Population dynamics of the mona monkey, *Cercopithecus mona* (Schreber, 1774) and anthropogenic threats in selected areas of Lagos State, Nigeria

Olaleru, F.[1]*, Emmanuel,[1] M. M.[1], Agbaosi, J. S.[1], Agidi, H. C.[1] and Tijani, O. F.[1]

[1] Natural Resources Conservation Unit, Department of Zoology, University of Lagos

* Corresponding author: folaleru@unilag.edu.ng

Abstract

The mona monkey (*Cercopithecus mona*) is the major non-human primate adapted to swamp forests that characterizes Lagos State. It is useful in ecological services as seed disperser and reforestation. Efforts to legally conserve this species have been ineffective due to non-enforcement of conservation laws. This study determined the population estimate and threats to *C. mona* in order to provide useful information for its conservation in Lagos State. Using total head count and questionnaires, the occurrence, abundance, population composition, and the anthropogenic threats to the *C. mona* in three Local Government Areas (LGAs) viz: Eti-Osa, Ibeju-Lekki and Kosofe were determined. Population surveys were conducted during the wet and dry seasons from September, 2021 to April, 2022. Data were collected through field surveys and administration of questionnaires. The data were analysed descriptively and inferentially. Significant differences were at $p<0.05$. Mona monkeys were sighted in all the three LGAs. The estimated population was 466 individuals. The highest wet and dry season's population of 206 and 196, respectively were recorded in Ibeju-Lekki LGA. The juveniles (185) and adult females (104) were the most abundant in the three LGAs. There was a significant difference (Chi-square = 16.18, $p< 0.05$) in the population of infants in Ibeju-Lekki and Kosofe LGAs. A decline in *C. mona* population was indicated by 54.4% of the respondents, while 50.8% showed that high rate of urbanization was a major threat to the monkeys. Most respondents (74.7%) indicated that decline in forest cover over the years was affecting the monkeys' population. The need for conservation of *C. mona* is critical in Lagos State. This could be achieved through the effective enforcement of existing conservation laws and promulgation of new efficient ones.

Keywords: Mona monkey population, anthropogenic threats, habitat, fragmentation, Lagos State

Received: 30 June 2022 **Revised:** 18 September 2022 **Accepted:** 4 October 2022

Introduction

Non-human primates have been used for research in many disciplines including biomedical research because of their similarities with humans (Carlsson *et al* 2004; Hau and Schapiro 2006; Okeke *et al.,* 2015). Mona monkeys (*Cercopithecus mona*, Schreber 1774) are one of the twelve non-human primates found in the West African tropical forests (Groves 2005) and the most common social guenons found in Africa (Nash and Oates 2011). They occur in the Republic of Bénin, Cameroon, Congo, Gambia, Ghana, Guinea, Ivory Coast, Liberia, Nigeria, Senegal, Sierra Leone, Togo and Uganda (Olaleru *et al* 2020). Introduced population of the mona monkey is found on the African islands of Sao Tome and Principe in the Gulf of Guinea. It was also introduced to the Caribbean island of Grenada sometime between the late 17th and 18th centuries during the height of the African slave trade to the Americas (Liu 2000; Matsuda Goodwin *et al* 2020).

Mona monkeys dwell in groups of up to thirty-five individuals in the middle and upper storeys of forests (Groves 2005). They are categorized as "Near Threatened" by the International Union for Conservation of Nature (Matsuda Goodwin *et al* 2020). The remaining large communities of mona monkeys in Africa are found in Nigeria (Uloko and Lameed 2019). This is because in Nigeria, they are legally protected under the Federal Decree 11 of 1985, although the law is loosely enforced (Tooze and Baker 2008; Olaleru *et al* 2020). As it is common with other cercopithecine frugivores, the mona monkey does ecological services of seed dispersal thereby enhancing forest regeneration in degraded habitats and carbon sequestration.

Lagos in south-west Nigeria, is a megacity and one of the economic focal areas with one of the highest rates of urbanization in the country (Onwuemele 2014). The city has evolved from a settlement of about 3.85km^2 in 1881 to a huge metropolis of over 1,183km^2 in 2004 (Okude and Ademiluyi 2006). It has grown in human population from about 5.7million in 1991 to over 9.1million in 2006 (National Population Commission 2006), with an average population density of 20,000 persons/km^2 (The Presidential Committee on the Redevelopment of Lagos mega-city Region, 2006). Consequently, these shifts generate negative impacts on the environment (UN-Habitat 2010) resulting to changes in landscape patterns,

http://dx.doi.org/10.4314/tzool.v20i1.14

ecosystem functions, as well as their capacity to support human populations, especially when this growth is rapid or unplanned in highly vulnerable areas (Obiefuna *et al* 2013). Increased urbanization in Nigeria especially in Lagos is a major challenge to wildlife conservation.

The swamp and rainforests of Lagos State is among the richest in species diversity and endemism in the world (Ogunyebi *et al* 2018). Mona monkey is one of the wildlife found in the swampy forests in the state. These monkeys are constantly faced with major anthropogenic threats such as deforestation, habitat destruction, fragmentation and degradation, persistent and severe hunting by poachers for bushmeat and for the purpose of using the young ones as pets (Bukie *et al* 2016). The data on land use by Lagos State Ministry of Environment showed that the urban land use/built up area increased from 230.8km^2 in 1976 to 805.4 km^2 in 2015 (Ayeni 2017). This implies decreasing habitats for non-human animals. As a result of urbanization, the population density is 20,000 persons/km^2 (The Presidential Committee on the Redevelopment of Lagos mega-city Region 2006), thus, making it Nigeria's largest city and one of the most populous metropolis in Africa (Lawal and Iwajomo 2020).

Changes in land cover through deforestation pose serious threats to ecosystem sustainability especially when natural vegetation is altered for human uses such as agriculture, settlement and timber exploitation (Melle *et al* 2019). Tropical forest loss and fragmentation have been proposed as the main cause of population decline and species extinction of flora and fauna in the tropics (Laurance *et al* 2002). According to Melle *et al* (2019), fragmented habitats negatively affect the movement of species between empty patches for recolonization resulting in a high rate of population decline and faunal extinction (Laurance *et al* 2002).

There are limited researches on the occurrence and abundance of mona monkeys in urban areas like Lagos State and how they are affected by the increasing rate of urbanization (Onwuemele 2014). The aim of the study, was to determine the occurrence, abundance, population composition and the anthropogenic threats to *C. mona* in three Local Government Areas (LGAs): Eti-Osa, Ibeju-Lekki and Kosofe of Lagos State.

Materials and methods

Study area

The study was conducted in 18 locations in three LGAs of Lagos State (Figure 1). The LGAs and their respective locations were Eti-Osa (Badore-Ajah, Ikota Villa, Ilaje, Iroko-Awe, Rasta Garden, Lafiaji-Lekki, and Ogombo-Ajah,), Ibeju-Lekki (Baba-Adisa/Abule-Folly, Okun-Badore, GRA Phase 2 Abijo, Idasho, La Campagne Resort, Mesia-Abijo, and Lakowe Golf and Country Homes), and Kosofe (Agiliti Community, Anthony Village, Gbagada, and Mende). Lagos lies approximately between Longitude 2°34′ and 3°42′ E and Latitude 6°24′ and 6°42′ N (Idiege *et al* 2017). It is located in south-west Nigeria and bounded by the Atlantic Ocean in the south, Republic of Benin in the West, Ogun State in the North and East (Obiefuna *et al* 2013). The state has a total of

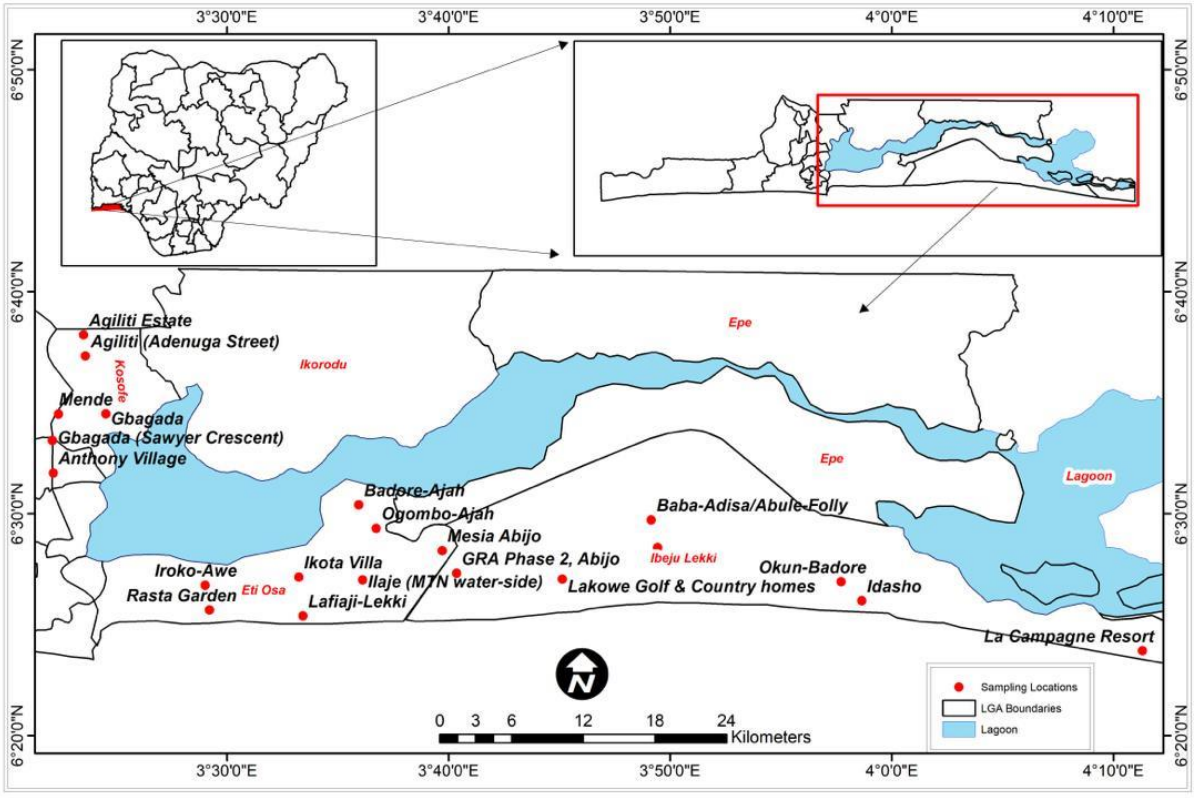

Figure 1. Map of Lagos State showing the study sites (map of Nigeria inserted)

3,577km^2 of land with water bodies covering an area of about 256.26km^2 and remains the smallest in Nigeria (Idiege *et al* 2017). Lagos State has two vegetation types: swamp rain forest of the coastal belt and dry lowland rainforest (Ogundele 2012). The annual rainfall of the state generally ranges between 1400 millimetres and 1800 millimetres with maxima in June and September, then a short break in August (Ayeni 2017; Idiege *et al* 2017). Lagos has two seasons, the dry season (from November to March) and wet season (from April to October) with the air temperature being averagely high ranging between 30°C and 38°C (Ayeni 2017).

Reconnaissance Survey

Assessment was conducted to acquaint the researchers with the terrain of the locations and to establish the presence of mona monkeys. Information was gathered from residents in the different study areas. Only places with reported presence of mona monkeys were used for the study. Data collection was through regular field surveys and headcounts of mona monkeys, and administration of structured questionnaire.

Census of mona monkey abundance

The population estimates of mona monkeys in the three LGAs were determined by counting sighted individuals. The monkeys in each of the sites established during reconnaissance surveys were enumerated at least twice monthly for eight months. This was conducted from September, 2021 to April, 2022: four months in wet season (September, October, November 2021 and April 2022) and four months in dry season (December, 2021 - March, 2022). Repeated counts at the same site technique as described by Greenwood and Robinson (2006) and point count technique (Tanko *et al* 2014) were used. On arrival at a location, the researchers stationed themselves at an established point. They waited for three minutes to allow the monkeys to feel safe before counting commenced. Monkeys were observed non-invasively at a distance of 50m radius of the point and were identified based on their categories and enumerated.

Total head count method was used for the population census (Plumptre *et al* 2013; Spaan *et al* 2017; Olaleru *et al* 2020). Due to the nature of the study areas and the regular human activities taking place, standard line transect method was not used. Monkeys were observed and counted between 6:00hrs-8:00hrs in the early hours of the morning when they were leaving for foraging, or between 17:00hrs-19:00hrs in the evening when they were returning from their foraging sites. Sometimes they were lured to come out from the forest by providing them with banana, biscuit and bread. They were also lured by the researcher making “ham sounds”, the usual boom call of the alpha male (Bukie *et al* 2016).

Determination of population composition

Mona monkeys typically live in groups called troops as they are mostly polygynous in nature (i.e. one male and several females). The troop comprised of alpha males, adult males, adult females, juveniles and infants. The alpha males were easily identified as the biggest sized males that led their troops. Since they are sexually dimorphic, adult females were smaller in size than the adult males. All adult females were identified through their conspicuous nipples, and the adult males through their developed testes. Lactating females had dangling nipples. Juveniles were smaller in size than the adult males or females but bigger than the infants and were independent of their mothers. Depending on their development stage, infants were carried by or followed their mothers (Olaleru *et al* 2020). The estimated population of monkeys in a LGA and season was the highest number sighted in that location or season.

Questionnaire administration

Data on occurrence, perceived abundance, and threats to mona monkey population were obtained from respondents through the administration of structured questionnaire that had both open and close ended questions. A total of 702 copies of questionnaires were purposely administered to respondents made up of landlords, tenants and visitors to the communities. The questionnaires were administered personally by the research team.

Data analysis

The data were analysed using descriptive and inferential statistics. Microsoft Excel (2016) and Statistical Package for the Social Sciences (SPSS) Version 25 (IMB Corp. 2015) software were used for the analyses. Since the data were categorical and independent, Chi-square test was used to compare the total population of monkeys during wet and dry seasons, and population compositions between LGAs. Statistically significant differences ($p<0.05$) were separated through a Z test. Results were presented in bar charts and tables.

Results

Mona monkey population dynamics

Occurrence of mona monkeys

Mona monkeys were sighted in all the three LGAs studied. They inhabited the swamp and fragmented tropical rain forests. They occurred in different troop sizes of 10-19, 7-15 and 5-11 individuals in Eti-Osa, Ibeju-Lekki, and Kosofe LGAs. In Eti-Osa, the highest number of individuals (47) was recorded in Ilaje-Ajah. In Ibeju-Lekki, the highest number was in Lakowe (70), while in Kosofe LGA, the highest number was in Agiliti (30).

Population abundance

The population of mona monkeys based on LGAs is shown in Figure 2. The population in Eti-Osa, Ibeju-Lekki, Kosofe LGAs were 281, 402 and 162, respectively. In Eti-Osa LGA, at $p>0.05$, there was no significant difference in the population of monkeys between the seasons ($\chi^2 = 2.69$, df 6, $p = 0.85$). Similarly, in Ibeju-Lekki and Kosefe LGAs with respective values of $\chi^2 = 0.69$, df 6, $p = 0.99$, and $\chi^2 = 1.97$, df 3, $p = 0.58$.

Figure 3 shows the population of mona monkeys in the whole study area during the wet and dry seasons. A total of 452 and 389 individual monkeys were recorded during the wet and dry seasons, respectively. There was no significant difference between these values at $p>0.05$ ($\chi^2 = 4.67$, df 2, $p = 0.10$).

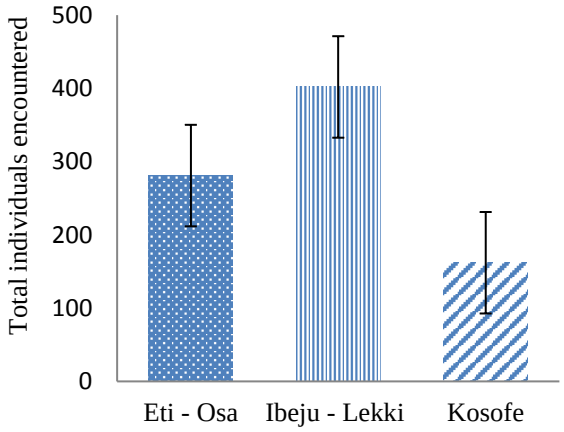

Figure 2. Population of *C. mona* in each Local Government Area.

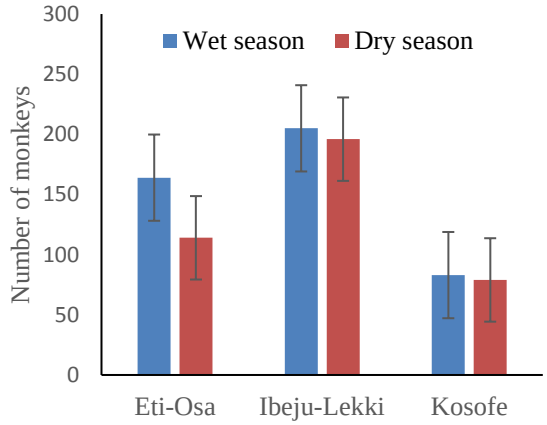

Figure 3. Population of *C. mona* in all the locations during wet and dry seasons

Population composition during the wet and dry seasons

Figures 4 and 5 show the respective wet and dry seasons' compositions of mona monkeys based on LGAs. In the wet season, Eti-Osa had the highest number (77) of juveniles followed by Ibeju-Lekki (70), while in the dry season Ibeju-Lekki had the highest number of juveniles (72) followed by Eti-Osa (45). In both seasons, Kosofe had the least number of individuals in all the different population categories. When the group values based on season were summed up, Ibeju-Lekki had the highest number of monkeys sighted during both wet (205) and dry season (196), while Kosofe had the least during wet (83) and dry (79) seasons.

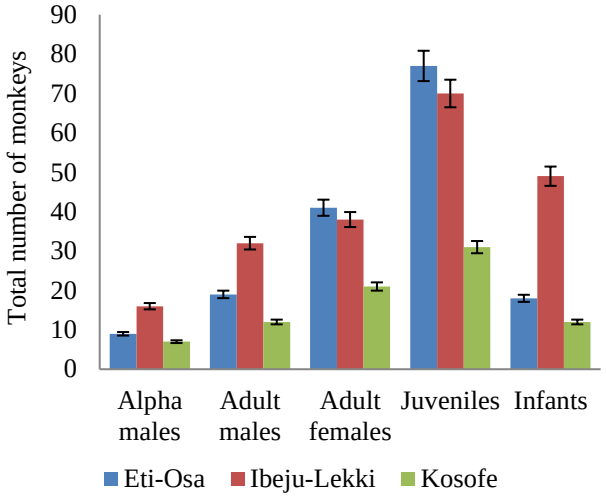

Figure 4. Population composition of *C. mona* in all Local Government Areas during the wet season

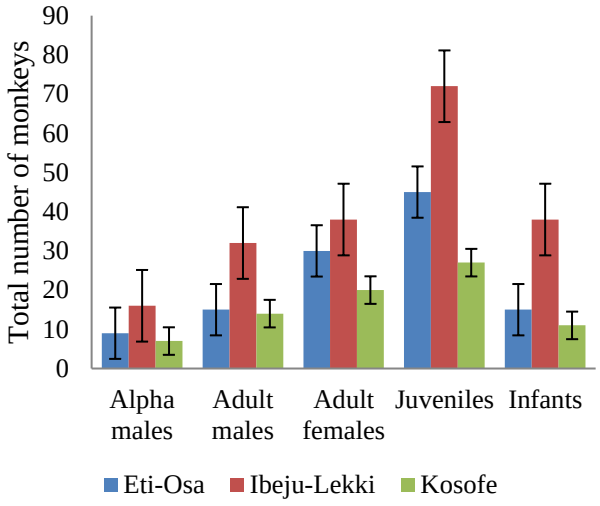

Figure 5. Population composition of *C. mona* in all Local Government Areas during the dry season

The population compositions of *C. mona* in the whole study area are presented in Table 1. Juveniles were the most abundant (185), followed by adult females (104). The alpha males were the least (32). There was a significant difference (χ^2 = 16.18, df 8, p = 0.04) in the population composition between the LGAs. The significant difference was among the infants in Ibeju-Lekki and Kosofe LGAs.

Table 1: Population of *C. mona* composition across the three Local Government Areas

Species	Eti-Osa	Ibeju-Lekki	Kosofe	Total	df	Chi-Square	Sig
Alpha males	9_a	16_a	7_a	32			
Adult males	19_a	32_a	14_a	65			
Adult females	42_a	39_a	23_a	104	8	16.18	0.04
Juveniles	77_a	75_a	33_a	185			
Infants	18_a	49_b	$13_{a,b}$	80			
Total	**165**	**211**	**90**	**466**			

Subscripts with different alphabets (a, b) are significantly different (p<0.05).

Anthropogenic threats to mona monkey populations based on questionnaires

Biodata and socio-demography of respondents

A total of 645 questionnaires were retrieved, giving a retrieval rate of 91.88%. The biodata of respondents presented in Table 2 showed that 62.3% were males, while 37.7% were females. Age bracket 20-29 years had the highest number (37.5%) of respondents. All respondents had formal education except 4.2 % that did not have. The respondents were made up of 77.5% tenants, 14.4% of Landlords, and 8.1%, visitors.

Threats to the mona monkeys

Table 3 shows the population status and associated threats to mona monkeys in the study areas. Over half of the respondents (54.4%) indicated that the populations of mona monkeys were decreasing. One of the major causes for the decrease was attributed to forest clearings with 74.7% respondents indicating in the affirmative on the incidence. Another major threat was land transformation to estate development, as indicated by 50.8% of the respondents.

Discussion

The presence of the mona monkey in all the forested parts of all the locations in the study area buttresses the fact of its arboreal nature. The swampy and other forest types where they were sighted connotes their adaptation to these areas. They depend on the forest ecosystem for food and other needs (Ejidike and Okosodo 2007; Olaleru *et al* 2018). The occurrence of *C. mona* in the urban areas of Lagos, indicates their resilience (Olaleru 2017). The estimated population size of *C. mona* recorded in the study area showed that despite the high population density of Lagos metropolis, some relic forests still harbour this species, even though in low numbers. This was evident in the fewer study locations and low populations recorded in Kosofe LGA. Eti-Osa, though it had similar number of study locations with Ibeju-Lekki, had lower number of monkeys. The lower populations of monkeys recorded in Eti-Osa could be due to urbanization that has fragmented the contiguous forests needed as habitat by wildlife, especially the arboreal ones. Such human activities could limit movement of wildlife, gene flow exchange, extirpation and perhaps result in extinction (Laurance *et al* 2002; Kindlmann and Burel 2008).

Ibeju-Lekki, a sub-urban area had higher troop sizes, and consequently the highest population of mona monkeys. The comparatively less human activities and the remaining larger forest areas could be attributable to this population size. Currently undergoing major land use changes such as housing estates and infrastructural developments, it is likely that, the population of this species will decline over time. The age long effects of habitat destruction have been the cause of wildlife population declines in the tropics (Rovero *et al* 2012; Uloko and Lameed 2019), and urbanization is also culpable (Olaleru *et al* 2020).

More monkeys were sighted during the wet compared with the dry seasons. This result is contrary to that reported by Orimaye *et al* (2017) where red capped mangabey (*Cercocebus torquatus*) in Omo Biosphere and Idanre Forest Reserves were sighted more in the dry than wet season. It is uncertain if food resource availability affected the difference in the sightings during the present study.

Table 2: Socio-demography of respondents

Demographic	**Respondents**	
	No.	**%**
Females	243	37.7
Males	402	62.3
Total	**645**	**100.0**
Marital Status		
Married	285	44.2
Single	303	47.0
Widowed	57	8.8
Total	**645**	**100.0**
Age Group		
20 – 29	242	37.5
30 -39	228	35.3
40 – 49	132	20.5
50 & above	43	6.7
Total	**645**	**100.0**
Religion		
Atheist	4	0.6
Christianity	400	62.0
Islam	227	35.2
Traditional	14	2.2
Total	**645**	**100.0**
Education Level		
No Formal education	27	4.2
Primary schools	14	2.2
Secondary schools	266	41.2
Tertiary institutions	338	52.4
Total	**645**	**100.0**
Employment Status		
Employed	267	41.4
Self employed	268	41.6
Unemployed	100	15.5
Not specified	10	1.6
Total	**645**	**100.0**
Period of Staying in the Community		
Less than 5 years	245	38.0
11-15 years	129	20.0
5-10 years	222	34.4
16-20 years	32	5.0
Above 20 years	17	2.6
Total	**645**	**100.0**
Status in the community		
Landlord	93	14.4
Tenant	500	77.5
Visitor	52	8.1
Total	**645**	**100.0**

Being surrounded by urbanization, human presence and perhaps food provisioning by residents could have affected this present result. A study of the mona monkey's wild food resources in Lekki Conservation

Centre, an area within the present study showed that similar number of foods were found in both wet and dry seasons (Olaleru *et al* 2018).

Table 3: Respondents perception on mona monkey population status and the associated threats

Population of Monkeys	**Respondents**	
	No.	**%**
Decreased	331	54.4
Increased	169	27.8
Remained the same	**71**	11.7
Not Specified	37	6.1
Total	**608**	**100.0**
Reasons for the decrease/constant in the number of monkey		
Deforestation for Agriculture	15	2.5
Diseases	10	1.6
Hunting	27	4.4
Land transformation for Estate development	309	50.8
No food for the monkeys	2	0.3
Others	245	40.3
Total	**608**	**100.0**
Are there forest clearings in your area?		
Yes	454	74.7
No	144	23.7
Not Specified	10	1.6
Total	**608**	**100.0**
Incidents of killing and trapping of monkeys		
Yes	76	12.5
No	511	84.0
Not Specified	21	3.5
Total	**608**	**100.0**

The easy sighting of non-human primates in the wild could be affected by the resources they seek during the wet and dry seasons. Yitayih *et al* (2021) sighted more grivet monkeys (*Chrocebus aethiops*) in agricultural areas during the wet than dry seasons, but they were sighted more in the dry season than wet season in the lakeshore. Seasonality which results in the alternation of dry and wet seasons in rain forests causes variation in the availability of reproductive and vegetative parts of plants thereby resulting in abundance or scarcity of food for consumers such as primates (van Schaik and Brockman 2005).

The population composition showed the presence of an alpha male signifying a troop. More adult females in a troop implied a biased female sex ratio and confirms the polygynous nature of *C. mona*. As mothers breast-fed their babies, it was easy to identify these members of the group who clung to the underline of their mothers. This agrees with the observation of Matsuda Goodwin (2007) in Republic of Bénin, where mona monkey infants clung to their mothers. High number of juveniles indicates a viable population. The size of a population and its age and sex composition do indicate its viability. Thus, the biased female sex ratio combined with high juveniles as observed in this study implies a healthy population (Yitayih *et al* 2021).

The large number of respondents that have stayed in the study area for more than 10 years enabled their ability to provide useful information about their observation on mona monkey's population status, habitat changes, and the threats faced over time.

In Nigeria, the population of primates is confronted with a myriad of problems as a result of human activities (Uloko and Lameed 2019). Ayeni (2017) reported on the increased changes in land conversions in Lagos State to residential areas. Although, deforestation is the major threat faced by the mona monkey in Lagos due to habitat conversion, the mona monkey was reported by Oates *et al* (2008) to be very resilient and well adapted to secondary habitats. Thus, the mona monkey has remained in fragmented and human-dominated areas of Lagos State, including the University of Lagos (Olaleru 2016). Generally, considered a bushmeat delicacy at local restaurants, the mona monkey also faces severe poaching and illegal hunting; they are sometimes traded as pets in the southwestern part of Nigeria (Uloko and Lameed 2019).

Conclusion

This study has vital information and evidence on the presence, abundance, population dynamics and various threats faced by the mona monkey, *C. mona* within the study location. This can aid current and future conservation actions in Lagos State. The study confirmed that mona monkeys are more abundant in the sub-urban areas. This implies that conservation action can still be done along this axis as there are still large forest areas, though patchy. A large contiguous forest would be needed for a sustainable conservation area. The study also confirms urbanization as a leading cause of the decline in mona monkey population in urban areas.There is an urgent need for proper conservation of the remaining forest areas. New and existing conservation policies should be totally enforced. Protecting some mona monkey habitats cascades to the conservation of the rich biodiversity of Lagos State. This could boost ecotourism and revenue generation.

Acknowledgement

We are grateful to the management of Lakowe Golf and Country, La Campagne Resort, and Ikota Villa Estate for permission to conduct this study in their facility. We are also grateful to the residents in the study locations, especially Rasta Garden in Eti-Osa LGA who not only called the monkeys for us but shared incredible information about the troop.

References

Ayeni, A.O. 2017. Increasing population, urbanization and climatic factors in Lagos State, Nigeria: The nexus and implications on water demand and supply. *J. Glob. Init. Policy, Pedagogy Perspect. 2*(*2*): 69-87.

Bukie, J.O., Nchor, A.A., Ebu, V.T., Mgbang E.U. 2016. Population Density of the Mona Monkeys

(*Cercopithecus mona*, Schreber, 1774) in Afi Mountain Wildlife Sanctuary, Cross River State, Nigeria. *Agric. For. Fish. 5*(*6*): 261-265.

Carlsson, H.E., Schapiro, S.J., Farah, I. and Hau, J. 2004. Use of primates for research: A global overview, *Am. J. Primatol. 63*(*4*): 225-237.

Ejidike, B.N. and Okosodo, F.E. 2007. Food and feeding habits of the thick-tailed galago (*Otelemurcrassi caudatus*) in Okomu National Park, Edo State. *J. Fish. Int. 2*(*3*): 231-233.

Greenwood, J.J.D. and Robinson R.A. 2006. Repeated Counts at the same Site. In. W.J. Sutherland (ed.), *Ecological Census Techniques* (2nd ed.), 58-66.

Groves, C.P. 2005. Order Primates. In Wilson, D.E. and Reeder, D.M. (eds.). *Mammal Species of the World: A Taxonomic and Geographic Reference*. John Hopkins University Press. Baltimore, Maryland, USA, 111-184.

Hau, J. and Schapiro, S.J. 2006. Non-human Primates in Biomedical Research. *Scandinavian J. Lab. Anim. Sci. 33*(*1*): 9-12.

IBM Corp. 2015. 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.

Idiege, D.A., Akise O.G., Amani, D.C.A., and Uruku, N.M. 2017. Effect of Urbanization on wetland biodiversity in the Mangrove Forest of Lagos State, Nigeria. *FUW Trends Sci. Technol. J. 2*(*2*): 991-995.

Kindlmann, P. and Burel, F. 2008. Connectivity measures: A review. *Landsc. Ecol. 23*(*8*):879-890.

Laurance, W.F., Lovejoy, T.E., Vasconcelos, H.L., Bruna, E.M., Didham, R.K., Stouffer, P.C., Gascon, C., Bierregaard, R.O., Lawrance, S.G. and Sampaio, E.M. 2002. Ecosystem Decay of Amazonian Forest Fragments: A 22-Year Investigation. *Conserv. Biol. 16*(*3*): 605–618.

Lawal, O.S. and Iwajomo, S.B. 2020. An assessment of Avifaunal Potential of Lagos State Urban Green Spaces. *J. Sci. Res. Dev. 19*(*1*): 382-394.

Liu, S. 2000. "Cercopithecus mona" (On-line), Animal Diversity Web. Accessed March 07, 2022 at https://animaldiversity.org/accounts/Cercopithecus_mona/.

Matsuda Goodwin, R. 2007. Behaviour and ecology of the mona monkey in the seasonally dry Lama Forest, Republic of Bénin. PhD Dissertation submitted to City University of New York, New York. 351pp.

Matsuda Goodwin, R., Segniagbeto, G., Nobimé, G. and Imong, I. 2020. *Cercopithecus mona*, Mona Monkey. The IUCN Red List of Threatened Species e.T4222A17946672.

Melle, M.E., Nkwatoh, F.A., Amos, Z.F. 2019. The Effects of habitat fragmentation on the distribution of primates in the Kimbi-Fungom National Park, North West Region, Cameroon. *MOJ Ecol. Environ. Sci. 4*(*2*): 60-68.

Plumptre, A.J., Sterling, E.J., and Buckland, S.T. 2013. Primate census and survey techniques. In: E.J. Sterling, N. Bynum and M.E. Blair (eds.). *Primate Ecology and Conservation: A Handbook of Techniques*. Oxford University Press, Oxford, 10-26.

National Population Commission of Nigeria. 2006. The population of Local government areas (LGAs) of metropolitan Lagos. www.citypopulation.de/Nigeria-Lagos.html. Accessed March 09, 2022.

Oates, J.F., Gippoliti, S. and Groves, C.P. 2008. *Cercopithecus mona*. The IUCN Red List of Threatened Species. www.iucnredlist.org. Accessed March 07, 2022.

Nash, S. and Oates, J.F. 2011. *Primates of West Africa*: *A field guide and Natural History*. IUCN (IUCN-2011-047), Arlington 556pp.

Obiefuna, J.N., Atagbaza, A.O., Nwilo P.C., Okolie J.C. 2013. Spatial Changes in the Wetlands of Lagos/Lekki Lagoons of Lagos, Nigeria. *J. Sustain. Dev. 6*(*7*): 123-132.

Ogundele, F.O. 2012. Variation in the Physicochemical Properties of Badagry and Ikorodu Soils, Lagos Nigeria. *Int. J. Humanit. Soc. Sci. 2*: 244- 258.

Ogunyebi, A., Abiodun, M.J., Oludoye, O., Omoyajowo, K.O., Fayenuwo, G., and Fingesi, T.S. 2018. Assessment of tree species diversity in the University of Lagos, Akoka, Lagos. *J. Appl. Sci. Environ. Manag. 22*: http//doi.12. 10.4314/jasem.v22i1.3.

Okeke, J., Umeaniebue, A., Ufele, A., Tochukwu, M., and Nwosu, M. 2015. A Preliminary Study on the Diversity of Monkeys in Nnamdi Azikiwe University Awka and Its Environs. *J. Nat. Sci. Res. 5*(*19*): 1-4.

Okude, A.S., and Ademiluyi, I.A. 2006. Implications of the Changing Pattern of Land cover of the Lagos Coastal Area of Nigeria. *Am.-Eurasian J. Sci. Res. 1*(*1*): 31-37.

Olaleru, F. 2017. Seasonality and nutrient composition of the plant diets of mona monkey (*Cercopithecus mona*) in University of Lagos, Nigeria. *Zoologist 15*: 13-21.

Olaleru, F. 2016. Nutritional ecology and the conservation of mona monkey *(Cercopithecus mona*, Schreber, 1774) in selected urban, semi-urban and wild habitats of southwestern Nigeria. PhD thesis submitted to the Department of Zoology, Faculty of Science, University of Lagos, Nigeria. 336pp.

Olaleru, F., Ogunjemite, B.G., Onadeko, A.B., and Egonmwan, R.I. 2018. Seasonal availability and nutrient contents of mona monkey (*Cercopithecus mona*, Schreber, 1774) plant diets in Lekki Conservation Centre, Nigeria. *Munis Entomol. Zool. 13*(*2*): 574-582.

Olaleru, F., Omotosho, O.O. and Omorogie, Q.O. 2020. Population composition and density of monkey in Lekki Conservation Centre, Lekki, Lagos, Nigeria. *J. Res. For. Wildl. Environ. 12*(*3*): 259-265.

Onwuemele, A. 2014. Socio-Economic and Environmental Impacts of Urbanization in Lagos, Nigeria: *A Review of Grey Literature*. 210-223. 10.4018/978-1-4666-7328-1.ch012.

Orimaye, J.O., Ogunjemite, B.G. and Agbelusi, E.A. 2017. Density and abundance of the red-capped mangabey (*Cercocebus torquatus*) in Omo Biosphere Reserve and Idanre Forest Reserve, south western Nigeria. *MOJ Proteom. Bioinform. 5*(*2*): 63-67.

Plumptre, A.J., Sterling, E.J., and Buckland, S.T. 2013. Primate census and survey techniques. In: E.J. Sterling, N. Bynum and M.E. Blair (eds.). *Primate Ecology and Conservation: A Handbook of Techniques*. Oxford University Press, Oxford, 10-26.

Rovero, F., Mtui, A.S., Kitegile, A.S. and Nelson, N.R. 2012. Hunting or habitat degradation? Decline of primate populations in Udzungwua Mountains, Tanzania: An analysis of threats. *Biol. Conserv. 146*(*1*): 89-96.

Spaan, D., Ramos-Fernandez, G., Schaffner, C.N., Pinacho-Guendulain, B. and Aureli, F. 2017. How survey design affects monkey counts: A case study of individually recognised spider monkeys (*Ateles geoffroyi*). *Folia Primatol. 88*: 409- 420.

Tanko, D. Ezealor A.U. and Bako, S.P. 2014. Community Structure and Abundance of Avian and Non-Avian Vertebrates Fauna of Dumbi Inselberg and Adjacent woodland in Zaria, Northern Nigeria. *Zoologist. 12*: 46-53.

The Presidential Committee for the Redevelopment of Lagos Megacity Region, 2006. Report of the Presidential Committee on the Redevelopment of Lagos Megacity Region. April, 2006. Federal Ministry of Housing and Urban Development. Abuja, 86pp.

Tooze, Z.J. and Baker, L.R. 2008**.** Re-introduction of mona monkeys to supplement depleted population in community forest in Southeast Nigeria. In Soorae, P.S. (Ed.). *Global Re-introduction Perspectives: Re-introduction Case-studies from Around the Globe*. IUCN/SSC Re-introduction Specialist Group, Abu Dhabi, United Arab Emirate, 207-212.

Uloko, J.I. and Lameed, G.A. 2019. Preliminary Study of the Population Density of Mona Monkeys (*Cercopithecus mona*) in Omo Forest Reserve. *Open J. Ecol.* 9: 413-425.

United Nations (UN) -Habitat. 2010. Urban Development, Biodiversity and Wetland Management: Expert Workshop Report. Expert Workshop, 16-17 November, 2009. Kenya Wildlife Training Institute, Naivasha, Kenya. 57pp.

van Schaik, C.P. and Brockman, D.K. 2005. Seasonality in primate ecology, reproduction, and life history: an overview. In: D.K. Brockman and C.P. van Schaik (ed.). *Seasonality in Primates: Studies of Living and extinct Human and Non-Human Primates*. Cambridge University Press, New York, 3-12.

Yitayih, Y., Ejigu, D. and Mola, M. 2021. Population size and human-grivet monkeys (*Chlorocebus aethiops*) conflict in Zegie peninsula, Bahir Dar, Ethiopia *BMC Zoology 6*: 2. https://doi.org/10.1186/s40850-021-00066-w.

Citation: Olaleru, F., Emmanuel, M. M., Agbaosi, J. S., Agidi, H. C. and Tijani, O. F. 2022. Population dynamics of the mona monkey, *Cercopithecus mona* (Schreber, 1774) and anthropogenic threats in selected areas of Lagos State, Nigeria. http://dx.doi.org/10.4314/tzool.v20i1.14.

The Zoologist, 20. 108-115 October, 2022, ISSN 1596 972X.
Zoological Society of Nigeria