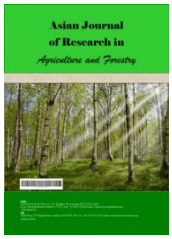

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Assessment of Conflict between Humans and the Sclater's Guenon (*Cercopithecus sclateri* Pocock 1904) in relation to Plant Species Utilization in Aboh-Mbaise Communal Forest, Imo State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author OIO designed the study, wrote the protocol, performed the statistical analysis, and also wrote the first draft of the manuscript and managed literature searches. Author s BTT, TJO and Author POE Proofread and made corrections to the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Assessment of conflict between humans and sclater's guenon in relation to plant species utilization was carried out to determine the conflict between humans and monkey, and identify the plant species parts utilized by the monkeys in area.
Place and Duration of Study: The study was conducted in Lagwa community forest, Aboh-Mbaise Local Government Area, Imo State, between December 2019 and November 2021.
Study Design: The Point transect and visual observation methods were used to collect data on population and food availability.
Methodology: The research was conducted during the dry and wet seasons. Questionnaire were used to collect information on conflict between humans and guenons, while visual observation and faecal examination were used to identify plant species and part utilized.
Results: Habitat loss, raiding of farms, destruction of roof tops, and food scarcity were the causes of conflicts between monkeys and humans, while awareness creation and establishment of wildlife

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sanctuary were ways of reducing conflicts between monkeys and humans. Twenty six plant species were utilized by the monkeys for cover. Pear (21%), oil palm (16%), and mango (13%) were the most utilized during the dry season, while *Pterocarpus erinaceous* (15%), *Dacryodes edulis* and *Treculia africana* (11%) were utilized mostly during the wet season. The monkeys consumed more seeds (63%), less fruits (25%), and leaves (13%) during the wet season, and fruits (71%), leaves and seeds (14%) during the dry season.

Conclusion: The findings of this research is a guide to understanding the conflict that exist between humans and the sclater's guenon, as well as communicate the type of plants and parts consumed by the animals. Awareness creation on the need to regenerate the remaining fragmented habitat and establishment of a rehabilitation centre for the animals can be a conflict reduction measure, and can provide alternative food sources for the animals.

Keywords: Conflict; feed; preference; seasons; Sclater's monkeys.

1. INTRODUCTION

The Sclater's guenon (*Cercopithecus sclateri*) is an endangered primate that is endemic to Nigeria, classified as endangered by the International Union for the Conservation of Nature [1] and listed on Appendix of the Convention on International Trade in Endangered Species (CITES), the species was originally thought to be nearly extinct until the late 1980s. The Sclater's guenon is restricted to the rainforest zone between the Niger and Cross Rivers in southern Nigeria. Its extent of occurrence is 28,500km^2 [2]. 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 and strips of forest along waterways.

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 an extremely small range, high human population in parts of Nigeria where this species are found, habitat fragmentation and loss and hunting. This species is endemic to the forests in the floodplain between the Niger River and the Cross River in Southeast Nigeria [3] 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.

The Sclater's guenon is sacred to the Abo-Mbaise people and this has kept it safe and allowed it to live freely among the rural people [4] until the destruction of human property and agricultural produce became more intensified giving rise to conflicts. The conflicts generated between the local people and the monkeys are of great concern to conservationists. Adequate research has not been conducted in this regard and as such, there is no systematic record or centralized database for such conflicts. Thus, only a few verified cases for studying exactly what is taking place in these interactions and to what extent the conflicts overlap. The study therefore evaluates the human-guenon conflicts in relation to agricultural and domestic damages, as well as other forms of conflict in the area of study [5] Hence, the necessity to study and document such interactions or overlaps between humans and guenons in the study area, for the purpose of adopting measures for the conservation of the Sclater's guenon in the area of study.

2. METHODOLOGY

2.1 Study Area

The study was carried out in Lagwa community forest of Aboh-Mbaise Local Government Area in Imo State. The land area of Aboh-Mbaise is about 184km^2, 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 2,297mm. Aboh-Mbaise have a population according to the 2006 census of 195,652.

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 Umunikwu, Umuabazu, Umunoke, Umunokere, Eziudo, Obo, Okwuato and Umuosi, the community has 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 [6].

2.2 Sample Population of the Study

The total household size (400) for the different communities according to the 2006 census was used to determine the sample frame. Fifty percent (50%) of the household size was then taken to determine the sample size. The household sizes are Umunokwu (50), Umuabazu (44), Umunoke (46), Umunokere (58), Eziudo (38), Obo (62), Okwuato (42) and Umuosi (60). The sample sizes for the communities were Umunokwu (25), Umuabazu (22), Umunoke (23), Umunokere (29), Eziudo (19), Obo (31), Okwuato (21) and Umuosi (30). The sample size for the study was therefore Two hundred (200) respondents (Table 1).

2.2.1 Determination of the human-guenon conflict in the study area

Two hundred (200) copies of structured questionnaire) each were randomly distributed to selected households in all the eight (8) villages that make up Lagwa council ward. The communities include Umunokwu, Umuosi, Eziudo, Obo, Umunoke, Umuokere, Umuabazu and Okwuato. Personal interviews with village heads were also conducted to obtain information on Human – guenon conflict. The questionnaire was designed using Likert style rating scale based on the objective of the study and distributed to respondent in study area [7] The questionnaire was divided into three sections; section A which addressed the social and demographic attributes of respondents, section B addressed human-guenon conflict in the area, while Section C addressed how to reduce the conflict between humans and guenons in the area.

2.2.2 Identification of the Plant species parts utilized by the Sclater's guenon

To identify the plant species parts utilized by the guenons in the study area, plant species together with fresh faecal samples were collected from different locations where the species were sighted [8] The eight (8) faecal samples, each collected from each of the communities were then placed on slides and examined under a microscope, with the assistance of an experienced laboratory technician, in the Microbiology Laboratory of the Department Microbiology, Cross River University of Technology, Calabar. This was done in order to make comparison with the remnant in the faecal samples and the plant species collected.

2.3 Data Analysis Techniques

Figures were assigned to the Likert scale rating option (Strongly Agree – 4, Agree – 3, Disagree – 2, and Strongly Disagree – 1). Thus, the average score of the respondent on the items of the instrument yields a mean of 2.5. The cut-off point between acceptable (Agree) and unacceptable (Disagree) response for each questionnaire item, using the 2.5 mean and assigned to the options.

For the level of acceptance to be established, the questionnaire items having a score of 2.5 and above are regarded as agree. Any item having a mean score below 2.5 is regarded as disagree. In analyzing each questionnaire item, the sample mean was obtained by multiplying the frequency of each respondent pattern by its respective nominal value. The sum of the value calculated was divided by the number of respondents that responded to the items. The mean score for each group of an item in the questionnaire was arrived at by using the above formula and calculation. Data on feed materials consumed was presented using frequency tables and charts.

3. RESULTS AND DISCUSSION

3.1 Human-Guenon Conflict in the Study Area

The male respondents formed 54% of the pool, while the female respondents were 46%. Majority of the respondents fell within the age bracket of 25 years and above. About 61% of the respondents were married while 39% were single. About 61% of the respondents were into one trade or the other, while about 49% of them have had their secondary education (Table 2). More than 95% of the respondents agreed that there was conflict between humans and the monkeys, occasioned by habitat loss and food scarcity. The monkeys were also reported to be destroying crops, livestock, buildings and occasionally attach humans. The respondents however agreed that controlling the monkey's population was a sure way of reducing the conflict but disagreed that poisoning and shooting the animals was not an option to consider in controlling the animals (Table 3). They agreed in totality that payment of

compensation, provision of extension services and establishment of conservation areas in the communities can help reduce human – monkey conflict.

Table 1. Proportionate questionnaire allocation within communities in the Study Area

Communities	Sample Frame (No. of Household)	Sample Size (50% of Households)
Umunokwu	50	25
Umuabazu	44	22
Umunoke	46	23
Umunokere	58	29
Eziudo	38	19
Obo	62	31
Okwuato	42	21
Umuosi	60	30
Total 8	**400**	**200**

Source: Field Survey (2019-2021)

Table 2. Respondents demography in the study area

Parameters	Frequency	Percentage (%)
Sex		
Male	108	54
Female	92	46
Religion		100
Christianity	167	83.5
Traditional	33	16.5
Islam	0	0
Age		100
15-19	0	0
20-24	13	6.5
25-29	49	24.5
30-34	29	14.5
35-39	43	21.5
40-45	37	18.5
46 & Above	29	14.5
Marital Status		100
Single	79	39.5
Married	121	60.5
Divorced	0	0
Household Size		100
1 to 4	114	57
5 to 8	80	40
9 to 12	6	3
Occupation		100
Civil Servant	16	8
Artisan	40	20
Farming	23	11.5
Trading	121	60.5
Educational Qualification		100
Primary	40	20
Secondary	97	48.5
Tertiary	38	19
No Formal Education	25	12.5
		100

Sourcce: Field Survey, 2019 - 2021

Table 3. Rating of Sclater's guenon impact on communities from 2019 to 2021 field survey in study area

Parameter	SA	A	D	SD	Mean	Remark
Are monkeys present in your community?	103	94	3	0	4.4	Agree
Have the monkeys lived in your community for 25 years?	84	116	0	0	4.3	Agree
Have the monkeys lived in your community for 50 years?	66	118	16	0	4.1	Agree
Have the monkeys lived in your area for over 100 years?	94	101	7	0	4.3	Agree
Is there any clash between humans and the monkeys?	79	113	8	0	4.2	Agree
Is habitat loss the reason for the clash?	101	99	0	0	4.4	Agree
Is food scarcity the reason for the clash?	65	134	1	0	4.2	Agree
Is habitat loss and food scarcity the reason for the clash?	104	83	13	0	4.3	Agree
Do the monkeys destroy crops and livestock?	81	107	12	0	4.2	Agree
Do the monkeys destroy economic trees?	93	107	0	0	4.3	Agree
Do the monkeys destroy buildings?	66	126	8	0	4.1	Agree
Do the monkeys attack humans?	108	79	13	0	4.3	Agree
Do the monkeys destroy crops in the farm?	75	125	0	0	4.2	Agree
Do the monkeys destroy crops and livestock at home?	82	128	8	2	4.6	Agree
Are adults the group that cause the most damage?	80	126	3	1	4.4	Agree
Are Juveniles the group that cause the most damage	96	101	3	0	4.3	Agree
Are adults and juveniles the groups that cause the most damage?	63	137	0	0	4.1	Agree
Do you lessen the conflict by scaring the monkeys away?	106	92	1	1	4.4	Agree
Do you lessen the conflict by shooting and trapping the monkeys?	21	16	103	60	2.1	Disagree
Do you lessen the conflict by poisoning the monkeys?	24	18	106	62	2.3	Disagree
Will controlling the population reduce human-monkey conflict?	92	93	6	9	4.1	Agree
Will compensation of affected individuals reduce human-monkey conflict?	76	120	4	0	4.2	Agree
Will provision extension services reduce human-monkey conflict?	88	110	1	1	4.3	Agree
Will establishment of conservation area in the community reduce human-monkey conflict?	69	93	12	6	3.6	Agree

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. An increase in cases of conflict between humans and wildlife are a result of expansion into the natural habitats of the animals [8]. This results in the destruction of the natural food sources of the guenons, and substituted with those cultivated 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 [9].

The research revealed that both negative and positive impacts exist between the monkeys and humans. These conflicts which were evidence of habitat destruction and food unavailability was manifested in the destruction of agricultural crops, roof tops, invasion of farms and destruction of economic trees supposedly meant for local consumption and sale [10]. Fish farms were also invaded by the monkeys and fingerlings taken away, as well as eating food items from the fire in the absence of the owners. The economic trees destroyed by the guenons were *Magnifera indica*, *Dacryodes edulis*, *Persea americana*, *Psidium guajava,* as well as food crops like *Musa spp* and *Dioscorea spp.* Both juvenile and adult groups were responsible for the damages on crops, trees and roof tops as indicated by more than 80% of the respondents. Regardless of all these damages caused by the guenons, the decent story is that the guenons still remain companions to the inhabitants of the area [11]. Unfortunately, the locals are helpless as the only action taken is to scare the monkeys away. Shooting, trapping and poisoning the monkeys were not at all conflict resolution measures as indicated by more than 90% of the respondents. Killing the guenons in the area is a taboo, the only reason the monkeys are still enjoying protection and living together in the area for hundreds of years. Though the sclater's guenons are considered important species, and needs urgent attention, they cause untold hardship to the local people who have lost valuables to the destructive nature of the monkeys. They were reports that the local people contracted people from neighbouring communities to kill the monkeys, a case of compromise, which calls to question the extent, severity and implications of the taboo protecting the monkeys. This calls to question the protection of these species by the existing local taboo, because one cannot say for sure how long their patience of bearing this untold hardship will last [12]. This concern was further expressed by Cynthia *et al*., 2020. The habitat of the monkeys is still being destroyed, which may have resulted to the low population density recorded during the survey. Massive sensitization of the local people on the need to conserve the monkeys should be embarked upon, albeit resistance in the past from NGOs and other stakeholders. Concrete steps should be taken to assure the indigenes of the benefits of establishing a wildlife sanctuary, as highlighted by Ijeomah *et al*., 2011. This will help restore the animal's population and some part of its habitat [13]. The indigenes should be made to understand that the establishment of a sanctuary may reduce if not eliminate the damage on crops, economic trees and roof tops by the monkeys, while at the same time creating employment opportunities for them, improve their environment, and boast their local economy through tourist attraction [14]. In attempting to resolve the conflict therefore, modifications of the habits and traditional institutions of the local people should be very effective, as management approaches should include food availability and habitat rehabilitation as agreed by Wolfgang *et al*., 2019.

3.2 Utilized Plant Species/Parts by the Guenons in the Study Area

The plant species that were mostly utilized during the dry season were *Dacryodes edulis*, *Elaeis guineensis*, *Magnifera indica* and *Musa balbisiana*. In the wet season, *Pterocarpus erinaceous*, *Dacryodes edulis*, and *Treculia africana* were the most utilized (Table 4). The plant parts that were utilized in both seasons were fruits, leaves and seeds (Table 5). The guenons utilized more of seeds during the wet season (Fig. 1a), and more of fruits during the dry season (Fig. 1b).

The sclater's guenons are generally frugivores, but leaves, insects and flowers have been found to be components of its diet. This omnivorous nature may be due to their cohabitation with humans in villages and communities where the forest cover has been seriously degraded. This agrees with the work of [15]. This may also be so as the species raided farms and home gardens for roots, tubers, grains, seeds, nuts and nectar. These destructive behaviour is the reasons the species is regarded as crop pests and nuisance. Besides these, the sclater's monkeys play important roles in the functioning of ecosystems, seed dispersal, and have the potential for tourism

development. Twenty six (26) plant species were identified to be utilized by the monkeys for cover and food, with local pear, oil palm, mango and banana being the most utilized during the dry season. *Pterocarpus erinaceous*, *Dacryodes edulis* and *Treculia africana* were mostly utilized during the wet season. The monkeys consumed more of seeds compared to fruits, and leaves during the wet season. During the dry season the monkeys consumed more of fruits compared to leaves and seeds. This feeding characteristics is typical of monkeys, and the sclater's monkeys are no exception. The monkey's feeding selectivity may be due to food availability in relation to seasons and habitat types.

The monkeys consumed mostly pawpaw fruits and leaves, local pear, avogado pear, banana, oranges, African star apples, as well as oil pail fruits. Others were guava, plantain, maize, bush mango and *Gnentum africana*. The food items were detected in location where the monkeys were sighted, and further confirmed by their faecal samples which were collected and examined visually under a light microscope.

The faecal examination of the samples revealed the presence of some particles of different sizes of parts of the plant species consumed. This was a confirmation that the monkeys actually fed on the identified food materials. Dietary examination is therefore necessary if management decisions are to be taken [16]. Most of the feeding by the monkeys was noticed in areas close to human habitation and where economic trees dominated. The longevity of guenons is largely dependent on the flexibility of its diet, which are a result of the phonological changes in their habitats [17]. Dietary requirement and choices are influenced by habitat size, habitat health, and rainfall. Prevailing environmental changes can results in dietary shifts and flexibility which increases the chances of survival of the animals.

Table 4. Seasonal utilized plant species for cover and food by the Sclater's guenon in the study area

Family	Species	Dry	Freq.	%	Wet	Freq.	%
Anacardiaceae	*Magnifera indica*	+	13	12.75	+	8	6.84
Arecaceae	*Elaeis guineensis*	+	16	15.69	+	9	7.69
Burseraceae	*Dacryodes edulis*	-	21	20.59	+	13	11.11
Bromeliaceae	*Ananas comosus*	+	3	2.94	-	-	0.00
Caricaceae	*Carica papaya*	+	7	6.86	+	11	9.40
Combretaceae	*Terminalia catappa*	+	-	0.00	-	-	0.00
Fabaceae	*Afzelia Africana*	-	2	1.96	+	-	0.00
	Arachis hypogea	-	6	5.88	+	-	0.00
	Pentracletra mycrophylla	-	-	0.00	+	-	0.00
	Pterocarpus erinaceous	+	3	2.94	-	17	14.53
	Pterocarpus mildbradii	+	1	0.98	-	-	0.00
	Tetrapleura tetraptera	-	1	0.98	+	8	6.84
Gnetaceae	*Gnetum african*	+	4	3.92	+	5	4.27
Irvingiaceae	*Irvingea wombulu*	+	1	0.98	-	-	0.00
Lauraceae	*Persea americana*	+	-	0.00	-	-	0.00
Leguminosae	*Brachyztegia eurycoma*	+	-	0.00	-	-	0.00
Malvaceae	*Bombax buonopozense*	+	-	0.00	-	9	7.69
Moraceae	*Treculia africana*	-	1	0.98	+	13	11.11
Musaceae	*Musa acuminate*	+	5	4.90	-	-	0.00
	Musa balbisiana	+	10	9.80	+	9	7.69
Myristicaceae	*Pycnantus angolensis*	+	1	0.98	-	4	3.42
Myrtaceae	*Psidium guajava*	+	-	0.00	-	1	0.85
Poaceae	*Zea mays*	-	3	2.94	+	7	5.98
Rubiaceae	*Nuclea diderrichi*	-	-	0.00	+	-	0.00
Rutaceae	*Citrus sinensis*	+	1	0.98	-	1	0.85
Sapotaceae	*Chrysophyllum albidium*	+	-	0.00	-	2	1.71
Sterculiaceae	*Cola nitida*	-	3	2.94	+	-	0.00
Total	26		102	100.00		117	100.00

+ = Utilized during the season, - = Not utilized during the season

Table 5. Utilized plant species parts for food by the Sclater's guenon in the study area

Family	Species	Parts Utilized	Wet Season	Dry Season
Anacardiaceae	*Magnifera indica*	*	*	**
Arecaceae	*Elaeis guineensis*	*	*	**
Burseraceae	*Dacryodes edulis*	*	**	*
Caricaceae	*Carica papaya*	*	**	*
Combretaceae	*Terminalia catappa*	**	**	*
Fabaceae	*Afzelia Africana*	**	**	*
	Arachis hypogea	**	**	*
	Pentracletra mycrophylla	**	*	**
	Pterocarpus erinaceous	***	*	**
	Pterocarpus mildbradii	***	*	**
	Tetrapleura tetraptera	*	*	**
Gnetaceae	*Gnetum african*	***	**	*
Irvingiaceae	*Irvingea wombulu*	*	*	**
Lauraceae	*Persea americana*	*	*	**
Leguminosae	*Brachyztegia eurycoma*	**	*	**
Moraceae	*Treculia africana*	**	**	*
Musaceae	*Musa acuminate*	*	*	**
	Musa balbisiana	*	*	**
Myrtaceae	*Psidium guajava*	*	*	**
Poaceae	*Zea mays*	**	**	*
Rutaceae	*Citrus sinensis*	*	*	**
Sapotaceae	*Chrysophyllum albidium*	*	*	**

** = Not related to the season, ** = Related to the season, * Fruit, ** Seed, *** Leaves*

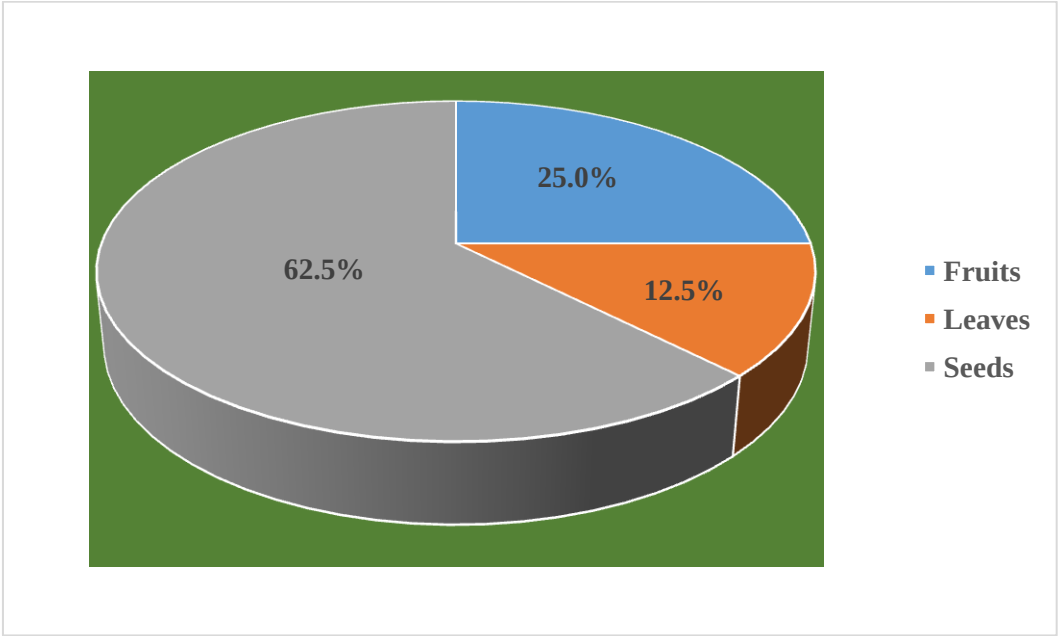

Fig. 1(a). Percentage Plant species utilized as food during the wet seasons in the study area

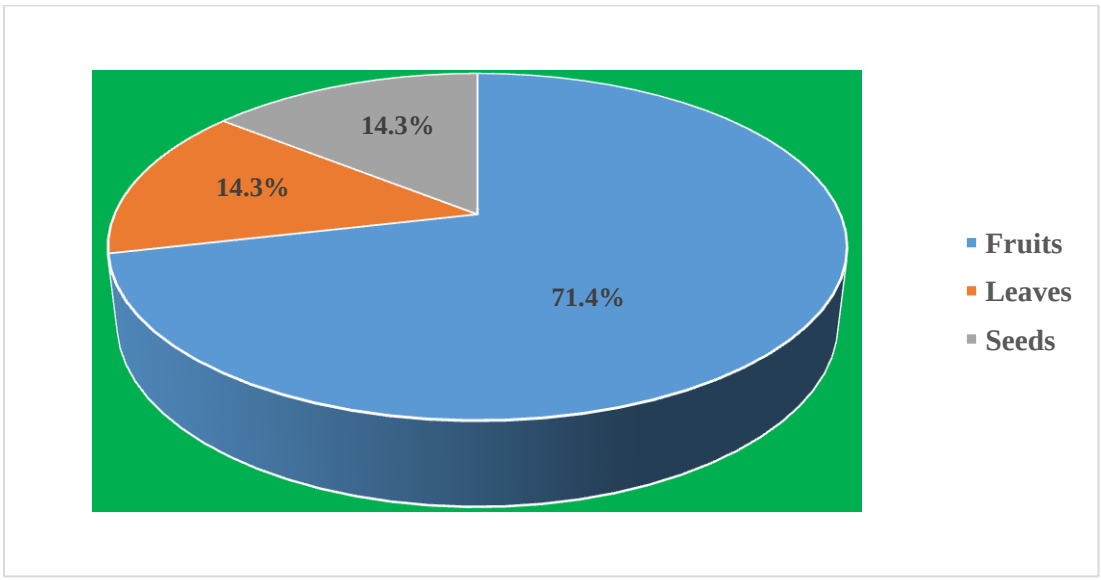

Fig. 1(b). Percentage Plant species utilized as food during the dry seasons in the study area

4. CONCLUSION

The Sclater's guenon is a species that is urgently in need of conservation, but due to population pressure in host communities conservation efforts are hindered. The conservation of this species solely resides in the hands of the local people of Lagwa, who unfortunately are unaware of the immense benefits of conserving this important monkey. The conflicts arising from the existence of these species amongst the people pose a huge conservation challenge. The leeway to overcoming this challenge is public enlightenment and mass sensitization of the people on the need and long term benefits of conserving the Sclater's guenon. Concerned stakeholders, non-governmental organizations and responsible government agencies must ensure the communication of these benefits to the people in a language that can best be understood by the people. Conservation bodies should create more awareness on potential benefits from the conservation of the species in the community. Conservation experts should also involve indigenes of the state, especially in resolving land tenure issues pertaining to acquisition, ownership rights and occupancy, so as to allay fears from minds of the local people from within the surrounding communities.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX

(a) Psidium guajava (b) *Carica papaya* *(c) Irvingia gabonensis* *(d) Terminalia catapa*

Plate 1. Plant leaves consumed by the guenons in the study area

(a) Terminalia catapa* *(b) Elaeis guinensis* *(c) Musa balbisiana* *(d) Dacryodes edulis

Plate 2. Plant fruits consumed by the guenons in the study area

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