories to seek shelter elsewhere.

**Farming:** A lot of farming activities were carried out around the villages which border the sanctuary leading to serious encroachment on its land. Most inhabitants of the area were farmers engaging in cultivation of cocoa, plantains, bananas, cassava and other crops. New areas of the sanctuary were cut down each year and more request for land were made to the state government every year by the local people.

**Poaching:** Poaching is defined as stealing of games or fish from private property or from a place where shooting, trapping or fishing rights are reserved[19]. This continued to have a heavy toll on the fauna populations of this sanctuary. Some of the people of this area still engage in hunting as one of their means of livelihood especially in the dry seasons. Several firearms and ammunitions were confiscated from illegal hunters during the last December / January dry season patrols by the protection staff while many were prosecuted.

The antelopes and bush pigs were generally abundant in this area apart from chimpanzees, gorillas and guenons as proved by their foraging signs and faeces but were scarcely seen because of the difficult topography. The area has fairly steep slopes with hills and valleys, rock boulders and outcrops, caves and dense vegetation where animals hide, making sighting difficult. However, the size of the Afi Sanctuary coupled with its distance from other ecosystems affected the diversity and population abundance of species. The size of an ecosystem

and closeness to other ecosystems normally influence diversity and abundance of species of plants and animals in them. This determines the number of species as well as the population an ecosystem will hold at equilibrium. According to the theory of island biogeography, isolated reserves or ecosystems, or biological islands, decrease in species composition and number after several years of isolation [20]. Animals require large size of ecosystems since each individual or group demarcate territories and home ranges for themselves, and aggressively protect and defend such against intra-specific and inter-specific invasion. This leads to spacing out and regulation of the population which this area can host. This is so because the larger the size of a particular species, the larger the territorial area the animal delineates for itself and the lesser the island forest can host. However, no matter how large an isolated forest may be, it loses some species after several years of isolation. It was reported that a joint team from World Wildlife Fund and Brazil's National Institute for Research on Amazonia carried out a research on fragmented forests of various sizes in the Amazon forest [20]. The result showed an unusual high densities in birds and primates immediately after fragmentation indicating influx of animals into a remnant piece of forest. However, after three years of isolation, species numbers declined and several birds and monkeys disappeared. There were local extinctions of large mammals such as jaguar, mountain lion and deer. Therefore, it may not be surprising that the species diversity and populations in Afi Sanctuary may not experience periodic increase as may be expected because of its isolated nature from nearby ecosystems. Moreover, they may experience genetic drift, that is, the gradual reduction in genetic properties or traits of species due to inbreeding which leads to formation of weak populations. This is because there are no nearby ecosystems for the animals to interchange genetic materials with similar species to improve their genetic quality. These are a few of the problems of habitat fragmentation experienced worldwide, apart from other worries such as the menace of climate change.

Chimpanzees are both arboreal and terrestrial and omnivorous in feeding behavior [7]. It was reported that chimpanzees hunt and kill leopard cubs, galagos, monkeys; cannibalize its young, and attack and eat human infants occasionally; the only animals besides humans known to create and use tools such as tree limbs stripped of bark and sharpened at one end with their teeth to kill galagos sleeping in hollows [11][21]. The omnivorous feeding behaviour helps the animal to secure proper nutrition or balance diet for physiological immunity, mental alertness and physical fitness in order to succeed in propagating a viable population in the environment.

Tracking gorillas along their trails during this study revealed that they are heavy consumers, feeding extensively on root tubers, stem tubers, leaves, fruits, seeds, pith or pulp of plants and succulent barks as shown by their food residues. They are, therefore, omnivorous in feeding behaviour. However, it was stated that their diet is vegetarian; they eat leaves, stalks, shoots, and fruit, and spend much of their time foraging and resting [22]. The four species of monkeys: Drill, Mona, Putty and Red eared monkeys were found to be similar in foraging behaviour. They are arboreal in nature and were found utilizing the top crown of trees for food, resting and sleeping, and sometimes come down to the forest floor to complete their activities. They were found to exhibit omnivorous feeding behaviour, consuming plant materials. Invading some areas of cocoa, banana and plantain farms for feeding had become their routine activity thereby becoming a nuisance to the local farmers. These monkeys carried food in their cheek pouches. It was stated that guenons live in groups of up to 35 in arboreal regions and mainly feeds on fruits but sometimes eats insects and leaves [23]. They were found to exhibit omnivorous feeding behaviour, consuming plant materials. Invading some areas of cocoa, banana and plantain farms for feeding had become their routine activity thereby becoming a nuisance to the local farmers. They also consumed eggs, larvae, young animals, nestlings, insects and several crawling animals. These monkeys carry food in their cheek pouches

## **VI. Conclusion and Recommendation**

The conservation of this sanctuary was a rational action by the Cross River State Government tantamount to implementation of a global conservation policy or strategy which is very commendable. Some of the objectives for which this sanctuary was established were realized though at low levels whereas some were still moribund, meaning that the conservation effectiveness of the park was inadequate and desired more to be done. There is therefore, a serious necessity for the authority of the park to make a more concerted effort to step up the conservation of this sanctuary to achieve the objectives of establishment for the benefits of the present generation without compromising the needs and aspirations of posterity. Targeting those objectives which are yet to be realized is one good thing that should be done as well as committing funds and technical expertise to salvage the situation. If the management will apply active management measures and tackle the improvement of tourists facilities such as roads and hotels, there is bright prospect for this sanctuary.

The authority should make adequate planning and implementation of regular or routine research and monitoring of species which is necessary to determine population dynamics of important or desired species in order to understand the management practices to adopt to improve the ecosystem. This can be done by funding some of the research works and encouraging other self sponsored researchers by prompt approval and issue of permits to carry out such activity. Moreover, there is necessity for increase in the number of rangers as well as

equipping them with guns and ammunitions for patrols and monitoring of the park against illegal exploiters to upgrade the conservation status of the park. There should be improved community participation in the planning and management of this sanctuary through setting up of local planning and management committee to carry out local organization of the affairs of the park to increase commitment to conservation and reduce poaching, illegal logging and farming within the borders of this ecosystem. It is understood that if villagers who are the culprits in these illegal practices are committed to the project, they will reduce these illegal activities to the barest minimum. There is necessity for a moderate hotel to be built in this area to cater for the needs of visitors. Visitors who require travel comfort also require comfortable accommodation to rest especially in the nights as well as secure their property especially electronic monitoring devices. The presence of visitors in these villages will boost the local economy through rendering of services such as sales of items, restaurants, transportation, guide services and others by the villagers to the visitors. This will invoke commitment of the local people to the conservation of the park as well as reduce the incidence of illegal activities.

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