

Assessment of Population Abundance, Density and Habitat Preference of Sclater's Guenon (*Cercopithecus sclateri* Pocock 1904) in Aboh-Mbaise Communal Forest, Imo State, Nigeria

ABSTRACT

Aims: ~~We assessed~~ Assessment of the population abundance, density and habitat preference of Sclater's guenon (*Cercopithecus sclateri*) in Aboh-Mbaise communal forest ~~to inform conservation efforts for the species now and in the future.~~ ~~was carried out to determine the population abundance, density and habitat requirements of the species in the study area.~~

Study design: ~~We used t~~he point count sampling method ~~was used for collecting data~~ ~~to estimate~~ population size.

Place and duration of study: The study was carried out in Lagwa ~~community~~ forest, Aboh-Mbaise Local Government Area, Imo State, between December 2019 and November 2021.

Methodology: ~~We laid-out e~~Eight 2-5-km transects, ~~each measuring 2.5km were laid~~ ~~on~~ in a land area of 28,500 km². ~~We~~ Trees were enumerated and measured ~~trees~~ using the point-centered quarter method.

Results: Results of this study indicated that they were ~~738~~ individuals of the monkeys, 392 in dry and 346 in the wet seasons. The ~~p~~Population density was 0.04±0.01 individuals/km², with troop sizes of 4.09±0.83 and 3.68±0.75 for dry and wet seasons, respectively. The monkeys were sighted mostly in secondary forest, sacred groves, and economic trees. Most of the trees ~~encountered fell~~were within the diameter-at-breast-height class of 21-30 cm—30cm. ~~A total of Three hundred and four (304)~~ plant species were ~~utilized-used~~ by the monkeys for cover in both seasons; ~~these and~~ included *Dacryodes edulis*, *Elaeis guinensis*, *Magnifera indica*, *Treculia africana* and *Pterocarpus erinaceous*.

Conclusion: The findings of this research is a prelude to understanding the population dynamics and habitat structure of the sclater's guenon in the study area. Massive sensitization of the locals, regeneration of the remaining fragmented habitat, and establishment of a wildlife sanctuary ~~are needed to allow ean contribute to the~~ conservation of the species and its habitat.

Keywords: Population, dynamics, habitat, selectivity, guenon

Comment [KL1]: Is it "communal" or "community"? You have it both ways.

Comment [KL2]: Is it "communal" or "community"? You have it both ways.

Comment [KL3]: IMPORTANT: I did not review any of the tables.

Comment [KL4]: You give us no idea whether this is enough individuals to maintain a population through time.

Formatted: Space Before: 0 pt, After: 0 pt

Comment [KL5]: I don't see why you add the two seasons together to make a total. If you go into a building and count people on May 1, then count people in the same building on June 1, you don't add the two totals together. You need to explain this.

Comment [KL6]: This should be an en-dash (used for ranges of numbers), not a hyphen.

1. INTRODUCTION

The Sclater's guenon (*Cercopithecus sclateri*) is an endangered primate that is endemic to Nigeria. It is classified as endangered by the International Union for the Conservation of Nature (IUCN, 2019) and listed on Appendix II of the Convention on International Trade in Endangered Species (CITES). The species was originally thought to be nearly extinct until the late 1980s.

Comment [KL7]: This was a long run-on sentence.

The Sclater's guenon is restricted to the rainforest on the floodplain zone between the Niger and Cross Rivers in southeastern Nigeria (Scholte, 2011). Its extent of occurrence is 28,500 km² (Lynne and Olusegun, 2007). Much of the remaining forest throughout the species' range comprises small, often degraded forest fragments within a largely agricultural landscape; swampy areas difficult to farm; or strips of forest along waterways.

Three populations of Sclater's guenon *C. sclateri* survive in mostly deforested communities where the local human population regards this monkey as sacred. Although they are not hunted in these sites, the monkeys' sacred status does not necessarily guarantee their long-term survival. The population of this species is dwindling largely due to four factors: (1) its extremely small range, (2) high human population in parts of Nigeria where this species is found, (3) habitat fragmentation, and (4) loss and hunting. This species is endemic to the forests in the floodplain between the Niger River and the Cross River in Southeast Nigeria (Scholte, 2011). The species does not occur in any officially protected areas, but three populations of the species are known to be protected by local people who consider the monkeys' sacred status.

Comment [KL8]: This is in the paragraph above.

Anthropogenic disturbance occasioned by habitat destruction, hunting, conversion of land to agricultural use, and establishment of non-native plantations are the major threats to the survival of the Sclater's guenon, a situation which has led to the species occurring only in small and

Comment [KL9]: You have a list two sentence above, and a different list here. Consolidate them into one list.

isolated patches of forests. The communal forest of Aboh-Mbaise is an important habitat for this species largely because the species is associated with shrines and sacred groves of trees in the area. Also, due to taboos associated with killing or eating the monkeys, the species is protected in this area (Lynne *et al.*, 2009).

Comment [KL10]: Is it "communal" or "community"? You have it both ways.

Presently, the consequences of human-guenon conflict ~~is~~ are very evident in the area as the guenons participate in agricultural damage, thereby causing some of the indigenous people to

contemplate disregarding the taboos associated with these monkeys. ~~This species is endemic to the forests in the floodplain between the Niger River and the Cross River in Southeast Nigeria.~~

Comment [KL11]: This is the third time you state this.

The sSpecies cannot be found in any of the protected areas in Nigeria, ~~the obvious reason why no study has been carried out on the species.~~

Comment [KL12]: That's not obvious, at least to me.

The species is known to occur in captivity only at the Centre for Education, Rehabilitation, and Conservation of Primates and Nature (CERCOPAN) in Cross River State, Nigeria (Oates *et al.*, 2008).

Comment [KL13]: This shouldn't be in its own paragraph.

Comment [KL14]: This should not be underlined and in blue.

The Sclater's monkey is found in moist tropical forests and marshy eroded forests, low mountain habitats along the Nigeria coast. Even though the species' natural habitat is primary and secondary growth forest just like most of the other species of guenon, it is said to be surviving in extremely dissipated habitats (Nowak, 1999). The species preferred habitat is in Igbo villages and their sacred tree groves, which are mostly surrounded by non-native tree plantations and agricultural areas.

Comment [KL15]: This is the fourth time you state something like this. State it once only.

Comment [KL16]: This should not be underlined.

In one community called Lagwa in Imo State, all the patches of forest which the monkeys previously inhabited have been destroyed, leaving the animals to roam and live in villages, where

food from gardens and farms is stolen by the animals (Stewart, 1996). Closely related species appear to prefer the lower levels of the canopy and sometimes come to the ground. (Fleagle, 1999).

Small populations numbering eleven have been confirmed to exist in states such as Akwa Ibom, Enugu, Imo, Abia and Cross River State. The localities known for this species include Utuma, Stubbs creek, Akpugoeze, Osomari, Lagwa, Blue River, Enyong creek/Ikpa River (Baker and Tooze, 2003). Some authors have, however, speculated that the Sclater's monkey may be a hybrid between the red-eared guenon, which occurs on the eastern side of the Cross river in Nigeria and Cameroon, and white-throated guenon which occurs on the western side of the Niger delta in Nigeria. Several authors, however, agree that the Sclater's monkey deserves full specific status.

The study therefore evaluates the population abundance, density, and habitat preference of sclater's guenons in the area of study to inform conservation efforts for the species now and in the future, and serve as a baseline study for the species, further revealing information on the population density, troop size, nutrition, threats to its population, behavior and interaction with other animals.

2. METHODOLOGY

2.1 Study area.

The study was carried out in Lagwa community forest of Aboh-Mbaise Local Government Area in Imo State (Figure 1). The land area of Aboh-Mbaise is about 184 km², and lies between latitude 6°50'E and 7°25'E N and longitude 4°45'N and 7°15'N. Its annual rainfall is about

Comment [KL17]: This means there are 11 populations, all of the groups total 11? Confusing.

Comment [KL18]: This is out of place. This should be at the beginning where you first mention the species.

Comment [KL19]: You need to give the references for these authors.

Comment [KL20]: This is important and needs further explanation.

2,297mm. Aboh-Mbaise ~~have had~~ a population ~~according to the 2006 census~~ of 195,652 ~~according to the most-recent census (?reference 2006).~~

Lagwa is one of the twelve council wards and the largest traditional community in Aboh-Mbaise Local government area. ~~Others include Amuzu, Enyiogugu, Ibeku, Lorji, Mbutu,~~

~~Nguru Ahiato, Nguru Nweke, Nguru Nwankwo, Umuhu, Uvuru I, Uvuru II.~~ Comprising eight communities ~~such as of~~ Umunikwu, Umuabazu, Umunoke, Umunokere, Eziudo, Obo, Okwuato and Umuosi, ~~the community has people have been living here been in existence~~ since the 15th century alongside the monkeys. Lagwa and Aboh-Mbaise people are mostly farmers and traders ~~as well~~, cultivating and domesticating the popular non-timber forest product species called

Okazi (*Netum africana*). The popularity of this community in the world is due to the presence of the Sclater's guenon in the area (Lynne *et al.*, 2014).

Comment [KL21]: These should not be underlined or in blue.

Comment [KL22]: Are you saying this area is known world-wide due to the monkeys? That's important, and needs to be stressed in the introduction to this issue. Do tourists and biologists visit to see the monkey? If so, then this adds income to the local communities and adds to the need to protect the species.

Figure 1: Map of Aboh-Mbaise showing Council Wards (Source: Imo State Forestry Commission (Owerri))

2.2 Determination of the population status of the Sclater's guenon.

The point counts method of survey was used for this study. On arrival in each point, ~~five (5)~~ minutes was allowed for the animals to settle, while ~~ten (10)~~ minutes which is the minimum time required for less mobile and visible species was used to sample guenons in each points in each of the eight communities in the study area, with between five to ten minutes spent moving from one point to another. Sampling points were taken in each of the eight communities, with the distance

Comment [KL23]: How did you choose the locations of the points?

Comment [KL24]: We can read numbers without them being in alpha and numeric.

Comment [KL25]: This is very confusing. I have no idea what you mean here. Also, it's a run-on sentence.

between points and radius from the point of detection of the species measured (Bibby *et al.*, 2000).

The survey with each transect length of 2.5 km, and 160 m between points, was carried out twice every month for ~~eight~~ (8) months, ~~four~~ (4) months each (both dry and wet seasons) in each of the communities, and every ~~fourteen~~ (14) days per community, between 9.00 am and 4.00 pm and with the help of trained and experienced indigenes who were used as research assistants. The assistants were trained on how to use the GPS and binoculars, the census protocol and how to record data such as time, number of animals, number of groups sighted, behavioural characteristics such as feeding habits/signs, interaction with other wildlife species, and mating.

~~Both~~ Visual and sound observations encountered were recorded. The survey was avoided during rainy days, since raindrops in the forest creates unfavourable sound background for survey reducing the ability to observe animal movements, and potentially preventing the detection of the monkeys *C. sclateri*.

2.3. Determination of the habitat requirements of the Sclater's guenon.

The Point-Centred Quarter Method (PCQM) as described by Kevin (2007) was employed to determine the relative importance of the various tree species in a community. The importance value index was determined via density, size and frequency of the species. In each of the 2.5 km transects, ~~ten~~ (10) points were randomly selected, and data collected, with the smallest random number indicating the first sampling point. At every sampling point, an imaginary line was drawn perpendicular to the transect, dividing it into four equal quarters. In each of the quarters, the nearest tree to the point with diameter not below 4 cm; the species and the distance from the sampling point to the trunk of the tree was also recorded. The trees were identified with the help of a taxonomists to species and family levels in the study area.

Comment [KL26]: It sounds like you did point counts located every 160 m along a 2.5-km transect. Is that correct? If so, please state this.

Comment [KL27]: A space is required between numbers and what is being measured (e.g., 15 km).

Comment [KL28]: Here you need a hyphen because "2.5-km" serves as one idea modifying "transects."

Comment [KL29]: Do you mean a person (a taxonomist) was used, or that you used a taxonomic key to help identify species?

2.4. Data analysis techniques.

~~Data obtained from was subjected to the equation below, and was used to estimate d~~Density and abundance of the Sclater's monkey were estimated using the following formula:-

$$Dp = NLW / A \quad (1)$$

Where: Dp: population density; number of individuals N; transect length (km) L; transect width (m) W; transect area (km²) A; (Buckland *et al.*, 2001., Edet *et al.*, 2017, Daniel *et al.*, 2016, Jacob and Nelson, 2015).

Troop size was estimated with the ~~equation:-~~

$$ANS / Ni \quad (2)$$

Where: ~~ANS =~~ number of animals sighted and; ~~Ni =~~ number of observations Ni

The importance value index for the tree species enumerated were calculated using the ~~equations:-~~

$$\text{Relative density (RD)} = \text{density of a species} / \text{total density of all species} * 100 \quad (3)$$

$$\text{Relative frequency (RF)} = \text{frequency of a species} / \text{total frequency of all species} * 100 \quad (4)$$

$$\text{Relative dominance (RDO)} = \text{dominance of a species} / \text{total dominance of all species} * 100 \quad (5)$$

$$\text{Importance value index} = \text{RD} + \text{RF} + \text{RDO} \quad (6)$$

Comment [KL30]: You must use a colon (not a semi-colon) in such places.

The t-test statistical analysis was used to determine whether troop sizes and troop densities differed significantly between the dry and wet seasons, and also between the different locations.

3. RESULTS AND DISCUSSION

3.1 Seasonal population density/troop sizes of the Sclater's guenon

The study revealed a population size of 738 individuals, 346 in the wet season and 392 in the dry season. The troop sizes of the monkeys was 4.09 ± 0.83 for dry season, while observed population density was 0.04 ± 0.01 individuals/km² (Table 1).

The investigation of sclater's guenon population indicated a mean population size of 738 individuals, 392 individuals during the dry season, and 346 individuals during the wet season.

However the troop sizes for dry and wet seasons were 16 and 14 respectively. Though the total population of the guenons seemed high, they there was a low population density of the Sclater's monkey in the study area, which was at variance with its population

Comment [KL31]: I don't see why you add the two seasons together to make a total. If you into a building and count people on May 1, then count people on June 1, you don't add the two totals together. You need to explain this.

Comment [KL32]: You just stated that above.

Comment [KL33]: This sounds like you had only two troops. You mean they averaged 16 and 14? If so, then there should have at least one decimal point to the averages.

Comment [KL34]: Why did it seem high? This is very confusing.

Comment [KL35]: "variance" is a statistical term. You mean "differed from"?

Table 1: Dry season summary population data of Sclater's monkeys in the study area.

Location	Density (Troops/km ²)	
	Troop Size	
DT ₁	7.29	0.070
DT ₂	6.01	0.058
DT ₃	2.08	0.020

DT ₄	4.59	0.044
DT ₅	0.00	0.000
DT ₆	2.67	0.026
DT ₇	4.92	0.047
DT ₈	5.13	0.049
Mean± S.E	4.09 ± 0.83	0.039 ± 0.008

DT (Dry Season Transect),

The troop sizes of the monkeys for the wet season ~~was averaged~~ 3.68±0.75, ~~and their, with its~~ density ~~was~~ 0.035 ± 0.007 (Table 2).

This very low population density might be a result of evident habitat decimation, land encroachment, and emigration of the species to other areas. The high number of individuals in all communities where the study was undertaken correlates with work of Lynne *et al.*, (2014) that reported cases of killing the guenons had no negative impact on the population of the species. The high population size recorded in both seasons was also a result of the local taboo which prohibits from killing the monkeys. This population size also corroborates with Lynne and Olusegun (2007), that the guenons reproduce at early stages of their lives and survives in habitats that are fragmented. The low density recorded may also have been due to the fact that some monkeys may have migrated to other areas or were missed during the survey period.

Comment [KL36]: We readers have no idea whether this is a low density. You should give examples of "healthy" densities of primates from other areas.

Comment [KL37]: What? "No negative impact" from killing? Makes no sense. If that's what you think, then why did you list killing as a negative impact near the beginning of this manuscript?

Comment [KL38]: But you just said that killing them has no negative impact. So confusing.

Table 2: Wet season summary population data of Sclater's monkeys in the study area.

Location	Density (Troops/km ²)	
	Troop Size	
WT ₁	6.29	0.054
WT ₂	5.26	0.056
WT ₃	4.46	0.044
WT ₄	1.88	0.000
WT ₅	2.13	0.039
WT ₆	0.00	0.021
WT ₇	4.58	0.040
WT ₈	4.84	0.024
Mean± S. E	3.68 ± 0.75	0.035 ± 0.007

WT (Wet Season Transect)

Though there was no significant difference in troop size for both seasons, there was however, a difference in troop density as indicated in the t-test analysis (Table 3).

The troop sizes and density were higher in the dry season than in the wet season, and may be because there was less disturbance during the dry season than the wet season, as the monkeys were more visible during the dry season. Several individuals of these species were sighted in different locations during the study, against reports from different researchers that the Sclater's guenons are rare and at the brink of extinction. The relatively small size of the guenons compared to other monkeys made the monkeys visible from a distance in all transects surveyed.

Comment [KL39]: This whole section is very unorganized and confusing.

Comment [KL40]: I have no idea what you're trying to say here. Because a few individual monkeys were seen in various locations, they...what?

Comment [KL41]: Again, makes no sense. The small size of these monkeys would make them harder to see, not easier.

The monkeys are very intelligent, and can spot and run away from humans very quickly as reported by some hunters encountered (~~This agrees with the work of~~ Ijeomah *et al.*, (2011).

Primates generally are important for the conservation of other species of animals, as their

emotional, fascinating, and redolent nature makes them attractive to people (~~This agrees with the views of~~ Meijaard *et al.*, (2012). The health of guenon population is a reflection of the general health of an ecosystem, making it an indicator species (~~as highlighted by~~ Marshall *et al.*, (2009).

Comment [KL42]: You don't "connect the dots" as to why primates' good nature helps in the conservation of other species.

The classification of human beings as primates stimulates their conservation, providing opportunity for studying its behaviour and ecology (~~and in line with~~ Fleagle, (2013) ~~finding~~.

Comment [KL43]: Why?

The role of guenons in seed germination, dispersal and plant pollination cannot be over emphasized. These ecological functions are vital in the functioning of the ecosystems they are found.

Comment [KL44]: Please never say anything "cannot be overemphasized." If I stated anything 50 times, it would be overemphasized.

Table 3: T-test analysis (at $P = .05$) for troop size and troop density.

	Troop density			
	Troop size		Dry Season	Wet Season
	Dry Season	Wet Season	Dry Season	Wet Season
T ₁	7.29	6.29	0.070	0.054
T ₂	6.01	5.26	0.058	0.056
	2.08			

T ₃		4.46	0.020	0.044
	4.59			
T ₄		1.88	0.044	0.000
	0.00			
T ₅		2.13	0.000	0.039
	2.67			
T ₆		0.00	0.026	0.021
	4.92			
T ₇		4.58	0.047	0.040
	5.13		0.049	
T ₈		4.84		0.024
<i>T-cal.</i>	0.607		0.97	
			.36	
<i>P-value</i>	.56			

T (Transect)

3.2 Habitat requirements/species distribution of the [Sclater's guenon](#)

~~The most common habitat of the species was secondary forest, sacred groves and a combination of economic trees. The monkeys were also sparingly found within dense and open primary forests (Table 4).~~

The study revealed that the sSclater's monkeys were restricted mostly to secondary forest, sacred groves and economic trees (Table 4). This was largely so because most, if not all, of the primary forest is lost to land development, agricultural and livestock farming. This assertion is in line with Lynne *et al*, (2009), that habitat decimation has greatly impacted the sSclater's monkeys negatively (~~This assertion agrees with that of~~ Effiom *et al.*, (2013). Small numbers of the monkey ~~were however,~~ occasionally were sighted in the remaining fragmented portions within dense and open primary forest. ~~However, the species were not indicative of those in the secondary forest, sacred groves and economic trees.~~ This habitat loss may be responsible for the shrinking density of the Ssclater's monkeys.

Table 4: Distribution of tree plant species and in their habitats in the study area.

Family	Species	DPF	OPF	SF	VT	HP	SH	SG	ET
Anacardiaceae	<i>Magnifera indica</i>	-	+	+	-	-	-	-	+
Arecaceae	<i>Elaeis guinensis</i>	-	+	+	-	-	-	-	+
Burseraceae	<i>Dacryodes edulis</i>	+	+	+	-	-	-	+	+
Combretaceae	<i>Terminalia ivorensis</i>	+	+	-	-	-	-	-	-
	<i>T. superba</i>	+	-	+	-	-	-	+	-
Fabaceae	<i>Afzelia africana</i>	+	+	+	-	-	-	+	-
	<i>Brachystegia eurycoma</i>	-	-	+	-	-	-	+	+
	<i>Parkia biglobosa</i>	-	-	+	-	-	-	-	+
	<i>Tetrapleura tetraptera</i>	-	+	+	-	-	-	+	-
Irvingiaceae	<i>Irvingia gabonensis</i>	-	-	-	-	-	-	-	+
	<i>I. wombulu</i>	-	-	+	-	-	-	-	-
Lamiaceae	<i>Gmelina arborea</i>	-	+	+	-	-	-	-	+
	<i>Tectona grandis</i>	-	+	+	-	-	-	+	+
Lecythidaceae	<i>Napoleona vogelli</i>	-	-	-	-	+	-	-	-
Leguminosae	<i>Pterocarcus mildbradii</i>	-	-	-	-	-	+	-	-

		<i>P. osun</i>	-	-	-	-	-	+	-	-
<i>Malvaceae</i>	<i>Bombax buonopozense</i>	-	-	+	+	-	+	-	-	
	<i>Bosqueia angolensis</i>	-	+	-	-	-	-	-	-	
	<i>Tripochiton scleroxylon</i>	-	-	+	+	-	+	-	+	
<i>Meliaceae</i>	<i>Khaya ivorensis</i>	-	+	-	+	+	+	-	+	
<i>Moraceae</i>	<i>Melicia excelsa</i>	-	+	-	-	+	-	-	-	
	<i>Treculia africana</i>	-	+	-	+	-	+	-	+	
<i>Myristicaceae</i>	<i>Pycnathus angolensis</i>	-	+	-	-	+	-	-	-	
<i>Poligalaceae</i>	<i>Carpolobia lutea</i>	-	-	-	-	-	-	+	-	
<i>Rubiaceae</i>	<i>Heinsa crinata</i>				-	+	-	-	+	-
	<i>Nauclea diderrichi</i>				-	+	-	+	-	+
	<i>Randia longiflora</i>				-	+	-	-	+	-
<i>Rutaceae</i>	<i>Citrus sinensis</i>				-	+	-	+	-	-
<i>Sterculiaceae</i>	<i>C. gigantean</i>				-	+	+	-	-	+
	<i>C. nitida</i>				-	+	+	-	-	+
	<i>Sterculia oblonga</i>				-	-	+	-	-	-
	<i>Sterculia tragacantha</i>				-	-	+	-	-	-
<i>Urticaceae</i>	<i>Musanga cercopoides</i>				-	+	-	-	+	-
	<i>Myrianthus arboreus</i>				-	-	-	-	+	-

- Not Available, + Available; **DPF** Dense Primary Forest, **OPF** Open Primary Forest, **SF** Secondary Forest, **VT** Vine Tangle, **HP** Herb Patch, **SH** Shrubs, **SG** Sacred Groves, **ET** Economic Trees. Source: Field Survey 2019-2021

The most dominant plant species throughout the study area were *Khaya ivorensis*, *Treculia africana*, *Nauclea diderrichi*, *Gmelina arborea*, *Magnifera indica* and *Tectona grandis*, while the least dominant plant species was *Bosqueia angolensis* (Table 5).

The domination of the habitats by a few indigenous tree species like **Khaya ivorensis*, *Treculia africana*, *Nauclea diderrichi*, and more of *Gmelina arborea*, *Tectona grandis* and *Magnifera indica* is an indication that the habitat is highly degraded, and have become more or less a plantation, with a conglomeration of exotic tree species within the animal's range. This forced the animals most of the time, especially during the dry season, to take refuge in sacred shrines, mango, oil palm and kolanut trees. Apart from a few indigenous tree species, the monkeys spent much of its time resting, playing and feeding around mango, orange, oil palm, gmelina and teak, as indicated by the importance value index (IVI)

Comment [KL45]: You mix use of common names and scientific names. I am unfamiliar with all of the scientific names of the trees; maybe you should include common names as well.

Table 5: Trees/plant species composition in the study area.

Species	Frequency	No. of trees/ha	Rel. Density %	Relative Dominance %	Rel. freq. %	IVI	
<i>Afzelia africana</i>	11	84	3.3416	3.9069	3.6184	10.8669	
<i>Bombax buonopozense</i>	5	38	1.4413	1.0799	1.6447	4.1659	
<i>Bosqueia angolensis</i>	1	8	0.5437	0.1134	0.3289	0.986	
<i>Brachystegia eurycoma</i>	9	68	2.7781	4.5993	2.9605	10.3379	
<i>Carpolobia lutea</i>	1	8	0.5437	0.1278	0.3289	1.0004	
<i>Citrus sinensis</i>	7	53	2.4215	1.786	2.3026	6.5101	
<i>Cola gigantean</i>	8		61	2.6514	6.0015	2.6316	11.2845
<i>Cola nitida</i>	11		84	3.3416	7.3744	3.6184	14.3344
<i>Dacryodes edulis</i>	12		91	3.8341	2.4987	3.9474	10.2802
<i>Elaeis guinensis</i>	13		99	3.9672	1.7665	4.2763	10.01
<i>Gmelina arborea</i>	27		205	7.4402	6.7615	8.8816	23.0833*

<i>Heinsa crinata</i>	3	23	0.7673	0.7522	0.9868	2.5063
<i>Irvingia gabonensis</i>	3	23	0.7673	1.0892	0.9868	2.8433
<i>Irvingia wombulu</i>	1	8	0.5437	0.3239	0.3289	1.1965
<i>khaya ivorensis</i>	39	296	9.7231	12.5765	12.8289	35.1285**
<i>Magnifera indica</i>	24	182	7.5642	6.1051	7.8947	21.564*
<i>Milicia excelsa</i>	3	23	0.7673	3.545	0.9868	5.2991
<i>Musanga cercopoides</i>	5	38	1.4413	0.8116	1.6447	3.8976
<i>Myrianthus arboreus</i>	2	15	0.2647	1.1418	0.6579	2.0644
<i>Napoleona vogelli</i>	1	8	0.5437	0.0441	0.3289	0.9167
<i>Nauclea diderrichi</i>	26	198	7.3764	8.8261	8.5526	24.7551*
<i>Parkia biglobosa</i>	2	15	0.6579	0.4163	0.6579	1.7321
<i>Pterocarpus mildbraedii</i>	1	8	0.5437	0.1978	0.3289	1.0704
<i>Pterocarpus osun</i>	1	8	0.5437	0.2447	0.3289	1.1173
<i>Pycnathus angolensis</i>	3	23	0.7673	1.573	0.9868	3.3271
<i>Randia longiflora</i>	4	30	1.3158	1.3659	1.3158	3.9975
<i>Sterculia oblonga</i>	1	8	0.5437	0.2305	0.3289	1.1031
<i>Sterculia tragacantha</i>	2	15	0.2647	0.8877	0.6579	1.8103
<i>Tectona grandis</i>	24	182	7.5642	3.8492	7.8947	19.3081*
<i>Terminalia ivorensis</i>	12	91	2.7641	3.3687	3.9474	10.0802
<i>Terminalia superba</i>	3	23	0.7673	1.1982	0.9868	2.9523
<i>Treculia africana</i>	26	198	7.3764	10.8005	8.5526	26.7295**

<i>Tripochiton scleroxylon</i>	10	76	3.7363	3.2499	3.2895	10.2757
<i>Tetrapleura tetraptera</i>	3	23	0.7673	1.3864	0.9868	3.1405
	304	2310.4	99.7516	100.0002	99.9992	299.7510

Source: Field Survey 2019-2021

The family *Fabaceae* was higher in species richness, followed by *Sterculaceae*, *Malvaceae*, and *Rubiaceae* (Figure 2).

Figure 2: Trees species families in the study area.

~~The majority of the tree species were within the dbh class of between 21cm and 30cm (Table 6).~~

Major tree species had diameter at breast height (dbh) between 21 and 30 cm, an indication of a highly degraded habitat, with sparsely distributed tree species. Though the habitat was dominated by *Tectona grandis* and *Gmelina arborea*, mahogany, kolanut, obeche, opepe, silk cotton and bush apple were richer in diversity. This implies that indigenous tree species still enjoy some form of conservation in the form of sacred groves and shrines. The Sclater's guenons are a diverse group of organisms with ecological and behavioural variability. They inhabit a variety of habitats and consume different variety of diets, and understanding the diversity of this biological community becomes therefore imperative.

Table 6: Diameter at breast Height (DBH) Class distribution of trees in the study area.

Location	% DBH Class (cm)				Total
	10 ≥ 20	21 ≥ 30	31 ≥ 40	41 & above	
1	12.50	25.00	37.50	25.00	100
2	20.00	45.00	22.50	12.50	100
3	20.00	35.00	37.50	7.50	100
4	15.00	70.00	15.00	0.00	100
5	15.00	62.50	22.50	0.00	100
6	20.00	45.00	35.00	0.00	100
7	10.00	45.00	12.50	32.50	100
8	32.50	32.50	12.50	22.50	100
Total	18.13	45.00	24.38	12.50	100

Source: Field Survey 2019-2021

An increase in cases of conflict between humans and wildlife are a result of expansion into the natural habitats of the animals. This results in the destruction of the natural food sources of the guenons, and replaced with those planted by humans. According to a research by Shek and Cheng (2010). The feeding of monkeys on these anthropogenic crops is the reason for why the monkeys are usually regarded as pests.

Comment [KL46]: This sentence is a fragment. I don't know what this refers to.

4. CONCLUSION

The conservation and management of wild animal species population is better achieved through monitoring programs such as changes in population of wild animals, habitats, food availability and anthropogenic activities. In most cases, individual population may increase but available habitat may not be able to cater for the needs of such individuals. The range of these animals have shrunk due to habitat fragmentation, causing the animals to now compete with humans within the surrounding communities for survival. This portends danger for the animals as no one can predict what the future holds for the animals. If the only protection the animals enjoy is that

of a taboo which forbids its killing, then with increasing land development and expansion of agricultural fields, continuous raiding of farms, gardens and homes by the monkeys, which may result in more conflicts, this unconscious form of conservation may not be sustainable in the long run. These conflicts are threats to the remaining very fragile population and habitats, and extinction of the animal may be imminent. Resistance against the conservation of the species by the host communities may spell doom for the animal, further aggravating the conflict which may cause severe alteration to the habitat, and forcing the animals to migrate to other areas.

Concerted efforts ~~is~~are therefore needed by all concerned to ensure that the animal's populations and habitats are not negatively impacted. ~~Therey~~ should be conscious efforts geared towards restoration of the ~~s~~Sclater's monkey's habitat, through regeneration programs such as indigenous tree planting and regulated felling. The guenons should be considered as species of urgent public attention, necessitating the establishing of a wildlife sanctuary in the area ~~so as~~ to ensure the complete protection of the species.

References

1. Baker, L., Z. Tooze. Status of the Sclater's Guenon (*Cercopithecus sclateri*) in southeastern Nigeria. *American Journal of Primatology*. 2003; **60**(1): 88-89.
2. Bibby, C.J., Burgess, N.D., Hill, D.A., and Mustoe, S.H. *Bird Census Techniques*. 2000; 2nd ed. Academic Press, London.
3. Buckland S.T., Anderson D.R., Burnham K.P., Laake J.L., Burchers D.L., and Thomas L. *Introduction to Distance Sampling: Estimating Abundance of Biological Populations*, New York: 2001; Oxford University Press, pp.126
4. Daniel Ibiang Edet., Samuel Sunday Odunlami., Ovat Innocent Ovat. Preliminary Studies on Population Status of Mona Monkey (*Cercopithecus Mona*) in Afi Mountain Wildlife Sanctuary, Cross River State, Southern Nigeria. *Agriculture, Forestry and Fisheries*. 2016; **5**(4): 108-114.

5. Edet, D.I., Akinyemi, A.F. and Mbagwu, C. I. Evaluation of Human-Monkey Conflict in Lagwa villages of Aboh-Mbaise Local Government Area, Imo State, Nigeria. *Nigerian Journal of Forestry*. 2017; **46** (1) 13- 20.
6. Effiom, E. O., Nuñez-Iturri, G., Smith, H. G., Ottosson, U., and Olsson, O. Bushmeat hunting changes regeneration of African rainforests. *Proceedings of the Royal Society B: Biological Sciences*. 2013; 280: DOI: 10.1098/ rspb.2013.0246.
7. Fleagle, J. (1999). *Primate adaptation and evolution*. New York: Academic Press.
8. Fleagle, J. G. *Primate Adaptation and Evolution*, 3rd edn. San Diego, CA and London: 2013; Academic Press
9. Ijeomah, H. M., Eniang, E. A and Ikiba, B. A. Impact of the indigenous conservation of sclater's guenon (*cercopithecus sclateri*, pocock) in lagwa community, Nigeria. *Journal of Agriculture, Forestry and the Social Sciences*. 2011; 9(2): 32-38.
10. International Union for the Conservation of Nature. The I.U.C.N Red List of Threatened Species. Version 2019-1. Available at <https://www.iucnredlist.org> (assessed 20th June, 2019).
11. Jacob D.E., I.U. Nelson. A Survey of Sclater's Guenon in Ikot Uso Akpan Community Forest, Itu, Nigeria. *International Journal of Mol. Ecol. and Conservation*. 2015; **5**(2): 1-6.
12. Kevin Mitchell. *Quantitative Analysis by the Point-Centered Quarter Method*. Department of Mathematics and Computer Science Hobart and William Smith Colleges. 2007; Geneva, NY 14456 mitchell@hws.edu.
13. Lynne R. Baker, Adebowale A. Tanimola, Oluseun S. Olubode, and David L. Garshelis. Distribution and abundance of sacred monkeys in Igboland, Southern Nigeria. *American Journal of Primatology*. 2009; **71**:574–586
14. Lynne, R. Baker., Adebowale, A. Tanimola., and Oluseun, S. Olubode. Sacred Populations of *Cercopithecus sclateri*: Analysis of Apparent Population Increases from Census Counts. *American Journal of Primatology*. 2014; **76**:303–312
14. Lynne R. Baker and Oluseun S. Olubode. Correlates with the distribution and abundance of endangered Sclater's monkeys (*Cercopithecus sclateri*) in southern Nigeria. *African. Journal of Ecology*. 2007; **46**:365–373
15. Marshall, A. J., Lacy, R., Ancrenaz, M., Byers, O., Husson, S., Leighton, M., et al. Orangutan population biology, life history, and conservation: perspectives from PVA models. In: Wich, S. A., Utami, S., Mitra Setia T., and van Schaik C. P. (Eds), *Orangutans: Geographic Variation in Behavioral Ecology and Conservation*. 2009; 311– 326. Oxford: Oxford University Press

16. Meijaard, E., Wich, S. A., Ancrenaz, M., and Marshall, A.J. Not by science alone: why orangutan conservationists must think outside the box. *Annals of the New York Academy of Sciences*. 2012; 1249: 29–44.
17. Oates, J. F.; Baker, L. R. & Tooze, Z. J. "[Cercopithecus sclateri](#)". [The IUCN Red List of Threatened Species](#). IUCN. 2008.
18. Nowak, R. Walker's Mammals of the World, *Sixth Edition*. Baltimore and London: The Johns Hopkins University Press, 1999.
19. Scholte, P. Towards understanding large mammal population declines in Africa's protected areas: A west-central African perspective. *Tropical Conservation Science*. 2011 ; **1**: 1–11.
20. Shek C.T, Cheng W.W. Population survey and contraceptive neutering programme of macaques in Hong Kong. *Hong Kong Biodiversity*. 2010; 19: 4–7
21. Stewart, C. Africa's Vanishing Wildlife. Washington, D.C.: Smithsonian Institution Press, 1996.

APPENDIX

Appendix 1: Global Positioning System Transects Coordinates in the study area

Transect	Coordinates
1	5.412691 ⁰ N, 6.514272 ⁰ E
2	5.731462 ⁰ N, 4.751621 ⁰ E
3	5.625171 ⁰ N, 6.461320 ⁰ E
4	5.491721 ⁰ N, 6.772130 ⁰ E
5	5.561413 ⁰ N, 4.756135 ⁰ E
6	5.596141 ⁰ N, 7.415260 ⁰ E
7	5.643121 ⁰ N, 7.315612 ⁰ E
8	5.714213 ⁰ N, 5.168174 ⁰ E

Appendix 2: Other wildlife species observed in the study area

Family	Species	Frequency	%	Rem.
Ardeidae	Grey Heron	5	1.4	DS
	Plantain Eater	12	3.3	DS

Laughing Dove	63	10.1	WS
Common Bulbul	37	10.1	WS
Senegal Coucal	18	4.9	DS
Cattle Egret	42	11.5	DS
Pied Crow	26	7.1	DS
Grey Headed Sparrow	29	7.9	WS
Little Egret	48	13.2	DS
Village Weaver	67	18.4	WS
Black Kite	6	1.6	DS
Red Bishop	3	0.8	DS
Fire-Crown Bishop	7	1.9	DS
Yellow-Mantled Whydal	2	0.5	DS
Total	14	365	92.9

DS (Dry Season), WS (Wet Season)