



POPULATION COMPOSITION AND DENSITY OF MONA MONKEY IN LEKKI CONSERVATION CENTRE, LEKKI, LAGOS, NIGERIA

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ABSTRACT

*The mona monkey (*Cercopithecus mona*) is the only non-human primate in Lekki Conservation Centre (LCC), a 78 hectares Strict Nature Reserve located in a peri-urban part of Lagos, Nigeria. This study aimed to of population composition and density of mona monkeys in LCC. Total count method using woods walk ways and perimeter road as line transects was used for the enumeration. The censuses were conducted for 27 days in October, November, and December, 2018. Counts were carried out between 06:30 and 10:30 hours for 22 days, and between 16:30 and 19:00 hours for five days. Monkeys were enumerated by counting all sighted individuals on both sides of the walk ways, and other study points. Data was subjected to analysis of variance to compare the monthly means, and statistically significant means ($P < 0.05$) were separated using Tukey post hoc test. A total of 3.65 km was walked and 333 monkeys in 12 troops were enumerated. There were 11 alpha males, 61 adult females, 77 adult males, 163 juveniles, and 21 infants. The highest troop size was 32.75 ± 4.11 ; the lowest was 0.20 ± 0.42 , while the population density was $4.27/\text{km}^2$. There were significant differences ($P < 0.05$) in number of individuals in troops T4, T6, T8, and Nature Station. With such a viable population within the isolated forest area of LCC, regular census of the monkeys is recommended to establish its carrying capacity and sustainable harvesting of the species.*

Keywords: Carrying capacity, Lekki Conservation Centre, mona monkeys, population composition, population density

INTRODUCTION

Mona monkey (*Cercopithecus mona*) is a forest-dwelling arboreal guenon, originally ranging in West to Central Africa. They are found in Benin, Cameroon, Ghana, Nigeria, Togo, Senegal, Congo, Gambia, Guinea, Ivory Coast, Liberia, Sierra Leone and Uganda. They inhabit a variety of forest habitats such as primary and secondary rain forests, swamp, mangrove, riverine, dry forests and woodland savanna. Mona monkeys exhibit an omnivorous diet comprised of plant parts – fruits, leaves, flowers, nectar, seeds, and bark – and animal sources – insects, crustaceans, lizards, eggs, and nestlings (Glenn, 1997; Nowak, 1999; Matsuda Goodwin, 2007). Mona monkey is listed by the International Union for the Conservation of Nature (IUCN) as “Least Concern” (IUCN, 2010).

According to IUCN (2015), the main threats to primate species are loss of habitat due to agriculture, logging and wood harvesting, and livestock farming and ranching, as well as direct loss due to hunting and trapping. These threats affect the population size of mona monkeys (IUCN, 2015). In Cameroon, Nigeria, and Ghana, *Cercopithecus mona* populations have been locally reduced or extirpated due to hunting (Olaleru, 2016). In Nigeria, the mona monkey has been legally protected by Federal Decree 11 of 1985; even though this law is not generally known and rarely enforced (Tooze and Baker, 2008). They are under protection in such protected areas as Cross River and Okomu National Parks, Afi Mountain Wildlife Sanctuary, Ayede/Isan Forest Reserves,

and Lekki Conservation Centre (LCC) (Agbelusi *et al.*, 2003, Nigerian Conservation Foundation 2009, Akinsorotan *et al.*, 2011; Edet *et al.*, 2016). They are also found in unprotected places, urban areas such as Awka and the University of Lagos (Asiwaju, 1987; Tooze and Baker, 2008; Nwufoh, 2011).

A major problem facing wildlife conservation in Nigeria is the increasing rate of habitat loss or modification due to human activities (Ogunjemite *et al.*, 2007). There has been large-scale destruction and mismanagement of the forest ecosystems of Nigeria. It was observed that about 75% of the original wildlife habitat in Nigeria had been lost (Afolayan *et al.*, 2004). This has affected wildlife resources within these ecological systems leaving only remnant populations of these resources in protected areas (Afolayan *et al.*, 2004).

Several studies have reported on the population of the mona monkey in protected areas such as Afi Mountain Wildlife Sanctuary in Cross River State, Okomu National Park in Edo State, and Lekki Conservation Centre in Lagos State, and unprotected areas such as Awka town and University of Lagos (Akinsorotan *et al.*, 2011; Nwufoh, 2011; Olaleru and Egonmwan, 2013; Edet *et al.*, 2016; Odewumi and Ogunjemite, 2016). There are no habitat and wildlife losses in LCC due to its Strict Nature Reserve status. Rather with the infrastructural developments around, it is fast becoming a forest island that is flooded with water (Odewumi and Ogunjemite, 2016). With new births,

and non extraction of the monkeys through controlled hunting, the consequent increase in their population density could lead to conflicts with neighbouring households as monkeys range for food. For proper conservation actions of protection and sustainable extraction, the mona monkey population in LCC needs regular monitoring. The objectives of the study were to determine the total population estimate, troop number/size, troop composition structure, and density of mona monkeys in LCC. The result of the study would be useful to the management of LCC who should begin to consider the need for sustainable harvesting of the monkeys at some certain population threshold.

MATERIALS AND METHODS

Study Area

This study was carried out in Lekki Conservation Centre (LCC) a Strict Nature Reserve owned by the Nigeria Conservation Foundation (NCF) a Non-Governmental Organization. It lies on latitude 6° 25' 45" to 6° 26' 30" N and longitude 3° 32' 0" to 3° 32' 20" E (Figure 1). The Reserve is located on the coastal environs covering an approximate land area of 78 hectares, extending from kilometer 19 along the Lagos-Epe Expressway and ends up very close to the Atlantic Ocean near Okun Ibeju Village, Eti-Osa Local Government Area in the Eastern district of Lagos State. The Reserve has two vegetation types: a dominant mangrove swamp forest and a secondary coastal savanna. The common trees in the fresh water marshes include *Alstonia boonei*, *Elaeis guineensis*, *Ficus spp.*, *Raphia hookeri*, and *Xylopiya aethiopica* (Osinubi, 2007).

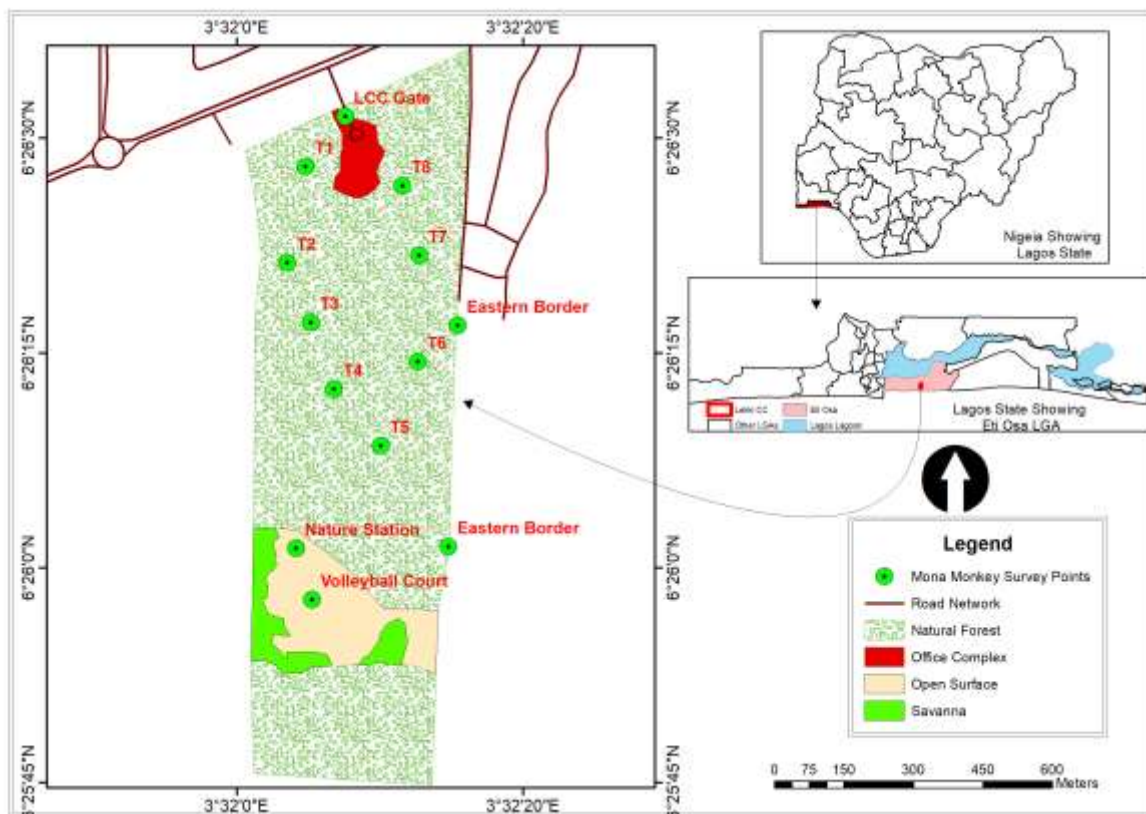


Figure 1: Map of Lekki Conservation Centre, Lagos.

Experimental Design and Survey Method

Total count method was used on line transects for the population census (Plumptre *et al.*, 2013; Spaan *et al.* 2017). The previously existing 1600 m woods walk way, and the remaining walkway to the savanna were used as transect lines. The 1600 m were marked at 200 m intervals into eight sections from the western to the eastern ends/entrance. The monkeys sighted within each were considered as Troop 1-8 (T1-T8). The 300 m wood walkway from T5 to the Nature Station (NS) was another transect, and the 200 m walkway from Nature Station to Volley Ball Court in the savannah (Family Park) was surveyed as an additional location. Another transect was the forest area by the gate to the Centre, estimated as 50 m. The 1500 m road on the Eastern Border of the Reserve and which separates it from the neighbouring community was also surveyed. The presence of an alpha male among the monkeys found within each 200 m distance constituted a troop. An isolated group made up of all males or without an alpha male was also considered a troop, if they were sighted consistently in an area.

Assessment of Monkey Population

The census was conducted for three months: October, November and December, 2018. Enumerations were conducted between 06:30 and 10:30 hours for 22 days, and 16:30 – 19:00 hours for five days. Starting from western walkways, at least two observers enumerated the monkeys sighted within each transect interval. When a group of monkeys was sighted, observers took 5-10 minutes to count them from both sides of the transect. Observation date, time, transect point/location, group number and composition of monkeys were recorded in a field note. No group was counted twice. A total of 3.65 km was walked 27 times.

Group composition/structure determination

Group composition was studied based on the body size and sex of individuals. They were categorized into alpha males, adult males, adult females, juveniles, and infants. The alpha males were the biggest sized males that led the group. Due to their sexual dimorphism, the adult males were bigger in

size than adult females. All adult males were detected through their developed testes. All adult females had conspicuous nipples, while lactating females had protruding nipples. Juveniles were those that were smaller in size than the adult males or females but bigger than the infants, and were not dependent on their mothers. Infants were known to cling to their mothers (Matsuda Goodwin, 2007; Spaan *et al.*, 2017).

Analysis of data

Descriptive and inferential statistics were used in analyzing the data and results were presented in Tables. Since unequal number of days was used for the monthly surveys, non-parametric analysis of variance using Kruskal-Wallis test was used to check for significant difference ($P < 0.05$) in the population of the troops during the period. Post hoc was conducted using Dunn's pair-wise test. Statistical Package for the Social Sciences (SPSS) version 23 (IBM Corp., 2015) was used for the analysis. Population density was expressed as total number of individuals divided by the area of LCC (Plumptre *et al.*, 2013). We expressed troop density as the total number of identified troops divided by the total area of LCC.

RESULTS

Population size, troop density, and composition of Mona monkey in LCC

The population size and composition of mona monkeys in LCC is presented in Table 1. A total of

333 individuals were estimated. Thus the population density of the 78 ha Reserve was 4.27 individuals/ha. There were 12 troops, eight of these (T1-T8) were on the 1.6 km wood walk way transects, and four other sampling sites (Nature Station, Volleyball Court, Outside LCC gate, and the Eastern Border of the Reserve). Thus the troop density was 6.5 groups/km². Each troop except the group along the Eastern Border of the Reserve, had an alpha male. Thus there were 11 alpha males, 61 adult females, 77 were adult males, 163 were juveniles and 21 were infants. No infants were observed in three troops: T7, Volley Ball Court and Eastern Border.

Average troop size of Mona monkeys

The highest recorded number of individuals was 51, found in T1, while the lowest was 7 recorded on the Eastern Border. The average troop size of mona monkeys sighted in the month of October, November and December in LCC is presented in Table 2. The highest troop size was 32.75 ± 4.11 (T1) while the lowest recorded average number of 0.30 ± 0.68 was at the Eastern Border of the Reserve. There was no significant difference in mona monkeys sighted across the three months for eight of the troops. However, significant differences ($P < 0.05$) across the three months were found for monkeys sighted in T4 ($F = 9.01, 0.01$), T6 ($F = 6.60, 0.04$), T8 ($F = 8.87, 0.01$), and Nature Station ($F = 6.95, 0.03$).

Table 1: Troop size and composition of mona monkeys in Lekki Conservation Centre

Troops	Alpha Male	Adult Female	Adult Male	Juvenile	Infant	Total
T1	1	8	10	28	4	51
T2	1	9	8	20	5	43
T3	1	9	9	18	1	38
T4	1	8	5	29	1	44
T5	1	2	6	14	1	24
T6	1	3	7	6	2	19
T7	1	4	5	10	0	20
T8	1	8	8	14	3	34
NS	1	4	4	8	3	20
VBC	1	4	5	5	0	15
OLG	1	2	7	7	1	18
EBOR	0	0	3	4	0	7
Total	11	61	77	163	21	333

Key: T = Troops NS= Nature Station VBC = Volley Ball Court, OLG = Outside LCC Gate, EBOR = Eastern Border of the Reserve

Table 2: Average troop size of mona monkeys sighted in LCC during study period

Troop	October	November	December	F value	Sig.
T1	21.38 ± 9.34	26.0 ± 7.63	32.75 ± 4.11	5.80	0.06
T2	13.77 ± 7.04	11.70 ± 6.34	23.25 ± 12.99	3.70	0.16
T3	16.46 ± 7.43	16.30 ± 6.26	12.00 ± 9.24	0.71	0.70
T4	11.08 ± 11.85	1.50 ± 1.58	4.25 ± 1.71	9.01	0.01*
T5	5.31 ± 6.56	5.20 ± 2.53	7.25 ± 5.38	1.76	0.41
T6	3.00 ± 3.72	3.50 ± 4.09	9.50 ± 3.32	6.60	0.04*
T7	3.69 ± 4.55	6.70 ± 4.69	6.50 ± 1.73	5.23	0.07
T8	10.00 ± 5.20	6.90 ± 6.62	22.75 ± 6.70	8.87	0.01*
NS	5.08 ± 3.75	6.70 ± 6.58	11.75 ± 1.71	6.95	0.03*
VBC	4.85 ± 3.58	5.90 ± 2.99	8.50 ± 4.79	1.45	0.49
OLG	3.92 ± 5.19	6.90 ± 4.07	5.00 ± 3.74	2.64	0.27
EBOR	00 ± .00	0.30 ± .68	1.50 ± 3.00	3.17	0.21

Key:: T = Troop, NS= Nature Station, VBC = Volley Ball Court, OLG = Outside LCC Gate, EBOR = Eastern Border of the Reserve.
* = Sig (P < 0.05).

Mean comparison between the months

The mean separation for T4, T6, T8, and Nature Station is shown in Table 3. For T4, the difference of the means was between October and November. In T6, the difference of the means was between

November and December; while the difference was between November and December. At the Nature Station, the difference was between October and December.

Table 3: Means comparison between the months

Troop	Months	Months	Sig.	Adj Sig.
T4	October	November	.003	0.008*
T6	November	December	.011	0.034*
T8	November	December	.030	0.009*
Nature Station	October	December	.009	0.027*

*. *The mean difference is significant at the 0.05 level.*

DISCUSSION

The estimated population size of the monkeys of 333 was higher than 247 individuals reported by Odewumi and Ogunjemite (2016), but lower than 375 reported by Williams (2017) in the same study area. The difference in total population between this study and Odewumi and Ogunjemite (2016) could be due to population increase. The results obtained in this study could be comparable to the results of Gunst *et al.* (2016) where population density of mona monkeys in a 48 km² forest in the island of Grenada was 6.0 individuals/km².

The higher average troop sizes recorded in November and December was due to new births as new infants were sighted clinging to their mother's chest. This agreed with the observation of Matsuda Goodwin, 2007 in Republic of Bénin where mona monkey infants clung to their mothers. More mona

monkey were observed when they were closer to the transect lines than when they were far away. This agreed with the report of Dunn (1993) that visibility is low in the rain forest.

The 12 groups of mona monkeys observed and estimated number per group that ranged from 7 individuals to as much as 35 individuals was similar the average of 12 and 35 individuals per group as reported by previous studies (Groves, 2005; Oates *et al.* 2008; Odewumi and Ogunjemite 2016). The troop on the eastern border did not have an alpha male. These individuals that were always in that area seemed to be benefiting from human food provisioning and raids for they lived very close to the neighbouring community.

The highest troop size of 32.75 ± 4.11 was higher than 20.3 ± 1.9 reported by Odewumi and

Ogunjemite, 2016 in the same study area, and 8.20 ± 1.87 reported by Edet *et al.*, 2016 in Afi Mountain Wildlife Sanctuary. Also, the population are spreading out and into non-forested areas such as the grass land areas. Three adult males were consistently found foraging together in the forest around the volleyball court and the Tilapia fish pond in the savannah area. These are evidences that population could continue to grow and be sustained. The significant difference ($P < 0.05$) in troops T4, T6, T8, and NS was due to new births recorded in those troops in the month of December. Given the small size of the study area and non hunting of the mona monkeys, the population is increasing. It was easy to sight them in groups. The possibility of aggregation and dispersion (fusion and fission) of such groups for resource sharing as is characteristics of social animals. The presence of an alpha male in all the troops indicated their status as such since a troop is always controlled by an alpha male.

CONCLUSION

The peri-urban nature of the LCC, ecotourism activities, and strict prohibition of extraction of

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wildlife resources have made the Mona monkeys in LCC quite habituated to humans. This accounted for easier sighting and enumeration. The increase in population of the monkeys is an obvious evidence of the positive effect of protection of wildlife habitats and species.

Recommendations

- i. In the absence of human predators, the future challenge with this would be pressure on their food resources.
- ii. Regular population monitoring and proper management plan that could include sustainable harvesting of old and sick individuals is recommended.

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